

**PROJECTION OF TRAFFIC, TOLL REVENUES  
AND EXPENSES**

AND

**REVIEW OF PHYSICAL CONDITIONS**

OF THE FACILITIES OF

**TRIBOROUGH BRIDGE AND TUNNEL AUTHORITY**

April 27, 2001

Prepared for the  
**Triborough Bridge and Tunnel Authority**

By

**URS**

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April 27, 2001

To Triborough Bridge and Tunnel Authority:

In accordance with your request, URS Corporation Group Consultants (URS), successor to URS Greiner Woodward Clyde Corporation conducted this annual study to develop projections of traffic, revenues and expenses for the toll bridge and tunnel facilities operated by TBTA, and to provide an overview of the physical conditions of each facility. We have reviewed the bridge and tunnel inspection reports provided by TBTA, toured the facilities in light of these inspection reports, and discussed TBTA's on-going maintenance and capital programs with its engineering staff.

Our projections have taken into account: (1) the general physical condition of TBTA's toll facilities; (2) traffic and revenue data, reflecting the 10 toll increases since 1972; (3) the impact of the *E-ZPass* electronic toll collection system; (4) the toll structure; (5) possible future toll increases; (6) population, employment and other demographic forecasts in the New York Metropolitan Area; (7) the traffic capacities of the bridges and tunnels and the existing roadway network that feeds the facilities in terms of the potential for future growth of peak versus non-peak period traffic; and (8) construction conditions on the arterial highway network serving the New York Metropolitan Area, including the toll-free East River bridges.

## **TRANSPORTATION INFRASTRUCTURE**

The New York Metropolitan Area's transportation infrastructure consists of an extensive network of highways, tunnels and bridges (both tolled and toll-free), regional commuter rail and the New York City transit system.

### **Triborough Bridge and Tunnel Authority (TBTA)**

TBTA operates nine toll facilities within New York City (the "City"), consisting of seven bridges and two tunnels that provide vital links across the City's rivers and bays. In 2000, these facilities carried 299 million total vehicles, of which 296 million were toll paying, and generated \$941 million in toll revenue. (Non-revenue transactions include police, emergency and TBTA vehicles.) The locations of the facilities are shown on the following map in the context of the regional highway network.



The facilities are briefly described as follows:

*Verrazano-Narrows Bridge* - a two-level suspension bridge, with three lanes of traffic in each direction on both decks. It crosses the entrance to New York Harbor and connects Brooklyn and Staten Island.

*Triborough Bridge* - a complex of three bridges connecting Manhattan, The Bronx and Queens, with a central connecting interchange on Randall's Island. Manhattan is reached via a six-lane vertical lift bridge over the Harlem River. The Bronx is accessed via a six-lane truss bridge over The Bronx Kill. An eight-lane suspension bridge over the East River leads to Queens.

*Bronx-Whitestone Bridge* - a suspension bridge, with three lanes of traffic in each direction, which crosses the East River connecting the boroughs of Queens and The Bronx.

*Throgs Neck Bridge* - a suspension bridge, with three lanes of traffic in each direction, which crosses the upper East River also connecting the boroughs of Queens and The Bronx.

*Queens Midtown Tunnel* - a twin-tube tunnel with each tube carrying two lanes of traffic under the East River between the boroughs of Queens and Manhattan. During normal commuting hours, three lanes are operated in the peak traffic direction.

*Brooklyn-Battery Tunnel* - a twin-tube tunnel with each tube carrying two lanes of traffic under the East River connecting the southern tip of Manhattan with Brooklyn. During normal commuting hours, three lanes are operated in the peak traffic direction.

*Henry Hudson Bridge* - a two-level steel arch bridge, with four southbound lanes on its lower deck and three northbound lanes on its upper deck, that crosses the Harlem River to connect the northern tip of Manhattan with the Spuyten Duyvil section of The Bronx.

*Marine Parkway - Gil Hodges Memorial Bridge* - a four-lane crossing of the Rockaway Inlet which connects the Rockaway peninsula in Queens with Brooklyn.

*Cross Bay Veterans' Memorial Bridge* - a pre-stressed concrete viaduct with three lanes of traffic in each direction crossing Beach Channel in Jamaica Bay, connecting the Rockaway peninsula in Queens with the Queens mainland, via Broad Channel.

### **Metropolitan Area Arterial Network**

The New York Metropolitan Area is served by an extensive network of highway facilities. Many of the bridges and tunnels operated by TBTA are links in the Interstate highway network, as these limited-access expressways pass through New York City to serve both local and long distance traffic. These other regional facilities are shown on the map on page M-2.

The Verrazano-Narrows Bridge is part of I-278 (Staten Island, Gowanus and Brooklyn-Queens Expressways) which connects with the Brooklyn-Battery Tunnel and the Triborough Bridge. The Queens Midtown Tunnel carries I-495 (Long Island Expressway) into Manhattan. The Triborough Bridge joins I-87 (Major Deegan Expressway), and I-278 (Bruckner Expressway) with I-278/Grand Central Parkway in Queens and the FDR Drive in Manhattan. The Bronx-Whitestone Bridge carries traffic between the Hutchinson River and Merritt Parkways and Long Island via I-678 (Whitestone and Van Wyck Expressways) and the Cross Island Parkway. The Throgs Neck Bridge carries traffic between I-95 (New England Thruway and George Washington Bridge) and Long Island via I-295.

The Henry Hudson Bridge is part of the Henry Hudson Parkway, a major commuter route into Manhattan from the extensive parkway network in Westchester County and beyond.

In addition to the TBTA facilities and their expressway/parkway connections, New York City's toll-free East River Bridges — Brooklyn, Manhattan, Williamsburg and Queensborough — also connect Manhattan with Brooklyn and Queens; and nine toll-free bridges over the Harlem River connect Manhattan with The Bronx. Unlike the TBTA facilities, the approaches to these bridges are mostly surface arterials, such as Flatbush Avenue and Queens Boulevard. Only a few have expressway ramp connections (such as the Brooklyn-Queens Expressway connection to the Williamsburg Bridge), and the Alexander Hamilton Bridge, or I-95, is part of the Cross Bronx Expressway.

### **Other Regional Toll Facilities**

TBTA is one of a number of toll authorities that operate bridge, tunnel and highway facilities in the New York Metropolitan Area. The agency whose facilities are geographically closest to TBTA's bridges and tunnels is the Port Authority of New York and New Jersey. The Port Authority's George Washington Bridge is linked to the Triborough, Bronx-Whitestone and Throgs Neck Bridges via the expressway system in The Bronx (plus the George Washington-Triborough Bridge connection in Manhattan via the Harlem River Drive and the George Washington-Henry Hudson Bridge connection in Manhattan via the Henry Hudson Parkway); while the Bayonne Bridge, Goethals Bridge and Outerbridge Crossing are linked to the Verrazano-Narrows Bridge via the expressway system in Staten Island. Only motorists using the Port Authority's two tunnels — Holland and Lincoln — must traverse surface streets (in Manhattan) to reach TBTA's and the City's East River crossings.

The other toll authorities in the region are the New York State Thruway Authority (Tappan Zee Bridge and several Thruway sections), New York State Bridge Authority (five Hudson River Bridges), New Jersey Turnpike Authority, and the New Jersey Highway Authority (Garden State Parkway).

All of these authorities and several authorities beyond the New York Metropolitan Area are already, or are in the process of being, linked through *E-ZPass* to better serve the regional traveler. *E-ZPass* and its impact on the TBTA facilities are discussed further in this report.

## **Regional Public Transportation**

In addition to the TBTA facilities, most of the public transportation facilities within New York City and the suburban counties north and east of the City are part of the Metropolitan Transportation Authority (“MTA”) system. These include the New York City Transit Authority subway and buses, Staten Island Rapid Transit, Metro-North Commuter Railroad, Long Island Rail Road, and the Long Island Bus system (in Nassau County, which serves adjacent portions of Queens and Suffolk County).

For those major TBTA facilities directly serving Manhattan — Triborough Bridge, Queens Midtown Tunnel and Brooklyn-Battery Tunnel — the motorist can, for the most part, choose to use transit; but for the outlying bridges, the choice is more difficult, due to less transit service or different trip characteristics.

## **TOLL COLLECTION ON THE TBTA FACILITIES**

The nine TBTA toll facilities have three toll structures, in terms of toll levels and methods of collection: major, minor and the Verrazano-Narrows Bridge. The major crossings include the Triborough Bridge, Bronx-Whitestone Bridge, Throgs Neck Bridge, Queens Midtown Tunnel and Brooklyn-Battery Tunnel. The minor crossings are the Henry Hudson Bridge, Marine Parkway-Gil Hodges Memorial Bridge and Cross Bay Veterans’ Memorial Bridge. The Verrazano-Narrows Bridge is the only facility on which tolls are collected only in one direction, while the cash tolls for passenger cars on the minor bridges are only at half the level of those on the major facilities.

### **Current Toll Structure and Operation**

The current toll structure, in place since March 24, 1996, is shown in Table 1. Tolls are determined using a basic rate as modified by variables specific to a number of factors. These factors include:

- ▶ crossing used
- ▶ vehicle classification
- ▶ toll payment method
- ▶ place of residence
- ▶ vehicle occupancy

**Table 1 Current Toll Rates at TBTA Facilities  
Effective Since March 24, 1996**

Classification	Verrazano-Narrows Bridge <sup>(a)</sup>		Triborough Bridge Bronx-Whitestone Bridge Throgs Neck Bridge Queens Midtown Tunnel Brooklyn-Battery Tunnel		Henry Hudson Bridge		Marine Parkway-Gil Hodges Memorial Bridge Cross Bay Veterans' Memorial Bridge	
	Cash	<i>E-ZPass</i>	Cash	<i>E-ZPass</i>	Cash	<i>E-ZPass</i>	Cash	<i>E-ZPass</i>
Two-axle vehicles, including: Passenger vehicles, station wagons, self-propelled mobile homes, ambulances, hearses, vehicles with seating capacity of not more than 15 adult persons (including the driver) and trucks with maximum gross weight of 7,000 lbs. and under	\$3.50	\$3.00	\$3.50	\$3.00	\$1.75	\$1.25	\$1.75	\$1.25
Each additional axle costs	1.50	1.50	1.50	1.50	0.75	0.75	0.75	0.75
The following discounted prepaid charges are presently available for the two-axle vehicles referenced above:								
Prepaid charges through token roll purchases							1.25	
Prepaid charges per crossing for registered Staten Island Residents using an eligible vehicle with three or more occupants	0.625							
Prepaid charges per crossing for registered Staten Island Residents using an eligible vehicle through token roll purchase	2.40							
Registered Staten Island Residents using an eligible vehicle		1.60						
Prepaid charges per crossing for registered Rockaway Peninsula/Broad Channel Residents using an eligible vehicle							1.00	0.67 <sup>(b)</sup>
All two axle vehicles greater than 7,000 lbs. and buses (other than franchise buses and motor homes)	6.00	4.80	7.00	5.60	(c)	(c)	3.50	2.80
Each additional axle costs	3.50	2.80	4.00	3.20	(c)	(c)	2.00	1.60
Two-axle franchise buses		2.00		2.00	(c)	(c)		1.00
Three-axle franchise buses		2.60		2.60	(c)	(c)		1.40
Motorcycles	1.75	1.75	1.75	1.75	1.75	1.25	1.75	1.25
Each additional axle costs	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75

- Notes: (a) Under the Verrazano-Narrows one-way crossing charge collection program, all per crossing charges shown should be doubled; toll is collected in westbound direction only.
- (b) Rockaway Peninsula and Broad Channel residents using *E-ZPass* at the Cross Bay Veterans' Memorial Bridge receive a rebate of this amount, reimbursed to TBTA by MTA. This program was instituted January 1, 1998.
- (c) Passage prohibited.

### *Passenger Car Tolls*

TBTA crossings are separated into major and minor categories for toll classification purposes. The passenger car cash toll is \$3.50 for the major crossings. The minor crossing passenger car cash toll is \$1.75. All tolls are collected in each direction, except on the Verrazano-Narrows Bridge where the round-trip tolls are collected only in the westbound (Staten Island-bound) direction in order to comply with a provision of Federal law.

Tolls for passenger cars are discounted under the following programs: (1) *E-ZPass* and tokens; (2) place of residence/crossing used; (3) place of residence/vehicle occupancy; and (4) some combination of the foregoing. *E-ZPass* electronic toll collection is available on all TBTA bridge and toll facilities (see the following section for a more complete description of *E-ZPass* and its impact). Motorists open a pre-paid *E-ZPass* account and receive a transponder that they mount on their windshields. TBTA toll plazas are all equipped with *E-ZPass* antennas that identify and read the on-board tags and electronically debit the toll from the motorist's pre-paid account. Passenger cars equipped with *E-ZPass* are allowed a \$0.50 discount per trip for all facilities (\$1.00 for Verrazano-Narrows Bridge westbound only).

Toll payment by token had provided a \$0.50 discount per trip; *E-ZPass*, which has replaced the tokens, continues the \$0.50 per trip discount. A separate discount program is in place for registered Staten Island residents on the Verrazano-Narrows Bridge and for registered Rockaway peninsula and Broad Channel residents on the Cross Bay and Marine Parkway-Gil Hodges Memorial Bridges. A toll-rebate program for the benefit of *E-ZPass* customers who are residents of Broad Channel and the Rockaway peninsula was implemented on January 1, 1998 for use on the Cross Bay Bridge. The MTA reimburses the TBTA in the amount of the toll rebates.

### *Tolls for Vehicles over 7,000 Pounds*

The toll charges for vehicles over 7,000 pounds are a function of weight/number of axles as well as the crossing used. For the major crossings (except for the Verrazano-Narrows Bridge), the cash rate for these vehicles is \$7.00, and \$4.00 for each additional axle over two. For *E-ZPass* customers, the corresponding rates are \$5.60 and \$3.20. For the Verrazano-Narrows Bridge (tolls collected westbound only are doubled), the cash rate for vehicles over 7,000 pounds is \$6.00, and \$3.50 for each additional axle over two. For *E-ZPass* customers the corresponding rates are \$4.80 and \$2.80 (doubled for westbound collection only).

For the minor crossings, the two-axle rate for vehicles over 7,000 pounds is \$3.50, with an additional per axle rate at \$2.00. These vehicles are eligible for a 20 percent discount with *E-ZPass*. Commercial vehicles are not permitted on the Henry Hudson Bridge.

## ***E-ZPass* Electronic Toll Collection System**

The *E-ZPass* electronic toll collection system has been fully installed at all TBTA bridges and tunnels since December 1996. The *E-ZPass* market share at each facility has shown strong growth as motorists have become more familiar with the system and its time-saving advantages. Unlike cash transactions, vehicles equipped with *E-ZPass* tags can use the gated *E-ZPass*-only lanes. As mentioned previously, an electronic reader identifies the tag code at the toll plaza and charges the customer's pre-paid account with the toll amount. TBTA has approximately 2.1 million *E-ZPass* tags in use. Participation rates grew to approximately two-thirds of toll-paying traffic systemwide by the end of 2000. The total number of active tags of various entities in New York and New Jersey as of the end of February 2001 was 4.9 million.

With the introduction of *E-ZPass* at all TBTA crossings, toll plaza operations have improved and vehicle-hours of delay have been reduced. This, in turn, has led to even more motorists enrolling in *E-ZPass*. Electronic payment of tolls has accelerated vehicle processing through the *E-ZPass* lanes, thereby reducing the overall vehicle queue at the plazas. TBTA estimates that manual toll lanes are able to process approximately 250 vehicles per hour, and dedicated *E-ZPass* lanes are able to process approximately 900 to 1,000 vehicles per hour. Prior to implementation of *E-ZPass*, vehicle processing through the TBTA toll plazas during peak periods was a primary cause of congestion at the crossings.

Table 2 lists the *E-ZPass* systemwide participation rates starting in January 1997, when all nine crossings had *E-ZPass* in operation. Implementation of *E-ZPass* had started in October 1995 on the Verrazano-Narrows Bridge and was phased in gradually on the other crossings through December 1996.

**Table 2 Systemwide *E-ZPass* Participation Rates**

Month	<i>E-ZPass</i> Users as a Percent of Toll-Paying Vehicles				
	1997	1998	1999	2000	2001
January	29%	55%	60%	62%	68%
February	35	56	61	63	68
March	39	57	61	64	
April	42	57	60	63	
May	43	56	59	63	
June	44	57	60	63	
July	44	55	58	61	
August	44	55	58	63	
September	50	58	59	64	
October	52	59	60	66	
November	52	59	61	67	
December	53	59	61	66	

Source: TBTA

Based on customer acceptance of the technology, TBTA projects that the *E-ZPass* share of total transactions will reach 69 percent by 2005.

Implementation of the *E-ZPass* system also has occurred and is occurring on other regional toll facilities, e.g., the six interstate crossings of the Port Authority of New York and New Jersey, the New Jersey Turnpike, the Garden State Parkway, the New York State Thruway including its Tappan Zee Bridge, the five bridges of the New York State Bridge Authority (from Bear Mountain northward), the Atlantic City Expressway, the four bridges between New Jersey and Pennsylvania operated by the Delaware River Port Authority, the two toll roads in Delaware, the West Virginia Turnpike, the Massachusetts Turnpike and the Pennsylvania Turnpike. The growing number of *E-ZPass*-equipped toll plazas has resulted in an increasing number of tag-equipped vehicles.

During 2000, TBTA *E-ZPass* market share was aided by the introduction of *E-ZPass* on the Garden State Parkway gradually over the summer months and by the New Jersey Turnpike on September 30, 2000. At the same time as the introduction of *E-ZPass*, the Turnpike increased tolls for cash passenger cars with lower rates for *E-ZPass* users, with additional discounts during off-peak periods. A similar variable pricing program utilizing *E-ZPass* was introduced by the Port Authority of New York and New Jersey on its crossings on March 25, 2001.

TBTA was a founding member of the *E-ZPass* Interagency Group (IAG), originally comprised of toll authorities in Delaware, Pennsylvania, New Jersey and New York, and now including Maryland, Massachusetts, West Virginia, New Hampshire and the Peace Bridge between Buffalo and Fort Erie, Ontario. The IAG has been working since 1991 toward the development and delivery of a compatible electronic toll collection system for the entire region. In 1995, TBTA entered into an inter-operability agreement with the IAG.

Customers of the member IAG agencies are able to use their tags at any *E-ZPass*-equipped facility operated by an IAG member. All IAG members will provide inter-operability among agencies for their customers. As IAG members implement electronic toll collection systems, the *E-ZPass* customer base will increase, which will help increase usage of *E-ZPass* on TBTA facilities.

### **Passenger Car Toll Rate Trends and Inflation**

Since 1971, toll rates have been periodically increased on the TBTA facilities. Table 3 displays passenger car toll rates for the nine TBTA bridges and tunnels over the past 30 years.

Since 1982, passenger car toll rates have been separated into three categories, as follows:

- ▶ Major crossings - Triborough, Bronx-Whitestone and Throgs Neck Bridges, and the Queens Midtown and Brooklyn-Battery Tunnels;

- ▶ Minor crossings - Henry Hudson, Marine Parkway-Gil Hodges Memorial and Cross Bay Bridges; and
- ▶ Verrazano-Narrows Bridge — a major crossing with one-way toll collection.

The Verrazano-Narrows Bridge one-way cash toll of \$7.00 is collected westbound only. The current one-way cash passenger car toll rate, effective March 24, 1996, for the major crossings is \$3.50, collected in each direction. Cash tolls on the three minor crossings are \$1.75, collected in each direction.

**Table 3 Trends in Non-Discounted Cash Passenger Car Toll Rates**

	Verrazano-Narrows Bridge	Triborough, Bronx-Whitestone and Throgs Neck Bridges and Queens Midtown Tunnel	Brooklyn-Battery Tunnel	Henry Hudson Bridge	Marine Parkway-Gil Hodges Memorial & Cross Bay Bridges
1971	\$0.50	\$0.25	\$0.35	\$0.10	\$0.10
1972 – 1975	0.75	0.50	0.70	0.25	0.25
1975 – 1980	1.00	0.75	0.75	0.50	0.50
1980 – 1982	1.00	1.00	1.00	0.60	0.75
1982 – 1984	1.25	1.25	1.25	0.90	0.90
1984 – 1986	1.50	1.50	1.50	0.90	0.90
1986 – 1987	1.75 <sup>(b)</sup>	1.75	1.75	1.00	1.00
1987 – 1989	2.00 <sup>(b)</sup>	2.00	2.00	1.00	1.00
1989 – 1992	2.50 <sup>(b)</sup>	2.50	2.50	1.25	1.25
1993 – 1995	3.00 <sup>(b)</sup>	3.00	3.00	1.50	1.50
1996 – Present <sup>(a)</sup>	3.50 <sup>(b)</sup>	3.50	3.50	1.75	1.75

Notes:

- (a) Last toll rate increase effective March 24, 1996.
- (b) Effective March 20, 1986, round-trip tolls (twice the amount shown) have been collected on the Verrazano-Narrows Bridge in the westbound direction only in compliance with a Federal legislative mandate. Eastbound traffic uses the bridge toll-free. These amounts are the equivalents of collecting tolls in each direction.

Over the years, various discount programs have been introduced. In March 1987, the Staten Island Carpool Program was initiated. Staten Island residents were offered 30-round trip coupons for vehicles with three or more occupants at a discounted price of \$30.00. This program was revised to 24 coupons for \$30.00 in July 1989 and is still available.

In general, tolls for vehicles over 7,000 pounds have also been adjusted upward whenever passenger car toll rates were increased. A notable exception was 1987 when these toll rates were not raised while there was a general increase for passenger cars. In 1989, tolls for vehicles over 7,000 pounds on the Verrazano-Narrows Bridge remained constant while all other tolls were raised. Historically, these vehicles received discounts on any TBTA facility when they used pre-paid accounts and this plan continues with *E-ZPass*.

The Consumer Price Index (CPI), compiled by the US Department of Labor, Bureau of Labor Statistics for United States Cities, is intended to represent the average inflation rate for all urban consumers. Table 4 displays the TBTA major crossing passenger car toll rates from the 1971 level of \$0.25 to the current toll rate of \$3.50 set in 1996, alongside the CPI. Also shown is the CPI for January 2001 alongside the \$3.50 toll.

**Table 4 Cash Passenger Toll Rates Versus Consumer Price Index**

Year	Triborough, Bronx-Whitestone and Throgs Neck Bridges and Queens Midtown Tunnel	Consumer Price Index <sup>(a)</sup>	Tolls Adjusted To 1982-84 Dollars <sup>(b)</sup>
1971	\$0.25	40.5	0.62
1972	0.50	41.8	1.20
1975	0.75	53.8	1.39
1980	1.00	82.4	1.21
1982	1.25	96.5	1.30
1984	1.50	103.9	1.44
1986	1.75	109.6	1.60
1987	2.00	113.6	1.76
1989	2.50	124.0	2.02
1993	3.00	144.5	2.08
1996	3.50	156.9	2.23
January 2001	3.50	175.1	2.00
Ratio 2001/1971	14.0	4.3	3.2

Notes: (a) United States City average, all Urban Consumers. Base period: 1982-1984 = 100.0  
(b) The minimal toll divided by the CPI and expressed as a decimal.

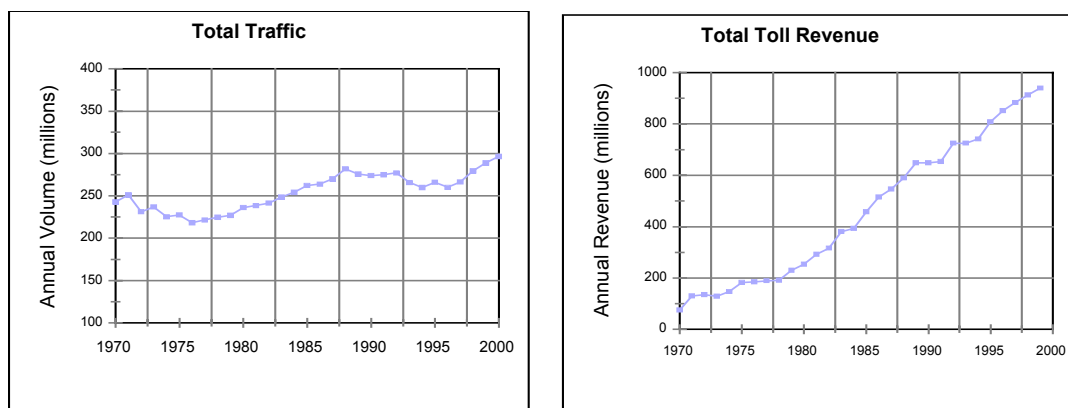
Source: US Department of Labor, Bureau of Labor Statistics.

As indicated in the table, TBTA tolls have risen faster than the CPI during the 30-year period. The actual passenger car cash toll for major crossings since 1996 has been \$3.50. As can be seen in Table 4, the current \$3.50 toll in 2001 dollars is equivalent to a toll of \$2.00 in 1982-1984 dollars. The actual 2001 cash toll for passenger cars is 14 times the actual toll in 1971. However, if adjusted for inflation, the toll is only 3.2 times that in 1971.

## HISTORICAL TRAFFIC, REVENUES AND EXPENSES AND ESTIMATED/BUDGETED NUMBERS FOR 2001

Historical traffic, revenues and expenses were reviewed for the nine TBTA bridges and tunnels. Over the last 30 years, traffic volumes on the crossings have ranged from 220 to 296 million. As displayed in the following figure, the growth of traffic reflects the region's moderate overall growth in population and employment, offset by the impact of 10 periodic toll increases. Toll revenues have increased more than 13-fold, from \$72 million to \$941 million, with tolls essentially now at 14 times the 1971 level. Since 1970, annual operating expenses for the toll facilities have risen by 9.7 times, from \$25 million to \$242 million in 2000, during which time the CPI increased by 4.3 times.

**Figure 2: Aggregated TBTA Facilities Traffic and Toll Revenue, 1970-2000**



### Traffic and Toll Revenue, 1990 - 2000

Table 5 lists the traffic and toll revenue record for each of the nine crossings for the 1990-2000 period. Total TBTA traffic and toll revenue are shown in Table 6. The peak in traffic during this period, 296 million crossings, occurred in 2000. The general systemwide pattern has been that when toll rates are increased, traffic declines moderately and then traffic begins to rise until the next rate increase. The two most recent toll increases, in 1993 and 1996, are evident in the jump in average tolls in such years. The strong growth of over 3 percent per annum since 1996 is due in part to increases in regional population and the introduction of *E-ZPass*.

In 1990, toll revenue was reported at \$649 million and it rose to \$941 million in 2000, an increase of approximately 45 percent. The Triborough Bridge reported the highest toll revenue for 2000 at \$223 million, while the Cross Bay Bridge registered the lowest revenue at \$8 million. (The relationship between toll increases and traffic volume, is described in the *Toll Impacts and Elasticity* section of this report.)

**Table 5 Annual Paid Traffic and Toll Revenue, by Facility:<sup>(a)</sup> 1990 to 2000**  
(000s)

Year	Verrazano-Narrows Bridge				Triborough Bridge				Bronx-Whitestone Bridge			
	Paid Traffic		Revenue	Average Toll <sup>(c)</sup>	Paid Traffic		Revenue	Average Toll	Paid Traffic		Revenue	Average Toll
	Volume <sup>(b)</sup>	Change			Volume	Change			Volume	Change		
1990	60,984		\$149,515	\$2.45	61,534		\$155,241	\$2.52	38,158		\$99,229	\$2.60
1991	61,783	1.3%	152,912	2.47	60,137	-2.3%	151,259	2.52	35,993	-5.7%	93,598	2.60
1992	63,063	2.1	155,112	2.46	60,246	0.2	151,669	2.95	36,471	1.3	94,560	2.59
1993	60,927	-3.4	166,935	2.74	57,566	-4.5	169,825	2.95	35,231	-3.4	106,153	3.01
1994	60,213	-1.2	167,249	2.78	54,871	-4.7	165,500	3.02	36,042	2.3	112,259	3.11
1995	61,351	1.9	169,766	2.77	56,913	3.7	171,103	3.01	40,215	11.6	125,106	3.11
1996	60,176	-1.9	178,444	2.97	54,976	-3.4	186,313	3.39	37,258	-7.3	132,434	3.55
1997	62,848	4.4	185,131	2.95	56,766	3.3	200,451	3.53	36,372	-2.4	135,593	3.73
1998	65,886	4.8	192,788	2.93	59,524	4.9	208,324	3.50	38,112	4.8	140,083	3.68
1999	67,480	3.4	196,556	3.91	61,929	4.0	216,414	3.49	40,123	5.3	147,597	3.68
2000	69,089	2.4	203,172	2.94	63,642	2.8	222,614	3.50	42,285	5.4	155,938	3.69

Year	Throgs Neck Bridge				Brooklyn-Battery Tunnel				Queens Midtown Tunnel			
	Paid Traffic		Revenue	Average Toll	Paid Traffic		Revenue	Average Toll	Paid Traffic		Revenue	Average Toll
	Volume	Change			Volume	Change			Volume	Change		
1990	35,422		\$100,436	\$2.84	19,926		\$47,907	\$2.40	25,582		\$62,747	\$2.45
1991	36,841	4.0%	102,726	2.79	20,622	3.5%	49,321	2.39	26,175	2.3%	64,143	2.45
1992	36,868	0.1	103,003	2.79	20,568	-0.3	49,064	2.39	26,829	2.5	65,686	2.45
1993	36,702	-0.4	122,273	3.33	18,277	-11.2	50,706	2.77	25,419	-5.3	72,664	2.86
1994	35,707	-2.7	122,838	3.44	18,550	1.5	53,068	2.86	23,052	-9.3	67,402	2.92
1995	33,440	-6.3	116,732	3.49	18,399	-0.8	52,742	2.87	22,812	-1.0	66,671	2.92
1996	35,208	5.3	136,948	3.89	17,064	-7.3	54,900	3.22	23,506	3.0	77,489	3.30
1997	36,711	4.3	147,106	4.01	17,029	-0.2	56,166	3.30	24,600	4.7	83,543	3.40
1998	37,660	2.6	149,711	3.98	19,651	15.4	63,578	3.24	25,362	3.1	85,626	3.38
1999	38,069	1.1	152,134	4.00	20,766	5.7	67,080	3.23	25,961	2.4	87,284	3.36
2000	37,525	-1.4	152,453	4.06	21,288	2.5	69,018	3.24	26,560	2.3	89,451	3.37

Year	Henry Hudson Bridge				Marine Parkway-Gil Hodges Memorial Bridge				Cross Bay Bridge			
	Paid Traffic		Revenue	Average Toll	Paid Traffic		Revenue	Average Toll	Paid Traffic		Revenue	Average Toll
	Volume	Change			Volume	Change			Volume	Change		
1990	19,052		\$20,004	\$1.05	7,917		\$7,994	\$1.01	5,617		\$6,136	\$1.09
1991	19,813	4.0%	21,733	1.05	8,009	1.2%	8,109	1.01	5,661	0.8%	6,213	1.10
1992	19,953	0.7	20,801	1.04	7,811	-2.5	7,835	1.00	5,476	-3.3	5,955	1.09
1993	18,784	-5.9	22,743	1.21	7,656	-2.0	8,153	1.06	5,362	-2.1	6,268	1.17
1994	18,829	0.2	23,329	1.24	7,456	-2.6	7,936	1.06	5,208	-2.9	6,043	1.16
1995	20,364	8.2	25,303	1.24	7,385	-1.0	8,178	1.11	5,184	-0.5	6,214	1.20
1996	19,922	-2.2	28,031	1.41	7,086	-4.0	8,219	1.16	4,967	-4.2	6,460	1.30
1997	19,757	-0.8	28,667	1.45	7,304	3.1	8,589	1.18	5,133	3.3	6,727	1.31
1998	20,300	2.7	28,731	1.42	7,322	0.2	8,577	1.17	5,647	10.0	7,021	1.24
1999	21,285	4.8	30,068	1.41	7,391	0.9	8,461	1.14	6,009	6.4	7,199	1.20
2000	22,541	5.9	31,938	1.42	7,206	-2.4	8,370	1.16	6,354	5.7	7,650	1.20

- Notes: (a) Toll rate changes occurred, during the time period shown in this table, on the following dates:  
January 31, 1993 and March 24, 1996.  
(b) Westbound toll traffic volume doubled.  
(c) Average toll on basis of revenues divided by doubled westbound volume.

**Table 6 Summary of Annual Paid Traffic and Toll Revenue:<sup>(a)</sup> 1990 to 2000**

Year	Total Paid Traffic (000)	Total Revenue (000)
1990	274,192	\$649,206
1991	275,034	649,014
1992	277,285	653,686
1993	265,924	725,720
1994	259,928	725,624
1995	266,063	741,815
1996	260,163	809,256
1997	266,520	851,993
1998	279,463	884,439
1999	289,013	912,792 <sup>(b)</sup>
2000	296,490	940,607 <sup>(c)</sup>

Notes: (a) Toll rate changes occurred, during the time period shown in this table, on the following dates January 31, 1993 and March 24, 1996.

(b) Includes \$2.5 million relating to tokens and tickets not likely to be redeemed.

(c) Includes \$9.7 million relating to tokens and tickets not likely to be redeemed.

Source: TBTA

Traffic volumes and toll revenues on the Throgs Neck Bridge and Bronx-Whitestone Bridge should be considered together since they serve many of the same trips; and, when there is construction activity in the area, traffic shifts between the two facilities. For example, in 1995 some traffic diverted from the Throgs Neck Bridge to the Bronx-Whitestone Bridge when the approach ramps from the Cross Island Parkway to the Throgs Neck Bridge were rehabilitated. In 2000, traffic again diverted from the Throgs Neck Bridge to the Bronx-Whitestone Bridge due to reconstruction activities on the Cross Bronx Expressway in the vicinity of the Throgs Neck Bridge.

### **Traffic by Facility and Vehicle Class, 2000**

TBTA maintains traffic counts for each crossing in 13 toll-paying categories, ranging from passenger cars to trucks with seven axles. Displayed in Table 7 are the 2000 traffic volumes by facility. Passenger cars totaled 278 million crossings and represented 94 percent (which has remained relatively constant over time) of the total toll-paying vehicles. The Verrazano-Narrows Bridge registered the highest two-way traffic volume of 69 million toll-paying vehicles. The lowest volume, 6 million vehicles, was recorded at the Cross Bay Bridge.

**Table 7 Traffic by Facility and Vehicle Class, 2000**  
(000's)

Facility	VC 1 Passenger Cars	VC 2 Pass. Cars w/ 1 Axle Trailer	VC 3 Pass. Cars w/ 2 Axles Trailer	VC 4 Trucks 2 Axles	Franchise Buses		VC 6 Trucks 3 Axles	VC 7 Trucks 4 Axles
					VC 5 2 Axles	VC 11 3 Axles		
Throgs Neck Bridge	33,770	36	24	1,368	1	*	256	343
Bronx-Whitestone Bridge	39,390	12	5	1,362	120	*	268	186
Triborough Bridge	60,149	18	5	2,206	189	*	397	101
Queens Midtown Tunnel	24,640	4	2	1,326	307	14	202	14
Brooklyn-Battery Tunnel	19,910	3	1	571	275	335	120	8
Verrazano-Narrows Bridge <sup>(a)</sup>	64,882	23	15	1,622	162	336	391	206
Henry Hudson Bridge	22,456	1	*	55	NA	NA	1	NA
Marine Parkway-Gil Hodges Mem. Br.	7,007	2	1	113	51	*	15	1
Cross Bay Bridge	6,037	5	1	188	71	*	26	2
Total	278,241	103	53	8,812	1,176	685	1,675	862
Percent of Paid Vehicles	93.8%	0.0%	0.0%	3.0%	0.6%	0.2%	0.6%	0.3%

Facility	VC 8 Trucks 5 Axles	VC 9 Motor- cycles	VC 12 Trucks 6 Axles	VC 13 Trucks 7 Axles	VC 14 Other Vehicles	Total Paid Vehicles	VC 10 Non-Rev. Vehicles <sup>(b)</sup>	Total Vehicles
Throgs Neck Bridge	1,636	44	42	2	2	37,525	222	37,747
Bronx-Whitestone Bridge	865	42	33	1	1	42,285	179	42,464
Triborough Bridge	481	70	23	2	1	63,642	1,094	64,736
Queens Midtown Tunnel	18	29	2	*	1	26,560	316	26,876
Brooklyn-Battery Tunnel	14	48	3	*	*	21,288	406	21,694
Verrazano-Narrows Bridge <sup>(a)</sup>	1,329	85	33	3	2	69,089	521	69,610
Henry Hudson Bridge	NA	27	NA	NA	NA	22,541	75	22,616
Marine Parkway-Gil Hodges Mem. Br.	8	8	1	*	*	7,206	71	7,277
Cross Bay Bridge	11	13	1	*	*	6,354	123	6,477
Total	4,362	366	138	7	8	296,490	3,007	299,496
Percent of Paid Vehicles	1.3%	0.1%	0.0%	0.0%	0.0%	100.0%		

Note: (a) Westbound traffic doubled.  
 (b) Includes police, fire and other emergency vehicles and TBTA vehicles.  
 VC = vehicle class  
 \* = Less than 500.  
 Source: TBTA and URS.

### Monthly Traffic, 2000

Monthly traffic variations on the nine crossings can be attributed to several factors. Traffic volumes historically have been weather-related; i.e., severe winter weather may result in lower volumes. Conversely, traffic reaches its highest levels during the summer months when recreational travel peaks. Toll rate increases also affect the monthly volumes. Individual facilities can be affected by construction projects on adjacent arterials or competing bridges. The limited number of crossings in the region sustains the overall demand for TBTA's bridges and tunnels.

**Table 8 Monthly Traffic Variations, 2000**

Month	Average Daily Toll-Paying Traffic										Ratio to AADT <sup>(b)(c)</sup>
	Throgs Neck	Bronx-Whitestone	Tri-borough	Queens Midtown	B'lyn-Battery	Verrazano Narrows <sup>(a)</sup>	Henry Hudson	Marine Pkwy	Cross Bay	Total	
Jan.	88,050	97,384	148,757	66,957	51,765	165,974	51,301	15,985	14,375	700,548	0.86
Feb.	95,426	105,168	162,122	73,481	58,030	178,526	56,664	16,826	15,141	761,384	0.94
Mar.	100,095	111,215	173,688	72,497	61,281	187,286	60,591	18,484	16,433	801,570	0.99
Apr.	102,956	113,299	176,333	71,397	59,329	188,804	62,313	17,812	16,081	808,324	1.00
May	108,714	117,718	182,869	75,941	60,209	193,996	65,137	20,675	18,239	843,498	1.04
June	108,864	127,401	188,069	79,118	62,385	200,348	66,818	23,743	20,982	877,728	1.08
July	110,374	121,290	176,622	72,111	55,821	192,436	60,003	23,791	20,214	832,662	1.03
Aug.	112,781	124,399	181,720	76,055	58,537	197,816	62,780	23,486	19,257	856,831	1.06
Sept.	107,270	122,070	180,350	71,207	58,505	194,846	64,349	21,002	18,047	837,646	1.03
Oct.	103,867	120,203	179,522	71,286	57,819	191,082	65,434	18,959	16,975	825,147	1.02
Nov.	98,928	117,050	173,338	72,144	57,276	189,424	63,335	18,431	16,492	806,418	1.00
Dec.	92,785	109,085	163,191	68,794	57,154	184,616	60,342	16,970	16,026	768,954	0.95
AADT <sup>(c)</sup>	102,526	115,532	173,884	72,568	58,163	188,768	61,587	19,690	17,361	810,079	1.00

Notes: (a) Westbound traffic doubled.  
 (b) For total traffic on the nine crossings.  
 (c) Annual Average Daily Traffic.

The data in Table 8 indicate that total traffic on the nine crossings peaked in the summer, the peak season for recreational travel in the Metropolitan Area. For the combined facilities the monthly variations ranged from 14 percent below the annual average in January to 8 percent above the annual average in June, which is indicative of a stable traffic mix comprised of a solid base of commuting and commercial traffic.

**Estimated Traffic and Toll Revenue, 2001**

URS estimated traffic, by facility, for 2001 by applying to the actual results for 2000 the anticipated growth rates developed by URS for traffic at each facility. Then, by applying the average tolls realized by each facility for 2000 to the estimated traffic for the year 2001, URS estimates that the total TBTA traffic and toll revenue for all of 2001 will be approximately 300 million vehicles and \$942 million, respectively.

**Table 9 Estimated 2001 Toll-Paying Traffic and Revenue**  
(000s)

Facility	Actual 2000 Traffic	Estimated Growth Rate	Estimated 2001 Traffic <sup>(a)</sup>	2000 Average Toll <sup>(b)</sup>	2001 Revenue Estimate <sup>(c)</sup>
Throgs Neck Bridge	37,525	1.10%	37,938	\$4.02	\$152,628
Bronx-Whitestone Bridge	42,285	1.10	42,750	3.65	155,878
Triborough Bridge	63,642	1.10	64,342	3.46	222,620
Queens Midtown Tunnel	26,560	0.80	26,772	3.33	89,052
Brooklyn-Battery Tunnel	21,288	0.80	21,458	3.21	68,798
Verrazano-Narrows Bridge	69,089	1.70	70,264	2.92	205,109
Henry Hudson Bridge	22,541	1.40	22,857	1.40	31,913
Marine Parkway-Gil Hodges Mem. Br.	7,206	1.70	7,329	1.14	8,380
Cross Bay Bridge	6,354	1.70	6,462	1.19	7,697
<b>Total</b>	<b>296,490</b>	<b>1.24</b>	<b>300,171</b>		<b>942,073</b>

- Notes: (a) Estimate based on actual 2000 traffic and anticipated growth rate.  
 (b) Adjusted for \$9.7 million for non-redeemed tokens and tickets.  
 (c) Based on estimated traffic for year 2001 and average toll for 2000, adjusted for non-redeemed tokens and tickets.

Total traffic for the first two months of 2001 on all TBTA facilities was 44.1 million vehicles compared with 43.8 million during the same period in 2000, an increase of 0.7 percent. Revenue during this period was \$137.5 million compared with \$137.3 million during 2000, an increase of 0.2 percent. The year 2000 was a leap year and consequently there was one additional day during the two-month period. A comparison of the average daily traffic and revenue during this period overcomes the distortion caused by the leap year. The average daily traffic in January and February 2001 was 747,800 compared with 730,000 in 2000, an increase of 2.4 percent. An additional factor that had an adverse effect on performance is the more severe weather conditions in January and February 2001 compared with the same period in 2000.

Table 9 provides the interface between the historical traffic and revenue data presented on the preceding pages and the 10-year forecasts in Tables 17 and 18. The methodology used to develop the estimated growth rates is discussed on pages M-36 and M-37.

**Operating Expenses 1990 – 2000**

Table 10 displays the historical operating expenses for the TBTA facilities from 1990 through 2000. TBTA divides operating expenses into two major categories: Personnel Services and Other Than Personnel Services (OTPS). Personnel services include salaries, overtime and fringe benefits, net of capital reimbursements. Maintenance, outside services, insurance, Coliseum operations, TBTA’s share of the *E-ZPass* Customer Service Center, and other non-personnel expenses are included in OTPS.

TBTA personnel services expenses increased from \$104.1 million in 1990 to \$112.3 million in 2000. Personnel expenses grew by much less than inflation because of the introduction of the *E-ZPass* system. TBTA was able to eliminate over 200 bridge and tunnel officer positions through attrition with *E-ZPass*, and these reductions were the primary offset to growth in wage and fringe benefit expenses in the period.

OTPS expenses increased from \$52.4 million in 1990 to \$129.0 million in 2000. The primary driving factors in TBTA's OTPS expense growth were inflation, an increase in major maintenance and bridge painting activities, and costs associated with *E-ZPass* including, particularly, the issuance of tags.

Timing of major expenses and extraordinary items have also resulted in some year-to-year fluctuations. In 1993, OTPS expenses increased primarily due to one-time expenses associated with lead remediation and an increase in insurance reserves. An enhanced bridge painting program, including lead paint removal, implemented as part of TBTA's effort to extend the useful life of the structural elements of its facilities, began to increase OTPS expenses starting in 1995.

*E-ZPass* startup costs for tags and customer service center operations were primarily responsible for OTPS growth in 1996 and 1997. In 1998, *E-ZPass* startup costs eased and bridge painting activities were deferred due to environmental reasons. Resumption of the planned level of bridge painting increased OTPS costs in 1999, and rental expenses for TBTA administrative offices at 2 Broadway that were formerly in the New York Coliseum office building increased OTPS costs in 1999 and 2000.

**Table 10 Historical Operating Expenses: 1990-2000**

Year	Operating Expenses (000s)			Percent Change <sup>(c)</sup>
	Personnel <sup>(a)</sup>	OTPS <sup>(b)</sup>	Total	
1990	\$104,104	\$ 52,425	\$156,529	6.2%
1991	104,651	50,986	155,637	-0.6
1992	114,659	53,855	168,514	8.3
1993	113,473	73,844	187,317	11.2
1994	107,417	62,976	170,393	-9.0
1995	112,212	84,858	197,070	15.7
1996	109,256	95,915	205,171	4.1
1997	111,651	112,222	223,873	9.1
1998	106,603	101,587	208,190	-7.0
1999	107,430	120,561	227,991	+9.5
2000	112,256	129,002	241,258	+5.8

- Notes: (a) Includes salaries, overtime and fringe benefits, net of capital reimbursements.  
 (b) OTPS is Other Than Personnel Services and includes the following categories: maintenance and supplies, outside services, insurance, power, New York Coliseum operation, and other expenses.  
 (c) For discussion on expense fluctuations, see preceding text.

Source: TBTA

### **Budgeted Expenses, 2001**

Operating expenses have been budgeted by TBTA for 2001 at \$256.3 million. These expenses are divided into the following two categories: Personnel Services of \$117.8 million and OTPS of \$138.5 million.

### **FACTORS AFFECTING TRAFFIC GROWTH**

The previous section of the report set forth the historical traffic and revenue data for the nine TBTA bridges and tunnels. Before developing the forecasts, several factors affecting future traffic were considered, including projected growth (population and other demographics), TBTA and regional construction impacts, capacity constraints in the regional highway network, and toll and elasticity impacts. *E-ZPass* improvements were discussed previously on pages M-8 and M-9. Finally in addition to these factors, this section of the report concludes with a summary of the assumptions and conditions upon which the traffic and toll revenue forecasts were based.

## **Employment, Population and Motor Vehicle Registrations**

Regional demographic data are maintained by the New York Metropolitan Transportation Council (NYMTC). Employment and population history and projections from 1970 to 2010 are included in the following tables. In assessing the impact of regional demographic indicators on potential traffic, in general, traffic volumes in the region are affected by changes in employment and population. Demand on the TBTA facilities, however, tends to be less influenced by regional demographic trends because water crossings are limited. Another indicator of trends in traffic volumes is motor vehicle registrations, which have continued to trend upward since 1970 in the tri-state region. To understand better how these indicators may influence traffic volumes on the TBTA crossings, URS reviewed historical trends and the NYMTC forecasts.

### *Employment Trends and Projections*

Jobs traditionally influence traffic generation. Generally, when the economy is robust and jobs are plentiful, there is a positive impact on traffic. Conversely, when employment trends are downward, traffic volumes generally decline.

A downward trend in employment occurred between 1970 and 1980 in New York City. Jobs declined by 1.2 percent per year, from 4,066,000 in 1970 to 3,614,000 in 1980. Staten Island, where employment increased by 3.5 percent per year, was the exception. Through 1998 (estimated), when employment for the City as a whole was at 3,862,000, jobs had not recovered to the 1970 level. These estimates of 1998 total employment by place of residence, developed by NYMTC, were compared with Bureau of Economic Analysis (BEA) estimates for the same year as shown in Table 11. As can be seen from the table the BEA employment estimates suggest that employment growth in the New York Region was considerably stronger in the last few years than NYMTC's estimates would suggest. NYMTC released new employment forecasts in December 2000. These forecasts have future year growth levels for New York City similar to the previous forecasts developed in 1996, but the estimated year 2000 employment base is higher than had previously been forecast. The year 2000 estimates now show New York City's employment at a higher level than at any time since 1970.

Between 1970 to 1990, employment increased in the New York suburbs, in Northern New Jersey and in Southern Connecticut, and continued to increase from 1990 to 1998, but at a lower rate of growth. NYMTC projects that employment in the area/region as a whole will grow during the forecast period, in the range of 0.4 to 1.3 percent annually.

**Table 11 Employment Trends and Projections  
(000s)**

Year	New York City						New York Region <sup>(b)</sup>	New Jersey Region <sup>(c)</sup>	Connecticut Region <sup>(d)</sup>
	Manhattan	The Bronx	Brooklyn	Queens	Staten Island	Total <sup>(a)</sup>			
1970	2,550	251	632	586	47	4,066	1,483	2,173	727
1980	2,278	217	516	537	66	3,614	1,834	2,848	869
1990	2,455	246	540	619	98	3,957	2,215	2,877	1,017
1998 Estimated	2,338	254	559	607	103	3,862	2,227	2,969	1,022
1998 BEA	2,650	269	580	637	114	4,250	2,307	3,138	1,116
2000-Projected	2,622	252	551	604	117	4,146	2,401	3,115	1,070
2005-Projected	2,730	266	569	619	125	4,310	2,494	3,279	1,126
2010-Projected	2,805	278	580	637	131	4,431	2,573	3,424	1,160
Average Annual Percent Change									
1970 to 1980	-1.1	-1.4	-2.0	-0.9	3.5	-1.2	2.1	2.7	1.8
1980 to 1990	0.8	1.3	0.5	1.4	4.0	0.9	1.9	0.1	1.6
1990 to 1998	-0.6	0.4	0.4	-0.2	0.6	-0.3	0.1	0.4	0.1
1998 to 2000	5.9	-0.0	-0.7	-0.2	6.6	3.6	3.8	2.4	2.3
2000 to 2005	0.8	1.1	0.7	0.5	1.3	0.8	0.8	1.0	1.0
2005 to 2010	0.5	0.9	0.4	0.6	0.9	0.6	0.6	0.9	0.6

- Notes: (a) Totals may not add due to rounding.  
 (b) Consists of the following counties: Dutchess, Nassau, Orange, Putnam, Rockland, Suffolk and Westchester.  
 (c) Consists of the following counties: Bergen, Essex, Hudson, Middlesex, Monmouth, Morris, Passaic, Somerset and Union.  
 (d) Consists of the following counties: Fairfield, Litchfield, New Haven.  
 Source: New York Metropolitan Transportation Council, US Bureau of Census, US Bureau of Labor Statistics.

A review of historical traffic demand for the TBTA crossings indicated that volumes did fluctuate systemwide during the 1970s and increased through the 1980s. During the 15-year period from 1985 to 2000, the most noticeable fluctuations occurred during the toll increase years, when traffic declined while revenues increased.

*Population Trends and Projections*

Between 1970 and 1980 population in New York City declined in The Bronx, Brooklyn, Manhattan and Queens, but increased in Staten Island. For the five boroughs, population totaled 7.9 million in 1970 and 7.1 million in 1980, as displayed in Table 12. The 1990 Census indicated that there was a turnaround and population grew at an average annual rate of approximately 0.3 percent. The recently released Census results for the year 2000 show the population of New York City grew by approximately one percent annually and now exceeds 8,000,000. The nearby New York and New Jersey counties also show increased growth. In Connecticut, population increases were in Fairfield County, the closest county to the TBTA facilities.

**Table 12 Population Trends and Projections**  
(000s)

Year	New York City						New York Region <sup>(b)</sup>	New Jersey Region <sup>(c)</sup>	Connecticut Region <sup>(d)</sup>
	Manhattan	The Bronx	Brooklyn	Queens	Staten Island	Total <sup>(a)</sup>			
1970	1,539	1,472	2,602	1,987	295	7,895	4,178	5,006	1,682
1980	1,428	1,169	2,231	1,891	352	7,072	4,314	4,915	1,725
1990	1,488	1,204	2,301	1,952	379	7,323	4,401	4,990	1,806
2000 Census	1,537	1,333	2,465	2,229	444	8,008	4,681	5,431	1,889
2000-Projected	1,560	1,184	2,267	2,010	417	7,449	4,598	5,278	1,821
2005-Projected	1,585	1,199	2,246	2,014	428	7,472	4,670	5,382	1,887
2010-Projected	1,612	1,205	2,253	2,024	438	7,534	4,747	5,525	1,920
Average Annual Percent Change									
1970 to 1980	-0.7	-2.3	-1.5	-0.5	1.8	1.1	0.3	-0.2	0.3
1980 to 1990	0.4	0.3	0.3	0.3	0.7	0.3	0.2	0.2	0.5
1990 to 2000	0.3	1.0	0.7	1.3	1.6	0.9	0.6	0.8	0.4
2000 to 2005	0.3	0.1	-0.2	0.0	0.5	0.1	0.3	0.4	0.7
2005 to 2010	0.3	0.1	0.1	0.1	0.5	0.2	0.3	0.5	0.3

- Notes: (a) Totals may not add due to rounding.  
 (b) Consists of the following counties: Dutchess, Nassau, Orange, Putnam, Rockland, Suffolk and Westchester.  
 (c) Consists of the following counties: Bergen, Essex, Hudson, Middlesex, Monmouth, Morris, Passaic, Somerset and Union.  
 (d) Consists of the following counties: Fairfield, Litchfield, New Haven.  
 (e) As of July 1, 1999.  
 Sources: New York Metropolitan Transportation Council, US Census Bureau.

NYMTC’s latest population projections for the Tri-State region for 2000 to 2010 were prepared in 2000, and 2010 population for New York City is forecast as reaching 7,534,100. As noted above, the recently released census results for New York City show the population already exceeds 8,000,000 and NYMTC’s forecast for 2010. It should be noted that NYMTC’s latest population projections for the Tri-State region for 2000 to 2010 were adopted in December 2000, prior to the release of the Census findings.

With the 2000 Census exceeding previous expectations and population increases region-wide, population should have a positive effect on traffic demand on the TBTA crossings.

*Motor Vehicle Registrations*

One of the indicators of traffic stability and/or growth in an area is the trend in the number of motor vehicle registrations. As shown in the following table, motor vehicle registrations increased slightly for the period 1992 through 1996 in New York, New Jersey and Connecticut, and decreased slightly in New York City. Motor vehicle registrations grew at a higher pace during the 1997-1999 period, reaching 2.4 percent in New York City, 2.0 percent in New York State and New Jersey and 2.3 percent in Connecticut. As illustrated in Table 13, these figures represent an upward trend in motor vehicle registration growth for the Tri-State area.

Motor vehicle registrations are not projected for future years. However, based on past trends, it is expected that growth will continue in regional motor vehicle registrations in parallel with the demographic indicators.

**Table 13 Motor Vehicle Registrations**  
(000s)

Year	New York City	New York State <sup>(a)</sup>	New Jersey	Connecticut
1992	1,898 <sup>(b)</sup>	8,988 <sup>(b)</sup>	5,364	2,527
1993	1,911	9,110	5,410	2,536
1994	1,907	9,149	5,534	2,559
1995	1,896	9,177	5,607	2,582
1996	1,862	9,235	5,632	2,578
1997	1,907	10,027 <sup>(c)</sup>	5,688	2,610
1998	1,943	10,174	5,683	2,663
1999	2,001	10,437	5,917	2,731
2000	2,044	10,661	NA	NA
Average Annual Growth				
1992-1996	-0.5%	0.7%	1.2%	0.5%
1997-2000	2.3	2.1	2.0 <sup>(d)</sup>	2.3 <sup>(d)</sup>

- Notes: (a) Including New York City.  
 (b) Beginning in 1992 New York State changed the reporting of motor vehicle registrations from the number of registrations issued to the number of registrations in force.  
 (c) A computer change in 1997 resulted in numbers that are not comparable to earlier years.  
 (d) Average annual growth rate for 1997-1999.  
 Source: New York State Statistics Yearbook 1988-1998, New York State Department of Motor Vehicles, Connecticut Department of Motor Vehicles and New Jersey Department of Motor Vehicles.

In summary, generally, employment indicators overall seem to have had a more noticeable effect on traffic volumes on the TBTA facilities than population growth. However, regional demographic trends are not always independently discernable relative to the yearly traffic variations. As discussed throughout this report, demand for the TBTA crossings has been strong overall, and NYMTC's regional employment and population projections indicate an increasing trend throughout the forecast period.

### Fuel Conditions

The availability and pricing of motor fuel has affected the use of TBTA facilities. During the past 29 years, fluctuations in traffic volumes occurred when fuel was either in short supply and/or prices increased rapidly. These conditions existed in 1973-1974, the summer of 1979, during the Persian Gulf tensions and war in 1990-1991 and, most recently, during 1999 and the beginning of 2000 when prices increased due to restricted supplies.

In 1974, there was a 4.9 percent decline in TBTA traffic and slower growth in subsequent years (1.5 percent per year in contrast to the 3.8 percent prior to 1974) as the economy slowed and fuel prices rose. Succeeding fuel shortages caused temporary traffic decreases that resulted in no permanent effects on traffic growth in subsequent years.

The United States has established the Strategic Petroleum Reserve (SPR) to provide protection against short-term disruptions in petroleum supplies. Recent inventory levels provide 67 days of protection based on the United States net import rate for crude and petroleum products during 1996. Nevertheless, as the United States becomes increasingly dependent on foreign sources for petroleum and refined products, it becomes more susceptible to foreign disruptions in supplies. There are factors in the world petroleum market, however, that lower these risks. These include the erosion in the market share held by the Organization of Petroleum Exporting Countries (OPEC) during the past 20 years due to the growth in production by non-OPEC nations and a diversity of interests among OPEC members that conditions OPEC's strategic objectives regarding pricing and resource development.

Unadjusted fuel prices declined from 1980 to 1985 and began to increase through the 1990s. However, when adjusted by the consumer price index, fuel prices actually declined between 1980 and 1997 by 51 percent.

Prices have increased for the last two years due to OPEC controls on output and increased demand due to improvements in the economy. However, these price increases did not adversely affect TBTA traffic. On March 19, 2001 (the latest period for which data are available), the average price was \$1.44 per gallon, compared to \$1.031 in January 1999. Since March 19, prices have increased by approximately 22 cents; however, when adjusted to reflect changes in the CPI, the current price of gasoline is still significantly below the 1980 peak price, which, if adjusted for inflation would be more than \$2.50 per gallon in current dollars. It is anticipated that future increases in gasoline prices will not affect traffic unless they are of a magnitude exceeding the adjusted 1980 value.

World oil prices nearly tripled in the period between December 1998, their lowest point in ten years, and August 2000, pushing gasoline prices up. Domestic gasoline prices dropped about 10 cents per gallon between September 2000 and March 2001, but have increased since then. It is anticipated by the Energy Information Administration (EIA), a division of the US Department of Energy that US gasoline prices will rise as the summer months approach. With the economic outlook deteriorating, oil demand in the United States and other regions of the world is now seen as likely to increase at a slower pace in 2001. OPEC recently announced cuts in production to offset normal seasonal declines in demand and prices expected to be exacerbated by a slowing US economy. Also, the availability of fuel could be restricted due to environmental requirements for reformulated gasoline, reductions in domestic refinery capacity and reduced inventories. At the present time, it is the domestic refining conditions rather than cuts in OPEC production that is driving up prices.

The Annual Energy Outlook, 2001, issued by the Energy Information Administration, addresses the longer-term trends in energy demand and supply. Fuel supplies in the transportation sector are projected to be sufficient during the next ten years. Motor gasoline use is projected to increase 1.3 percent per year over the next 20 years. Alternative fuels are projected to displace about 2.1 percent of light-duty vehicle fuel consumption, in response to current environmental and energy legislation intended to reduce petroleum-based fuel use during that 20-year period. Gasoline's share of demand is expected to be sustained, however, by relatively low gasoline prices and slower fuel efficiency gains for conventional light-duty vehicles than were achieved during the 1980s. Over the longer term, economic growth is expected to lead to an increase in freight transportation with a corresponding increase in diesel use.

### **Toll Impacts and Elasticity**

Tolls that are increased periodically affect traffic usage, especially if they outpace the rate of inflation, as they have on the TBTA facilities, as well as in those instances where competing facilities provide a good alternative. Elasticity, as used herein, is the relationship between traffic volume and the toll rate change. The factor,  $e$ , represents the relative decrease in traffic corresponding to a given increase in toll. The higher absolute value, which is a negative figure, the more apt a facility is to lose traffic, which can be due to diversions to competing facilities, switches in travel modes, consolidation of trips and elimination of trips.

URS developed a set of elasticity factors for each of the TBTA crossings based on historical toll increases to estimate the impact on traffic and toll revenue when tolls are increased in the future. Elasticity, in this sense, is used to analyze the relationship between tolls and use, i.e., when tolls are increased, motorists react and travel patterns may change.

In estimating revenue for toll facilities, elasticity factors represent the relationship between traffic volume and toll rate changes. As used herein, elasticity represents the decrease in traffic corresponding to the increase in tolls. The factors developed by URS for each crossing are updates of previously-derived factors (including the most recent toll increases) and are based on an analysis of traffic data for the periods before, at the time of, and after the toll increases.

URS last developed elasticity factors in 1997 following the TBTA general rate increase in March 1996. These elasticity factors (which are averages compiled from analyses of the 1996 and previous toll increases) remain appropriate, in the opinion of URS, for use in projecting traffic and revenues in reaction to future toll increases on the TBTA facilities. However, the factors are considered conservative since *E-ZPass* has afforded the users of the TBTA facilities improved travel conditions.

**Table 14 Elasticity Factors**

Facility	Elasticity Factor
Throgs Neck and Bronx-Whitestone Bridges	-0.085
Triborough Bridge	-0.196
Queens Midtown Tunnel	-0.208
Brooklyn-Battery Tunnel	-0.386
Verrazano-Narrows Bridge	-0.120
Henry Hudson Bridge	-0.298
Marine Parkway-Gil Hodges Memorial Bridge	-0.110
Cross Bay Bridge	-0.149

Elasticity factors vary, demonstrating that users react differently to toll increases depending on influencing conditions. On the TBTA crossings, elasticity tends to be influenced by the proximity of the toll-free City bridges and other considerations. The low factors for the Throgs Neck and Bronx-Whitestone Bridges indicate their relative isolation from the nearest toll-free competitor, the Queensboro Bridge. Further south on the East River at the Triborough Bridge and the Queens Midtown and Brooklyn-Battery Tunnels in that order, elasticity increases as the degree of toll-free competition increases. The TBTA tunnels tend to lose traffic particularly when the competing crossings are operating under reasonable levels of traffic service and providing motorists with viable toll-free alternatives during non-peak periods. In addition, trip purpose influences demand, i.e., peak-period, work-related trips are less elastic than off-peak trips that do not have travel-time constraints.

If the historical increase patterns continue, it can be expected that tolls will be increased again during the forecast period (through 2010). Accordingly, for the purposes of projecting traffic and toll revenue, URS has prepared two sets of forecasts: one at constant tolls (at the present level); and the other with toll increases in January 2003 and again in January 2008.

For the toll-increase alternative, it was assumed that the toll levels (i.e., the cash toll for passenger cars) on the major and minor crossings would be increased to \$4.00 and \$2.00 respectively in January 2003, and to \$4.50 and \$2.25 respectively in 2008. It was also assumed that the truck tolls would be increased proportionately, and that the *E-ZPass* tolls for passenger cars would consistently be 50 cents lower than the respective cash tolls. This is consistent with the experience of the March 1996 toll increase. In the context of the assumed toll increase scenario, the average toll would increase 14.3 percent in 2003 and 12.5 percent in 2008. (These percentages are listed in Table 15 in connection with the elasticity impacts.) The increases in the average tolls themselves are listed in Table 18 as part of the revenue forecast for the toll-increase alternative.

As for the impacts of the toll increases on traffic demand, the elasticity factors from Table 14 were applied in Table 15, assuming the toll increases described previously would occur on January 1, 2003 and January 1, 2008. These traffic impacts represent the reduction in values from the corresponding annual traffic levels that would be expected if the tolls were not increased.

**Table 15 Traffic/Toll Elasticity**

Facility	Elasticity Factor	Estimated Percent Change in Toll Rates and Traffic			
		2003		2008	
		Toll	Traffic	Toll	Traffic
Throgs Neck Bridge, Bronx-Whitestone Bridge	-0.085	14.3%	-1.2%	12.5%	-1.1%
Triborough Bridge	-0.196	14.3	-2.8	12.5	-2.4
Queens Midtown Tunnel	-0.208	14.3	-3.0	12.5	-2.6
Brooklyn-Battery Tunnel	-0.386	14.3	-5.6	12.5	-4.8
Verrazano-Narrows Bridge	-0.120	14.3	-1.7	12.5	-1.5
Henry Hudson Bridge	-0.298	14.3	-4.3	12.5	-3.7
Marine Parkway-Gil Hodges Memorial Bridge	-0.110	14.3	-1.6	12.5	-1.4
Cross Bay	-0.149	14.3	-2.1	12.5	-1.9

### Bridge and Tunnel Capacities

URS assessed the peak-hour capacity level of each facility at the mid-point of the bridge or tunnel, based on a highway-type capacity analysis. We recognize, however, that the TBTA bridges and tunnels have different physical and operational characteristics than do highways. Therefore, in our capacity assessment, we considered operational factors such as ramp approaches, vehicle merges, grades, sight lines, lane widths, lack of shoulders, and vehicle spacing and lane configuration at toll plazas, including *E-ZPass* lanes.

The local street system feeding the TBTA crossings also becomes constrained during peak periods, with unstable traffic flows occurring on congested roadways.

We also reviewed toll plaza operations with the electronic toll payment system. Characteristics of the *E-ZPass* system are discussed throughout this report. The acceleration of vehicle throughput for *E-ZPass* customers has mitigated congestion at the toll plazas. With *E-ZPass* use at the 68 percent level at the beginning of 2001, and the customer base increasing, efficient toll plaza operations are anticipated throughout the forecast period.

Additionally, we reviewed past annual traffic volumes at each facility to determine the peak volume years. We found that, in 2000, the Bronx-Whitestone Bridge, the Verrazano-Narrows Bridge and the Henry Hudson Bridge were performing at the highest volumes achieved in past years, in part, as a result of the implementation of *E-ZPass*.

**Table 16 Comparison of 2000 Traffic with Highest Recorded Levels Since 1970**

Facility	Highest Volume Since 1970		2000 Volume (000s)	2000 Percent of Highest Volume
	Year	Volume (000s)		
Throgs Neck Bridge	1999	38,069	37,500	98%
Bronx-Whitestone Bridge	2000	42,300	42,300	100
Triborough Bridge	1988	64,215	63,600	99
Queens Midtown Tunnel	1971	28,742	26,600	92
Brooklyn-Battery Tunnel	1971	22,920	21,300	93
Verrazano-Narrows Bridge	2000	69,100	69,100	100
Henry Hudson Bridge	2000	22,500	22,500	100
Marine Parkway-Gil Hodges Mem. Br.	1971	9,150	7,200	79
Cross Bay Bridge	1972	7,562	6,400	79

While traffic volumes during peak hours may approach capacity and limit traffic growth during these hours, there is room for traffic growth during non-peak conditions through peak spreading. Traffic volumes can continue to grow, but growth would be at a slower pace.

**TBTA and Regional Construction Impacts**

Traffic volumes on TBTA facilities are influenced by construction and rehabilitation projects involving roadways and bridges in the New York City area. Major projects that result in long-term lane closures on the competing bridges may increase volumes on TBTA’s facilities. In particular, the rehabilitation of the Queensboro and Williamsburg Bridges has resulted in traffic diversions to the Queens Midtown Tunnel. Also, long-term lane closures on the roadway network serving TBTA crossings may adversely affect TBTA volumes or cause traffic to shift from the affected crossing to another TBTA facility. For example, when the approach ramps from the Cross Island Parkway to the Throgs Neck Bridge were rehabilitated in 1995, some traffic diverted from the Throgs Neck Bridge to the Bronx-Whitestone Bridge.

A number of roadway construction/rehabilitation projects, over the past few years, have influenced traffic volumes on TBTA facilities, and future construction will also affect traffic. The following descriptions highlight area construction activities that have influenced TBTA volumes and those that will affect traffic during the forecast period. Information on future construction activity was obtained from the New York State Department of Transportation, the New York City Department of Transportation, NYMTC, and the Port Authority of New York and New Jersey.

In general, construction activities programmed for the TBTA facilities themselves are scheduled to take place during off-peak hours, including nighttime lane closures in the tunnels. Therefore, they are expected to have no discernible effect on toll revenue. However, deck reha-

bilitation of the Bronx truss of the Triborough Bridge is scheduled to occur over five stages for three years. From January 1, 2000 through December 31, 2002, one lane will be closed at all times; an additional lane will be closed at off-peak and evening hours and on weekends. Due to available capacity in the lanes that will remain open, little adverse impact on revenue is anticipated.

### *Competing East River Crossings*

- ▶ Queensboro Bridge – Since 1989, numerous rehabilitation projects have involved the upper or lower levels, or ramp approaches to the bridge.

Most of this work is completed. The remaining work, which does not involve lane closures, is currently underway and will be completed in September 2001. Between August 1995 and July 2000 the lower outer roadways were rehabilitated. The north outer roadway (Manhattan bound) is now open to pedestrians and bicyclists at all times and the south outer roadway is now open at all times. Currently, one lane may be closed on either the south upper or south inner lower roadway during off-peak, night, and weekend periods. Also, one lane may be closed on the north inner roadway on weeknights and weekends for routine maintenance work.

These lane closures should not result in significant traffic diversions to the Queens Midtown Tunnel and Triborough Bridge.

- ▶ Williamsburg Bridge – Between 1991 and 1995, the bridge cables were rehabilitated and the suspenders were replaced. The south roadways were rehabilitated between 1994 and 1998.

The reconstruction of north roadways, which is a mirror image of the south roadways, started in April 1999 and is scheduled to be completed in December 2002. The replacement of the Marcy Avenue ramp connector to the Brooklyn-Queens Expressway has been added as a change order. As of January 29, 2001, the two north roadways were closed for rehabilitation. The north outer roadway will remain closed until January 2002 and the north inner roadway until July of the same year. During this time two lanes will be open in each direction on the south roadways. Truck traffic is accommodated on the south outer roadway eastbound and prohibited from using this bridge westbound to Manhattan until January 2002. The ramp from the Brooklyn-Queens Expressway (BQE) to the Williamsburg Bridge has been reduced from two lanes to one lane in each direction until mid-November 2001. A temporary bridge has been installed at Rodney Street and Borinquen Place to allow Brooklyn bound traffic from the Williamsburg Bridge to access the eastbound BQE.

These lane closures may result in traffic diversions to the Queens Midtown Tunnel.

- ▶ Manhattan Bridge – Since 1992, the south upper roadway has been undergoing reconstruction. Painting work started in August 1999 on the south upper roadway, and the

lower roadway was completed in April 2001. Currently, one lane of the lower roadway is closed 24 hours a day in the Manhattan-bound direction during the week, and a second lane may be closed Monday to Friday during off-peak periods of the day until August 2001. From August 2001 to April 2002, one lane on the lower roadway will be closed during off-peak hours. Between April 2002 and April 2003, both lanes on north upper roadway (Manhattan bound) will be closed at all times with one additional lane closed on the lower roadway during off-peak hours. One lane each on the north upper roadway and lower roadway will be closed during off-peak hours from April 2003 to April 2004. On the lower roadway, one lane will be closed at all times from January 2005 to January 2007.

These lane closures can result in traffic diversions to the Brooklyn-Battery Tunnel.

- ▶ Brooklyn Bridge –The Brooklyn Bridge Emergency Design Build Deck Replacement contract started in October 1998 and was completed May 2000. Currently, one lane is closed eastbound during off-peak hours for routine maintenance.

Since lane closures are scheduled for off-peak hours of the day, limited traffic diversion to the Brooklyn Battery Tunnel can be expected.

### *Major Roadways*

During the forecast period, several other major roadway projects, which are part of NYMTC's Transportation Improvement Program (TIP) for 2000-2004, will potentially have traffic implications for TBTA facilities. The TIP includes the planned year of construction; however, it is not mandated that this schedule be adhered to. Some of these projects do not yet have lane closure plans, which will be developed in coordination with NYCDOT and local community boards. As a matter of policy, NYCDOT seeks to restrict lane closures to off-peak and nighttime hours. Roads programmed for construction include:

- ▶ The Willis Avenue Bridge – Connecting the FDR Drive, Harlem River Drive, Major Deegan Expressway and Bruckner Expressway, this bridge will undergo major reconstruction during NYMTC's current five-year Transportation Improvement Program (TIP). Currently, one of two lanes may be closed during the off-peak daytime periods, to allow repair work on the First Avenue approach. Also, on weeknights one lane will be maintained on the Bruckner Boulevard exit ramp. This could divert some traffic to the Triborough Bridge.
- ▶ Major Deegan Expressway – Multi-year rehabilitation of roadway structures from the Triborough Bridge to the Westchester County line. This may have a negative effect on Triborough Bridge traffic. Between the end of March and the middle of May 2001, there will be closures on the northbound Major Deegan Expressway at 149th Street. There will also be single lane closures during off-peak hours and on weekends. In addition, there were double lane closures during late night hours.

- ▶ Cross Bronx Expressway – Rehabilitation of roadway structures from Morris Avenue to Castle Hill Boulevard. This work, scheduled for completion by June 2003, includes the ramp from the Bruckner Expressway northbound to Cross Bronx Expressway eastbound which will be completely closed until August 2001. A detour has been implemented. With the exception of this complete ramp closure, which is expected to affect access to the Throgs Neck Bridge, the impact on Throgs Neck and Bronx-Whitestone Bridge traffic should be minimal.
- ▶ Bruckner Expressway/Bronx River Parkway – Resurfacing includes off-peak one lane closures of the northbound and southbound Bronx River Parkway at E. 174th Street; closure of one lane of the southbound and northbound Throgs Neck Expressway at Randall Avenue and at Castle Hill Avenue during off-peak periods. This work was scheduled for completion in March 2001; however, sporadic closures continued through April 2001. The impact on Throgs Neck and Bronx-Whitestone Bridge traffic should be minimal.
- ▶ Gowanus Expressway – Several alternatives to rehabilitation are currently being reevaluated. The final EIS is expected to be completed in 2004 and an executive decision made in 2005. During 2001 the northern section of the Gowanus Expressway, from Brooklyn-Battery Tunnel to Sixth Avenue, will have single lane closures in the inbound and outbound directions during off-peak periods for on-going repairs while final alternatives are determined. The lane closures do not appear to reduce traffic at the Brooklyn-Battery Tunnel and Verrazano-Narrows Bridge.
- ▶ Brooklyn-Queens Expressway (BQE) Park Avenue Viaduct – Reconstruction of viaduct from Flushing Avenue to Sands Street. Other sections of the BQE are programmed for rehabilitation of pavement. Current plans call for maintaining six lanes of traffic during construction. The impact on the TBTA facilities should be minimal.
- ▶ Long Island Expressway (LIE) – Reconstruction work is being undertaken to repair and improve structural, operational and safety deficiencies of the roadway. The work primarily involves single lane closures during off-peak periods. The entire project is scheduled to be completed in 2003. This may have a negative effect on Queens Midtown Tunnel traffic.
- ▶ Queens Boulevard – Reconstruction of the Queens Boulevard and the Honeywell Street Bridges over The Long Island Rail Road's Sunnyside Yard began in April 2001 and is scheduled for completion in the fall of 2002. Of the total six lanes serving both directions, only two will be open inbound (westbound) during this period. This construction will have a positive impact on the volume of traffic using the Queens Midtown Tunnel, but it is too soon to assess the scale of that impact.
- ▶ Staten Island Expressway (SIE) – Rehabilitation of roadway structures from Verrazano-Narrows Bridge to Goethals Bridge. Resurfacing of the SIE scheduled for completion in April 2001. Both the east and westbound directions have single lane closures daily during the off-peak periods and for longer periods at the weekends, and closures as needed at

night. This may have a negative effect on Verrazano-Narrows Bridge traffic.

- ▶ Throgs Neck Bridge/Expressway approach in The Bronx – Rehabilitation of the southbound structure over the Cross Bronx Expressway recently began and will continue through July 2001, resulting in a one-lane closure throughout the project. This may result in a shift of traffic to the Bronx-Whitestone Bridge.
- ▶ Broadway Bridge – Rehabilitation in 2001 and 2002. This may divert traffic to the Henry Hudson Bridge.
- ▶ Henry Hudson Parkway – Two-year (2000-2002) safety improvement project, including roadway resurfacing. One of three lanes may be closed northbound and southbound between W. 125th Street and W. 100th Street during off-peak daytime periods. This project may counteract the effects of the Broadway Bridge rehabilitation.
- ▶ FDR Drive – NYSDOT has programmed and will design or implement rehabilitation projects from E. 28th to 38th Street and from E. 56th Street north to the Triborough Bridge. Work on the upper segment may have a negative effect on Triborough Bridge traffic. This year one of three lanes on FDR Drive will be closed in each direction at E. 125th Street during off-peak hours.
- ▶ Harlem River Drive – NYSDOT is designing and will reconstruct the Harlem River Drive viaduct from E. 127th Street to Dyckman as well as other spot ramp and geometric improvements on other sections of the Drive. During 2001, one lane may be closed southbound and northbound during off-peak time periods in the vicinity of W. 178th Street for bridge construction work. Further south, under the Macombs Dam Bridge, one of three lanes northbound and southbound may be closed weekdays during off-peak periods. This may have a negative effect on Triborough Bridge traffic.
- ▶ Belt Parkway – Four waterway bridges in Brooklyn have been identified (as of April 2000) in NYMTC's Transportation Improvement Program as in need of rehabilitation: Mill Basin (2001), Fresh Creek (2001), Gerritsen Inlet (2002) and Paerdegat Basin (2003). One of three lanes may be closed during off-peak daytime hours, in the westbound direction on the Belt Parkway at Flatbush Avenue and Coney Island Avenue. At Paerdegat and Mill Basins one of three eastbound and westbound lanes will be closed during off-peak periods. At Cropsey Avenue, one of three eastbound lanes will also be closed during off-peak periods. Assuming adequate management of traffic operations during construction, the impact on Verrazano-Narrows and Brooklyn-Battery Tunnel traffic should be minimal.

As of March 2001, the Port Authority of New York and New Jersey reported that modernization and expansion of the Goethals Bridge has been accepted in its 5-year capital strategy plan. The Final Environmental Impact Statement will be updated in conjunction with the US Coast Guard.

## Other Considerations

Other considerations in the development of the traffic and revenue forecasts for the TBTA facilities include the potential impacts of transit improvements and Clean Air regulations in the Metropolitan Area.

- ▶ *Impact of Transit Improvements.* There are no transit improvements that are expected to affect significantly TBTA traffic levels during the forecast period through the year 2010. This is reinforced, for example, by the last major transit improvement on Long Island that might have affected TBTA traffic levels when it was completed in 1988: the extension of electrification on The Long Island Rail Road's (LIRR) Ronkonkama branch. There was no noticeable impact.

A similar impact is expected for the two major transit improvements presently under construction: the subway connection between the 63rd Street tunnel and the Queens Boulevard line, scheduled for completion in the fall of 2001; and the JFK Airtrain connections to the subway line at Howard Beach and the LIRR and subway at Jamaica, planned for completion by 2004. The raising of concrete columns in the median of the Van Wyck Expressway to Jamaica has been completed and the superstructure is now under construction. Construction is now moving east toward the Jamaica Station site, where site preparation is underway on the Long Island Rail Road property.

Other longer-range transit improvements in various stages of planning that might affect TBTA traffic levels beyond the forecast period include the Eastside Access project to bring LIRR trains into Grand Central Terminal which LIRR anticipates will result in shifts from other modes, including TBTA facilities. Other long-range projects are the lower Manhattan-Brooklyn improvements to the existing subway tunnels (signalization, etc.), Metro-North access to Penn Station (via Amtrak's westside trackage), LaGuardia Airport subway access, and a Second Avenue subway.

On the operational side, MetroCard now provides free subway-bus transfers and 11 trips for the price of 10, plus unlimited-trip monthly, weekly and daily cards, all of which have not had any noticeable impact on TBTA traffic. The positive impacts of the economy and *E-ZPass* usage have masked any negative impact these MetroCard privileges may have had on vehicular traffic on TBTA facilities.

- ▶ *Clean Air Regulations.* In response to Section 182(d)(1)(B) of the Clean Air Act, the State of New York imposes voluntary regulations aimed at increasing the average vehicle occupancy of work-related trips. Known as the Employee Commute Options (ECO) program, the plan encourages employers of 100 or more persons in the severe ozone non-attainment areas to submit a compliance plan that is aimed, through ride sharing, at reducing the number of employees that commute to work alone by automobile. Included in New York State's severe ozone non-attainment areas are all five boroughs of New York City, and the counties of Nassau, Suffolk, Rockland, Westchester, and portions of Orange. Similar programs are currently in place for severe non-attainment areas in New

Jersey, Connecticut and Pennsylvania. Since URS' traffic estimates are derived from 2000 year levels which already take into account any impacts the ECO program may have, no further adjustments are necessary to reflect any negative effects this might have on TBTA revenues.

### **Summary of Assumptions and Conditions**

TBTA traffic, revenues and expenses have been projected by URS on the basis of the historical record of traffic, revenues and expenses, the capacities of the TBTA facilities, traffic growth forecasts, the estimated traffic elasticity due to toll variations and the following assumptions and conditions, which we believe are reasonable.

- ▶ All TBTA facilities will be operated efficiently and maintained in good physical condition in order to attract customers and to sustain traffic demand levels.
- ▶ The TBTA adopted capital programs for 2000-2004 will be implemented as planned throughout the forecast period. Future capital programs sufficient to maintain the structural integrity of bridges and tunnels will be adopted and implemented throughout the forecast period.
- ▶ For the scenario with periodic toll increases, toll rate increases will be implemented in accordance with the schedule contained in this report.
- ▶ Elasticity factors, prepared by URS based on previous toll increases, are valid in their application to future toll rate increases to estimate future traffic and toll revenue.
- ▶ Electronic toll payment by *E-ZPass* will continue to be available on all TBTA crossings, and the payment of revenue in full to TBTA will continue to be in accordance with inter-agency agreements.
- ▶ Capacity constraints in the arterial highway network will continue to limit traffic growth on the nine TBTA crossings.
- ▶ Highway/crossing improvements, in general, for the competing bridges and roadway network will be made in accordance with the plans and schedules described herein.
- ▶ Major TBTA roadway and structural improvements will continue to be performed during nighttime and non-peak hours, and approaches to the nine TBTA crossings will not be significantly impaired by construction work beyond the items discussed in this report.
- ▶ Competing East River crossings will continue to operate toll-free and to be maintained in efficient operating condition.

- ▶ The generally upward trend in regional employment and population, forecast by the New York Metropolitan Transportation Council and presented in this report, will be realized in the Tri-State area and in New York City.
- ▶ MetroCard discount privileges continue to have no material effect on traffic on TBTA crossings.
- ▶ Should fuel shortages occur, they will be limited in duration, and motor fuel prices (i.e., the average price for regular gasoline) in the foreseeable future will not increase above the 1980 peak, which, if adjusted for inflation, in current dollars would not be more than \$2.50 per gallon.
- ▶ Public transportation systems will not undergo any major construction programs nor schedule changes that would materially alter regional commuter patterns and result in significant traffic diversions from TBTA facilities.
- ▶ Current toll discount programs remain in effect at current projected levels including the \$0.50 discount for *E-ZPass* auto customers and the Staten Island residents' discount program for the Verrazano-Narrows Bridge.
- ▶ The effects of the toll-rebate program, implemented in January 1998, for the benefit of *E-ZPass* customers who are residents of Broad Channel and Rockaway peninsula traveling on the Cross Bay Bridge, are fully reflected in the results for 1998 and, therefore, no further impact will occur.
- ▶ No other toll discount programs will be introduced that would adversely impact the TBTA toll facilities' revenue stream.
- ▶ No natural disaster, or local, state or national emergency will occur that would alter travel patterns and divert traffic from the TBTA facilities.

While the projections are made and presented year-by-year by URS, they are intended to show trends on the basis of its analysis of historical data and the assumptions and conditions set forth above. Variations in the year-to-year forecasted results may occur and such variations may be significant.

## **PROJECTED TRAFFIC, REVENUES AND EXPENSES**

Future traffic and toll revenues are estimated for the ten-year (2001-2010) forecast period for each TBTA facility based on historical trends in traffic and revenue, demand for the crossings, elasticity factors for future toll increases, toll collection operations, capacities of the nine crossings, facility maintenance, *E-ZPass* participation levels, externalities such as area roadway improvement plans and regional demographic projections, and the assumptions and conditions summarized previously. Changes in these factors, which will potentially affect future traffic and toll revenue, are detailed throughout this report.

Trends in operating expenses for the toll facilities, TBTA's three-year budget projections, and growth estimates based on the Consumer Price Index (CPI) prepared by The WEFA Group, are input to the future operating expense forecast. Future operating expense estimates are used to develop net revenue projections over the forecast period.

Traffic and toll revenues were first projected on the basis that the current tolls will be continued throughout the forecast period. Then, using these estimates as a base, URS applied the elasticity impact factors listed in Table 15 and adjusted the average tolls to develop the forecast with periodic toll increases.

### **Traffic and Toll Revenue at Current Tolls**

The methodology employed by URS to forecast traffic was based on the development of an annual growth rate for each facility (based on the historical traffic trends), modified by the construction activities (historical and projected) throughout the highway network (bridges, tunnels and arterials) and the traffic capacity constraints in the network. Regional demographic projections were also taken into consideration.

All indicators point to the potential for traffic increases in the future at modest rates of growth. URS estimates that traffic on the Throgs Neck, Verrazano-Narrows, Bronx-Whitestone, Henry Hudson and Triborough Bridges will increase primarily during the off-peak period, since these bridges have exceeded or are expected to exceed their capacity levels with respect to the highest recorded levels achieved since 1970 (from Table 16) during the forecast period. Capacity constraints in the highway network (e.g., Cross-Bronx, Gowanus and Staten Island Expressways and Henry Hudson Parkway) during peak periods are the contributing factors. The technique used in the forecast was to reduce the potential growth rates by 50 percent to reflect lower overall growth once the capacity level is reached in the peak period. This approach produces conservative forecasts inasmuch as the introduction of *E-ZPass* has provided some additional capacity at the toll plazas.

For the other facilities, the use of the selected growth rates will result in volume increases during the forecast period that will remain below the previous highest levels achieved.

On this basis, starting with the estimated traffic by facility from Table 9 (that now fully reflects the impact of the use of *E-ZPass* on TBTA facilities as well as the traffic constraints in the highway network), URS projected the traffic by facility in Table 17, and calculated the corresponding toll revenue based on the 2000 average tolls by facility (also from Table 9).

General traffic growth in the range of 0.55 to 1.7 percent annually is estimated in the forecast period. This growth is based on the actual growth in traffic on each facility during the last ten years, after the impact of toll increases was taken into account, and a review of actual and forecast population growth in the region. Since the actual population growth during the last ten years exceeded NYMTC's estimated growth during the period and their population forecast for 2010, greater weight was given to the historical trends in developing the forecasts. The irregularities in the forecast (as indicated in the Table 17 footnotes) are the result of the construction, capacity and *E-ZPass* participation factors described herein:

1. For the Throgs Neck Bridge, Bronx-Whitestone Bridge, Verrazano-Narrows Bridge, Henry Hudson Bridge and Triborough Bridge, the growth rate for traffic is reduced by 50 percent to reflect network capacity conditions.
2. In 2003, Queens Midtown Tunnel traffic is estimated to be reduced by 3 percent from the 0.8 percent upward trend (net impact of minus 2.2 percent) due to the completion of construction on the Williamsburg Bridge at the end of 2002. (URS' review of the historical data indicates that Tunnel traffic was boosted 6 percent in 1996 when improvements at the tunnel and its approaches were completed and construction on the Williamsburg Bridge began.)

The reconstruction of the Gowanus Expressway, started during 2000, did not have an effect on traffic growth in the Brooklyn-Battery Tunnel and on the Verrazano-Narrows Bridge; therefore, there are no additional impacts estimated during the time period included in these forecasts. Also, in 2002, Throgs Neck Bridge and Bronx-Whitestone Bridge traffic have been redistributed to reflect a return to the historical distribution of traffic on these two bridges after the completion of the current construction projects on the Cross Bronx Expressway.

### **Traffic and Toll Revenue with Periodic Toll Increases**

As mentioned previously, the traffic forecast with periodic toll increases was built upon the base (current tolls) forecast (from Table 17), to which the elasticity impacts (from Table 15) were applied. URS then applied the appropriate increased average tolls (the 2000 averages from Table 9 increased by the percentages in Table 15) in the years 2003 and 2008 (effective January 1) to calculate the corresponding toll revenues in the respective years. URS made adjustments to the growth rates to reflect the available capacity due to traffic reductions resulting from the impacts of toll rate increases. The traffic and revenue forecasts with periodic toll increases are listed in Table 18.

**Table 17 Traffic and Toll Revenue Forecast  
Constant Tolls**

Years	Throgs Neck <sup>(b)</sup>	Bronx-Whitestone <sup>(b)</sup>	Tri-borough <sup>(b)</sup>	Queens Midtown <sup>(c)</sup>	Brooklyn-Battery	Verrazano Narrows <sup>(b)</sup>	Henry Hudson <sup>(b)</sup>	Marine Parkway-Gil Hodges Memorial	Cross Bay	Total
<b>Annual Traffic (000s)</b>										
2001 <sup>(a)</sup>	37,938	42,750	64,342	26,772	21,458	70,264	22,857	7,329	6,462	300,171
2002	39,983	41,592	64,696	26,987	21,630	70,861	23,177	7,453	6,572	302,950
2003	40,203	42,050	65,052	26,393	21,803	71,463	23,501	7,580	6,684	304,728
2004	40,424	42,512	65,410	26,604	21,977	72,071	23,830	7,709	6,797	307,334
2005	40,646	42,746	65,769	26,817	22,153	72,683	24,164	7,840	6,913	309,731
2006	40,870	42,981	66,131	27,031	22,330	73,301	24,502	7,973	7,030	312,150
2007	41,095	43,218	66,495	27,248	22,509	73,924	24,845	8,109	7,150	314,591
2008	41,321	43,455	66,860	27,466	22,689	74,552	25,193	8,246	7,271	317,054
2009	41,548	43,694	67,228	27,685	22,871	75,186	25,546	8,387	7,395	319,540
2010	41,777	43,935	67,598	27,907	23,054	75,825	25,903	8,529	7,521	322,048
<b>Traffic Growth (Percent)</b>										
2001-2002	1.10%	0.55%	0.55%	0.80%	0.80%	0.85%	1.40%	1.70%	1.70%	
2002-2003	0.55	1.10	0.55	-2.20	0.80	0.85	1.40	1.70	1.70	
2003-2004	0.55	1.10	0.55	0.80	0.80	0.85	1.40	1.70	1.70	
2004-2005	0.55	0.55	0.55	0.80	0.80	0.85	1.40	1.70	1.70	
2005-2006	0.55	0.55	0.55	0.80	0.80	0.85	1.40	1.70	1.70	
2006-2007	0.55	0.55	0.55	0.80	0.80	0.85	1.40	1.70	1.70	
2007-2008	0.55	0.55	0.55	0.80	0.80	0.85	1.40	1.70	1.70	
2008-2009	0.55	0.55	0.55	0.80	0.80	0.85	1.40	1.70	1.70	
2009-2010	0.55	0.55	0.55	0.80	0.80	0.85	1.40	1.70	1.70	
<b>Average Toll</b>										
2001	\$4.02	\$3.65	\$3.46	\$3.33	\$3.21	\$2.92	\$1.40	\$1.14	\$1.19	\$3.14
<b>Toll Revenues (000s)</b>										
2001 <sup>(a)</sup>	\$152,628	\$155,878	\$222,620	\$89,052	\$68,798	\$205,109	\$31,913	\$8,380	\$7,697	\$942,073
2002	160,856	151,656	223,845	89,764	69,348	206,852	32,359	8,523	7,827	951,031
2003	161,741	153,324	225,076	87,789	69,903	208,610	32,812	8,667	7,961	955,884
2004	162,630	155,011	226,314	88,492	70,462	210,383	33,272	8,815	8,096	963,475
2005	163,525	155,863	227,558	89,200	71,026	212,172	33,738	8,965	8,234	970,280
2006	164,424	156,721	228,810	89,913	71,594	213,975	34,210	9,117	8,373	977,138
2007	165,329	157,583	230,068	90,633	72,167	215,794	34,689	9,272	8,516	984,050
2008	166,238	158,449	231,334	91,358	72,744	217,628	35,175	9,430	8,661	991,016
2009	167,152	159,321	232,606	92,088	73,326	219,478	35,667	9,590	8,808	998,037
2010	168,072	160,197	233,885	92,825	73,913	221,344	36,166	9,753	8,958	1,005,113

- Notes: (a) From Table 9, based on actual results for 2000.  
 (b) Growth rates reduced by 50 percent based on assumption that the capacity level has been reached in the peak period.  
 (c) Throgs Neck Bridge and Bronx-Whitestone Bridge traffic redistributed in 2002 to reflect return to historical distribution pattern after completion of construction on Cross Bronx Expressway.  
 (d) Queens Midtown Tunnel traffic reduced by 3 percent in 2003 due to completion of construction on Williamsburg Bridge. The net impact after potential growth is minus 2.2 percent.

**Table 18 Traffic and Toll Revenue Forecast  
Periodic Toll Increases**

Years	Throgs Neck	Bronx-Whitestone	Tri-borough	Queens Midtown	Brooklyn-Battery	Verrazano Narrows	Henry Hudson	Marine Parkway-Gil Hodges Memorial	Cross Bay	Total
Traffic Change (from Table 15) due to Toll Elasticity										
2001-2002	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
2003-2007	-1.2	-1.2	-2.8	-3.0	-5.6	-1.7	-4.3	-1.6	-2.2	
2008-2010 <sup>(a)</sup>	-2.3	-2.3	-5.1	-5.5	-10.1	-3.2	-7.8	-3.0	-4.0	
Annual Traffic (000s)										
2001 <sup>(b)</sup>	37,938	42,750	64,342	26,772	21,458	70,264	22,857	7,329	6,462	300,171
2002	39,983	41,592	64,696	26,987	21,630	70,861	23,177	7,453	6,572	302,950
2003	39,721	41,319	63,230	25,601	20,582	70,248	22,490	7,459	6,537	297,187
2004	39,939	41,546	63,926	25,806	20,747	70,845	22,805	7,585	6,648	299,848
2005	40,159	41,775	64,629	26,012	20,913	71,447	23,125	7,714	6,761	302,535
2006	40,380	42,005	64,984	26,221	21,080	72,055	23,448	7,845	6,876	304,893
2007	40,521	42,236	65,342	26,430	21,249	72,667	23,777	7,979	6,993	307,193
2008	40,296	42,001	64,124	25,949	20,391	72,186	23,217	8,001	6,976	303,141
2009	40,517	42,232	64,477	26,157	20,554	72,799	23,543	8,137	7,095	305,510
2010	40,740	42,464	64,832	26,366	20,718	73,418	23,872	8,275	7,214	307,901
Average Toll										
2001-2002	\$4.02	\$3.65	\$3.46	\$3.33	\$3.21	\$2.92	\$1.40	\$1.14	\$1.19	
2003-2007	4.60	4.17	3.95	3.80	3.66	3.34	1.60	1.31	1.36	
2008-2010	5.17	4.69	4.45	4.28	4.12	3.75	1.80	1.47	1.53	
Toll Revenues (000s)										
2001 <sup>(b)</sup>	\$152,628	\$155,878	\$222,620	\$ 89,052	\$68,798	\$205,109	\$31,913	\$ 8,380	\$ 7,697	\$ 942,073
2002	160,856	151,656	223,845	89,764	69,348	206,852	32,359	8,523	7,827	951,031
2003	182,651	172,205	250,058	97,333	75,425	234,388	35,892	9,748	8,899	1,066,599
2004	183,656	173,152	252,809	98,112	76,028	236,380	36,394	9,914	9,050	1,075,495
2005	184,666	174,104	255,590	98,897	76,637	238,390	37,904	10,083	9,204	1,084,473
2006	185,682	175,062	256,996	99,688	77,250	240,416	37,421	10,254	9,360	1,092,127
2007	186,332	176,025	258,409	100,485	77,868	242,459	37,944	10,428	9,519	1,099,470
2008	208,457	196,927	285,294	110,987	84,063	270,959	41,684	11,764	10,685	1,220,820
2009	209,604	198,010	286,863	111,875	84,736	273,262	42,267	11,964	10,866	1,229,447
2010	210,757	199,099	288,440	112,770	85,414	275,585	42,859	12,168	11,051	1,238,143

Notes: (a) Compounded impact of the two toll increases in 2003 and 2008.  
(b) From Table 9, based on actual results for 2000.

## Operating Expenses

The projection of operating expenses is shown in Table 19. Total operating expenses, consisting of personnel and OTPS (other than personnel services), are estimated to increase from \$256 million in 2001 to \$341 million in 2010. Personnel expenses consist of wages, salaries, overtime and fringe benefits. OTPS includes items such as maintenance, supplies, utilities and other expenses.

The operating expense projections for the years 2001 through 2004 were based on TBTA budget estimates. For the remainder of the forecast period (2005-2010), URS estimated operating expenses based on the Consumer Price Index (CPI) trend forecasts prepared by The WEFA Group and provided by TBTA. The CPI (All Urban Consumers for the US City average) long-term inflation rates used were: 2005, 2.60 percent; 2006, 2.53 percent; 2007, 2.53 percent; 2008, 2.52 percent; 2009, 2.52 percent; and 2010, 2.50 percent. Such increases would not be related to specific expenses.

In addition, TBTA will replace the outstanding *E-ZPass* tags over the three-year period, 2002-2004. The estimated total cost is \$41.5 million, spread over the three-year period, with annual costs of \$7.9, \$16.2 and \$17.4 million, respectively. Thereafter, annual costs are estimated to be \$7.9 million. These costs have been included in the OTPS expenses for the appropriate years.

TBTA projects that personnel services in 2002 will increase by 1.7 percent. OTPS expenses will increase by 11.4 percent, including *E-ZPass* tag replacement costs of \$7.9 million. After 2004, personnel and OTPS expenses, including *E-ZPass* tag replacement costs, are projected to rise by the anticipated rate of inflation.

The fluctuation in Personnel expenses reflects such items as: decreases in overtime, changes in seniority, lower staff replacement costs and no increase in staff level.

URS does not project any variation in operating expenses resulting from the reduced traffic levels brought about by periodic toll increases.

**Table 19 Projected Operating Expenses**  
(000s)

Year	Personnel <sup>(a)</sup>	OTPS <sup>(b)</sup>	Total
2001 <sup>(c)</sup>	\$117,797	\$138,537	\$256,334
2002 <sup>(c)</sup>	119,765	154,299	274,064
2003 <sup>(c)</sup>	125,170	166,716	291,886
2004 <sup>(c)</sup>	129,952	173,484	303,436
2005 <sup>(d)</sup>	133,279	168,182	301,461
2006 <sup>(d)</sup>	136,651	172,437	309,088
2007 <sup>(d)</sup>	140,108	176,800	316,908
2008 <sup>(d)</sup>	143,639	181,255	324,894
2009 <sup>(d)</sup>	147,258	185,823	333,081
2010 <sup>(d)</sup>	150,940	190,468	341,408

- Notes: (a) Includes wages, salaries, fringe benefits and overtime, net of capital reimbursements  
(b) Represents Other Than Personnel Services and includes the following categories: maintenance and supplies, outside technical and maintenance services, insurance, power, and other expenses.  
(c) Personnel and OTPS forecasts for these years based on TBTA budget and financial plan forecasts.  
(d) Personnel and OTPS forecasts for these years based on CPI trend projections prepared by The WEFA Group.

### Net Revenues from Toll Operations

Finally, the projected operating expenses were deducted from the respective toll revenue forecasts to produce the two sets of estimated net revenues, one at constant tolls and the other with periodic toll increases, as shown in Table 20. For 2001, net toll revenue under either scenario is estimated at \$686 million. In year 2010, net toll revenue at constant tolls is estimated to be \$664 million and, with periodic toll increases, net toll revenue is estimated to be \$897 million.

**Table 20 Net Toll Revenue Forecast**  
(000s)

Year	Gross Toll Revenue		Operating Expenses	Net Toll Revenue	
	Constant Tolls	Periodic Toll Incr.		Constant Tolls	Periodic Toll Incr.
2001	\$ 942,073	\$ 942,073	\$256,334	\$685,739	\$685,739
2002	951,031	951,031	274,064	676,967	676,967
2003	955,884	1,066,599	291,886	663,998	774,712
2004	963,475	1,075,495	303,436	660,039	772,059
2005	970,280	1,084,473	301,461	668,819	783,014
2006	977,138	1,092,127	309,088	668,050	783,041
2007	984,050	1,099,470	316,908	667,142	782,561
2008	991,016	1,220,820	324,896	666,120	895,924
2009	998,037	1,229,447	333,081	664,956	896,366
2010	1,005,113	1,238,143	341,408	663,705	896,735

Note: May not add due to rounding

## REVIEW OF PHYSICAL CONDITION

The facilities under TBTA's jurisdiction include two tunnels and seven bridges listed on page M-43, together with Randalls Island Facilities and a parking garage in Manhattan near the Brooklyn-Battery Tunnel. Some of these crossings have been in service since the 1930s, i.e., the Triborough, Henry Hudson, Marine Parkway-Gil Hodges Memorial and Bronx-Whitestone Bridges. The Queens Midtown Tunnel opened to traffic in 1940, and the Brooklyn-Battery Tunnel in 1950. Two bridges opened to traffic in the 1960s: the Throgs Neck in 1961 and the Verrazano-Narrows in 1964 (lower level in 1969). The present Cross Bay Bridge opened to traffic in 1970. The aging of the TBTA facilities will influence the overall upkeep and capital improvements that will be necessary to maintain the infrastructure over the forecast period and beyond.

**Table 21 Opening Dates of TBTA Facilities**

Facility	Open to Traffic	Years in Use
Triborough Bridge	1936	65
Bronx-Whitestone Bridge	1939	62
Throgs Neck Bridge	1961	40
Henry Hudson Bridge	1936	65
Queens Midtown Tunnel	1940	61
Brooklyn-Battery Tunnel	1950	51
Verrazano-Narrows Bridge	1964 <sup>(a)</sup>	37
Cross Bay Bridge	1970 <sup>(b)</sup>	31
Marine Parkway-Gil Hodges Memorial Br.	1937	64

Notes: (a) Lower level opened in 1969.  
 (b) The present structure replaced the previous structure that had been in service since 1939.

Periodic contact with TBTA personnel is maintained by URS to monitor and review material, as it becomes available, pertaining to the physical condition of their seven bridges and two tunnels. This review material includes pertinent sections and updates of the following:

- ▶ Biennial Bridge Inspection Report,
- ▶ Scheduled Tunnel Inspection Report,
- ▶ Interim Inspection Report,
- ▶ TBTA’s 2000-2004 Capital Program,
- ▶ Current Quality Assurance Plan, and
- ▶ TBTA’s Routine and Major Maintenance Program.

The review by URS of the pertinent material consists of the following subtasks:

- ▶ Comparison of Conclusions and Recommendations sections of the current inspection reports with the previous inspection reports to note significant changes in observed deterioration, if any;
- ▶ Review of the 2000-2004 Capital Program to verify that the repairs recommended by the latest inspection reports are being addressed; and
- ▶ Review of TBTA’s Routine Maintenance Program to verify that the maintenance related recommendations of the current inspection reports are being addressed.

### **Review of Inspection Reports**

TBTA’s seven bridges and two tunnel facilities undergo periodic, comprehensive condition inspections. The tunnel inspection frequency is generally every ten years, whereas the bridges are inspected every two years. The TBTA’s bridges were last inspected and their physical condition appraised in 1999/2000, under the New York State Biennial Bridge Inspection Program, by various consultants. New cycles of NYSDOT Biennial Bridge Inspection are currently

underway. In addition, separate underwater and substructure inspections were performed in accordance with the five-year cycles of NYSDOT to obtain riverbed contours and to assess potential scour conditions at the substructure.

The most recent comprehensive condition inspection of TBTA's tunnels was performed in 1990. The Brooklyn-Battery Tunnel is currently undergoing an inspection. The Queens Midtown Tunnel is not currently scheduled for a comprehensive inspection, as current construction has addressed the critical needs of the structure at this time. Unlike bridges, federal and state mandated inspection cycles are not specified for tunnels; however, ongoing tunnel rehabilitation projects create ideal access conditions for the monitoring of these structures. As contract work progresses, construction inspection of the work and adjacent areas allows new areas of deterioration to be identified and addressed as part of the ongoing contract. TBTA has performed an assessment of the vulnerability of its tunnels to a major fire, as in Mont Blanc in France. Results of this assessment include significant differences between the TBTA's tunnels and Mont Blanc. These include the fact that TBTA's tunnels have two tubes each, with cross passages to allow motorist access to safe locations in the opposite tube. In addition, TBTA's tunnels provide much better ventilation (3-4 times better), a wet fire standpipe system, patrols several times an hour, and a superior communication system for emergencies.

These foregoing inspections, performed by the inspection consultants, consisted of visual examination, sounding and chipping concrete, scraping and cleaning steel, and taking appropriate measurements to determine the physical conditions of the bridges and tunnels.

The inspection consultants also prioritized the necessary repairs and provided the TBTA with cost estimates. The results of these facility inspections and appraisals form the basis for much of the rehabilitation and improvement projects to be funded under the 2000-2004 TBTA Capital Programs.

The consulting engineering firms who performed the 1999 and 2000 biennial bridge inspections and those who performed or are performing the 1990 or 2001 tunnel inspections for each facility were/are:

<i>Facility</i>	<i>Consulting Firm</i>
Triborough Bridge	Lichtenstein Engineering Associates (2000)
Throgs Neck Bridge	Lichtenstein Engineering Associates, P.C. (1999)
Bronx-Whitestone Bridge	Charles H. Sells, Inc. (1999)
Henry Hudson Bridge	Iffland, Kavanagh & Waterbury (1999)
Queens Midtown Tunnel	Sverdrup Corp. (1990)
Brooklyn-Battery Tunnel	Parsons Brinckerhoff (2001)
Verrazano-Narrows Bridge	Charles H. Sells, Inc. (2000)
Marine Parkway-Gil Hodges Mem. Br.	Ammann & Whitney, Inc. (1999)
Cross Bay Bridge	Ammann & Whitney, Inc. (1999)

These firms are well known in the field of structural inspection and appraisal. Copies of pertinent sections of the final inspection reports for the various facilities were requested and made available by TBTA.

Funds programmed for TBTA's 2000-2004 Capital Program total \$1.0 billion dollars. The plan breaks this amount into specific projects by facility as well as agency-wide projects. Comparisons between the Capital Program projects and total repair item lists for each facility, as prepared by inspection consultants, confirm that the Capital Program gives high priority to key rehabilitation projects. Conclusions, recommendations and cost estimates for each facility can be found in the latest biennial bridge and tunnel inspection reports. By prioritizing necessary facility rehabilitation projects, TBTA addresses all recommendations in the 2000-2004 Capital Program that had not been addressed as part of the 1995-1999 Capital Program.

Current major rehabilitation projects (and design) addressing the recommendations of the latest inspection consultants' reports include:

*Triborough Bridge* - Main cable rewinding and the suspension anchorage rehabilitation are complete. The electrical, mechanical and design of deck rehabilitation of the Bronx truss is complete, construction is ongoing. The rehabilitation of the Bronx approach and the cellular concrete junction structure are underway. The contract for the deck replacement for the Manhattan toll plaza and ramps is anticipated for the next capital program. The construction of the deck replacement of the East River suspended span and the Queens viaduct and suspender ropes replacement is underway. Design of the Ward's Island and Randall's Island viaducts is 70 percent complete. The Harlem River and Manhattan lift span design of deck replacement is 99 percent complete; construction should begin this year. Projects completed within the last four years include: bridge deck rehabilitation at the Queens Approach, a new east ramp auto shop, toll plaza canopy roof improvement, and sidewalk replacement; and numerous repair projects such as repair of the bridge deck joint drains, cracked deck, piers, superstructure, and substructure.

*Bronx-Whitestone Bridge* - The new two-story service building is complete. Oiling of the cable strands in the anchorages is ongoing. Portions of the recommendations from recently completed studies which investigated deck replacement with a lightweight deck which would reduce the load on the main cables, and improving the aerodynamic and seismic performance of the bridge are being incorporated with various structural repairs in TBTA's maintenance and capital programs. These programs include installation of acoustic sensors for cable status monitoring (which is substantially complete), replacement of the stiffening truss with a lightweight windfaring on the suspended span (the design of which is nearing completion), and replacement of the roadway deck with a lightweight orthotropic deck as part of the 2000-2004 Capital Program. Construction and testing of the prototype deck replacement for the suspended span is in progress. Also included is a study of feasible methods for complete replacement of the main cables should that become necessary in the future. Permanent relocation of the Lafayette Avenue exit ramp is under discussion with local agencies. Installation of a new gantry and variable message sign north of the toll plaza is substantially complete. Repairs of flagged conditions noted in the biennial inspection reports and pin replacement are continuing. Painting and replacement of

collars of the suspender ropes is continuing. The addition of a new toll booth is also underway. The 2000-2004 Capital Program also includes replacement of the roadway deck on the Bronx/Queens approach spans and design of a new fender system for the towers. Projects completed within the last four years include: the reinforcement of eyebars as part of the anchorage rehabilitation, cable rewrapping and rehabilitation of the suspension span superstructure, the rehabilitation of the Bronx/Queens approach ramps, the new entry ramp north of Schley Avenue, and an electrical system upgrade.

*Throgs Neck Bridge* - Resurfacing of the suspended spans deck has been awarded. The new electrical system is under construction and scheduled for completion this year. The construction contract for the Bronx approach (slab on grade) south of the toll plaza is 55 percent complete. The orthotropic deck prototype is complete, and design and construction are anticipated as part of the 2000-2004 Capital Program. The 2000-2004 Capital Program includes funds for design of the rehabilitation of the main cable, including lubrication and rewrapping in the suspended span. Scour backfilling at piers 42 and 52 and fender rehabilitation at the Queens anchorage and piers 19 and 20 is anticipated for 2002. Design of structural steel rehabilitation and drainage system improvement at the suspended span and viaducts and maintenance painting design is 30 percent complete. Suspender rope testing is also anticipated, possibly as part of the next Biennial Inspection. Projects completed within the last four years include: rehabilitation of the Queens approach slab on grade and the first eleven spans of the Queens viaduct reinforced concrete deck, ramp reconstruction (Cross Island Parkway to the bridge) and the new service building.

*Henry Hudson Bridge* - The contract for replacement of the Dyckman Street Bridge deck and superstructure with reinforced concrete beams and slab has begun, and new overlaying of all the toll lanes is 50 percent complete. The 2000-2004 Capital Program includes plans for southbound lower level toll plaza expansion, design for relocation of the northbound upper level toll plaza which are both in the scoping and study phase, and replacement of the upper level deck in the vicinity of the toll plaza. Under the maintenance program, one additional toll booth is under construction on the southbound lower level plaza, and the complete bridge structure will undergo comprehensive maintenance painting and steel repair with construction beginning this year. Rock bolting and scaling of the slopes adjacent to the approaches is 75 percent complete. Projects completed within the last four years include: Replacement of northbound approach roadway and drainage system, upper deck roadway replacement, expansion of the service building, southbound approach roadway and drainage system, toll booth HVAC system and new fuel oil tanks.

*Queens Midtown Tunnel* - Rehabilitation of tunnel ceiling and walls is approximately 90 percent complete and is proceeding. A contract for development of a master plan and scope for tunnel ventilation, tunnel finish and leak repairs and upgrading of the fire standpipe system has begun. The 2000-2004 Capital Program includes provision for design of the rehabilitation of the 36th Street and Second Avenue overpasses. The design for replacement of drainage pumps inside the ventilation building and at the plazas is complete and construction is scheduled for this year. Projects completed within the last four years include: structural rehabilitation and roadway

resurfacing at both tubes, rehabilitation of the elevator and various related structural repairs in the ventilation building, superstructure replacement for 37th Street Bridge, a new cellular phone system, ventilation building roof and masonry repairs, and upgrade of the gasoline and diesel fuel station in the service building.

*Brooklyn-Battery Tunnel* - Replacement of the exhaust fans in the ventilation buildings is ongoing. Rehabilitation of Battery Parking Garage Phase I (slab reconstruction) is complete. Construction of Phase II (façade replacement and related structural rehabilitation) has begun, and design of Phase III (mechanical/electrical system replacement) is nearly complete with construction to begin this year. Design of masonry and roof repairs to the existing service building is ongoing with construction scheduled for next year. Design of tunnel roadway and drainage system rehabilitation, tunnel leakage repairs and wall tile replacement, and fire standpipe and water line valve replacement is underway, with construction scheduled for 2002. Pump replacement design is complete, with construction imminent. Traffic control and signal system replacement construction has begun. The Brooklyn plaza is scheduled to be repaved, the Manhattan plaza reconstructed and the toll booth's HVAC ducts are being replaced this year. One lane of each tube of the tunnels was repaved last fall, and one lane in each tube will be repaved this fall. Sidewalks will be replaced and parking lots repaved in the service area. Projects completed within the last four years include: replacement of all underground fuel tanks, repainting of toll booths, addition of a new manual toll booth at lane 8, tunnel ceiling replacement, leak repairs, new lighting, and rehabilitation of the Manhattan plaza.

*Verrazano-Narrows Bridge* - Painting of the entire suspended spans except the towers at the upper and lower roadways is 40 percent complete. A contract to proceed with oiling of the eyebars and strands in the anchorages continues and should be completed this year. The Brooklyn approach pavement rehabilitation has begun. Dehumidifying of the Brooklyn and Staten Island anchorages has begun, sealing will follow (in design now). Rehabilitation of the electrical system in the suspended spans is designed; construction will follow. A study to evaluate the condition of the toll booths, plaza, tunnel pavement, utility and lighting systems and signage and traffic interchange in the vicinity of the toll plaza has begun. A feasibility study to investigate widening of the Belt Parkway ramps has also begun. Projects completed within the last four years include: prototype deck repairs at the suspended spans, expansion of the garage, rehabilitation of flagged floor beam and fascia stringers, painting of a portion of underside of the suspended spans, approach spans deck resurfacing (upper level), increased capacity of electrical substation, provision of permanent scaffolding to facilitate oiling within anchorages, and the previous cycle of oiling cables, strands and eyebars in the anchorages.

*Marine Parkway-Gil Hodges Memorial Bridge* - Deck replacement and bridge widening is continuing and is scheduled for completion in the spring of 2002. The repainting contract is ongoing and is 70 percent complete, with the towers remaining to be painted. The west side structural steel repairs are complete. A utility connection is in construction and is 25 percent complete. A design contract to replace the elevators in the towers is proposed, with construction planned for next year. The design of a new service building is also proposed, with construction scheduled for next year. Ongoing maintenance includes complete power upgrade in the mainte-

nance building, brick pointing and door replacement and boiler replacement, toll booth painting and refurbishing and toll lane repaving. Projects completed within the last four years include: precast deck installation, sanitary line repair, bearing repair in the clutch shaft in the main shaft tower, an intercom system, oil/gas tank replacement, an HVAC system for toll booths and the replacement of control and power wiring for the lift span.

*Cross Bay Bridge* - The door replacement design for the service building has been completed and the contract has been awarded. The design of structural and electrical rehabilitation of the concrete slab on grade at Ramp 'D' (southbound ramp extending from the main bridge lanes) is 40 percent complete, with construction anticipated for 2003. The design of the replacement of the main high voltage feeders from the south abutment to the main service building has begun. The design of the rehabilitation of the drainage system at the promenade at the Rockaway approach and the seawall is 40 percent complete with construction anticipated for 2003. Ongoing maintenance projects to begin this summer include design of rehabilitation of the air conditioning system in the service building, brick pointing and door replacement, toll booth painting and refurbishing, toll lane paving. Door replacement at Pier 8 will begin soon, installation of continuity plates in the median barrier, unit heater replacement inside the garage, and rumble strip repair will begin in the spring. Projects completed within the past four years include an intercom system, boiler replacement, pipe insulation in the garage, the oil/gas tank replacement and the HVAC system rehabilitation for the toll booths.

*Agency Wide* - The Robert Moses Building (Randalls Island Headquarters) door and window rehabilitation has been substantially completed. The Triborough Bridge overhead toll plaza Message Signs project is under construction. Installation of *E-ZPass* capability at remaining toll booths is complete. The design for expansion of the Variable Message System (VMS) system, and gantry to the remaining TBTA facilities is underway. State of the art security systems will be designed and installed at bridge and tunnel facilities to enhance the physical security at TBTA facilities and ancillary structures, and the design portion has begun. Projects scheduled for the 2000-2004 Capital Program include, the installation of weather recording systems at the Cross Bay, Henry Hudson and Marine Parkway-Gil Hodges Memorial bridges and the installation of Closed Circuit Television (CCTV) to allow observation of traffic and activity at all bridges and tunnels. Operations centers will be upgraded at all facilities including Randall's Island, antennas and readers will be installed at all facilities in order to monitor traffic flow, and copper cable will be replaced with fiber optic cable. The 2000-2004 Capital Program will also include toll registry system enhancement, and rotating prism signs will be installed above all toll plaza lanes at various facilities. Projects completed within the last four years include: the installation of the Computer Aided Drafting and Design (CADD) system, traffic safety improvements, tank testing and replacements, installation of weather recording system and inspection platform, Randalls Island Garage roof replacement, *E-ZPass* initial installation at 119 toll booths systemwide, facility improvements to comply with Americans with Disabilities Act (ADA) requirements, the installation of main electrical feeders to increase capacity at Randalls Island, and the installation of the HVAC system at the Robert Moses Building.

A Capital Programming System has been developed by the TBTA Engineering and Construction Department as part of TBTA's long-term needs assessment to help determine long-range capital and maintenance priorities. The system calculates estimated repair and rehabilitation costs based on mathematical modeling of structural deterioration.

URS' review of pertinent sections of the recent facility inspection reports found them to be extensive and detailed. Report conclusions and rehabilitation recommendations appear in the opinion of URS to be reasonable appraisals of the required effort to maintain the operational integrity of each facility.

URS performed a facility orientation walk-through at each TBTA facility in March 2001. This walk-through was for orientation purposes only, and not to re-inspect the facility or critique previous inspection reports. The walk-through visits included an on-site meeting with each facility's engineer/manager to obtain an update of the respective facility's status relative to the following issues:

- ▶ Ongoing rehabilitation projects;
- ▶ Ongoing maintenance projects;
- ▶ Rehabilitation projects addressing the recommendations of the previous inspection reports; and
- ▶ Repairs to alleviate the flagged conditions of the previous inspection reports.

The walk-through inspections and meetings proved informative. Facility projects and agency-wide projects specific to each structure were discussed at the meetings. The walk-through tours provided by the facility engineer/manager provided URS with a greater understanding of the structural make-up of each facility, as well as a check on the status of capital improvement and major maintenance projects.

### **Long-Term Outlook for TBTA Facilities**

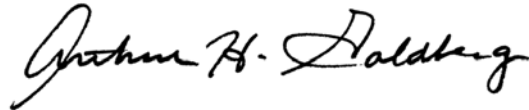
Bridges and tunnels, in general, can reach the end of their useful lives for two main reasons: (a) they are geometrically and functionally unsatisfactory because they are too narrow, too steep, lacking in clearance or sufficient spatial capacity to handle the traffic; or (b) they are structurally unsafe because of deterioration or because their load-carrying capacity is inadequate to handle the loads imposed under current conditions. Deterioration may occur for a variety of reasons, including aging, but it will occur sooner if there has been inadequate or improper maintenance.

On the basis of the foregoing review and other information available to us, it is our opinion that the TBTA bridges, tunnels and approaches are all geometrically and functionally adequate and structurally sound and generally maintained to high standards.

We are of the opinion that all the TBTA facilities are and will be physically capable of accommodating traffic volumes at the levels projected for 2010 through the duration of the outstanding bonds that have been issued and future bonds to be issued based on a pledge of TBTA revenues through 2031, assuming maintenance consistent with past practice.

Respectfully,

**URS CORPORATION GROUP CONSULTANTS**



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