NEW JERSEY TRAFFIC AND REVENUE STUDY

New Jersey Turnpike & Route 440 Asset Appraisal

Final Report

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Prepared for:

State of New Jersey
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Contents

APPENDICES

GLOSSARY OF DEFINED TERMS:

- Annual Average Weekday Traffic (AADTw)
- Atlantic City Expressway (ACE)
- Annual Average Daily Traffic (AADT)
- CRA International (CRAI)
- EDR Group (EDRG)
- Electronic Toll Collection (ETC)
- Federal Highway Administration (FHWA)
- Garden State Parkway (GSP)
- Gross Domestic Product (GDP)
- Gross Regional Product (GRP)
- Level of Service (LOS)
- Michael Baker Jr., Inc. (Baker)
- New Jersey Department of Transportation (NJDOT)
- North Jersey Regional Model (NJTPA)
- New Jersey Turnpike (NJTP)
- New Jersey Turnpike Authority (NJTA)
- Origin-Destination (O-D)
- Rutgers State University of New Jersey's Economic Advisory Service (RECON)
- South Jersey Regional Model (SJTPO)
- US Highway 1/9 (US-1/9)
- U.S. Highway Capacity Manual (HCM)
- Vehicle Miles Traveled (VMT)
- Wilbur Smith and Associates (WSA)

DISCLAIMER

This report has been prepared for the State of New Jersey as an initial overview of issues relevant to traffic and revenue projections to assist in the preparation of the possibility of monetizing a number of the transport assets at present owned and operated by the State (or its agents). This report is intended to provide an overview of relevant issues and does not provide investment grade analysis.

The analysis and projections of traffic and revenue contained within this document represent the best estimates of Steer Davies Gleave at this stage. While the forecasts are not precise forecasts, they do represent, in our view, a reasonable expectation for the future, based on the information available as of the date of this report.

However, the estimates contained within this document rely on numerous assumptions and judgments and are influenced by external circumstances that are subject to changes that may materially affect the conclusions drawn.

In addition, the view and projections contained within this report rely on data collected by third parties. Steer Davies Gleave has conducted independent checks of this data where possible, but does not guarantee the accuracy of this data.

No parties other than the State of New Jersey can place reliance on it.

1. INTRODUCTION

Statement of Objectives

1.1 The State of New Jersey is considering the possibility of monetizing a number of the transport assets at present owned and operated by the State or certain authorities in, but not of, the State. These include the New Jersey Turnpike (NJTP), the Atlantic City Expressway (ACE), the Garden State Parkway (GSP) and Route 440 (between the New Jersey Turnpike and the Outer Bridge Crossing).

1.2 The State has appointed a financial advisor to help it understand how such a process might be carried out – and it has appointed Steer Davies Gleave, together with CRA International (CRAI) and the EDR Group (EDRG), as traffic and revenue advisors. Our brief is to provide assistance in the estimation of the traffic that might be carried on the assets, and the toll revenue that might be generated.

1.3 Our overall work for this assignment consisted of two phases:

- Phase 1: Scoping; and
- Phase 2: Asset by Asset Appraisal of Future Traffic and Revenue streams.

1.4 The objective of the Phase 1 work was to prepare an initial review of the likely levels of traffic and revenue on the target roads across the likely duration of the forecast period. This work comprised the collection and collation of existing traffic data for each road, an initial review of the key drivers of future traffic growth and a literature review of elasticity parameters (a key determinant of traffic responsiveness to changes in tolls).

1.5 In Phase 2 work we have built on the analysis carried out for Phase 1 and developed a modeling framework that can explore the base assignment to the target facility under a range of scenarios – and for different traffic types. It has been built to allow sensitivity testing of a range of factors including values of time – and allows for rapid testing of different tolling scenarios. We have adopted a number of existing modeling tools to act as focused network models and have developed separate spreadsheet based revenue models to focus on the important traffic categories and the choices that road users would face.

Approach and Analysis Undertaken

1.6 In conjunction with our partners at CRAI and EDRG, we have undertaken the following key tasks as part of both work phases:

- Developed an overview of traffic and revenue on the road assets to understand the composition of traffic volumes by time of day and location;
- Reviewed the key economic issues and the likely impact on traffic of estimated growth in key economic parameters;
- Developed a modeling framework to explore the base assignment to the target facility under a range of scenarios – and for different traffic types;

- Undertaken a number of travel time surveys to assist in the model validation process, in particular to check that modeled travel times are representative of observed journey times;
- Undertaken an internet based attitudinal surveys with New Jersey residents to support our forecasting assumptions; and
- Reviewed relevant North American 'price elasticity of demand' studies to assess the likely impact of toll changes on traffic volumes.

1.7 In carrying out this work we reviewed and relied on third party reports and data without independent verification. However, in most instances we used recent data collected by recognized experts or firms with nationally recognized credentials.

Report Contents

1.8 The purpose of this document is to present our traffic and revenue forecasts for the New Jersey Turnpike and Route 440 and to provide an overview of the key assumptions made as part of the process to develop these forecasts. A separate report describes the background to our work and methodology in more detail.

1.9 This document is structured as follows:

- Chapters 2 and 3 provide an overview of the NJTP and Route 440 and present 2006 traffic and revenues for these facilities;
- Chapter 4 presents an overview of our forecasting methodology, discusses key forecasting issues and summarizes key forecasting assumptions;
- Chapter 5 discusses how future traffic growth rates have been derived and defined; and
- Chapter 6 presents traffic and revenue forecasts for the facilities.

1.10 Supporting documentation is included in a number of appendices.

2. THE NEW JERSEY TURNPIKE

Project Overview

2.1 As shown in Figure 2.1, NJTP is a 148 mile tolled facility that runs from the south-west to the north-east of New Jersey. The road opened in 1951 and has been managed and operated ever since by the New Jersey Turnpike Authority (NJTA). The road forms a key part of the I-95 corridor which connects the major economic centers along the eastern seaboard of the United States including Washington D.C, Philadelphia and New York.

2.2 The NJTP commences in the south-west of New Jersey at the Delaware Memorial Bridge and extends north-east to form part of an orbital route bypassing the city of Philadelphia. The route then progresses northwards to serve the Newark and New York metropolitan areas before terminating at the George Washington Bridge, where the I-95 route continues north through Connecticut.

FIGURE 2.1 NJTP OVERVIEW

2.3 The NJTP has two extensions, the Newark Bay Extension (8.3 miles), which connects into the Holland Tunnel, providing a connection with Lower Manhattan and the Pennsylvania Turnpike Extension leading into the Pennsylvania Turnpike from Exit 6 (6.6 miles). The NJTP has interchanges with nearly all of the major highway routes and major access points throughout New Jersey, including:

- ACE (Exit 3);
- GSP (Exit 11);
- Newark Liberty International Airport (Exit 13A);
- Holland Tunnel, providing access to New York City/Lower Manhattan (Exit 14); and
- Lincoln Tunnel, providing access to New York City (Exit 16E).

2.4 The NJTP forms part of the major I-95 corridor along the East coast of the United States. As such, it serves North-South through traffic for commercial and personal vehicles. Its links with the Port and Airport of Newark make it a major link along the northeast corridor.

2.5 Within New Jersey, the NJTP links the metropolitan areas surrounding Philadelphia and New York City. It also serves local commuters traveling into these employment locations.

2.6 Figure 2.2 shows the area served by the northern section of the NJTP in more detail. Detailed maps showing the location of all entries and exits are included in Appendix A.

FIGURE 2.2 NJTP - OVERVIEW (NORTHERN SECTIONS)

Road Configuration

2.7 The NJTP is a grade-separated limited access freeway with a speed limit of 65 mph in rural sections (south of Exit 13) and 55 mph in urban sections (north of Exit 13). A schematic summary of the lane geometry of the NJTP is shown in Figure 2.3.

FIGURE 2.3 NJTP - LANE GEOMETRY

- South of Exit 4 the facility operates as a 4-lane (2 lanes per direction) highway;
- Between Exits 4 and 8A, NJTP operates as a 6-lane highway (3 lanes per direction) to cater for the distribution of traffic to and from Philadelphia – traveling on the NJTP by the Pennsylvania Turnpike Extension (3 lanes per direction) at Exit 6;
- Between Exits 8A and 14, the geometry of the facility widens considerably to allow for between 10 and 14 lanes of traffic (5-7 lanes in each direction). In this section, truck traffic is restricted to using the outer lanes (typically 2-3 lanes in each direction), while the inner lanes (typically 3-4 lanes per direction) are exclusively available to cars;
- At Exit 14, the Newark Bay Extension diverges from the mainline, providing a 4-lane highway (2 lanes per direction) serving the Newark/Jersey City area; and
- From Exit 14, the NJTP splits into two spurs. The eastern spur, which serves Newark Liberty International Airport and Manhattan, provides 6 lanes (3 lanes per direction) of capacity. The western spur which acts as a bypass around the Jersey City/New York metropolitan areas is also a 6-lane (3 lanes per direction) highway reducing to 4 lanes (2 lanes per direction) after Exit 18W.

Competing Routes

2.8 Across the length of the NJTP there are a number of competing routes. In the southern section of the NJTP (between Exits 1 and 7) the I-295 and I-95 compete with the NJTP, as can be seen in Figure 2.4.

2.9 I-295 runs almost parallel to NJTP between the Delaware Memorial Bridge and Trenton. The route offers an un-tolled alternative to NJTP for journeys to and from the major centers of Philadelphia and Trenton. The route has a 60 mph speed limit but does suffer from considerable peak-hour congestion. Journey time savings carried out by Steer Davies Gleave show that peak hour average speeds can be as low as 12 mph between Exit 34 and the Pennsylvania Turnpike. However in the off-peak period, average speeds are much higher and thus the I-295 provides a much more viable alternative.

2.10 To the south, the I-95 route runs parallel to the NJTP and passes through the city of Philadelphia. It provides direct access to and from Philadelphia and extends northwards to form part of an orbital route to the north of Trenton. The predominant speed limit on the route is 55 mph. Again this route has considerable peak-hour congestion relative to the NJTP but offers a viable alternative in off-peak periods. Over time this route might become more attractive with the completion of the interchange between the I-95/Pennsylvania Turnpike Extension.

FIGURE 2.4 NJTP - COMPETING ROUTES (CENTRAL & SOUTHERN SECTIONS)

2.11 In the central section (between Exits 7 and 11) the only competing route is US Highway 1 (US-1) (see Figure 2.5), which runs parallel to the NJTP through Mercer and Middlesex counties. US-1 is predominately an 'at-grade' facility with a speed limit of 50 mph and therefore only an attractive alternative to the NJTP for shorter distance and local journeys. Indeed our travel time survey shows average off-peak period speeds of just 36 mph.

2.12 In the northern section (between Exits 11 and 18E/W) the GSP and US Highway 1/9 (US-1/9) compete with the NJTP. The GSP runs parallel to the NJTP between Exit 11 and 18E and can act as an alternative for a number of destinations in the Newark area including Newark Liberty International Airport. However, the GSP does not provide access to New York City as does the NJTP.

2.13 US-1/9 runs parallel to the NJTP between Exits 11 and 14. As shown in Figure 2.5, this un-tolled alternative route competes with the NJTP for key destinations in the Newark area including Newark International Airport, Elizabeth and Linden. The route provides predominately 'at-grade' access and has a speed limit of 50 mph. Travel time surveys carried out by Steer Davies Gleave show that even in off peak periods, average speeds are typically less than 40 mph.

FIGURE 2.5 NJTP - COMPETING ROUTES (NORTHERN SECTION)

2.14 Table 2.1 summarizes the competing routes.

TABLE 2.1 NJTP - SUMMARY OF COMPETING ROUTES

Section	Route	Lane Geometry	Speed Limit (mph)
Southern Section (Exits 1 – 7)	I-295	3x3	60
	I-95	4x4	60
Central Section (Exits 7 – 11)	US-1	2x2	50
Northern Section (Exits 11 – 18E/W)	US-1/9	3x3/4x4	50
	GSP	5x5	55

Source: NJTA / SDG Analysis

Planned Infrastructure Improvements

2.15 The NJTA plans to expand 20 miles of the NJTP from Exit 6 (Pennsylvania Turnpike) north to Exit 8A (NJ 32), most likely in a ten-lane (2-3-3-2) configuration. This project will provide for the construction of an extension to the NJTP's dual roadway from the existing merge at Exit 8A to the interconnection of the mainline roadway with the Pennsylvania Turnpike Extension at Exit 6. This project is scheduled to be completed in 2010. Further widening projects are planned for by the NJTA but have not been committed to and scheduled. These include the widening between Exits 8A and 11, between Exits 13 and 13A, and a widening from four to six lanes between Exit 1 (Delaware Memorial Bridge) and Exit 4 (New Jersey Route 73). Figure 2.6 shows Planned Infrastructure Improvements in New Jersey.

2.16 A connection between the Pennsylvania Turnpike (I-276) and I-95 is planned by the Pennsylvania Turnpike Commission. After completion of the project, a portion of I-276 will be renamed as I-95, assuring its continuity. As part of this project, I-276 will be widened from two to three lanes in each direction from the Delaware River to US-1. A bridge toll will be levied on westbound I-276 traffic after crossing the Delaware River Bridge, allowing eastbound NJTP traffic to move unimpeded on the new I-95 northbound into New Jersey. The Pennsylvania Turnpike Commission has indicated that they will establish a mainline toll collection facility east of the new I-276/I-95 interchange, with E-ZPass and conventional toll collection lanes. This part of the project is to be completed by 2008. Later phases of the project include the construction of an additional bridge over the Delaware River to provide three lanes in each direction.

FIGURE 2.6 PLANNED INFRASTRUCTURE IMPROVEMENTS IN NEW JERSEY

Tolling Regime

2.17 The NJTP operates as a 'closed' tolling system where users collect a ticket once entering the NJTP and then surrender this ticket along with payment when exiting the facility. Every exit point along the route has an operational toll plaza, making it theoretically impossible for travelers to use any section of the NJTP without payment.

2.18 Since 2000, an Electronic Toll Collection (ETC) system called E-ZPass has been in operation on NJTP. The system is governed by the E-ZPass Interagency Group which oversees the ETC operation across various states and facilities helping to promote free-flow tolling between collaborating states. Within this structure, NJTA manages its own billing and customer service center.

2.19 E-ZPass allows vehicles equipped with an E-ZPass tag to drive through designated toll lanes without the need to stop and manually pay a toll. Currently E-ZPass users have dedicated lanes prohibited to cash payment but work is under way to incorporate the E-ZPass technology into all toll lanes so that E-ZPass users are not just restricted to the designated lanes.

2.20 Tolls are distance based, with the tolling 'ticket' system recognizing the entry and exit point of each vehicle. Tolls are charged differentially according to vehicle size with the toll classification based on the number of axles. Passenger cars, 2-axle, 3-axle, 4-axle, 5-axle and 6-axle trucks make up Classes 1-6 respectively.

2.21 On a per mile basis tolls are not uniform across the length of the road with tolls for movements at the northern end of the road being charged at a higher rate than those at the southern end.

2.22 Users of the E-ZPass system benefit from an off-peak toll discount of 25%.

2.23 Table 2.2 below provides a matrix of tolls for journeys between some of the key interchanges on the NJTP. The tolls presented are for Class 1 vehicles (passenger cars) and for cash paying customers only.

TABLE 2.2 NJTP - 2006 TOLLS FOR SELECTED KEY MOVEMENTS (CLASS 1, CASH PAYMENT)

	Exit 1	Exit 6	Exit 7A	Exit 14	Exit 18E
Exit 1 (South Termini)		$2.55	$2.15	$5.75	$6.45
Exit 6 (Philadelphia)	$2.55		$1.00	$3.75	$5.50
Exit 7A (Trenton)	$2.15	$1.00		$2.85	$4.45
Exit 14 (New York)	$5.75	$3.75	$2.85		$1.70
Exit 18E (North Termini/New York)	$6.45	$5.50	$4.45	$1.70	

Source: NJTA

2.24 As mentioned, heavy vehicles are charged more, according to the number of axles on each truck. A 6-axle truck will typically pay a toll 4.5 times greater than the Class 1 toll whereas a 2-axle truck will pay a toll twice as much as the car toll.

2.25 There is currently no annual indexation of toll rates to price inflation. Instead toll rates have only historically increased on an ad-hoc basis. Since 1970, there have only been five increases with the most recent toll increases occurring in 2000 and 2003.

2.26 In Table 2.3 below we compare average toll rates per mile on NJTP to US average and maximum toll rates, based on an analysis by WSA of most US toll facilities. Toll rates for cars on NJTP are below average by US standards. Truck toll rates are roughly in line with US averages.

TABLE 2.3 NJTP - 2006 AVERAGE TOLL PER VEHICLE MILE, US AVERAGE AND MINIMUM

Vehicle Type	NJTP Average Toll ($/Mile)	US Average Toll ($/Mile)	US Maximum Toll ($/Mile)
Cars	0.055	0.09 to 0.14	1.00
Trucks	0.22	0.22	1.75

Source: NJTA / SDG Analysis

2006 Traffic Levels

2.27 Wilbur Smith and Associates (WSA) has worked for NJTA for many years, monitoring the development of traffic and revenue. From their most recent work (which has been provided to us as part of this study) we have a significant volume of past and present data on the road. Furthermore NJTA has provided us directly with up-to-date 2006 Transaction and Revenue Data for the NJTP. Based on this data and our own analysis of the characteristics of the road, we have established an overview of the following:

- General traffic volumes and characteristics;
- Transactions and revenue by vehicle type;
- Time of day transactions profiles;
- Analysis and observations of traffic patterns on different sections of each road;
- Capacity constraints.

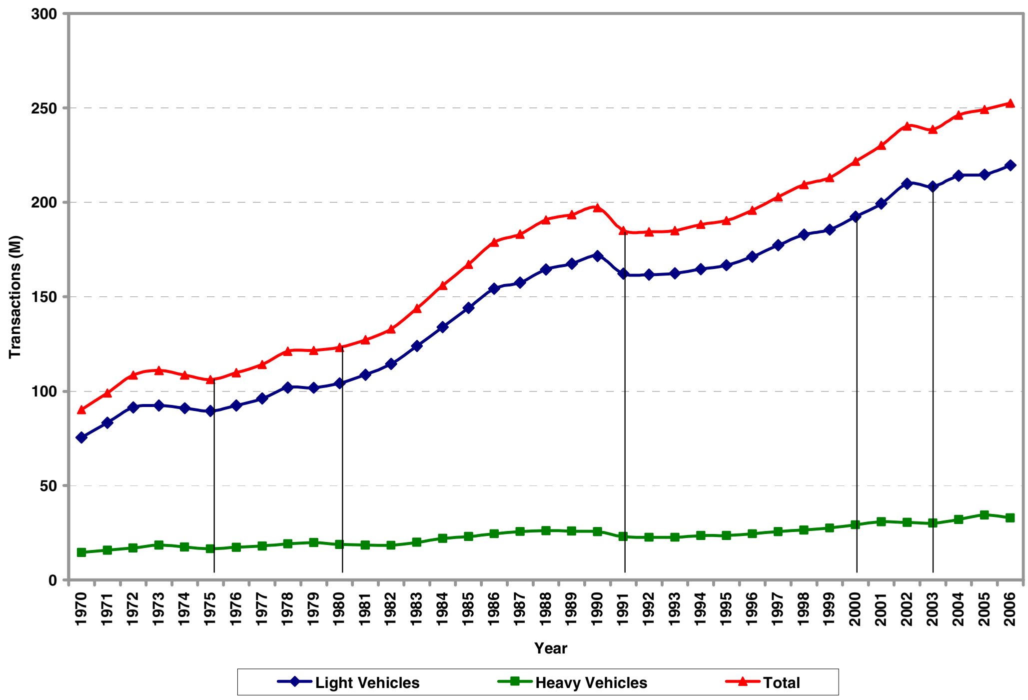
2.28 Data from the North Jersey and South Jersey regional models (NJTPA and SJTPO) and New Jersey State-wide assignment model enabled us to establish traffic composition by vehicle type and also enabled us to build up a picture of trip purposes on the NJTP.

Transactions

2.29 In 2006 over 250 million vehicles used the NJTP, equivalent to just over 690,000 vehicles per day on average. Cars accounted for 85% of transactions, with trucks and buses accounting for 15% of transactions.

2.30 Figure 2.7 below shows the number of vehicles using the NJTP for the period 1970-2006. As can be seen, traffic using the NJTP grew steadily from 1970 to 1990 except during the mid-70s when traffic growth stagnated following the global oil crises of 1973 and 1976. Traffic growth was rapid in the 1980s until the early 1990s when traffic growth slowed due to the combination of economic recession and a NJTP toll increase. Since the 1990s, traffic has continued to grow steadily with the only exception being 2003 when annual traffic fell following another periodic toll increase.

FIGURE 2.7 NJTP - TRANSACTIONS: 1970-2006



Source: NJTA / SDG Analysis

2.31 Since 1970, traffic on the NJTP has grown 2.9% per annum on average. Over the same period light vehicles have grown at an average of 3% per year, while heavy vehicles have grown by 2.3% per annum. In recent years traffic growth has slowed slightly.

2.32 Table 2.4 overleaf shows that between 1996 and 2006, annual total traffic growth has slowed to an average of 2.6% per annum, while over the last five years, traffic growth has slowed to just 1.9% per annum.

2.33 Traffic growth in heavy vehicles has slowed to just 1.3% per annum over the last five years. However the slow down in traffic growth over the last five years must be placed in the context of the toll rate increases in late 2000 and 2003 and other events such as 9/11 and the rise in fuel prices.

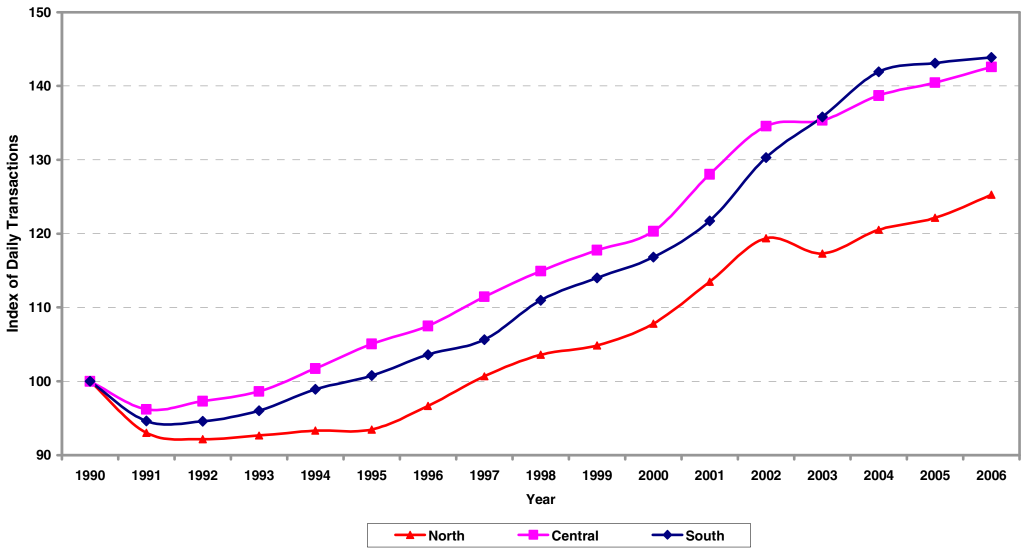
TABLE 2.4 NJTP - ANNUAL AVERAGE TRAFFIC GROWTH (TRANSACTIONS)

Period	Light Vehicles	Heavy Vehicles	Total Vehicles
1970 – 2006	3.01%	2.29%	2.90%
1996 – 2006	2.52%	3.00%	2.58%
2001 - 2006	1.96%	1.29%	1.87%

Source: NJTA / SDG Analysis

2.34 Over time, traffic has not grown uniformly across the length of the NJTP. Figure 2.8 below shows an index of traffic growth by section for the period 1990-2006.

FIGURE 2.8 NJTP - TRAFFIC GROWTH BY SECTION: 1990-2006 (1990 = 100)



Source: NJTA / WSA / SDG Analysis

2.35 As can be seen, traffic growth has been the highest in the southern section of the NJTP, with traffic growing at 2.3% per annum between 1990 and 2006. In contrast, the more heavily utilized northern section has grown at a slower rate of 1.4% per annum over the same period.

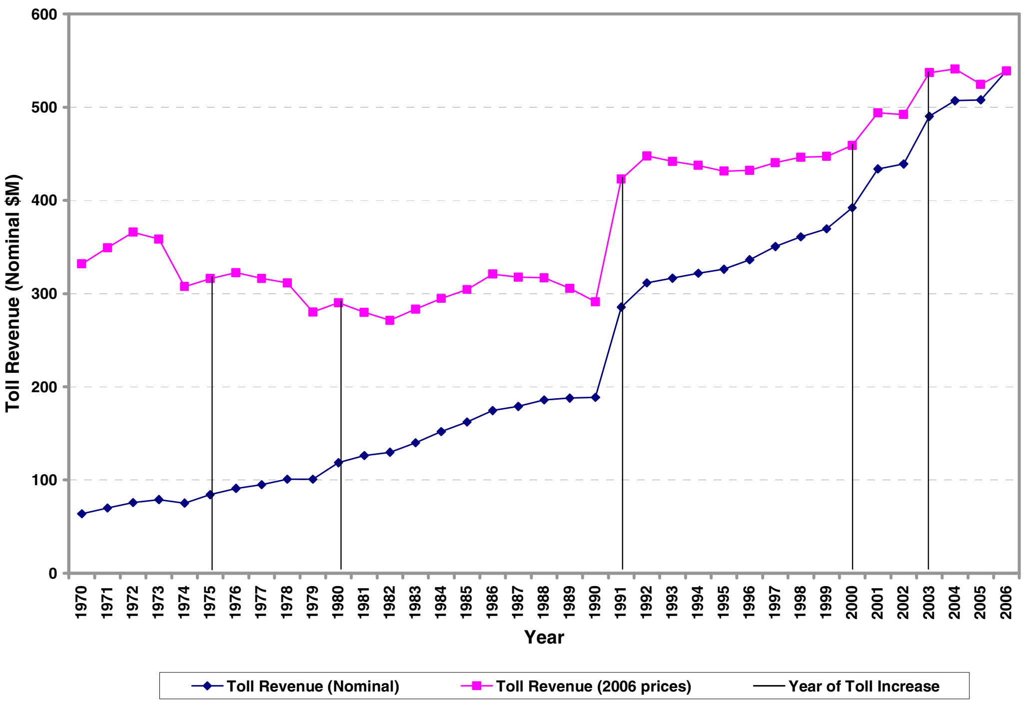
2.36 In the southern section traffic has grown most rapidly at the exits offering access and egress to the Philadelphia conurbation. Exit 3 which intersects I-76 and is the main arterial access point to the east of Philadelphia has grown at an average of 4.3% per annum over the past 16 years.

2.37 Exit 6 which intersects with the Pennsylvania Turnpike has witnessed growth of 2.6% per annum. The exit with the lowest observed growth over the period is Exit 1, which has seen growth of 1.8% per annum.

Revenue

2.38 2006 revenue totaled nearly $540 million. Light vehicles accounted for 65% of revenue whereas trucks accounted for 35% of revenue. Figure 2.9 below shows the development of toll revenue for the period 1970-2006, both in current and 2006 price levels.

FIGURE 2.9 NJTP - TOLL REVENUE: 1970-2006 ($M)

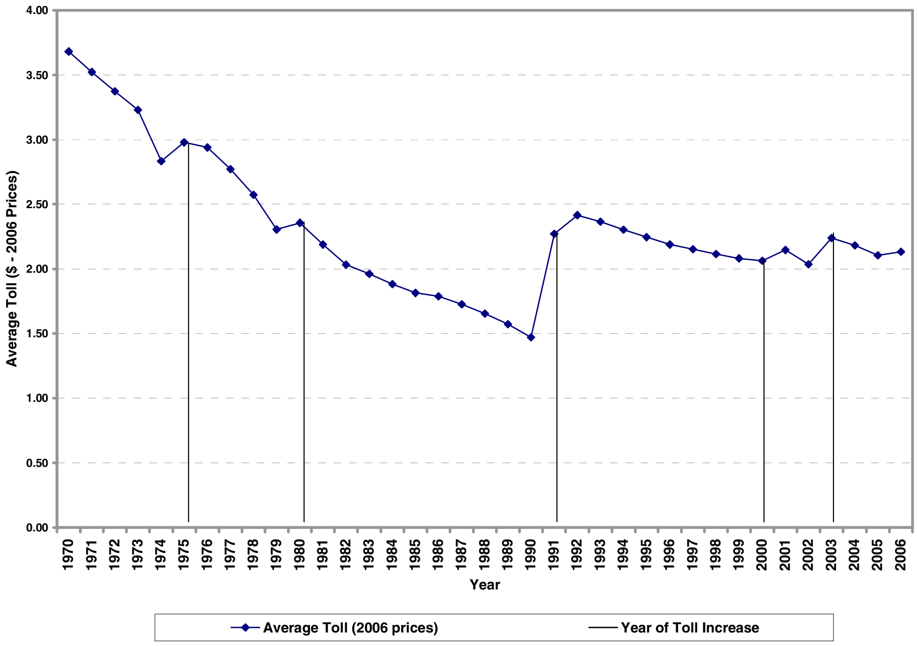


Source: NJTA / SDG Analysis

2.39 It can be seen that between 1970 and 1990, real toll revenues stagnated as toll rates failed to increase at the same rate as price inflation. Only when toll rates were effectively doubled in March 1991 was there a large surge in real toll revenues and a subsequent fall in traffic. However since 1991 toll increases have still only remained periodic and as a result toll revenues through the 1990s remained largely unchanged in real terms. In late 2000 and in 2003 tolls were further increased and this contributed to the increase in real toll revenues witnessed in these years.

2.40 Thus with no specific indexation of tolls, the cost of using the turnpike has actually fallen in real terms for users. Figure 2.10 overleaf shows the average real toll (2006 prices) since 1970. As can be seen the average toll has fallen from $3.68 in 1970 to just $2.13 in 2006 when we express tolls in 2006 prices.

FIGURE 2.10 NJTP - AVERAGE TOLL PER TRANSACTION: 1970-2006 ($, 2006 PRICES)



Source: NJTA / SDG Analysis

2.41 Table 2.5 summarizes traffic and revenue by payment method. The table shows that E-ZPass transactions currently account for 67% of all transactions on NJTP and nearly 65% of toll revenue. Over 30% of all transactions are made by vehicles taking advantage of the E-ZPass toll discount in the off-peak period. Penalty tolls collected following violations account for 2% of all transactions.

TABLE 2.5 NJTP - 2006 TRAFFIC AND REVENUE BY PAYMENT METHOD

Payment Method	Vehicles (M)	Revenue ($M)	% of Total Vehicles	% of Total Revenue
Cash	79.5	181.7	31%	34%
E-ZPass (Peak)	92.3	193.6	37%	36%
E-ZPass (Off-Peak)	76.6	153.0	30%	28%
Violations	4.2	10.6	2%	2%
Total	**252.6**	**538.9**	**100%**	**100%**

Source: NJTA / SDG Analysis

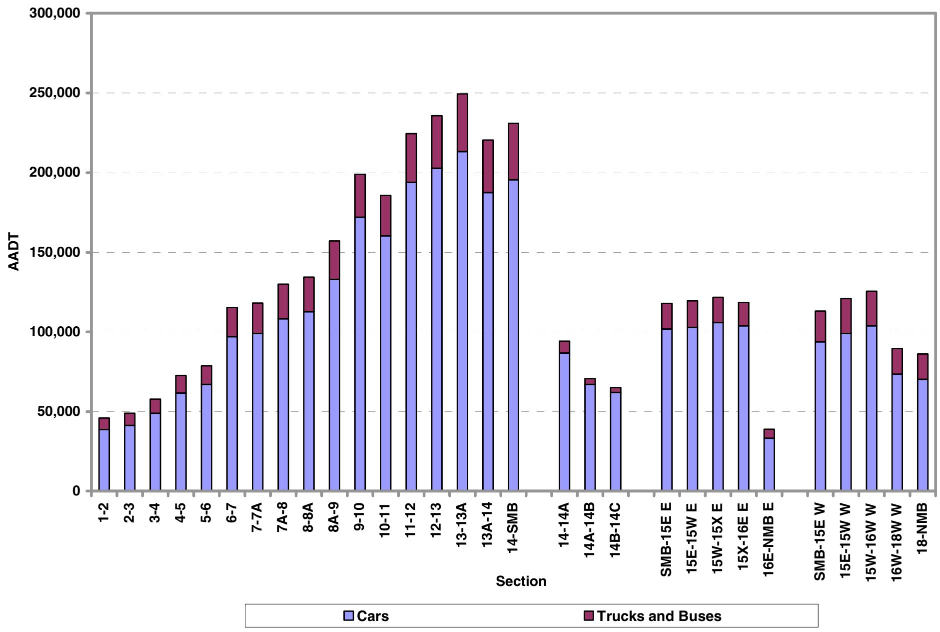
Traffic Patterns

2.42 The busiest sections of the turnpike are, as expected, to the north of Exit 11 as the route approaches the New York and Newark metropolitan areas. The highest observed flow on the route is the section between Exits 13 and 13A where Average Annual Daily Traffic (AADT) flows in 2006 were in excess of 250,000 vehicles per day.

2.43 Traffic flows on the Eastern and Western spurs beyond Exit 15 are also very high, with over 100,000 vehicles per day reported on all sections of both spurs, indicating significant capacity constraints on what are only 3-lane sections of the Turnpike.

2.44 Figure 2.11 below shows observed 2006 AADT for all sections of the NJTP. Usage increases on the approaches to Newark and New York are clearly visible.

FIGURE 2.11 NJTP - 2006 AADT BY SECTION

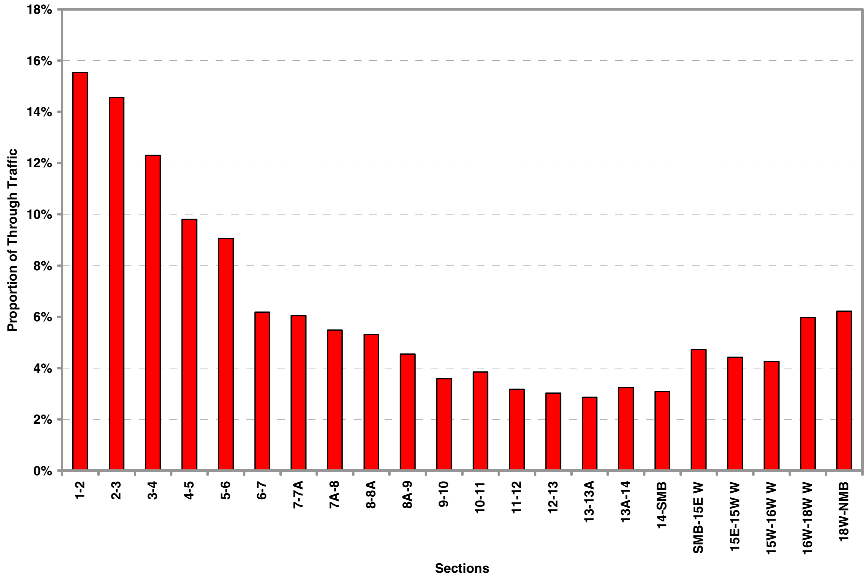


Source: NJTA / SDG Analysis

2.45 Journeys using the full length of the NJTP, that is, 'through' journeys entering the system at Exit 1 and leaving at Exit 18W account for just 1% of total recorded transactions (just over 7,100 transactions per day on average).

2.46 However, Figure 2.12 shows that through traffic as a proportion of total traffic is significantly higher at the southern end of the NJTP.

FIGURE 2.12 NJTP - 2006 THROUGH-TRAFFIC BY SECTION (% OF AADT)

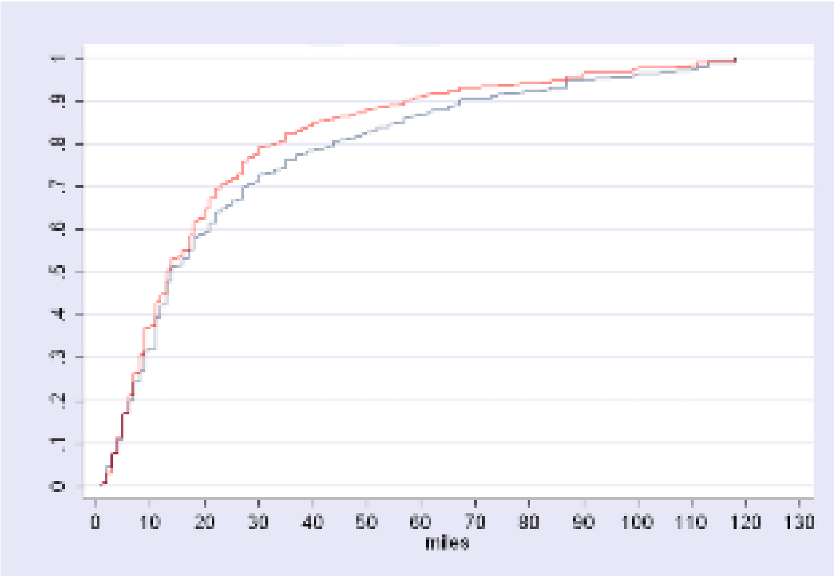


Source: NJTA / SDG Analysis

Trip Length Distribution

2.47 Figure 2.13 shows the cumulative trip length distributions for cars and trucks and buses combined. The average trip length for cars is 22.9 miles, for trucks and buses it is 26.6 miles. These are very low compared to the length of the road and are due to a large volume of relatively short distance trips in the northern part of the road and a relatively low percentage of through trips.

FIGURE 2.13 NJTP - 2006 CUMULATIVE TRIP LENGTH DISTRIBUTION

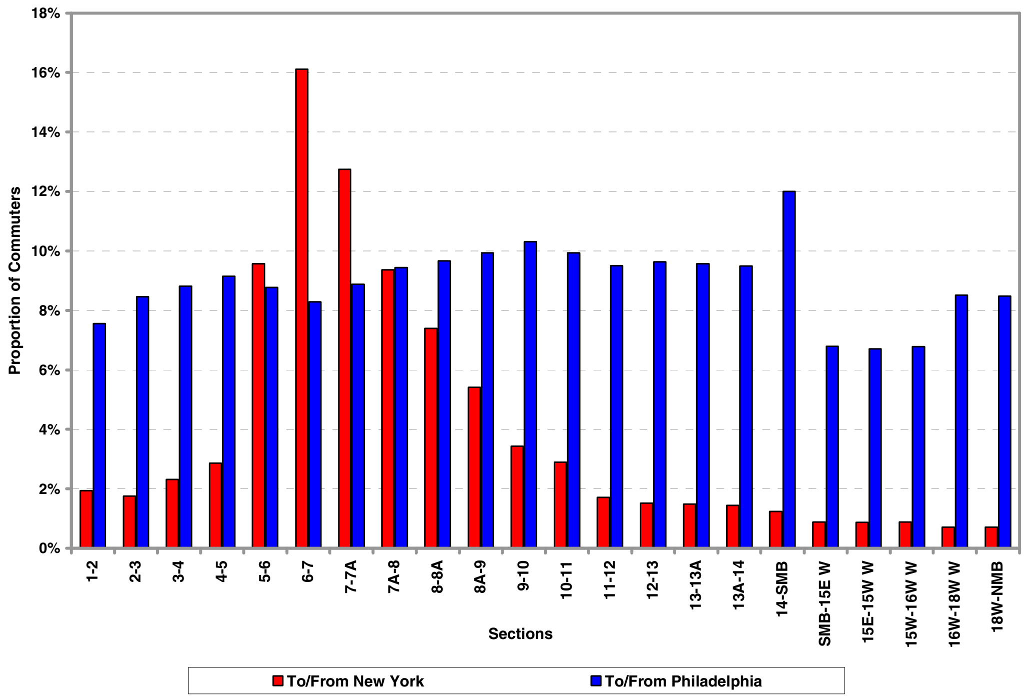


Source: NJTA / SDG Analysis

Trip Purpose Distribution

2.48 We used the NJTPA to extract trip patterns by journey purpose. Figure 2.14 shows the proportion of commuting trips into New York and Philadelphia for each section on the NJTP. It can be seen that commuting flows into Philadelphia are important between Exits 5 and 11 only, but influence traffic levels elsewhere on the NJTP to a lesser extent. Commuting flows into NY on the other hand are much more stable across the length of the road, suggesting a much larger area from which people commute.

FIGURE 2.14 NJTP - ESTIMATED COMMUTING TRIPS BY SECTION (% AADT)

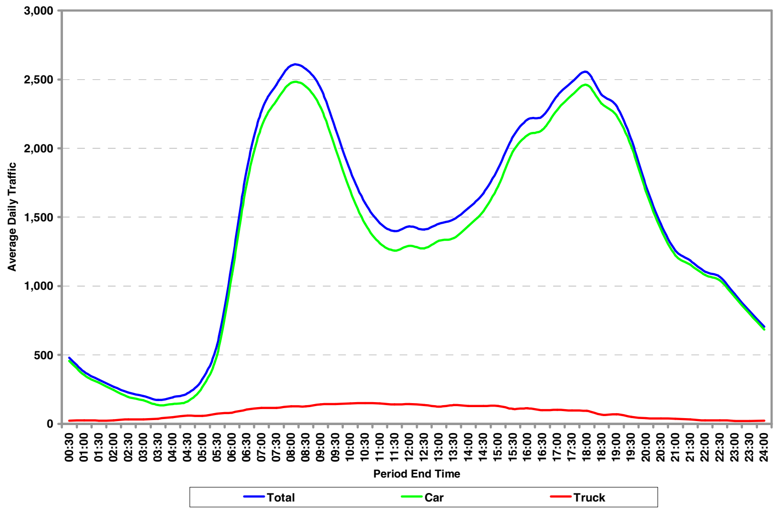


Source: NJTA / SDG Analysis

Hourly Traffic Profiles

2.49 The high density of traffic in the northern section of NJTP naturally affects the profile of traffic throughout the day. Figure 2.15 shows the hourly traffic profile for vehicles using Exit 14C (heading into New York). With an urban intersection such as Exit 14C, there are clearly defined peak periods in the morning and evening. However it is apparent that these peak periods are relatively wide in the sense that peak traffic flows are maintained over several hours. This is a common observation for congested links in urban areas and particular affects the evening peak where in this instance peak conditions appear to commence as early as 4:00 PM and finish as late as 7:00 PM.

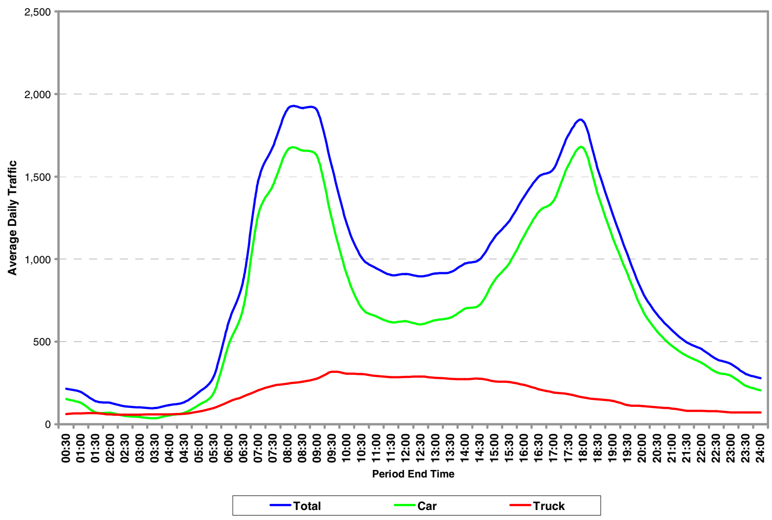
FIGURE 2.15 NJTP - 2006 HOURLY TRAFFIC PROFILE EXIT 14C



Source: NJTA / SDG Analysis

2.50 In the southern sections of the NJTP, smaller peak periods are observed because of the lower incidences of congestion. Figure 2.16 shows the hourly profile of traffic using Exit 8A. As can be seen, the peak periods are no less defined but clearly take place over a much more narrow time period. For example, the PM peak period commences at 4:30 PM and finishes at 6:30 PM, an hour less of peak conditions than that seen at Exit 14C.

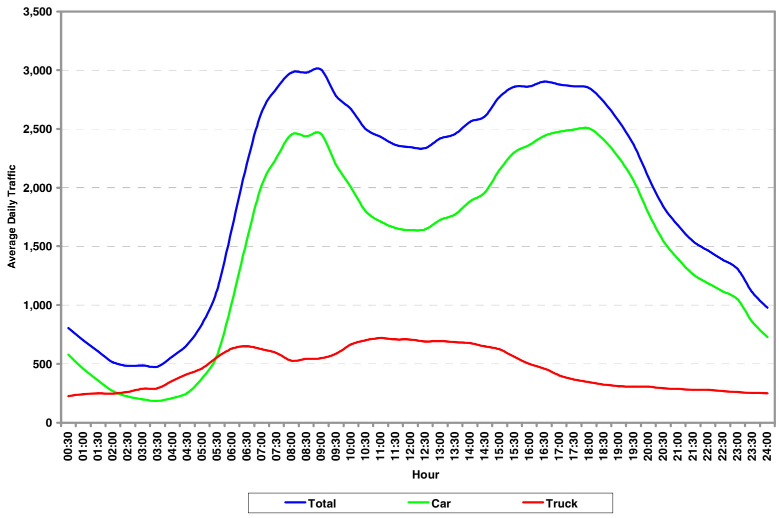
FIGURE 2.16 NJTP - HOURLY TRAFFIC PROFILE EXIT 8A



Source: NJTA / SDG Analysis

2.51 In contrast, on certain sections of NJTP, traffic is relatively more stable across the day with less well defined peak periods. An example of this is Exit 18W where traffic movements will tend to be relatively longer-distance trips traveling beyond the Newark and New York metropolitan area with relatively fewer commuter trips. Figure 2.17 shows how this is reflected in the profile of traffic over the day. As can be seen, at Exit 18W, there is clearly not the same significant decrease in flow in the period between the AM and PM peaks. Instead, traffic flows remain relatively constant across the whole day.

FIGURE 2.17 NJTP - HOURLY TRAFFIC PROFILE EXIT 18W



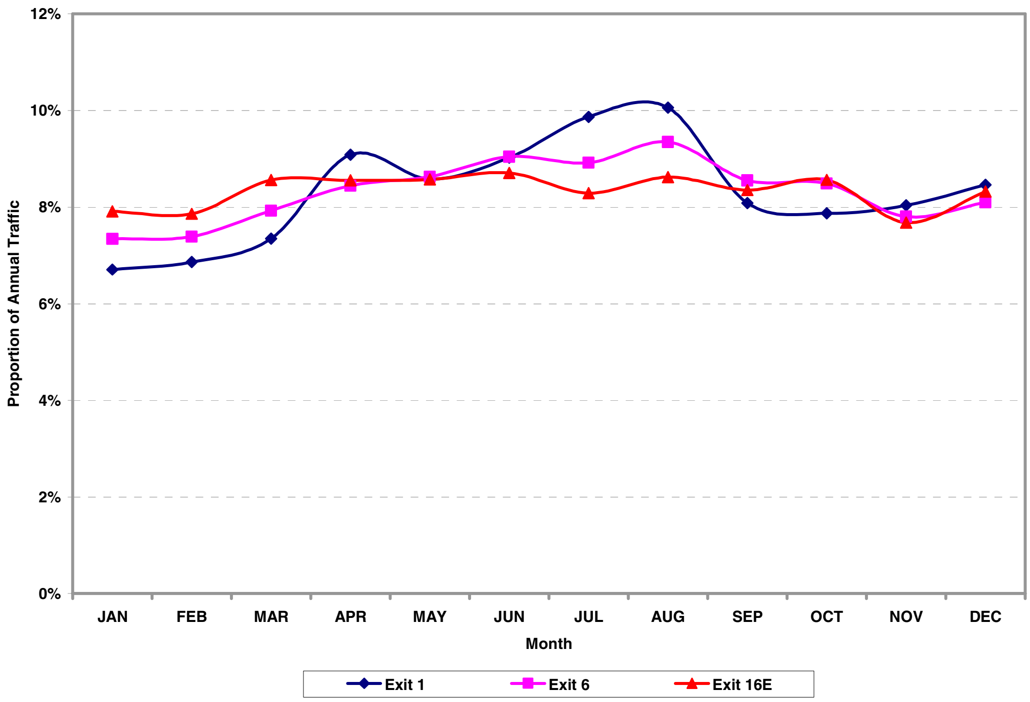
Source: NJTA / SDG Analysis

Monthly Traffic Profiles

2.52 Traffic flows on the NJTP vary across the year and transaction activity at a number of exits is shown in Figure 2.18. It can be seen that the monthly variations in traffic flow are more profound away from urban areas where frequent commuter flows allow traffic levels to remain relatively stable across the year.

2.53 This explains the relative flatness in the profile of Exit 16E which predominately serves New York City. In contrast, less frequently used plazas in the South typically show more seasonal variation, particularly during the winter months when discretionary trips like those taken for leisure purposes normally fall. This appears to be the case for Exit 1, although the difference is not as pronounced as that seen on the ACE and southern sections of the GSP.

FIGURE 2.18 NJTP - MONTHLY TRAFFIC PROFILE EXIT1, EXIT 6 & EXIT 16E



Source: NJTA / SDG Analysis

Traffic Speeds and Congestion

2.54 As we have mentioned, in some sections of the NJTP, the route is typically serving in excess of 200,000 vehicles per day. At such traffic flows, highway capacity constraints will be binding and traffic speeds can be affected. The U.S. Highway Capacity Manual (HCM) uses the concept of Level of Service (LOS) as a qualitative measure of describing the extent of capacity problems on a section of highway. The HCM adopts a sliding scale of LOS ranging from LOS A which represents almost entirely free-flow conditions to LOS F which in contrast describes breakdowns in vehicular flow which result in significant recurring congestion.

2.55 On a multi-lane grade-separated highway like NJTP, occurrences of LOS F are extremely rare and instead a clearer understanding of the extent of capacity problems on NJTP can be obtained by measuring if LOS D volumes are being observed. LOS D is believed to be the point at which free-flow speeds begin to significantly decline and even minor incidents can create queuing. Table 2.6 compares observed peak hour directional volumes on each section of the NJTP to the equivalent service volumes at which LOS D typically occurs. We adopted a link capacity of 2,250 vehicles/hour/lane to correspond to flow levels at which HCM recommends a LOS D.

TABLE 2.6 NJTP - 2006 PEAK HOUR SERVICE LEVELS

Section	Observed Peak Hour Volumes	LOS D Service Volumes	Volume/LOS D Service Volume (%)
1 – 2	1,563	4,500	35%
2 - 3	2,134	4,500	47%
3 - 4	2,318	4,500	52%
4 - 5	2,816	6,750	42%
5 - 6	2,856	6,750	42%
6 - 7	3,880	11,250	34%
7 – 7A	4,135	11,250	37%
7A - 8	5,045	11,250	45%
8 – 8A	5,513	11,250	49%
8A-9	6,786	11,250	60%
9 - 10	7,357	13,500	54%
10 – 11	7,115	13,500	53%
11 - 12	8,674	15,750	55%
12 - 13	8,868	15,750	56%
13 – 13A	8,773	15,750	56%
13A - 14	8,597	15,750	55%
14 - SMB	8,289	20,250	41%
SMB – 15E W	4,206	6,750	62%
15E – 15W W	4,498	6,750	67%
15W – 16W W	4,861	6,750	72%
16W – 18W W	2,677	6,750	40%
18 W - NMB	2,570	4,500	57%

Source: Highway Capacity Manual (TRB) / NJTA / SDG Analysis

2.56 In the northern sections of the road, it is apparent that peak hour volumes are close to the LOS D threshold. Given that the volumes presented in the table above are average annual peak hour volumes, it is likely that at various times of the year the northern section of the route is experiencing LOS D or lower. In contrast, the southern sections of the road have less capacity issues with the ratio of volume to LOS D service volume only ranging from roughly 35% to 60%.

2.57 Analysis of the 2006 tolling system data provides further evidence of relatively less capacity in the northern sections. Table 2.7 shows average traffic speeds in the AM Peak over a range of sections on NJTP.

TABLE 2.7 NJTP - AVERAGE AM PEAK TRAFFIC SPEED BY SECTION (MPH)

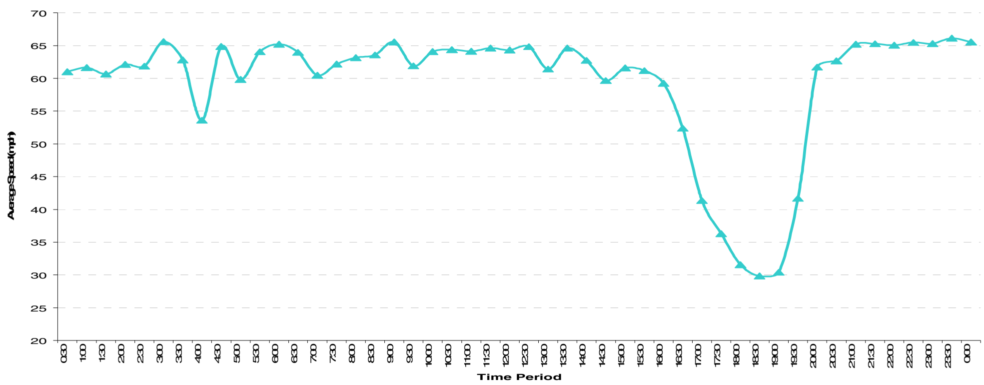
Section	Northbound Speed (mph)	Southbound Speed (mph)
1 - 3	60.0	69.0
3 - 7	65.4	68.1
7 - 9	65.2	70.9
9 - 11	54.4	54.8
11 - 14	45.1	61.3
14 – 18E	50.7	54.9
14 – 18W	49.6	58.0
14 – 14C	24.7	55.6

Source: NJTA / SDG Analysis

2.58 As can be seen, average peak time traffic speeds are typically below 55 mph in the Newark/New York area. On the Newark Bay Extension between Exits 14 and 14 C, average inbound traffic speeds are reported to be as low as 25 mph, these low speeds through the Newark Bay Extension are believed to produce incidences of downstream queuing on the main sections of NJTP, particularly in the event of traffic incidents such as breakdowns and accidents. As expected, the effect of reduced capacity is mainly restricted to the peak periods.

2.59 Figure 2.19 below shows a profile of average journey speeds over 30 minute periods across the day for southbound journeys between Exit 16E and Exit 6. This data was made available for 2 weeks in October 2006. As can be seen, there is clearly deterioration in level of service in the evening peak period when the outbound flow from the New York and Newark areas are at their highest. Speeds during the off-peak periods remain relatively stable

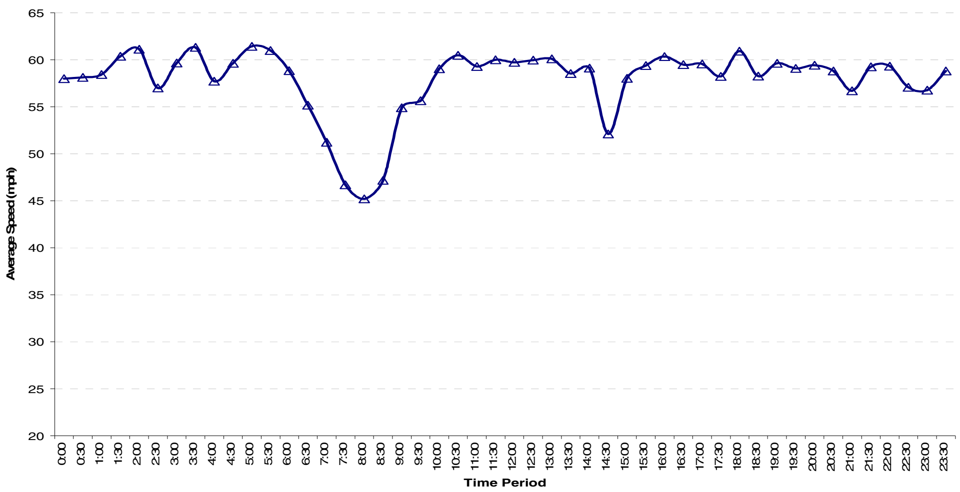
FIGURE 2.19 NJTP - AVERAGE WEEKDAY TRAFFIC SPEEDS BETWEEN EXIT 16E AND EXIT 6 FOR SOUTHBOUND JOURNEYS (MPH)



Source: NJTA / SDG Analysis

2.60 Figure 2.20 shows a similar chart for northbound journeys. Here speeds are plotted for journeys from Exit 9 to Exit 16. As can be seen there is a clearly defined deterioration in speeds in the AM period.

FIGURE 2.20 NJTP - AVERAGE WEEKDAY TRAFFIC SPEEDS BETWEEN EXIT 9 AND EXIT 16E FOR NORTHBOUND JOURNEYS (MPH)



Source: NJTA / SDG Analysis

Behavioral Research

2.61 As part of our literature review we concluded that it would be worthwhile undertaking fieldwork to compare the markets served by the three roads of interest, and possibly also to gather evidence on other key issues that the modeling process should address.

2.62 An online survey was undertaken to provide fresh evidence on certain key issues of relevance to the study. As part of the survey, 333 NJTP users were interviewed between Friday 16th March and Tuesday 20th March 2007. Further details of the survey methodology and analysis can be found in Appendix C of the Background Report, Behavioral Research.

2.63 Overall, the picture that emerges of NJTP users is that they are generally not deterred from using it by the inconveniences of tolls, stress and congestion, and they are not very sensitive to the price of the tolls at their present level. While NJTP users are undoubtedly sensitive to the idea of the tolls going up, the survey presents an accumulation of findings which show that currently many of them do not worry about the price of the tolls.

2.64 The NJTP users included a larger proportion of people with household income over $100,000 pa, with more than a third of them classifying themselves in this category, compared to about a quarter in the case of users of the GSP and the ACE. Of the NJTP users, 43% lived in NJ, 41% in New York, and the remainder in the adjoining states of Pennsylvania, Delaware and Connecticut.

2.65 While the NJTP users were more likely to complain of poor value for money, more likely to experience congestion, and more likely to describe driving on the road as stressful, compared to the users of the GSP and the ACE, these are all things that might have been expected. The more significant findings were that most NJTP users (56%) described the value for money of the tolls as being "average", many of them do not think about how much they spend on tolls, and congestion did not feature as a significant reason for using the road less.

2.66 NJTP users were more likely to describe their recent trips on the road as important, compared to users of the other roads, and they were also more likely to actually use the NJTP and to reject alternative routes, compared to users of the GSP and the ACE. The main alternative given to making a particular trip on the NJTP was to still use the NJTP, but at a different time of day.

2.67 While the NJTP users tended to spend more on road tolls than users of the other toll roads and tended to be more conscious of this spend, about half of NJTP users with E-ZPass do not normally think about the cost of using the road (this proportion was even higher for users of the other roads). The evidence on value of time showed that the proportion of people with medium or high values of time was higher for the NJTP users than for the users of the other roads, and the direct questions about toll price changes suggested that the NJTP users may be less likely to change their behavior in response to toll price rises than users of the other roads.

2.68 Individuals did not report big changes in their usage of the toll roads, and the reasons given for changes in usage were dominated by changes in personal circumstances. The evidence suggests that there has been a slight worsening in congestion on the NJTP over the last two years, but there is also evidence that the deterioration of conditions on alternative routes has been at least as bad over the same time period.

2.69 When asked about changes to the tolls over the past two years (there have not been any significant changes), only about 40% of the NJTP users correctly answered that the tolls had not changed - most of the rest responded that the tolls had gone up, with 10% saying that "tolls are now much higher" compared to two years ago. This adds to the impression that many NJTP users do not have a clear idea of how much they are paying and whether or not it has been changing.

2.70 The survey suggests that the gasoline price rises over the past two years have not had a big impact on people's use of the NJTP, and that many people would adapt to future gas price increases by switching to vehicles with greater fuel-efficiency.

Summary

- The NJTP is a 148 mile tolled facility which forms a crucial link through the state of New Jersey and forms part of the I-95 corridor which connects the major centers on the eastern seaboard of the USA;

- The facility intersects with the major highway routes within New Jersey including the GSP and the Holland and Lincoln Tunnels providing access to New York City;

- NJTP is a limited access interstate-standard facility with a speed limit of 65 mph in rural areas and 55 mph in urban areas. The number of lanes range from two per direction in the south of the facility to seven lanes per direction in the northern sections;

- NJTP has a number of alternative and competing routes. In the south, a network of Interstate routes run parallel to the NJTP and serve the major centers of Philadelphia and Trenton. In the north, less obvious alternatives are available, particularly for access and egress to New York City. NJTP faces limited competition from the GSP and US-1/9;

- NJTPA operates a 'closed' tolled system with toll plazas in operation on each NJTP exit. Payment can be made in cash or by E-ZPass - the ETC system in place on the facility. Vehicles with E-ZPass transponders receive a toll discount of roughly 25% if they travel in the off peak period;

- The NJTP is an existing road and has been open for decades. As a result we have precise knowledge about the amount of traffic that is currently carried by the road and how much toll revenue is collected;

- Historic transaction data allows us to consider how traffic levels have changed over time, how traffic has responded in the past to changes in toll rates and what the relation between traffic on the NJTP and past economic growth has been;

- Traffic has grown steadily on NJTP since opening in 1951. Since 1970 annual traffic growth has been 2.9% per annum. However in the last ten years traffic growth has slowed slightly to 2.6% per annum, but it must be noted that this period has been punctuated with two toll increases;

- The major traffic patterns observed on the NJTP are also understandably concentrated in the north of the facility: with an average trip length of 22.9 miles for cars and 26.6 for trucks and buses and the 10 most recorded entry and exit movements all internal to the New York/Newark area accounting for 22% of all transactions. Through traffic using the whole length of the facility accounts for just 1% of all movements;

- Traffic growth has been most rapid in the central section of the route, while growth in the north of the facility has stagnated – a possible cause of which is the growing congestion and capacity problems in this section;

- Capacity constraints are evident as the route reaches the Newark/New York metropolitan areas where traffic flows will typically reach in excess of 200,000 vehicles per day and average daily speeds can reach as low as 30 mph in peak periods;

- The obvious congestion in the northern section of the facility appears to have produced 'peak spreading' with peak conditions observed for several hours in the morning and evening peaks;

- Toll increases have not been rigidly indexed to consumer prices and as a result NJTP tariffs have failed to keep pace with inflation and the growth in real toll revenues has been just 1.2% per annum since 1970 (2006 prices); and

- 65% of toll revenue is generated from car tolls with the remaining 35% generated from truck tolls. E-ZPass usage accounts for 67% of all transactions and 65% of toll revenue.

- A key issue is to understand how traffic levels will be changing over time and what the impact of capacity constraints are. Important inputs into this process are assumptions with regards to economic growth, population, and major developments (mainly port and infrastructure) that are planned to take place in the study area or surroundings and that may impact on traffic levels.

3. ROUTE 440

Project Overview

3.1 Route 440 is a 13-mile un-tolled facility which extends from Exit 10 of the NJTP to Hudson County, passing through Staten Island. It links I-287 to the area around Jersey City where motorists can access New York City through Lincoln Tunnel.

3.2 The purpose of this section is to report on the 4 mile section between milepost 0 (MP 0) at the intersection with the New Jersey Turnpike, to milepost 3.98 (MP 3.98) at the western end of the presently tolled Outerbridge Crossing.

3.3 There are no major "free" alternatives to this section of Route 440. For journeys within New Jersey, for instance for motorists traveling between Perth Amboy and Edison, the only major alternative route is to drive along a combination of US-9 or GSP and the NJTP. This is considerably longer than using Route 440 and presently incurs one, if not two, toll charges. For vehicles traveling between Staten Island and New Jersey, the only alternative is to divert north to Goethals Bridge which is also tolled.

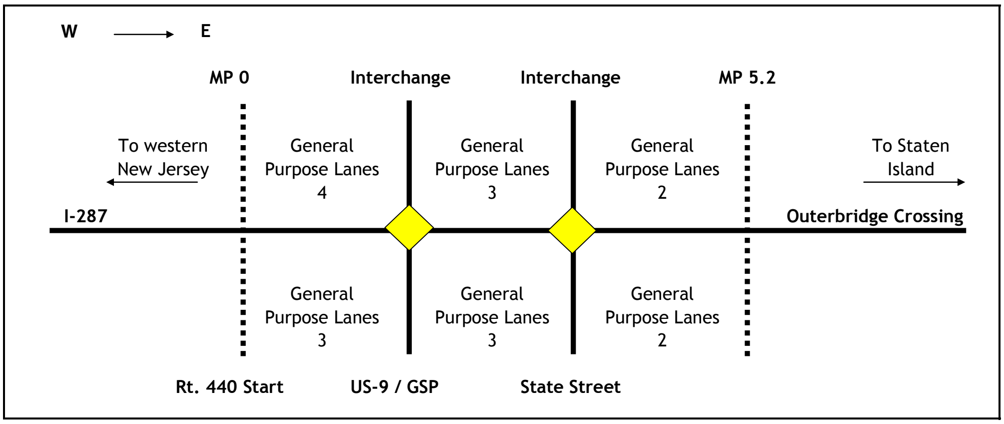
FIGURE 3.1 ROUTE 440 – LOCATION AND COMPETING ROUTES

3.4 The facility is a grade-separated freeway with a speed limit of 55 mph. The lane geometry of Route 440 can be summarized as follows:

- From the intersection with the NJTP to the intersection with US-9 and the GSP, Route 440 operates as a 7-lane highway (4 lanes westbound and 3 eastbound);
- Between the GSP intersection and State St, immediately before the Outerbridge Crossing, the facility operates as a 6-lane highway (3 lanes per direction); and
- From State Street onto the Outerbridge Crossing into Staten Island, the facility operates as a 4-lane highway (2 lanes per direction); and
- The rest of Route 440, from Staten Island to where it ends in Hudson County, is a 4-lane highway (2 lanes per direction).

3.5 A schematic summary of the lane geometry of this part of Route 440 is shown in Figure 3.2 below.

FIGURE 3.2 ROUTE 440 - LANE GEOMETRY (MP 0 TO MP 5.2)



3.6 The section of Route 440 studied provides motorists with a direct link from Exit 10 of the NJTP to Staten Island, by way of the Outerbridge Crossing. Vehicles with two axles traveling on this bridge pay a $6 toll when traveling eastbound during peak hours ($5 for E-ZPass users). From Staten Island, motorists can drive on Route 440 into Brooklyn using the Verrazano-Narrows Bridge. The majority of users of the facility are traveling to and from the eastern or southern part of New Jersey and the New York City area.

Tolling Regimes

3.7 Route 440 is currently an un-tolled highway, although vehicles do incur a charge to use the Outerbridge Crossing. This bridge toll means that journeys between central New Jersey and Staten Island are, in effect, already tolled. Other journeys not using the Outerbridge Crossing are toll free.

3.8 Consultants Michael Baker Jr., Inc. (Baker) produced a report in 2006[1] that presents an evaluation of toll collection options along Route 440 between the NJTP (MP 0) and the Outerbridge Crossing (MP 5.2). Feasibility, right-of-way impact, environmental impact and cost were examined for twelve different options.

3.9 The recommended solution in the Baker Report is an ETC option. This solution simultaneously maximizes revenue and minimizes capital expenditure while also minimizing right-of-way and environmental impacts.

3.10 We have assumed the following toll rates will apply, in line with those charged on the NJTP (2006 prices).

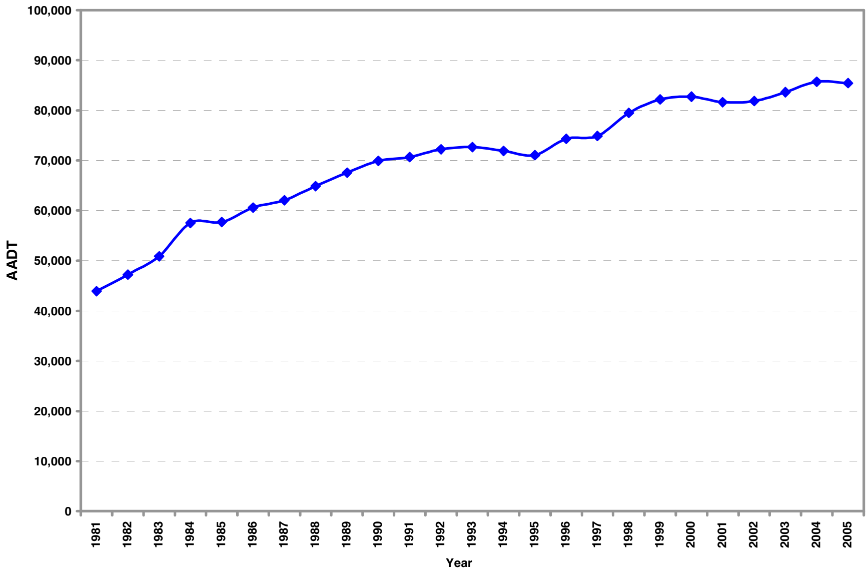
- Cars: $0.12/mile
- Trucks: $0.45/mile

Traffic Trends

3.11 Figure 3.3 shows AADT for the period 1981-2005.

[1] Engineering and Right of Way Assessment for New Jersey State Route 440 (M.P. 0.0 to M.P. 5.2), December 2006

FIGURE 3.3 ROUTE 440 - AADT OUTERBRIDGE CROSSING: 1981 - 2005



Source: NJDOT / SDG Analysis

3.12 As shown in Table 3.1 below, AADT at the Outerbridge Crossing on Route 440 has risen from 44,000 in 1981 to 85,000 in 2005. This average annual increase of 2.7% is less than the growth reported for the NJTP. Specifically, there are two periods when traffic decreased. The toll increases on the Outerbridge Crossing (which for eastbound 2-axle vehicles went from \$3 to \$4 in 1990, to \$5 in 1991 and to \$6 in 1993), explain that there were fewer trips made across the tolled Outerbridge Crossing in the first half of the nineties. The period following the 9/11 events also impacted the economy and the attitude towards traveling, which explains the decrease in traffic during that time. In addition, heavy maintenance work was carried out on the bridge's deck on 2003, which also explains the decrease during that time.

TABLE 3.1 ROUTE 440 - OUTERBRIDGE AADT AVERAGE ANNUAL GROWTH: 1981 - 2005

Year	AADT Beginning of Period (thousands)	AADT End of Period (thousands)	Average Annual Growth
1981 – 1985	44	58	5.6%
1986 – 1990	61	70	2.9%
1991 – 1995	71	71	0.1%
1996 – 2000	74	83	2.2%
2001 - 2005	82	85	0.9%
1981 - 2005	44	85	2.7%

Source: NJDOT / SDG Analysis

3.13 We have used the State-wide model to derive traffic flows for the section of route between the GSP and the NJTP – Table 3.2 below provides a summary of our assumptions. However, going forward, we would recommend undertaking traffic counts at this site to verify our assumptions.

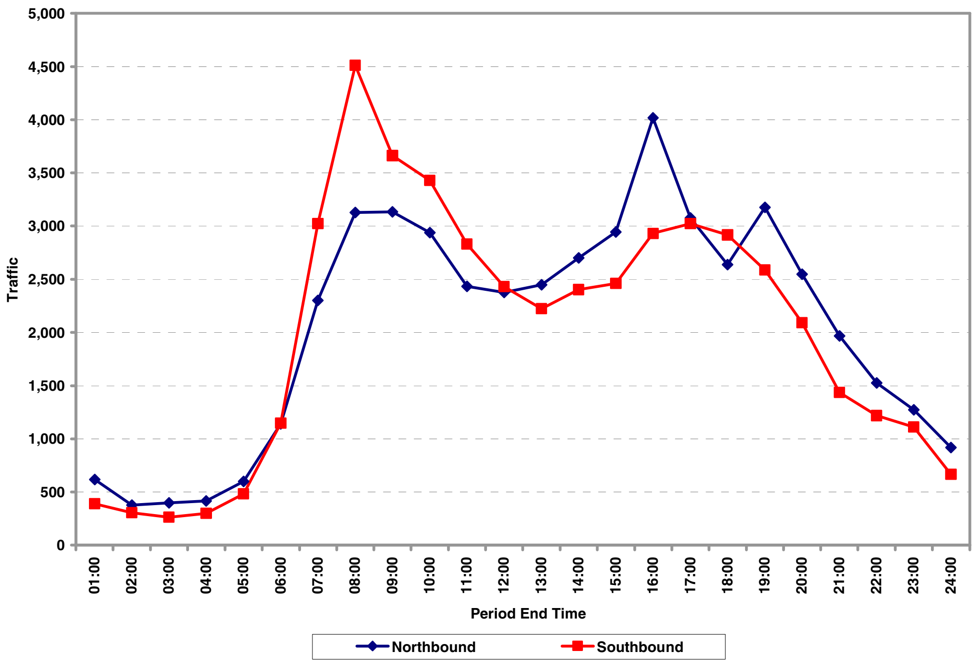
TABLE 3.2 ROUTE 440 - ASSUMED AADT BY SECTION AND VEHICLE TYPE

Section	Cars	Trucks	Total
NJTP-GSP	76,897	6,870	83,767
GSP- Crossing	78,402	7,004	85,406

Source: State-wide model / SDG Analysis

3.14 Figure 3.4 presents the hourly traffic profile by direction for Route 440. The main peak in the AM period represents users traveling northbound, into New York. In the PM period, the main peak represents southbound commuters, traveling into northern New Jersey.

FIGURE 3.4 ROUTE 440 - BI-DIRECTIONAL HOURLY TRAFFIC PROFILE



Source: Baker / SDG Analysis

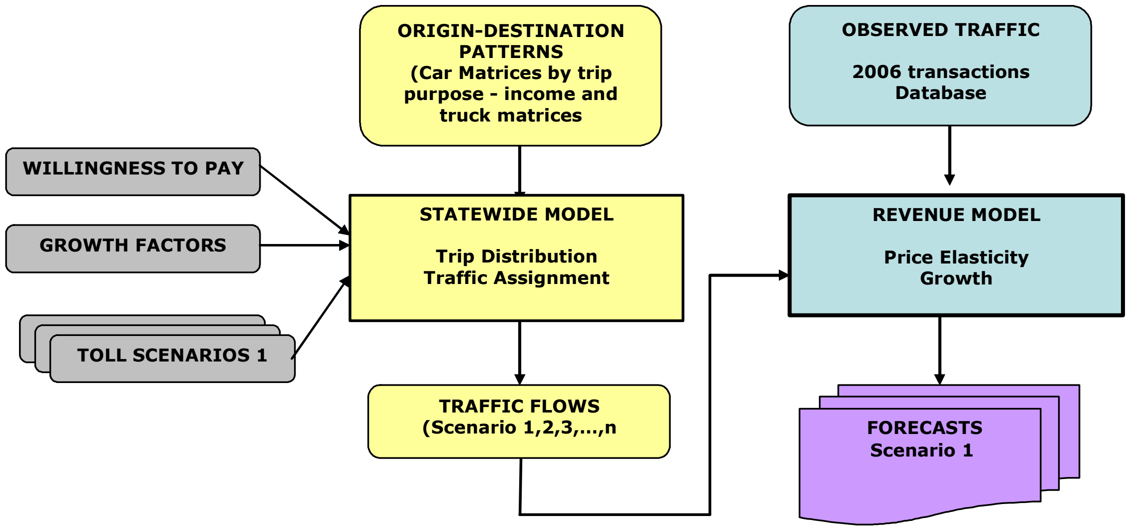
4. THE FORECASTING METHODOLOGY

Introduction

4.1 We have developed a modeling framework that can explore the base assignment to the target facility under a range of scenarios – and for different traffic types. The key issue for the NJTP concession is to understand how traffic levels will be changing over time and what the impact of capacity constraints are. Important inputs into this process are assumptions with regards to economic growth, population, and major developments (mainly port and infrastructure) that are planned to take place in the study area or surroundings and that may impact on traffic levels.

4.2 The central component of the modeling framework is a spreadsheet based revenue model – this has been built to allow testing of different tolling scenarios and to carry out a wide range of sensitivity tests to explore the impact on demand and revenue of a range of factors including growth rates, values of time, changes in trip distribution etc. Our forecasting methodology is illustrated in Figure 4.1 below.

FIGURE 4.1 FORECASTING METHODOLOGY



4.3 The model uses observed 2006 toll demand and revenue data as a basis from which future year forecasts are derived. Within the model demand and revenue are segmented by:

- Geography (toll plazas and toll barriers);
- Time of day (AM Peak, PM Peak, Off-Peak);
- Day of Week (Weekday and Weekend);
- Vehicle Type (Cars and Trucks);
- Payment Method (Cash, E-ZPass); and
- Journey Purpose (Work and Other).

4.4 We have adopted a number of existing modeling tools to inform the revenue model in terms of:

- Impact of congestion;
- Changes in trip distribution;
- Diversion; and
- Traffic Growth.

4.5 The *network models* used are an updated version of the State-wide model, which was initially developed over 10 years ago as an all day (24 hour) traffic assignment model. For the purpose of our assignment, we have updated the *trip tables*, *road network* (base and future) and *assignment procedures*.

4.6 The *trip tables* were updated with the information on trip patterns (Origin- Destination and Journey Purpose split by time of the day) from the NJTPA and SJTPO. Car trips were segmented into two journey purposes (home based work and other), with both journey purposes split into four income groups. The four income groups are based on county-level Census 2000 household income levels that fit into the income ranges of the four income groups identified in the NJTPA (values grown to 2000). Commercial vehicles were treated as one segment.

4.7 The *road network* for the area comprises the freeway, arterial and collector facilities. Each road link contains information on the number of lanes, free flow speeds, capacity, volume-delay relationships and toll charges at toll plazas. The link characteristics were updated to reflect coding of the NJTPA and SJTPO networks for significant roads. Also a future 2025 year network was built which incorporates those planned infrastructure improvements in the New Jersey area that could have a significant impact on the road network.

4.8 The link volume-delay relationships and factors to convert hourly capacity into each time period were reviewed and updated using recent traffic count travel time data collected specifically for the purpose of this assignment. The re-calibrated volume delay functions provided a significantly improved fit to the observed travel time data.

4.9 The third component is the *assignment process* used to estimate how origin-destination demand will route itself over the available network facilities. The vehicle (auto and truck) assignments are based on a process that iterates until network or passenger travel times are in equilibrium. The resulting outputs include vehicle (auto and truck) network volumes, travel times and costs.

Impact of Toll Changes and Congestion

4.10 There are several ways in which people can adapt to a change in toll levels and increased levels of congestion, as follows:

- Time period - in the case of relative changes in the tolls applying to specific time periods or congestion occurring at specific times;
- Route - in many cases, however, alternative routes offer considerably longer and more uncertain journey times;
- Vehicle occupancy - ride sharing can reduce the trip costs per passenger / reduce congestion;
- Mode - flying for long-distance through passenger traffic, rail for certain other Origin-Destination (O-D) combinations (the NJ Transit rail network focuses on trips to and from New York);
- Destination - in some cases people might consider going to a different city if there is a big difference in the cost of the trip or congestion levels; and
- Activity - some people might offset the higher costs of travel by doing the activity less often, or not at all.

4.11 Recent research by Ozbay et al[2] on the behavioral response to the time of day pricing initiative on the NJTP showed that the most common responses to increased peak-hour tolls and reduced off-peak tolls were to travel by alternative routes, to reduce use of the NJTP, to increase ride sharing, and to increase travel in off-peak periods. However it is important to note that approximately 93% of individuals did not change their travel behavior at all in response to the changes to the toll schedule in the year 2000. The research concluded that faced by a small differential between peak and off-peak tolls being introduced, the demand was very inelastic.

4.12 Our modeling framework currently handles route choice and changes in travel times. Trip suppression is due to changes in vehicle occupancy, mode-shifting, destination and activity changes are not currently modeled explicitly, but we do allow for trip suppression due to capacity constraints. However, we have checked the implied elasticities from the model are reasonable compared to evidence from other roads.

[2] Ozbay, K., J. Holguín-Veras, O. Yanmaz-Tuzel, S. Mudigonda, A. Lichtenstein, M. Robins, B. Bartin, M. Cetin, N. Xu, J.C. Zorrilla, S. Xia, S. Wang, and M. Silas (2005). 'Evaluation Study of New Jersey Turnpike Authority's Time-ofday Pricing Initiative'. Publication FHWA-NJ-2005-012.FHWA, U.S. Department of Transportation. Available online at time of writing:
http://knowledge.fhwa.dot.gov/cops/hcx.nsf/All+Documents/BA2414CE1EAC182685256DC500674090/$FILE/njtpa_final_report_may_31_2005.pdf

Existing and Future Capacity Constraints

4.13 Initially a set of constrained traffic forecasts was developed. These were then used to determine when lane expansions may be required over the life of the concessions of the project facility. The basis for this was the requirement specified by the State that Service Levels should not fall below "Level D". Our method for estimating capacity constraints is outlined below.

4.14 Firstly the 2006 transactions database was used to establish annual average weekday traffic flows (AADTw) by section of road, time of day and direction of travel.

4.15 From this the number of vehicles per hour per lane for each road section for the AM Peak period (defined as 6:00AM-9:00AM on weekdays) was derived. Traffic growth estimates from the forecasting model were applied to derive this information for each of the forecasting years.

4.16 Secondly on the basis of the HCM and speed/flow relationships calibrated on other inter-urban highways, we adopted a link capacity of 2,250 vehicles/hour/lane to correspond to flow levels at which HCM recommends a LOS D[3].

4.17 When forecast traffic levels exceeded the LOS D definition capacity constrains are believed to be binding and an expansion of one lane per direction has been assumed. The triggered expansions are summarized in Appendix C. It can be seen that for certain road sections a secondary expansion has been necessary due to further traffic growth. Finally the traffic models were rerun to include the additional network capacities.

[3] Our analysis is fully reliant on data supplied by NJDOT and its agencies, and is based on 'average' traffic conditions. It is however apparent that at certain times of the year and on certain days, volumes will be considerably higher than these averages. In addition unforeseen incidents may generate a severe breakdown in flow and these effects will be 'smoothed' by taking an average approach. However we feel this is the only method by which we can obtain an accurate picture of the performance of a facility over an extended period of time and thus a fair assessment of whether an expansion is genuinely required. The method applied is a 'link-based' assessment, i.e. it does not explicitly consider the capacity of interchanges or the interaction of the facilities with the 'secondary' highway network (from where downstream queuing often occurs because capacity is typically much less). By assessing constraints purely on the basis of link volumes and capacities we are effectively isolating highway sections where the provision of additional lane capacity will help solve prevailing congestion levels.

5. TRAFFIC GROWTH

Introduction

5.1 To derive the extent to which traffic will grow in the future, we have undertaken the following:

- Reviewed the extent of economic development in the region and derived appropriate 'economic' forecasts (e.g. we have used various recognized economic forecasting sources to derive population and employment forecasts at a county level – based on discussions with development agencies, we have also provided an 'overlay' to these forecasts, depending on the extent new sites and developments will generate additional population);
- Analyzed the extent to which travel-related parameters such as trip making by drivers have changed over time (e.g. there is considerable evidence from official New Jersey statistics that drivers are undertaking more mileage every year. For the appropriate traffic categories, we have therefore adjusted the county-based economic forecasts accordingly to reflect this); and
- So that the growth vectors can be incorporated into the traffic modeling framework, we developed matrices containing vectors at the county level for each of the three traffic categories. These reflect assumptions about growth to/from origins and destinations. The growth vector matrices then form an input to the traffic models.

5.2 As discussed in this chapter, observed economic and traffic growth in New Jersey have been extremely robust. Based on our review of all available data and forecasts, we believe that these robust level of growth will continue into the future.

Economic Development

5.3 New Jersey is a key region of economic activity within the United States and is situated at the centre of a metropolitan axis stretching from Washington, DC to Boston, MA. The State is the most densely populated in the United States, at 1,174 residents per square mile. According to the United States Census Bureau, it is also the second wealthiest state per capita in the United States.

5.4 According to the US Bureau of Economic Analysis, the State's median household income is the highest in the nation, at $55,146 and it is ranked second in the nation by the number of locations with per capita incomes above the national average of 76.4%. Nine of New Jersey's counties are in the wealthiest 100 of the country.

5.5 New Jersey has an extensive industrial base that comprises the following:

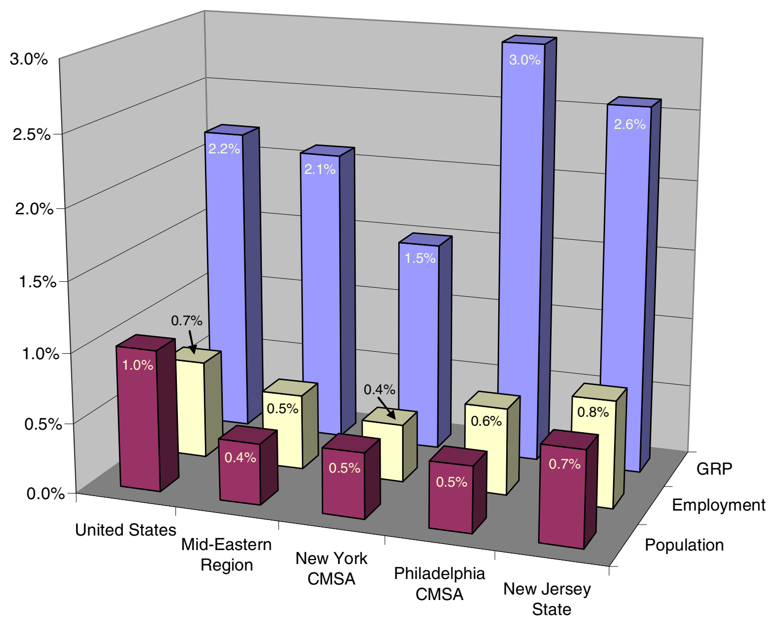
- The Port Newark-Elizabeth Marine Terminal is one of the world's largest container ports while Newark Liberty International Airport is ranked seventh among the nation's busiest airports and among the top 20 busiest airports in the world;

- New Jersey's industrial outputs include pharmaceutical and chemical products, food processing, electric equipment, printing and publishing, and tourism. Additionally, New Jersey is home to the largest petroleum containment/storage system outside of the Middle East;
- New Jersey hosts several business headquarters (fifty Fortune 500 companies have headquarters in or conduct business from Morris County alone);
- New Jersey has several oil refineries and chemical plants;
- Its agricultural outputs are numerous and include nursery stock, horses, vegetables, fruits and nuts, seafood and dairy products.

5.6 It is these types of activities that generate significant volumes of traffic on the toll roads in New Jersey. In addition, considerable volumes of car journeys are generated from the large number of residential developments throughout the States as well as the car trips generated by the employment in major centers such as New York City.

5.7 Figure 5.1 is based on historical data collated by Woods & Poole, a firm that specializes in long-term economic and demographic analyses. In the figure, the 'Mid-Eastern' region is defined as that comprising Delaware, Washington DC, Maryland, New Jersey, New York and Pennsylvania.

FIGURE 5.1 ANNUAL GRP, POPULATION & EMPLOYMENT GROWTH, 2000 - 2005



Source: Woods & Poole

5.8 The figure shows that economic growth between 2000 and 2005 (as measured by Gross Regional Product, GRP), was higher than that observed nationally. Although there is evidence that in the past years, New Jersey's economic expansion has lagged behind that in the country, long term forecasts by institutions such as Woods & Poole predict a return to robust growth of approximately 2.5% per year over the period to 2030.

5.9 The figure above also shows that over the period between 2000 and 2005, employment growth in New Jersey has exceeded that observed nationally while population growth has also been significant and has compared well with the national average.

5.10 Recent research by the Rutgers State University of New Jersey's Economic Advisory Service (RECON) supports the predictions of other forecasters, such as Woods & Poole, by indicating that over the longer term (between 2005 and 2016), economic growth in the State will continue to be robust.

5.11 The RECON forecasts of January 2007, for example, suggest that output in the State of New Jersey will increase by 2.5% per year (similar to the growth indicated in the Woods and Poole forecasts). This is an issue that has relevance to traffic growth forecasts and these are discussed later.

Trip Rates

5.12 In addition to evaluating forecast economic and demographic growth at the county level, we have also undertaken research into the following:

- The extent of any 'decoupling' between economic and traffic growth; and
- Investigating whether there is evidence of an increase in vehicle miles traveled (VMT) per capita.

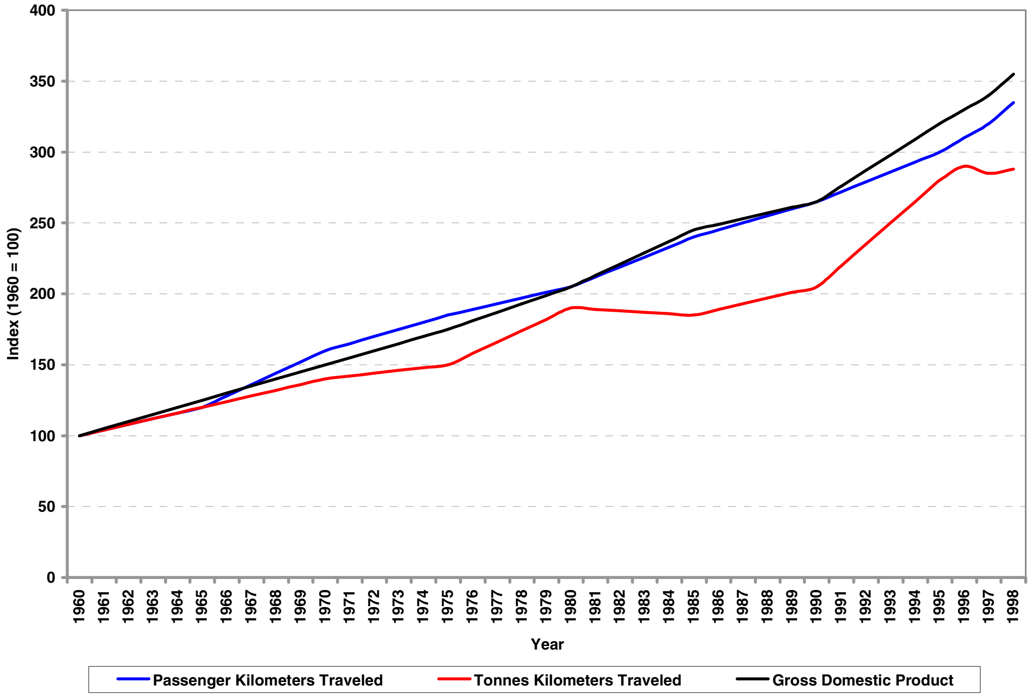
5.13 These are important parameters since they provide guidance as to whether the demographic growth-based vectors should be adjusted to reflect observed changes in trip making and vehicle mileage.

5.14 One of the key issues here is the evidence of any increase in annual vehicle mileage per member of the population in New Jersey. If, for example, the number of miles each person travels is increasing each year, this indicates that an allowance should be made for this within any demographics-based growth vectors.

Decoupling of Economic & Traffic Growth

5.15 Research undertaken in the United States ('Decoupling Economic Growth & Transport Demand: A Requirement for Sustainability', R Gilbert & K Nadeau, May 2002) has shown that there is some evidence of 'decoupling' of economic growth and traffic growth. This is indicated in Figure 5.2 below (albeit with data only available up to 1998).

FIGURE 5.2 DECOUPLING OF ECONOMIC & TRAFFIC GROWTH 1960 – 1998 (USA)

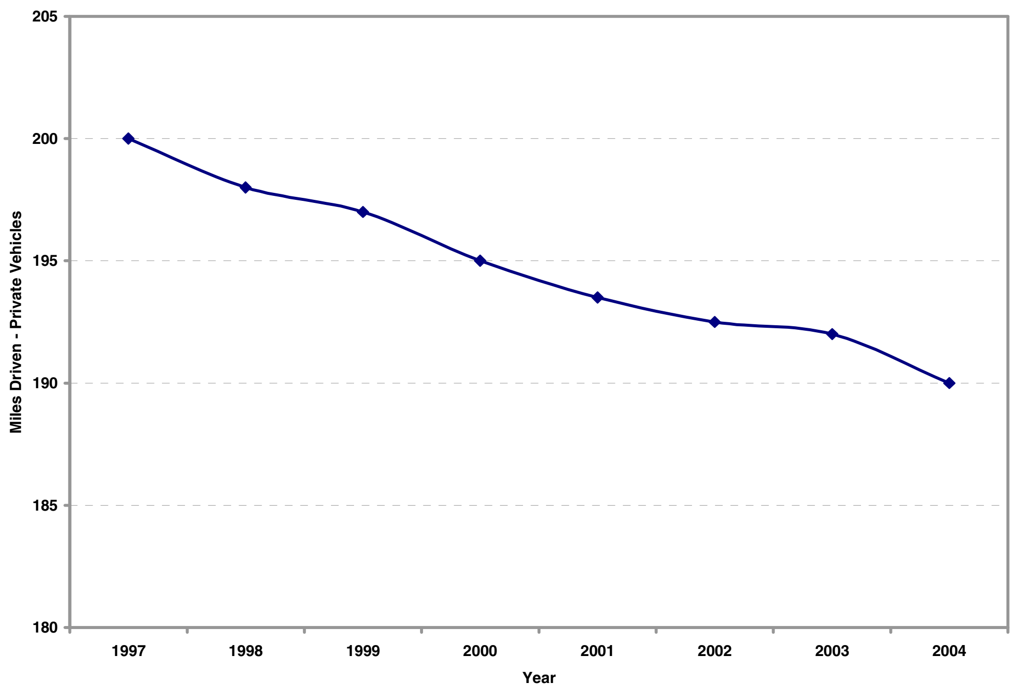


Source: US Bureau of Transport Statistics ('National Transport Statistics') / US Bureau of Economic Analysis ('Current Account Data')

5.16 As the figure indicates, although the motorized movement of people in the US has closely matched the growth in the economy, there has been some decoupling of economic activity and freight transport activity since the early/mid 1970s and of economic activity and passenger transport since the early 1990s.

5.17 Private motoring data from the New Jersey Department of Labor and Workforce Development and the Federal Transit Administration's National Transit Database (for 1997 to 2004) shows that for every $1,000 of Gross State Product, total mileage driven decreased by approximately 5% over the period. This is indicated in Figure 5.3.

FIGURE 5.3 PRIVATE VEHICLE MILES DRIVEN PER $1,000 GROSS STATE PRODUCT, NEW JERSEY, 1997-2004



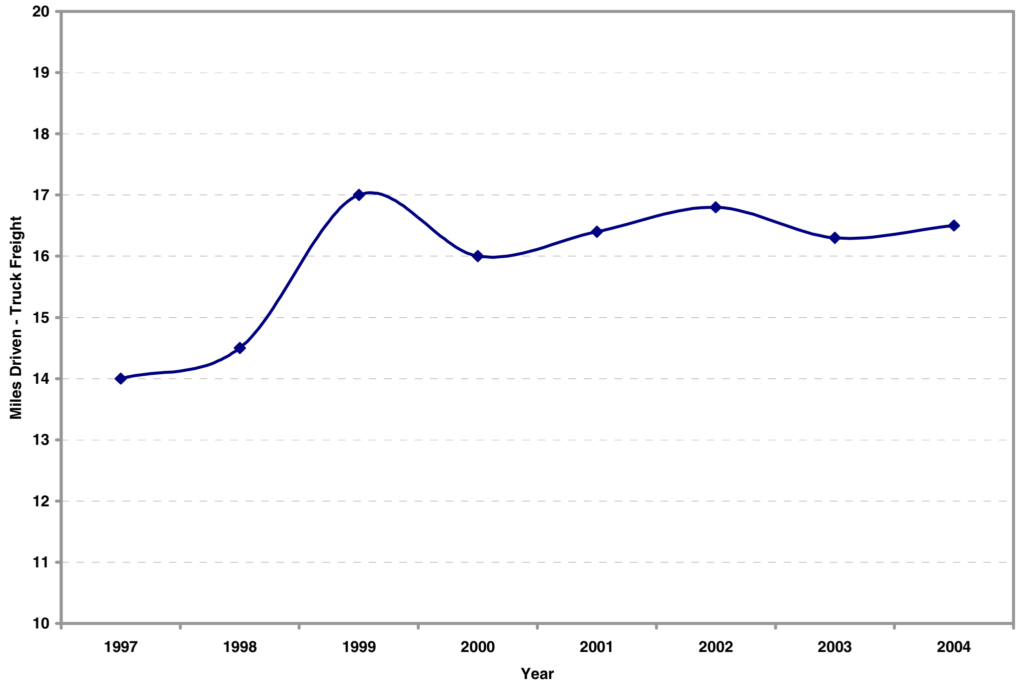
Source: NJ Dept of Labor & Workforce Development, FTA National Transit Database, 1997-2004

5.18 For passenger mileage, although this indicates some decoupling of economic activity from transport activity, the annual extent of this (-0.7% per annum) is relatively small and may reflect factors such as growth in transit use statewide as well as a 13.6% increase in 'output per worker' over the same period. This indicates that fewer workers (and fewer drivers) are required to produce a larger Gross State Product.

5.19 Given this relatively small level of 'decoupling' each year, we have not adjusted the car traffic growth vectors as there is considerably more evidence (see below) that on a per capita basis, drivers in New Jersey have been traveling increasing vehicle mileages each year.

5.20 For truck freight traffic in New Jersey, the outcome appears to be different as on average, the number of miles driven per $1,000 of Gross State Product has increased over the period by almost 18%. Figure 5.4 overleaf indicates this trend, including the two years where the volume of mileage per Gross State Product decreased.

FIGURE 5.4 TRUCK VEHICLE MILES DRIVEN PER $1,000 GROSS STATE PRODUCT, NEW JERSEY, 1997-2004



Source: NJ Dept of Labor & Workforce Development, FTA National Transit Database, 1997-2004

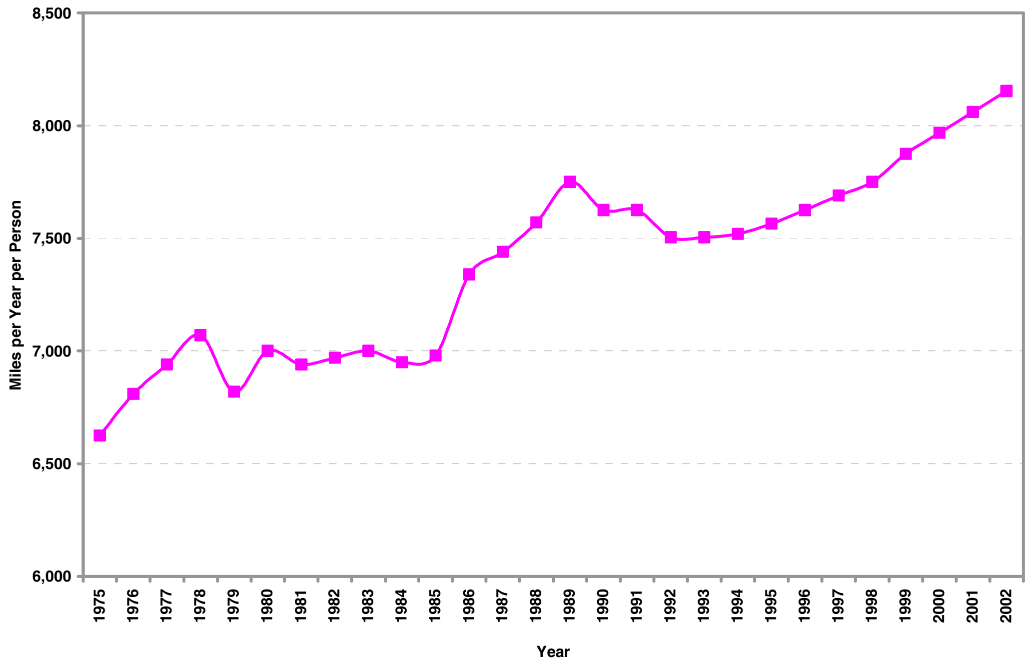
5.21 For truck traffic, although we have not made a direct upward adjustment to reflect this increased level of mileage per unit of economic activity, the growth vectors derived for this traffic category are higher than those for other traffic types are due, in part, to this phenomenon.

5.22 To demonstrate the high level of truck traffic observed in New Jersey between 1997 and 2004, data from NJDOT's 'Travel Activity by Vehicle Type' shows that truck travel grew by 44%, compared to 15% for all vehicles. Trucks traveled more than 6.3 billion miles in 2004, up nearly 2 billion miles from 1997. Trucks also made up a growing share of the vehicles on New Jersey's roadways. In 2004, trucks comprised almost 9 percent of the total miles traveled, up from 7 percent in 1997, an increase of 25%.

Evidence of Increases in VMT Per Capita over Time

5.23 Data collected for New Jersey indicates that there has been a steady increase in VMT per capita over time. Using both FHWA and Census data from 1975 through to 2002, there have been several trends over different periods in the VMT per capita relationship as indicated in Figure 5.5.

FIGURE 5.5 SUMMARY OF VEHICLE MILES TRAVELED PER CAPITA, 1975 - 2002



Source: NJDOT (figure produced in New Jersey Department of Environment Protection's 'Environmental Trends 2005')

5.24 As the figure shows, there are several distinct 'periods' in which the relationship between vehicle mileage per person changes and these are summarized below:

- 1975 – 1980: a period of comparatively strong growth (despite downturn in 1979);
- 1980 – 1985: VMT per capita remained broadly constant;
- 1985 – 1989: VMT per capita increased by just over 2% per annum;
- 1989 – 1995: VMT per capita fell;
- 1995 – 2005: VMT per capita increased by just over 1% per annum.

5.25 The most important conclusion to be drawn from the data in the figure is that there has been a steady increase in miles per capita since the mid-1990s. Following the end of the economic downturn of the early 1990s, drivers throughout New Jersey have been undertaking more mileage each year as their need to travel increases.

5.26 Over the last five years (2001-2005), for example, the average increase has been approximately 1.2% per annum. In other words, New Jersey residents are driving approximately 1.2% more miles compared to the previous year.

5.27 Figure 5.6 shows the absolute vehicle miles traveled per capita between 2000 and 2005. The figure clearly indicates that although VMT per capita decreased between 2002 and 2003, this was more than made up in the following year. The decrease between these years is most likely, however, to be attributed to the 'one off' economic shock associated with the events of 9/11. We would thus conclude from the longer term average that vehicles miles traveled per capita is likely to grow by at least 1% per annum.

FIGURE 5.6 VEHICLE MILES TRAVELED PER CAPITA, 2000 - 2005

Source: NJDOT / US Census Bureau

5.28 The observed increase in VMT per capita is a key finding since it suggests that for certain traffic categories, forecast growth based on forecast changes in population and employment will be supplemented by growth attributable to the increases in mileage per capita.

5.29 To demonstrate this, the majority of official county-based demographic forecasts in New Jersey (e.g. including those produced by Woods & Poole) indicate annual increases in population of approximately 1%. To derive an overall growth vector that reflects these and the increases in VMT per capita of 1% per year, the two growth rates are multiplied together to produce a combined vector of over 2% per annum.

5.30 The derivation of vectors incorporating an allowance for increases in VMT per capita is discussed in more detail under 'Car – Other' below.

WSA Forecasts

5.31 WSA produced transactions projections in 2005 for the NJTP. These estimates were based on historical data and covered the period 2006 – 2015. The results of this report are summarized below and in Table 5.1.

5.32 The projections were based on a number of assumptions. The most significant are:

- No toll increase during the forecast period;
- No major competing highway construction during the forecast period;
- Population, employment and local development will follow the WSA report's socio-economic projections;
- No reduced growth initiatives will be introduced; and
- Fuel will remain available at stable prices

5.33 Employment in southern New Jersey was expected to grow, specifically in Camden and Mercer counties, whereas slow employment growth was expected in the northern New Jersey region. Population was forecast to grow across the state, with Somerset County growing most rapidly. The report projected steady increases in the number of the region's residential building permits issued.

5.34 Major infrastructure and land developments were projected to add traffic onto the NJTP. Among theses projects were Meadowland Xanadu, the Secaucus Interchange and the Pennsylvania Turnpike/I-95 connection.

5.35 WSA projects total traffic to rise from 257 million in 2005 to just under 335 million by 2011. Revenue is projected to increase from $525 million in 2005 to $676 million in 2011, representing an average annual growth of 4.3 %.

TABLE 5.1 NJTP - WSA TRAFFIC PROJECTIONS (2005 - 2011)

Year	Traffic (M)	Observed Traffic	Revenue (Nominal SM)	Observed Revenue (Nominal $M)
2005	257	241	525	508
2006	285	252	583	539
2007	297		603	
2008	305		617	
2009	311		629	
2010	321		650	
2011	335		676	
Average Annual Growth	4.5%	4.6%	4.3%	6.1%

Source: WSA / SJTA / SDG Analysis

Steer Davies Gleave Forecasts

5.36 The following paragraphs contain descriptions of the how the growth vectors for each traffic category have been derived. In addition to using forecasts of demographic parameters, the growth vectors also reflect 'Trend Analyses' of historical traffic growth on the toll road. This has informed our view of the most appropriate growth factors to use for the traffic forecasts.

Development of Growth Vector Matrices

5.37 Before discussing how the growth vectors by vehicle category have been derived, we provide a summary of how the growth matrices are developed. These growth matrices form a key input to the traffic forecasting process.

5.38 For traffic forecasting purposes, there are three different 'growth' matrices developed for each traffic type. These represent:

- Car – work journeys;
- Car – 'other' journeys (including business & leisure journeys);
- Truck.

5.39 In each of these matrices, the 'zoning' system is based on the 21 counties within the State of New Jersey as well as 28 'external' counties that are located in neighboring States. The 28 external counties are shown below in Table 5.2.

TABLE 5.2 SUMMARY OF 'EXTERNAL ZONE' COUNTIES

New York	Pennsylvania	Delaware	Maryland	Connecticut
Bronx	Berks	Kent	Cecil	Fairfield
Dutchess	Bucks	New Castle		
Kings	Chester	Sussex		
Nassau	Delaware			
New York	Lancaster			
Orange	Lehigh			
Queens	Monroe			
Richmond	Montgomery			
Rockland	Northampton			
Sullivan	Philadelphia			
Ulster	Pike			
Westchester				

5.40 Within each matrix, the objective is to derive a series of annual growth rates to apply to trips between each origin and destination. The derivation of these growth rates is discussed below with each county-to-county vector reflecting forecasts in variables such as employment and population growth as well as any adjustments made to reflect changes in trip rates / trip making over time.

5.41 There is thus a three-step process used to derive the annual growth vectors for each traffic type:

1) Derive 'economic' growth factors for each county-based zone (A full description of how these population and employment-based growth vectors are derived is included in the 'Economic Analysis' section of the Background Report of the Traffic and Revenue study);
2) For each traffic type, evaluate how these growth vectors should be adjusted to reflect changes in trip rates / trip making (e.g. for 'Car – Other' journeys, evidence of increases in vehicle mileage per capita will warrant an appropriate adjustment to the basic growth vectors);
3) Given the potential 99 year duration of the forecast period, appropriate changes to the traffic growth vectors are made at key points in the concession timescale.

5.42 If appropriate, matrix Furnessing[4] is undertaken for those traffic types where origin vectors (e.g. based on 'population' growth) are different to destination vectors (e.g. based on 'employment' growth). This technique has been specifically applied to the 'Car – work' category where origins are related to population growth and destinations based on employment forecasts.

5.43 The format of the output from the traffic growth matrices is in a format suitable for direct input to the traffic models.

Car - Work

5.44 For car-based journeys to work, we have used county employment growth vectors as a basis for 'destination' trips. This is because growth in this traffic category will be very closely linked to growth in at 'employment destinations'. For the 'origin' trips, these are based on forecast increases in population in each county as the relative growth in the number of residents will also influence the rate of increase in work trips.

5.45 Given that there will be differing rates of growth at both origins and destinations within the 'Car – Work' matrices, these are 'balanced' by use of an appropriate Furnessing process. Through a series of iterations, this ensures that the resulting row totals of trips matches the column totals of trips.

[4] Furnessing: Process by which traffic volumes are adjusted using an iterative process in order to satisfy defined control totals.

5.46 The growth rates in the table are annual vectors applicable to the earlier years of the concession period. Over time, it is necessary to adjust these vectors as it becomes increasingly difficult to forecast changes in economic variables over the long term. The profile indicated below applies to all growth vectors:

- 2007 – 2025: annual growth vectors are based on those indicated in the table above;
- 2026 – 2050: all growth vectors are reduced by 25%;
- 2051 – 2075: all growth vectors are reduced by 50%; and
- 2076 – 2107: all growth vectors are reduced to zero as there is considerable uncertainty surrounding growth levels so far into the future.

TABLE 5.3 CAR - WORK: SUMMARY OF ANNUAL GROWTH VECTORS

County	Pop	Emp
Atlantic, NJ	1.03%	1.00%
Bergen , NJ	0.54%	1.05%
Burlington , NJ	1.00%	1.24%
Camden , NJ	0.63%	0.93%
Cape May , NJ	0.23%	1.27%
Cumberland , NJ	0.67%	0.85%
Essex , NJ	0.51%	0.77%
Gloucester , NJ	1.25%	1.38%
Hudson , NJ	0.33%	0.92%
Hunterdon , NJ	1.19%	1.12%
Mercer , NJ	0.73%	1.19%
Middlesex , NJ	0.72%	0.87%
Monmouth , NJ	0.77%	0.96%
Morris , NJ	0.91%	1.25%
Ocean , NJ	1.20%	1.52%
Passaic , NJ	0.54%	0.76%
Salem , NJ	0.83%	0.75%
Somerset , NJ	1.00%	1.16%
Sussex , NJ	1.21%	1.61%
Union , NJ	0.54%	0.91%
Warren , NJ	1.21%	1.03%
Fairfield, CT	0.52%	1.35%
Kent, DE	1.09%	1.33%
New Castle, DE	0.97%	1.46%
Sussex, DE	1.53%	1.67%
Cecil, MD	1.82%	2.04%
Bronx, NY	0.78%	1.06%
Dutchess, NY	0.81%	0.98%
Kings, NY	0.35%	1.17%
Nassau, NY	0.14%	0.76%
New York, NY	-0.17%	0.22%
Orange, NY	1.26%	1.32%
Queens, NY	0.58%	0.99%
Richmond, NY	1.53%	2.14%
Rockland, NY	0.81%	1.14%
Sullivan, NY	0.49%	0.91%
Ulster, NY	1.11%	1.16%
Westchester, NY	0.56%	0.93%
Berks, PA	0.57%	0.96%
Bucks, PA	1.21%	1.55%
Chester, PA	1.21%	1.76%
Delaware, PA	0.19%	0.90%
Lancaster, PA	0.86%	0.86%
Lehigh, PA	0.63%	1.36%
Monroe, PA	2.13%	1.94%
Montgomery, PA	0.55%	1.01%
Northampton, PA	1.00%	1.16%
Philadelphia, PA	-0.30%	0.50%
Pike, PA	2.15%	1.93%

Car - Other

5.47 For this traffic category, we have used an amalgam of county-based population and employment growth vectors as a basis for both 'origin' and 'destination' trips. For the employment vectors, these are based on forecast employment growth in different sectors of the labor market. Forecast growth in total employment across all sectors is also taken into account. A fuller explanation as to the selection of these variables is contained in the 'Economic Analysis' section in Report Set 2, 'Background To Our Work'.

5.48 To demonstrate the use of different employment forecasts for the 21 New Jersey counties, these represent employment growth in six different sectors of the labor market. Growth in employment across all sectors is also taken into account.

5.49 The reason for using growth in different employment sectors is the 'Car – Other' category covers an extremely wide range of trip purposes and is likely to be influenced by changes in economic activity across several sectors. For the 28 'external' county zones, the employment forecasts represent both the 'Retail' and 'Service' sectors, as well as forecast growth across all employment sectors.

5.50 By assigning appropriate 'weights' to each population and employment vector, a final series of growth vectors are derived.

5.51 To reflect the phenomena of increases in VMT per capita, an adjustment is made to each county-based growth vector. This is necessary as 'Car – Other' trips are those most likely to be affected by increases in vehicle mileage as drivers make more leisure and business trips. An uplift of 1% per annum was applied.

5.52 There is no requirement to 'Furness' these growth vectors as they are based on a synthesis of population-based 'origin' movements and employment-based 'destination' movements.

5.53 The profile of adjustments in these growth vectors is identical to that indicated under the 'Car – Work' category above. The growth vectors used as inputs to the 'Car - Other' traffic matrices are given in Table 5.4.

TABLE 5.4 CAR - OTHER: SUMMARY OF ANNUAL GROWTH VECTORS

County	
Atlantic, NJ	2.39%
Bergen , NJ	2.27%
Burlington , NJ	2.56%
Camden , NJ	2.20%
Cape May , NJ	2.36%
Cumberland , NJ	2.16%
Essex , NJ	2.03%
Gloucester , NJ	2.75%
Hudson , NJ	2.11%
Hunterdon , NJ	2.53%
Mercer , NJ	2.44%
Middlesex , NJ	2.19%
Monmouth , NJ	2.28%
Morris , NJ	2.54%
Ocean , NJ	2.84%
Passaic , NJ	2.02%
Salem , NJ	2.11%
Somerset , NJ	2.50%
Sussex , NJ	2.92%
Union , NJ	2.17%
Warren , NJ	2.46%
Fairfield, CT	2.26%
Kent, DE	2.55%
New Castle, DE	2.32%
Sussex, DE	2.93%
Cecil, MD	3.38%
Bronx, NY	2.05%
Dutchess, NY	2.16%
Kings, NY	2.01%
Nassau, NY	1.66%
New York, NY	1.16%
Orange, NY	2.68%
Queens, NY	2.00%
Richmond, NY	3.04%
Rockland, NY	2.28%
Sullivan, NY	1.82%
Ulster, NY	2.32%
Westchester, NY	1.98%
Berks, PA	2.10%
Bucks, PA	2.72%
Chester, PA	2.77%
Delaware, PA	1.71%
Lancaster, PA	2.14%
Lehigh, PA	2.41%
Monroe, PA	3.23%
Montgomery, PA	2.03%
Northampton, PA	2.31%
Philadelphia, PA	1.47%
Pike, PA	3.15%

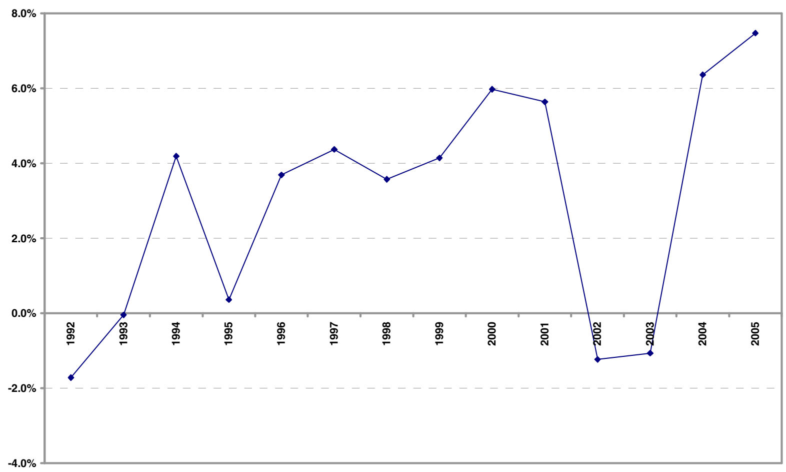
Trucks

5.54 For truck traffic, extensive use was made of 'Trend Analysis' of past growth as well as forecasts of truck movements made by organizations such as the Federal Highway Administration's (FHWA's) Freight Analysis Framework (FAF). The latter comprises, for example, forecasts of truck movements by county in New Jersey.

5.55 The findings from this analysis show that truck traffic growth in New Jersey, both observed and forecast, is extremely robust with the key findings being:

- Based on data from the NJTA, observed truck traffic on the NJTP over the 15 year period from 1991 to 2006 grew at an average of 2.5% per annum (with slightly negative growth in the years following the events of 9/11), as shown in Figure 4.7;
- According to data from the Bureau of Transportation Statistics, total truck ton mileage across New Jersey increased by just over 2.6% per annum between 1993 and 2002 (over the shorter period between 1997 and 2002, annual growth was just over 2.5%); and
- According to the FHWA's Freight Analysis Framework, forecast annual growth in truck traffic across all 21 New Jersey counties is predicted to be 2.7% per annum between 1998 and 2020.

FIGURE 5.7 NJTP - YEAR ON YEAR TRUCK TRAFFIC GROWTH 1992-2005



Source: NJTA / SDG Analysis

5.56 Although there have been fluctuations in truck traffic across different years, the 15-year average growth of 2.5% per annum is consistent with that observed across the State since 1993. In addition, historic growth in the New Jersey's Gross State Product is very similar, at 2.5% on average between 1998 and 2005.

5.57 There thus appears to be a very close link between historic truck traffic and economic activity in the State. This is reflected in our selection of truck growth vectors.

5.58 We have based the selection of truck growth vectors on the basis of these findings and have derived a growth vector of 2.5% per annum across all county-based zones;

5.59 The selection of a vector of 2.5% appears prudent given both observed truck traffic and Gross State Product growth in the State as well as the forecasts for growth in these two parameters. Woods & Poole, for example, forecast that Gross State Product growth in New Jersey will be close to 2.5% per annum.

5.60 Similar to the 'Car – Work' and 'Car – Other' traffic categories, annual truck growth is adjusted by the same profile of adjustments given in Paragraph 1.42 above.

6. FORECASTS

Introduction

6.1 Traffic and Revenue forecasts have been developed, for a scenario which has been defined as the most likely outcome, taking into account the balance of probabilities with all the different risks and uncertainties in any forecasting process.

6.2 The revenues presented in the report are in real terms – the price base for the results is 2006. Table 6.1 below summarizes the main assumptions underlying the forecasts.

TABLE 6.1 SUMMARY OF FORECASTING ASSUMPTIONS

Item	
Base Year Demand and Revenue	2006 Transaction Databases for NJTP / GSP and ACE providing transactions and revenues by location, day of year, payment type and toll rate – provided by toll authorities General assumption on exempted traffic and others: reflected in average toll per vehicle taken from Transaction database
O/D Pattern and Journey purpose split	Taken from Statewide Model. Matrices updated with NJTPA and SJTPO (including DVRPC) data. 2 time periods: Peak (represented by AM flow direction) and Off Peak. The factors applied to each period come from most recent NJTPA script parameters adjusted using count data available for 24 hours period. Segmentation by 2 journey purposes (home based work and other), both journey purposes split into four income groups. The four income groups are based on county-level Census 2000 household income levels fit into the income ranges of the four income groups identified in the NJTPA (values grown to 2000). Number of households in each income group converted to trips using the income group trip levels in NJTPA documentation. Commercial vehicles treated as one segment.
Traffic Growth – Cars (work journeys)	Based on economic growth variables for 21 New Jersey counties and 28 'external' counties Key parameters are annual 2005 – 2025 employment & population and forecasts (sources = Woods & Poole, DLWFD & Metropolitan Planning Organizations) For 'origin' trips, population growth vectors are used and for 'destination' trips, employment growth vectors are used Origin-based & destination-based growth is then 'balanced' within the matrix by using an appropriate Furnessing process

Traffic Growth – Cars (‘other’ journeys)	Based on economic growth variables for 21 New Jersey counties and 28 ‘external’ counties Key parameters are annual 2005 – 2025 population & employment forecasts – the latter are based on forecasts across a variety of labor market sectors (sources: Woods & Pool, DLWFD & Metropolitan Planning Organizations) The vectors from the different labor markets are then weighted according to assumptions about what proportions form ‘total’ growth – the population vectors are also ‘weighted’ as part of this process Further adjustments to growth factors: for this traffic category, the annual growth vectors are multiplied by 1% to reflect VMT, per capita.
Traffic Growth - Trucks	Based on analysis of historical & forecast truck traffic trends throughout New Jersey, Truck growth is based on forecast Statewide GDP growth.
Highway Model Network	Taken from State-wide model and updated to reflect coding of NJTPA and SJTPO networks for significant roads. Also updated to reflect other key coding elements (e.g. Auto only section of New Jersey Turnpike). Link speeds and capacities based on NJTPA values. NJTP free flow speeds are set at 70 mph regardless of the area type. Link volume-delay relationships follow the conventional BPR function (a=0.15, b=4.0) for high-type roadways (tollways, freeways, expressways and divided principal arterials), and follow a modified BPR function (a=0.135, b=5.35) for lower-type roadways. The modified BPR function was estimated from graphical presentations of the relationships used in the NJTPA. All significant toll plazas were coded for two-way collection to avoid creating unrealistic differences in assigned traffic volumes in the O->D and D->O directions.
Highway Model Network Toll Rates	Taken from State-wide model and updated with current NJTP, GSP, and ACE toll rates, as well as current toll rates of bridge crossings to/from New Jersey to Delaware, New York, and Pennsylvania.
Year of dollar in Model runs	All model runs include tolls, and values of time in 2006 dollars. VOT are assumed to remain constant in real terms in the future.
Traffic Assignment Principle	Equilibrated generalized cost, where generalized cost is travel time adjusted for motorway bonus * VOT + travel distance * VOC + toll. In each iteration, the equilibration procedure determined a minimum generalized cost OD path for each distinct user class, reflecting the class’s individual VOT and VOC.
Equilibrium Calculation Tolerance	An assignment tolerance of 0.05 was used.

Value of Time (VOT) (2006 prices)	Based on Census 2000 Household income levels. Household income levels were converted into average wage rate by dividing by 2080 hours; commuter VOTs were calculated as 50% of the wage rate, and other VOTs as 35% of the wage rate ($ / hr): • Car Commute: 4.2 / 10.8 / 18.1 / 36.9 • Car Other: 2.9 / 7.6 / 12.7 / 25.9 Trucks: 54.25
Value of Time Growth	Assumed constant in the future
Perceived Vehicle Operating Cost (VOC) (2006 prices)	Auto VOC ($/mile):0.01 Truck VOC was calculated as a 2 X multiple of auto VOC.
Motorway Bonus	A 30%-35% bonus for time spent traveling on motorways was applied in the generalized cost calculation. This bonus was computed on a link basis, by reducing the travel time by 30-35% for motorway links.
Toll Road Time Savings compared to other routes	Based on an equilibrium assignment model. Journey time surveys undertaken for validation purposes.
Tolling Policy	Scenarios as defined by New Jersey
E-ZPass Penetration	Assumed constant in the future.
Lane Expansions	Additional lanes as set out in Appendix C.

Toll Scenarios

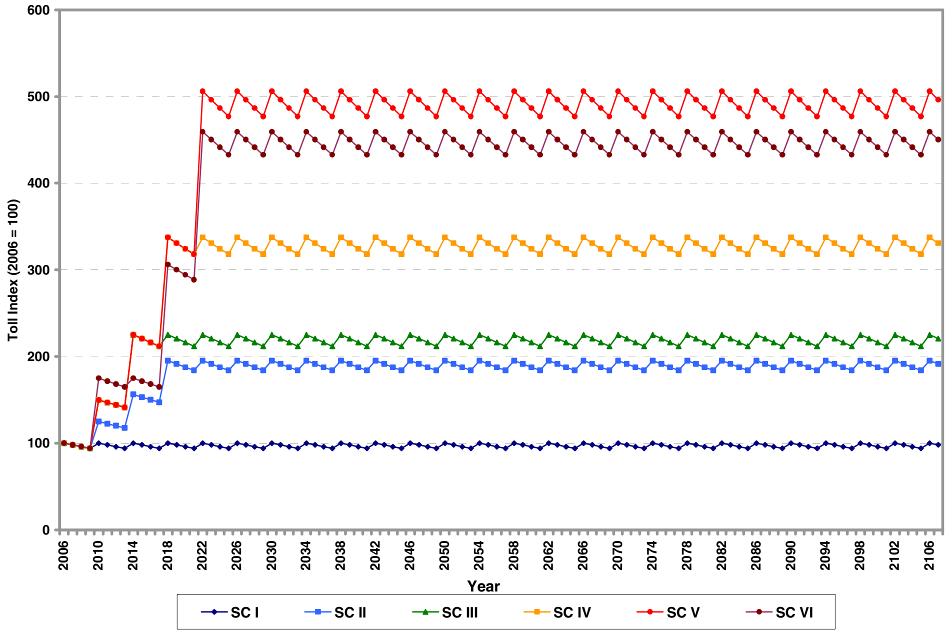
6.3 For the Phase II traffic and revenue forecasts, a number of toll scenarios have been defined by the State, as follows.

- Control Case - 2% annual inflationary increases levied in arrears 1/1/2010, 1/1/2014 and every 4th year thereafter. An annual inflationary increase of 2% has been assumed, as defined by the State. (Scenario I);
- Control Case PLUS 25% real toll increases 1/1/2010, 1/1/2014 and 1/1/2018 (Scenario II);
- Control Case PLUS 50% real toll increases 1/1/2010 and 1/1/2014 (Scenario III);
- Control Case PLUS 50% real toll increases 1/1/2010, 1/1/2014 and 1/1/2018 (Scenario IV);
- Control Case PLUS 50% real toll increases 1/1/2010, 1/1/2014, 1/1/2018 and 1/1/2022 (Scenario V); and
- Control Case PLUS 75% real toll increases 1/1/2010, 1/1/2018 and 50% 1/1/2022 on the NJTP, ACE and Rte 440 and a 75% real toll increase 1/1/2010 and 50% in 2018 on the GSP (Scenario VI).

6.4 The scenarios represent a range of toll policies. Scenario I (SCI) sees tolls kept constant in real terms. Scenario V (SCV) implies toll rates by 2026 that are almost five times higher in real terms than they are today.

6.5 Figure 6.1 below shows the index of real NJTP and Rte 440 tolls for the scenarios analyzed. The saw-tooth pattern is the result of the inflationary adjustments to toll levels that are levied in arrears every 4th year.

FIGURE 6.1 NJTP AND RTE 440 TOLL SCENARIOS



NJTP Traffic and Revenue Forecasts

6.6 Tables 6.2 and 6.3 present a summary of the traffic and revenue forecasts for a selection of forecasting years, for each of the six toll scenarios.

TABLE 6.2 NJTP - REVENUE FORECAST SUMMARY ($M, 2006 PRICES)

Year	SC I	SC II	SC III	SC IV	SC V	SC VI
2008	545.7	544.5	544.5	547.0	547.2	545.3
2010	596.7	685.7	754.3	761.4	761.9	833.8
2014	654.5	846.6	1005.0	1023.2	1024.3	888.6
2018	712.4	1029.6	1105.5	1349.3	1349.4	1295.8
2022	770.2	1119.2	1206.9	1500.5	1881.7	1576.0
2026	828.0	1208.8	1308.9	1655.2	2081.1	1610.1
2036	908.0	1430.7	1547.3	1914.5	2467.7	1986.8
2046	1037.3	1691.3	1831.7	2232.3	3005.1	2367.7
2066	1159.1	1978.3	2174.8	2712.3	3663.6	3065.6
2086	1260.4	2198.0	2447.4	3213.6	4349.3	3859.7
2106	1358.8	2412.2	2708.8	3703.6	5020.0	4636.5

TABLE 6.3 NJTP - TRAFFIC FORECAST SUMMARY (2008 = 100)

Year	SC I	SC II	SC III	SC IV	SC V	SC VI
2008	100	100	100	100	100	100
2010	105.1	97.5	90.0	90.7	90.6	84.6
2014	115.4	97.3	80.1	81.7	81.6	98.2
2018	125.6	94.9	88.5	72.6	72.4	76.2
2022	135.9	103.5	97.0	81.2	67.7	60.9
2026	146.1	112.2	105.4	89.8	75.6	62.6
2036	161.4	131.5	123.9	103.5	89.8	78.2
2046	172.8	143.8	136.0	112.5	101.6	87.4
2066	190.4	164.7	157.9	132.7	120.9	110.5
2086	207.0	182.3	176.6	154.8	140.5	136.1
2106	223.2	199.2	194.2	176.1	159.6	161.0

6.7 Traffic growth over the life of the concession for the Control Case equals 0.8% per year on average, although average growth in the early years (until 2022) is much higher at 2.2% per year.

6.8 After 2022, assumed traffic growth rates are lower and the effects of capacity constraints are starting to slow down how much traffic can be accommodated by the road, resulting in significantly lower average growth rates.

6.9 The average growth over the life of the concession for the other toll scenarios equals 0.7% per year for Scenario II, 0.7% for Scenario III, 0.6% for Scenario IV, 0.5% for Scenario V and 0.5% for Scenario VI. These lower rates are due to the increases in toll rates which diverts traffic away from the NJTP. As a result however capacity issues are not an issue until much later in the forecasting period.

6.10 In 2022 traffic levels are predicted to be 24%, 29%, 40%, 50% and 55% lower than in the Control Case.

6.11 Revenue growth for the Control Case equals 0.9% per year on average over the life of the concession. This increases to 1.5%, 1.7%, 2.0%, 2.3% and 2.2% for the various toll scenarios. The toll increases far outstrip the loss in demand, meaning revenues are increased substantially as a result of the potential toll increases. 2022 revenue levels are 45%, 57%, 95%, 144% and 105% higher than in the Control Case.

6.12 Figures 6.2 and 6.3 present the traffic and revenue forecasts graphically. Again the saw-tooth pattern results from the inflationary adjustments that have been assumed to be levied every 4th year.

FIGURE 6.2 NJTP - REVENUE FORECASTS ($M, 2006 PRICES)

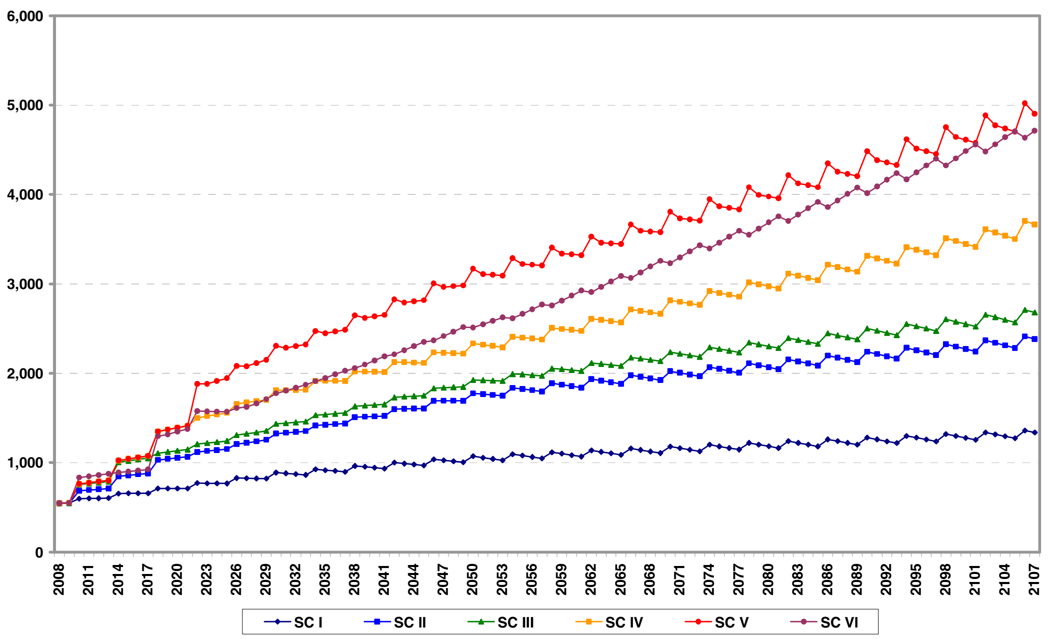
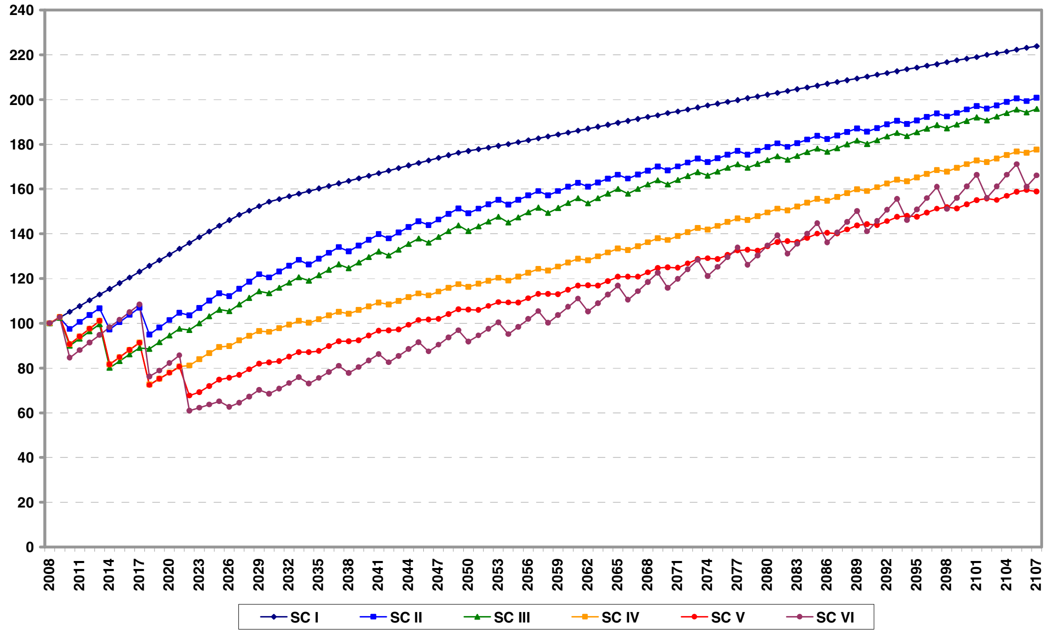


FIGURE 6.3 NJTP - TRAFFIC FORECASTS (2008 = 100)



6.13 Tables 6.4 – 6.8 provide a summary of demand and revenue forecasts for each toll scenario, disaggregated by vehicle type.

TABLE 6.4 NJTP - TRAFFIC AND REVENUE FORECASTS – TOLL SCENARIO I

	Cars			Trucks		
Year	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)
2008	100	353.0	-	100	192.7	-
2010	105	384.1	4.3%	107	212.6	5.1%
2014	115	417.5	2.1%	120	237.0	2.7%
2018	124	451.0	1.9%	133	261.3	2.5%
2022	134	484.5	1.8%	146	285.7	2.3%
2026	144	518.0	1.7%	160	310.0	2.1%
2036	155	541.8	0.4%	196	366.2	1.7%
2046	164	598.3	1.0%	225	439.1	1.8%
2066	179	659.9	0.5%	255	499.2	0.6%
2086	196	723.2	0.5%	273	537.1	0.4%
2106	211	784.7	0.4%	291	574.2	0.3%

TABLE 6.5 NJTP - TRAFFIC AND REVENUE FORECASTS – TOLL SCENARIO II

	Cars			Trucks		
Year	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)
2008	100	352.1	-	100	192.4	-
2010	98	446.2	12.6%	96	239.5	11.5%
2014	98	556.1	5.7%	94	290.5	4.9%
2018	95	674.4	4.9%	92	355.2	5.2%
2022	104	731.9	2.1%	101	387.2	2.2%
2026	113	789.5	1.9%	110	419.3	2.0%
2036	127	863.7	0.9%	156	567.1	3.1%
2046	135	959.2	1.1%	194	732.1	2.6%
2066	152	1089.3	0.6%	235	889.0	1.0%
2086	169	1214.7	0.5%	258	983.3	0.5%
2106	185	1335.6	0.5%	281	1076.6	0.5%

TABLE 6.6 NJTP - TRAFFIC AND REVENUE FORECASTS – TOLL SCENARIO III

	Cars			Trucks		
Year	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)
2008	100	352.1	-	100	192.4	-
2010	91	497.8	18.9%	86	256.5	15.5%
2014	81	660.7	7.3%	77	344.3	7.6%
2018	89	725.6	2.4%	85	379.9	2.5%
2022	97	790.5	2.2%	94	416.4	2.3%
2026	106	855.4	2.0%	103	453.5	2.2%
2036	120	939.9	0.9%	146	607.4	3.0%
2046	128	1051.1	1.1%	180	780.6	2.5%
2066	147	1206.3	0.7%	223	968.5	1.1%
2086	164	1356.1	0.6%	250	1091.3	0.6%
2106	180	1498.0	0.5%	275	1210.8	0.5%

TABLE 6.7 NJTP - TRAFFIC AND REVENUE FORECASTS – TOLL SCENARIO IV

	Cars			Trucks		
Year	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)
2008	100	354.9	-	100	192.0	-
2010	91	505.7	19.4%	86	255.6	15.4%
2014	83	680.7	7.7%	77	342.6	7.6%
2018	74	906.7	7.4%	66	442.5	6.6%
2022	83	1010.3	2.7%	73	490.2	2.6%
2026	91	1113.9	2.5%	81	541.3	2.5%
2036	102	1208.2	0.8%	112	706.3	2.7%
2046	108	1345.4	1.1%	136	886.9	2.3%
2066	125	1564.6	0.8%	177	1147.7	1.3%
2086	144	1812.0	0.7%	216	1401.6	1.0%
2106	163	2051.1	0.6%	254	1652.5	0.8%

TABLE 6.8 NJTP - TRAFFIC AND REVENUE FORECASTS – TOLL SCENARIO V

	Cars			Trucks		
Year	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)
2008	100	354.9	-	100	192.3	-
2010	91	505.6	19.4%	86	256.2	15.4%
2014	82	680.4	7.7%	77	344.0	7.6%
2018	74	904.7	7.4%	66	444.7	6.6%
2022	69	1264.4	8.7%	61	617.3	8.5%
2026	77	1413.7	2.8%	66	667.4	2.0%
2036	90	1589.5	1.2%	91	878.3	2.8%
2046	99	1844.6	1.5%	116	1160.5	2.8%
2066	116	2175.5	0.8%	150	1488.1	1.3%
2086	133	2509.4	0.7%	184	1839.9	1.1%
2106	149	2834.6	0.6%	218	2185.4	0.9%

TABLE 6.9 NJTP - TRAFFIC AND REVENUE FORECASTS – TOLL SCENARIO VI

	Cars			Trucks		
Year	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)
2008	100	354.6	-	100	190.8	-
2010	85	546.3	24.1%	84	287.5	22.8%
2014	98	582.3	1.6%	97	306.3	1.6%
2018	77	853.6	10.0%	74	442.1	9.6%
2022	61	1021.2	4.6%	60	554.7	5.8%
2026	63	1043.0	0.5%	62	567.1	0.6%
2036	77	1240.3	1.7%	86	746.5	2.8%
2046	84	1425.6	1.4%	105	942.1	2.4%
2066	105	1777.7	1.1%	145	1287.9	1.6%
2086	127	2160.4	1.0%	191	1699.3	1.4%
2106	148	2533.1	0.8%	236	2103.4	1.1%

Route 440 Traffic and Revenue Forecasts

6.14 Tables 6.10 and 6.11 present a summary of the traffic and revenue forecasts for a selection of forecasting years, for each of the five toll scenarios.

TABLE 6.10 ROUTE 440 - SUMMARY OF REVENUE FORECASTS ($M, 2006 PRICES)

Year	SC I	SC II	SC III	SC IV	SC V	SC VI
2010	19.6	22.7	25.3	25.3	25.3	27.2
2014	20.9	27.5	33.0	33.2	33.1	28.1
2018	22.3	32.0	35.1	45.6	45.6	45.3
2022	23.7	33.9	37.2	48.7	54.1	62.8
2026	25.1	35.8	39.3	51.9	58.4	65.1
2036	26.9	39.4	42.4	55.4	67.3	70.5
2046	30.5	43.2	47.1	60.9	73.4	75.2
2066	34.2	48.9	53.3	68.1	83.7	84.0
2086	37.8	54.6	59.6	75.6	93.1	93.3
2106	41.3	60.2	65.7	82.9	102.4	102.5

TABLE 6.11 ROUTE 440 - SUMMARY OF TRAFFIC FORECASTS (2008 = 100)

Year	SC I	SC II	SC III	SC IV	SC V	SC VI
2008	100.0	100.0	100.0	100.0	100.0	100.0
2010	104.5	98.9	93.7	93.9	93.9	88.6
2014	112.5	99.0	86.0	86.4	86.3	98.1
2018	120.5	95.8	91.7	79.3	79.2	82.5
2022	128.5	101.7	97.3	85.1	63.9	71.7
2026	136.5	107.6	103.0	91.0	69.1	77.2
2036	148.8	119.9	113.5	99.3	80.6	86.4
2046	159.2	125.5	119.7	103.6	84.2	89.5
2066	175.0	139.1	132.8	114.5	94.8	99.8
2086	190.0	152.9	146.2	126.2	104.7	110.7
2106	204.6	166.3	159.3	137.6	114.4	121.3

6.15 Traffic growth over the life of the concession for the Control Case equals 0.7% per year on average, although average growth in the early years (until 2022) is much higher at 1.8% per year.

6.16 After 2022 assumed traffic growth rates are lower and the effects of capacity constraints are starting to slow down how much traffic can be accommodated by the road, resulting in significantly lower average growth rates.

6.17 The average growth over the life of the concession for the other toll scenarios equals 0.5% per year for Scenario II, 0.5% for Scenario III, 0.3% for Scenario IV, 0.1% for Scenario V and 0.2% for Scenario VI. These lower rates are due to the increases in toll rates which diverts traffic away from the NJTP. As a result however capacity issues are not an issue until much later in the forecasting period.

6.18 In 2022 traffic levels are predicted to be 21%, 24%, 34%, 50% and 44% lower than in the Control Case.

6.19 Revenue growth for the Control Case equals 0.8% per year on average over the life of the concession. This increases to 1.0%, 1.0%, 1.2%, 1.4% and 1.4% for the various toll scenarios. The toll increases far outstrip the loss in demand, meaning revenues are increased substantially as a result of the potential toll increases. 2022 revenue levels are 43%, 57%, 105%, 128% and 164% higher than in the Control Case.

6.20 Figure 6.4 and Figure 6.5 present the traffic and revenue forecasts graphically.

FIGURE 6.4 ROUTE 440 - REVENUE FORECASTS ($M, 2006 PRICES)

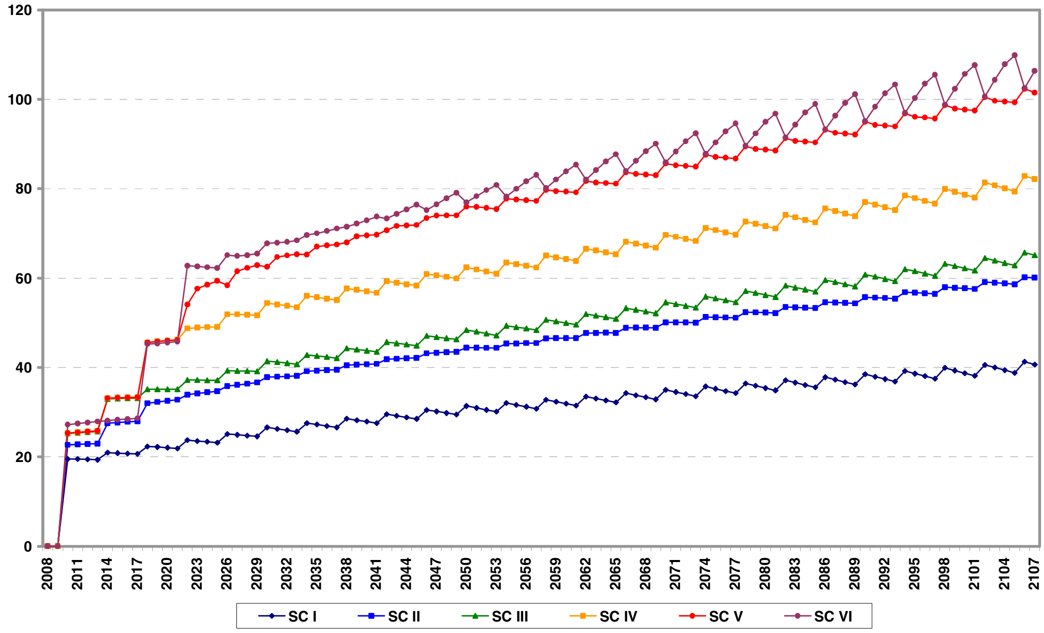
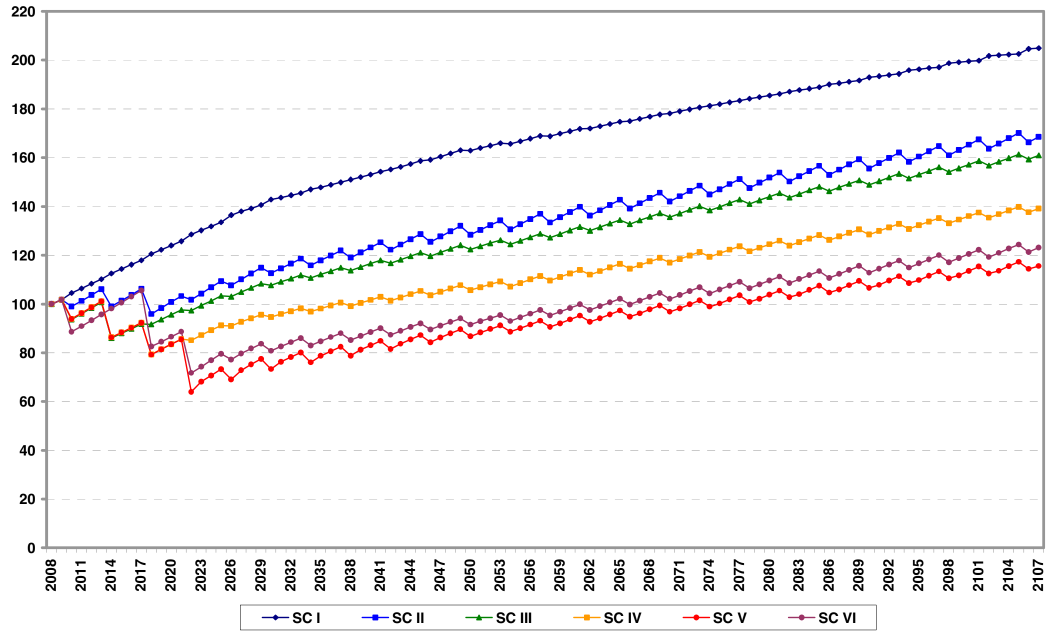


FIGURE 6.5 ROUTE 440 - TRAFFIC FORECASTS (2008 = 100)



6.21 Tables 6.11 – 6.15 provide a summary of demand and revenue forecasts for each toll scenario, disaggregated by vehicle type.

TABLE 6.12 ROUTE 440 - TRAFFIC AND REVENUE FORECASTS – TOLL SCENARIO I

	Cars			Trucks		
Year	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)
2008	100	0.0	-	100	0.0	-
2010	105	14.8	-	101	4.8	-
2014	113	15.9	1.9%	106	5.0	1.2%
2018	121	17.1	1.8%	111	5.2	1.1%
2022	130	18.3	1.7%	116	5.5	1.1%
2026	138	19.4	1.6%	121	5.7	1.0%
2036	149	20.2	0.4%	149	6.7	1.7%
2046	158	22.2	1.0%	175	8.2	2.0%
2066	172	24.2	0.4%	213	10.1	1.0%
2086	185	26.0	0.4%	250	11.8	0.8%
2106	197	27.8	0.3%	285	13.5	0.7%

TABLE 6.13 ROUTE 440 - TRAFFIC AND REVENUE FORECASTS – TOLL SCENARIO II

	Cars			Trucks		
Year	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)
2008	100	0.0	-	100	0.0	-
2010	100	17.6	-	86	5.1	-
2014	102	22.4	6.1%	70	5.2	0.5%
2018	100	27.6	5.4%	48	4.5	-3.7%
2022	106	29.3	1.5%	50	4.6	1.0%
2026	113	31.0	1.4%	52	4.8	1.0%
2036	124	32.8	0.6%	74	6.6	3.2%
2046	129	35.6	0.8%	82	7.6	1.4%
2066	142	39.1	0.5%	106	9.8	1.3%
2086	155	42.7	0.4%	130	12.0	1.0%
2106	168	46.1	0.4%	153	14.1	0.8%

TABLE 6.14 ROUTE 440 - TRAFFIC AND REVENUE FORECASTS – TOLL SCENARIO III

	Cars			Trucks		
Year	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)
2008	100	0.0	-	100	0.0	-
2010	96	20.2	-	71	5.0	-
2014	90	28.5	9.0%	42	4.5	-2.7%
2018	96	30.4	1.6%	44	4.7	1.0%
2022	102	32.3	1.5%	46	4.9	0.9%
2026	108	34.2	1.4%	47	5.0	0.9%
2036	118	36.0	0.5%	63	6.4	2.4%
2046	124	39.2	0.9%	74	7.9	2.1%
2066	136	43.2	0.5%	95	10.1	1.3%
2086	149	47.2	0.4%	116	12.3	1.0%
2106	161	51.2	0.4%	137	14.5	0.8%

TABLE 6.15 ROUTE 440 - TRAFFIC AND REVENUE FORECASTS – TOLL SCENARIO IV

	Cars			Trucks		
Year	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)
2008	100	0.0	-	100	0.0	-
2010	96	20.3	-	71	5.1	-
2014	90	28.6	9.0%	43	4.5	-2.7%
2018	83	39.5	8.4%	39	6.1	7.8%
2022	89	42.4	1.8%	40	6.3	0.7%
2026	95	45.4	1.7%	41	6.5	0.7%
2036	103	47.3	0.4%	53	8.1	2.3%
2046	107	51.1	0.8%	62	9.8	2.0%
2066	118	56.1	0.5%	75	12.0	1.0%
2086	130	61.7	0.5%	87	13.9	0.7%
2106	141	67.1	0.4%	99	15.7	0.6%

TABLE 6.16 ROUTE 440 - TRAFFIC AND REVENUE FORECASTS – TOLL SCENARIO V

	Cars			Trucks		
Year	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)
2008	100	0.0	-	100	0.0	-
2010	96	20.3	-	71	5.1	-
2014	90	28.6	9.0%	43	4.5	-2.7%
2018	83	39.4	8.3%	38	6.1	7.8%
2022	67	48.1	5.1%	25	6.0	-0.4%
2026	73	52.0	2.0%	27	6.4	1.6%
2036	84	57.6	1.0%	42	9.7	4.2%
2046	88	62.6	0.8%	45	10.9	1.2%
2066	98	70.0	0.6%	57	13.7	1.2%
2086	108	77.1	0.5%	67	16.0	0.8%
2106	118	84.0	0.4%	77	18.4	0.7%

TABLE 6.17 ROUTE 440 - TRAFFIC AND REVENUE FORECASTS – TOLL SCENARIO VI

	Cars			Trucks		
Year	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)	Transactions (2008=100)	Revenue ($M, 2006 prices)	Average annual growth (%)
2008	100	0.0	-	100	0.0	-
2010	91	22.5	-	57	4.7	-
2014	101	23.0	0.5%	68	5.2	2.5%
2018	86	39.4	14.4%	39	5.9	3.4%
2022	75	54.7	8.6%	33	8.1	8.2%
2026	81	57.0	1.0%	34	8.1	0.2%
2036	90	61.0	0.7%	42	9.5	1.6%
2046	93	64.1	0.5%	48	11.1	1.5%
2066	103	70.4	0.5%	59	13.6	1.0%
2086	114	77.2	0.5%	71	16.1	0.8%
2106	125	84.0	0.4%	82	18.5	0.7%

Review of Responses in Demand to Toll Changes

6.22 As part of our work we undertook a review of existing studies of how the level of demand for a toll road might change in the face of changes in toll levels. We note that, in the literature as elsewhere, this is commonly referred to as a toll elasticity – with a concomitant perception that such an elasticity revealed on a particular project is in some way *general* and thus can be transferred/ compared across different projects. This is, of course, not the case: the response of toll road users to changes in toll levels is project specific, reflecting the comparative attractions of the toll road and its competitors. However, given that many projects have been constructed in congested areas, with broadly similar comparative advantage for the tolled facility, it does remain interesting to examine what has happened on other facilities across the United States.

6.23 It was found that there is a considerable body of existing evidence on so-called demand elasticities, with several studies specific to New Jersey and others relating to other States.

6.24 The tolls on the New Jersey toll roads (NJTP, GSP and ACE) are currently low – in comparison with most other facilities within the United States, and certainly with tolled facilities in other advanced economies – while the advantage in using the toll road is high. For most users, the level of toll is well below the indifference price: the toll can, for these users, be raised very significantly before they will seriously consider using a free alternative. At this point, we would expect the revealed demand elasticity to be very low. However, if the tolls increase *significantly* the changes in behavior might themselves become measurable, until a new equilibrium is achieved.

6.25 There are recent studies available for the NJTP and for the crossings between New Jersey and New York, but not for the ACE or the GSP. The evidence from the recent research on the NJTP Time of Day Pricing Initiative suggests that the demand for the road is relatively inelastic to price. This is consistent with the available evidence from time-series data of traffic and revenue for the NJTP, GSP and ACE, which again points to the demand being relatively inelastic.

6.26 In the first phase of this study (the Scoping Study), our analysis was based on an elasticity approach – relying on imported values derived from our experience elsewhere. Elasticity estimates of -0.1 for the NJTP, -0.07 for the GSP and -0.12 for the ACE were adopted, taking on board additional local evidence from time series of transaction and revenue for the NJTP, the GSP and the ACE. In the Phase II analysis, however, we employed the State-wide network assignment model to estimate directly the impact of toll increases on NJTP usage; this analysis indicated elasticity estimates in a range from -0.2 to -0.3. We have further reviewed the elasticity estimates by time of day, journey purpose and vehicle type. We have found that the out-turn weekday peak elasticities are indeed in line with our Phase I assumptions, but that off-peak elasticities are significantly higher than those adopted earlier. The results obtained from the models are, on review, unsurprising. The assignment models show traffic diverting onto the competing routes, when (as in the off-peak) capacity is genuinely available.

6.27 To provide further validation of our results, we reviewed modeled elasticities developed in work carried out in the development of forecasts for the Indiana Toll Road. On the first 24 miles - close to Chicago with high volumes on the road and in the corridor in general - there is a single toll barrier with a toll of c2.08/ mi and c7.29/ mi,. Here the elasticities derived from the models were -0.23 (cars) and -0.07 (trucks). In the rest of the 125 miles of the road, which runs across the rural areas in the north of Indiana and is lightly used, the elasticities derived from the models were substantially higher, in the range -0.69 to -0.34 for cars and -0.19 to -0.14 for trucks.

6.28 Similarly, work carried out by Maunsell Aecom on the Houston toll road system looking at the response of demand to actual toll increases in 2004, suggested effective elasticities ranging between -0.08 and -0.32. Further, the work showed that, on the predominantly *radial* toll roads, the traffic levels were more responsive to toll changes – while the orbital routes revealed lower elasticities.

6.29 The 2003 paper "Demand Elasticity on Tolled Motorways" by Anna Matas and José-Luis Raymond for the Journal of Transportation and Statistics states that most demand elasticities are within the -0.2 to -0.3 range, though an overall range of -0.03 to -0.5 was found.

6.30 We concluded from this review that the elasticities we derived from the models developed for the analysis in New Jersey were both realistic in terms of the network performance across New Jersey and broadly in line with the behavior of travelers elsewhere.

APPENDIX A

MAPS

Detailed Overview Maps

FIGURE A.1 NJTP - NORTHERN SECTION

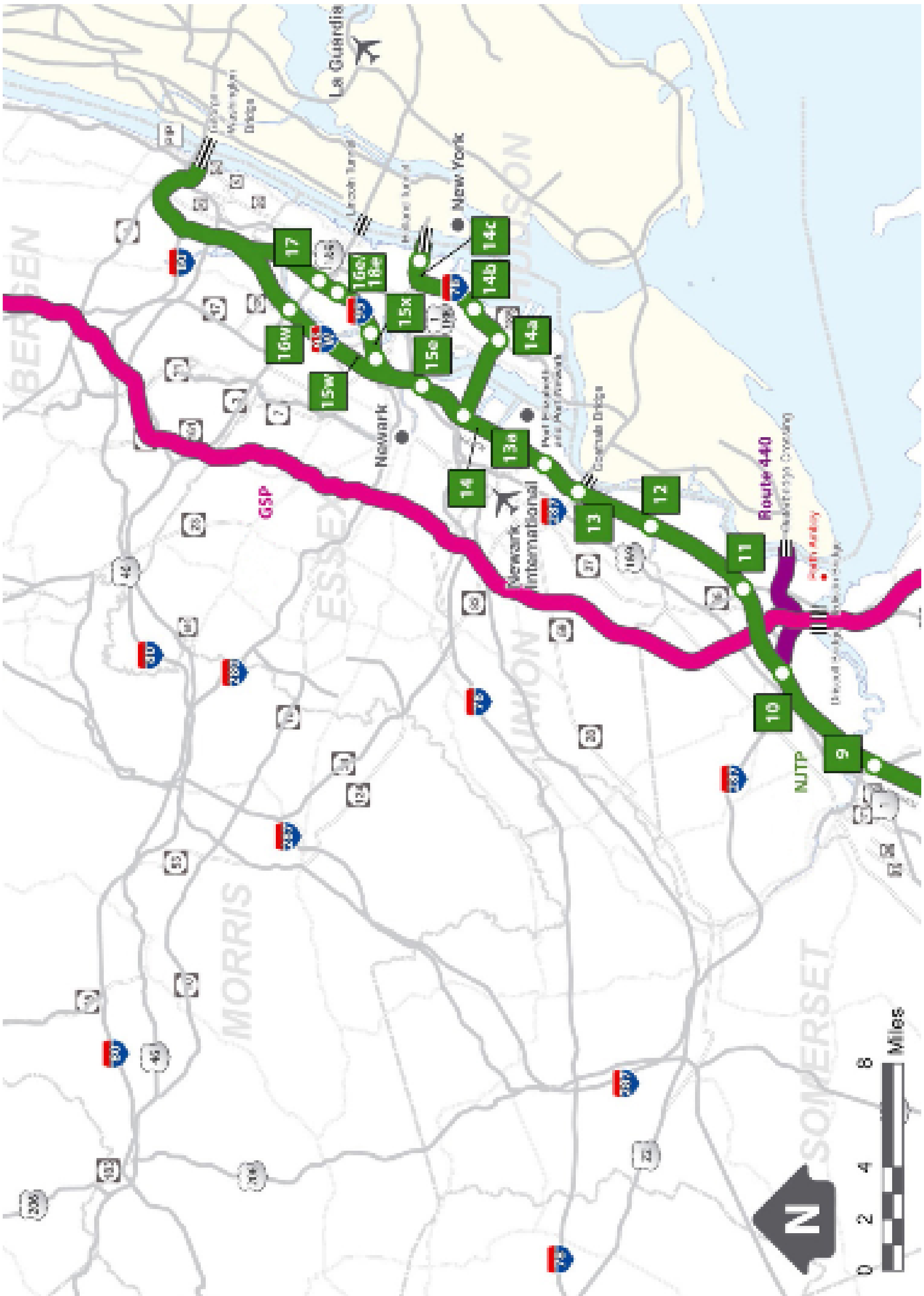


FIGURE A.2 NJTP - CENTRAL SECTION

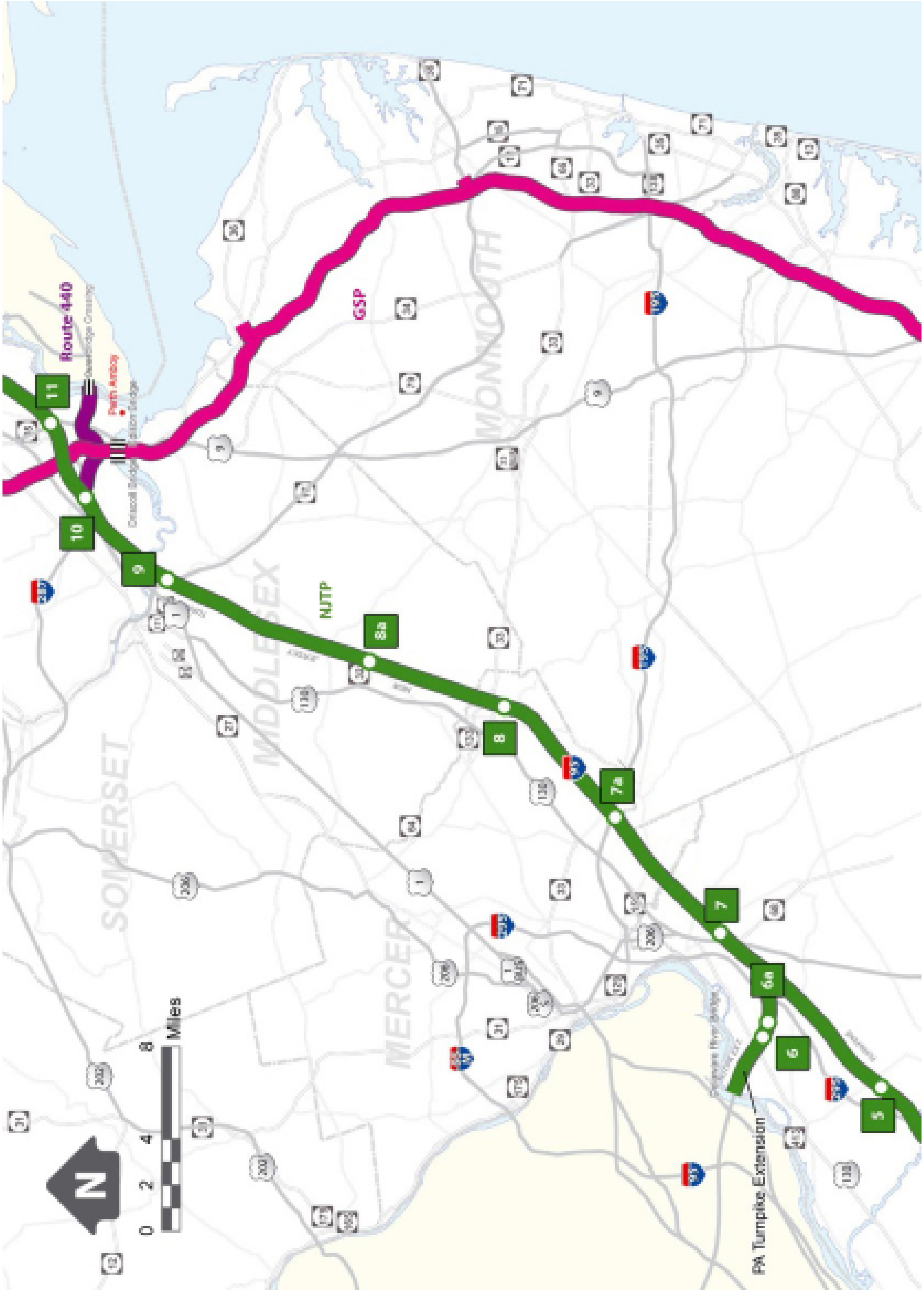
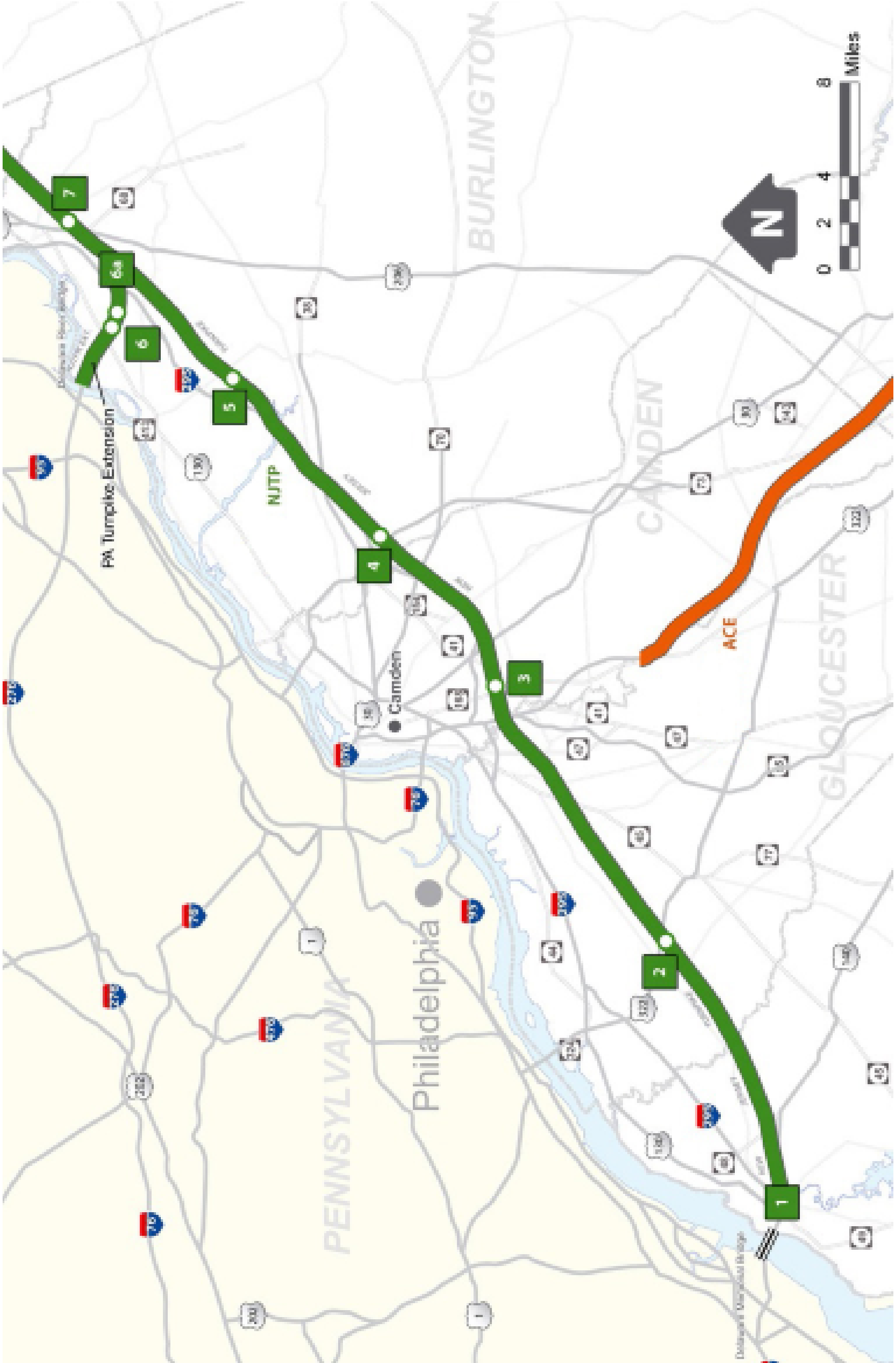


FIGURE A.3 NJTP - SOUTHERN SECTION



APPENDIX B

FORECASTS

APPENDIX: TABLE B.1 NJTP - REVENUE FORECAST SUMMARY ($M, 2006 PRICES)

Year	SC I	SC II	SC III	SC IV	SC V	SC VI
2008	545.7	544.5	544.5	547.0	547.2	545.3
2009	548.7	546.9	546.9	550.5	550.8	548.0
2010	596.7	685.7	754.3	761.4	761.9	833.8
2011	599.2	694.0	766.2	774.8	775.5	847.9
2012	601.3	701.8	777.3	787.5	788.3	862.0
2013	603.2	709.0	787.8	799.5	800.4	875.5
2014	654.5	846.6	1005.0	1023.2	1024.3	888.6
2015	655.9	858.0	1021.1	1041.4	1042.6	901.1
2016	656.9	869.0	1035.9	1058.2	1059.6	912.6
2017	657.7	879.2	1049.7	1074.2	1075.6	923.4
2018	712.4	1029.6	1105.5	1349.3	1349.4	1295.8
2019	712.6	1042.1	1119.9	1369.5	1370.0	1315.6
2020	712.5	1053.7	1133.3	1389.5	1390.6	1346.3
2021	712.2	1064.7	1145.8	1409.5	1411.0	1375.5
2022	770.2	1119.2	1206.9	1500.5	1881.7	1576.0
2023	769.3	1130.3	1219.8	1520.7	1881.2	1573.1
2024	768.1	1140.7	1231.6	1539.6	1912.7	1571.4
2025	766.7	1151.2	1242.3	1557.4	1944.0	1569.1
2026	828.0	1208.8	1308.9	1655.2	2081.1	1610.1
2027	826.2	1221.5	1322.6	1672.6	2078.4	1623.3
2028	824.4	1237.7	1338.2	1687.9	2114.3	1661.5
2029	822.4	1256.9	1354.8	1702.2	2148.6	1709.6
2030	887.7	1325.8	1434.3	1808.0	2306.9	1775.6
2031	879.8	1335.2	1441.5	1811.0	2285.2	1804.1
2032	871.8	1343.5	1450.2	1812.8	2303.7	1837.4
2033	863.8	1351.6	1458.3	1813.7	2321.0	1872.0
2034	926.1	1415.4	1531.1	1913.3	2471.4	1911.5
2035	917.0	1423.6	1539.6	1914.4	2446.9	1947.1
2036	908.0	1430.7	1547.3	1914.5	2467.7	1986.8
2037	898.9	1436.4	1554.3	1913.7	2486.3	2026.1
2038	963.2	1507.1	1630.4	2019.4	2648.2	2058.1
2039	953.4	1513.2	1637.8	2018.5	2619.4	2097.9
2040	943.6	1517.9	1644.9	2016.5	2636.7	2143.2
2041	933.9	1521.3	1651.8	2013.7	2651.7	2187.9

2042	1000.3	1599.2	1730.2	2125.6	2826.6	2211.6
2043	989.8	1602.8	1737.7	2122.6	2792.0	2256.6
2044	979.3	1605.1	1744.3	2118.6	2805.6	2304.7
2045	968.8	1606.2	1750.1	2114.8	2817.0	2351.7
2046	1037.3	1691.3	1831.7	2232.3	3005.1	2367.7
2047	1026.1	1692.4	1838.1	2228.9	2964.7	2415.4
2048	1014.8	1692.3	1843.6	2224.8	2974.6	2466.2
2049	1003.7	1691.1	1848.4	2219.9	2982.3	2515.6
2050	1071.3	1775.7	1924.6	2334.1	3168.7	2510.8
2051	1056.3	1767.1	1921.7	2320.0	3108.6	2547.7
2052	1041.5	1757.7	1918.2	2305.5	3101.3	2587.3
2053	1026.9	1747.7	1914.0	2290.4	3093.1	2625.4
2054	1095.9	1837.0	1992.2	2408.6	3287.6	2614.9
2055	1079.6	1823.9	1986.7	2398.9	3222.1	2663.5
2056	1063.5	1810.3	1979.9	2388.4	3213.7	2715.6
2057	1047.6	1795.3	1972.1	2377.0	3206.3	2767.5
2058	1117.0	1886.5	2053.1	2506.7	3405.1	2758.8
2059	1100.3	1871.2	2045.8	2495.4	3339.0	2810.3
2060	1083.7	1855.2	2037.3	2484.3	3330.6	2867.9
2061	1067.4	1838.4	2027.7	2472.4	3320.5	2924.3
2062	1138.1	1933.6	2114.0	2608.9	3528.9	2906.7
2063	1120.9	1916.1	2104.8	2596.6	3459.4	2965.7
2064	1103.9	1898.1	2094.6	2583.4	3452.5	3028.2
2065	1087.1	1880.7	2082.7	2569.3	3445.9	3088.1
2066	1159.1	1978.3	2174.8	2712.3	3663.6	3065.6
2067	1141.5	1959.7	2163.9	2697.8	3593.8	3128.2
2068	1124.0	1941.5	2150.0	2682.4	3586.4	3194.6
2069	1106.8	1923.0	2134.6	2666.3	3577.2	3258.1
2070	1180.2	2023.2	2234.4	2815.8	3805.7	3229.1
2071	1162.1	2004.3	2219.6	2799.0	3731.2	3294.9
2072	1144.2	1985.0	2202.3	2781.5	3720.8	3364.1
2073	1126.6	1965.4	2184.4	2763.3	3708.6	3429.6
2074	1201.2	2069.0	2290.5	2919.2	3947.8	3394.2
2075	1182.3	2048.2	2271.8	2898.7	3866.5	3459.5
2076	1163.7	2027.1	2252.9	2877.5	3850.9	3528.4
2077	1145.4	2005.8	2233.3	2855.8	3833.8	3593.1
2078	1220.9	2112.0	2342.5	3016.1	4081.0	3548.9
2079	1201.6	2090.1	2322.8	2993.8	3995.5	3616.5

2080	1182.6	2067.9	2302.4	2971.6	3977.3	3687.6
2081	1163.9	2045.5	2281.5	2948.8	3957.6	3754.3
2082	1240.6	2155.0	2395.0	3114.5	4215.1	3704.3
2083	1220.9	2132.0	2373.7	3090.9	4125.2	3773.9
2084	1201.5	2108.7	2352.0	3066.6	4104.1	3847.2
2085	1182.4	2085.2	2329.7	3041.9	4081.6	3915.7
2086	1260.4	2198.0	2447.4	3213.6	4349.3	3859.7
2087	1240.2	2173.8	2424.7	3187.9	4255.0	3931.3
2088	1220.4	2149.4	2401.5	3161.6	4231.0	4006.8
2089	1200.9	2124.8	2377.9	3134.9	4205.6	4077.1
2090	1280.1	2240.9	2499.9	3312.6	4483.4	4015.0
2091	1259.6	2215.5	2475.7	3284.9	4384.7	4088.7
2092	1239.3	2190.0	2451.1	3256.6	4357.8	4166.3
2093	1219.4	2164.3	2426.0	3228.0	4329.6	4238.5
2094	1299.8	2283.7	2552.2	3411.7	4617.6	4170.4
2095	1278.9	2257.2	2526.5	3381.9	4514.5	4246.1
2096	1258.2	2230.6	2500.4	3351.6	4484.7	4325.9
2097	1237.9	2203.9	2473.9	3321.0	4453.6	4399.8
2098	1319.5	2326.5	2604.4	3510.7	4751.7	4325.8
2099	1298.1	2298.9	2577.3	3478.8	4644.3	4403.5
2100	1277.1	2271.2	2549.7	3446.6	4611.5	4485.5
2101	1256.3	2243.5	2521.9	3413.2	4577.6	4559.4
2102	1339.2	2369.3	2656.6	3609.7	4885.9	4481.1
2103	1317.4	2340.6	2628.0	3573.9	4774.0	4561.0
2104	1295.9	2311.8	2599.1	3537.9	4738.4	4642.0
2105	1274.8	2283.0	2569.9	3500.7	4701.6	4707.3
2106	1358.8	2412.2	2708.8	3703.6	5020.0	4636.5
2107	1336.6	2382.4	2678.8	3664.1	4903.8	4714.6

APPENDIX: TABLE B.2 ROUTE 440 - REVENUE FORECAST SUMMARY ($M, 2006 PRICES)

Year	SC I	SC II	SC III	SC IV	SC V	SC VI
2008	0.0	0.0	0.0	0.0	0.0	0.0
2009	0.0	0.0	0.0	0.0	0.0	0.0
2010	19.6	22.7	25.3	25.3	25.3	27.2
2011	19.5	22.8	25.4	25.5	25.5	27.5
2012	19.4	22.9	25.6	25.7	25.7	27.7
2013	19.4	22.9	25.7	25.8	25.8	27.9
2014	20.9	27.5	33.0	33.2	33.1	28.1
2015	20.9	27.7	33.1	33.2	33.2	28.3
2016	20.7	27.8	33.1	33.3	33.3	28.5
2017	20.6	28.0	33.1	33.3	33.3	28.6
2018	22.3	32.0	35.1	45.6	45.6	45.3
2019	22.2	32.3	35.1	45.8	45.8	45.4
2020	22.1	32.6	35.1	46.1	46.0	45.6
2021	21.9	32.8	35.1	46.2	46.2	45.8
2022	23.7	33.9	37.2	48.7	54.1	62.8
2023	23.6	34.2	37.2	48.9	57.7	62.6
2024	23.4	34.4	37.2	49.0	58.5	62.4
2025	23.2	34.7	37.1	49.1	59.4	62.2
2026	25.1	35.8	39.3	51.9	58.4	65.1
2027	24.9	36.1	39.2	51.9	61.5	65.0
2028	24.7	36.4	39.2	51.8	62.3	65.1
2029	24.6	36.6	39.2	51.7	62.9	65.5
2030	26.6	37.8	41.4	54.4	62.5	67.8
2031	26.3	37.9	41.2	54.1	64.7	67.9
2032	25.9	38.0	41.0	53.8	65.1	68.1
2033	25.6	38.1	40.7	53.5	65.4	68.4
2034	27.6	39.2	42.8	56.0	65.3	69.6
2035	27.2	39.3	42.6	55.7	67.0	70.0
2036	26.9	39.4	42.4	55.4	67.3	70.5
2037	26.6	39.5	42.1	55.1	67.5	71.1
2038	28.5	40.5	44.3	57.7	68.0	71.5
2039	28.2	40.6	44.0	57.3	69.4	72.2
2040	27.9	40.7	43.8	57.0	69.6	73.0
2041	27.6	40.8	43.5	56.7	69.7	73.8
2042	29.5	41.8	45.7	59.3	70.7	73.3
2043	29.2	42.0	45.4	59.0	71.7	74.3

2044	28.8	42.1	45.2	58.6	71.8	75.4
2045	28.5	42.1	44.9	58.3	71.9	76.4
2046	30.5	43.2	47.1	60.9	73.4	75.2
2047	30.1	43.3	46.8	60.6	74.0	76.5
2048	29.8	43.4	46.6	60.3	74.0	77.8
2049	29.5	43.5	46.3	59.9	74.0	79.1
2050	31.4	44.4	48.4	62.4	75.9	76.9
2051	30.9	44.4	48.0	61.9	75.9	78.3
2052	30.5	44.4	47.6	61.5	75.7	79.7
2053	30.1	44.4	47.2	61.0	75.5	80.9
2054	32.0	45.3	49.4	63.5	77.8	78.2
2055	31.6	45.4	49.0	63.1	77.6	80.0
2056	31.2	45.4	48.7	62.8	77.4	81.6
2057	30.8	45.5	48.4	62.4	77.3	83.1
2058	32.8	46.5	50.7	65.0	79.7	80.1
2059	32.3	46.6	50.3	64.6	79.5	82.0
2060	31.9	46.6	50.0	64.3	79.3	83.9
2061	31.5	46.6	49.6	63.9	79.2	85.4
2062	33.5	47.7	52.0	66.6	81.7	82.0
2063	33.1	47.7	51.6	66.2	81.4	84.1
2064	32.6	47.8	51.3	65.8	81.3	86.1
2065	32.2	47.7	50.9	65.3	81.1	87.7
2066	34.2	48.9	53.3	68.1	83.7	84.0
2067	33.8	48.9	52.9	67.7	83.3	86.2
2068	33.3	48.9	52.5	67.3	83.2	88.4
2069	32.9	48.9	52.1	66.8	83.0	90.1
2070	35.0	50.1	54.6	69.7	85.6	85.9
2071	34.5	50.1	54.2	69.2	85.2	88.3
2072	34.0	50.1	53.8	68.8	85.1	90.6
2073	33.6	50.0	53.4	68.3	84.9	92.4
2074	35.7	51.3	55.9	71.2	87.6	87.8
2075	35.2	51.2	55.5	70.7	87.1	90.4
2076	34.7	51.2	55.0	70.2	86.9	92.8
2077	34.2	51.1	54.6	69.7	86.7	94.6
2078	36.4	52.4	57.1	72.7	89.4	89.6
2079	35.9	52.3	56.7	72.2	88.9	92.3
2080	35.4	52.3	56.2	71.6	88.7	94.9
2081	34.9	52.2	55.8	71.1	88.5	96.8

2082	37.1	53.5	58.3	74.1	91.3	91.4
2083	36.6	53.5	57.9	73.6	90.7	94.3
2084	36.1	53.4	57.4	73.0	90.5	97.1
2085	35.5	53.3	57.0	72.5	90.3	99.0
2086	37.8	54.6	59.6	75.6	93.1	93.3
2087	37.3	54.6	59.1	75.0	92.5	96.3
2088	36.7	54.5	58.6	74.4	92.3	99.2
2089	36.2	54.3	58.1	73.8	92.1	101.1
2090	38.5	55.7	60.8	77.0	95.0	95.1
2091	37.9	55.7	60.3	76.5	94.3	98.3
2092	37.4	55.5	59.8	75.8	94.1	101.4
2093	36.8	55.4	59.3	75.2	93.9	103.3
2094	39.2	56.8	62.0	78.5	96.8	97.0
2095	38.6	56.8	61.5	77.9	96.1	100.3
2096	38.1	56.6	61.0	77.3	95.9	103.5
2097	37.5	56.5	60.5	76.6	95.7	105.5
2098	39.9	58.0	63.2	79.9	98.7	98.8
2099	39.3	57.9	62.7	79.3	97.9	102.3
2100	38.7	57.7	62.2	78.7	97.7	105.7
2101	38.2	57.6	61.7	78.0	97.5	107.7
2102	40.6	59.1	64.5	81.4	100.5	100.7
2103	40.0	59.0	63.9	80.7	99.7	104.3
2104	39.4	58.8	63.4	80.1	99.5	107.8
2105	38.8	58.6	62.9	79.4	99.3	109.8
2106	41.3	60.2	65.7	82.9	102.4	102.5
2107	40.7	60.1	65.1	82.2	101.5	106.4

APPENDIX C

ROAD EXPANSIONS

APPENDIX: TABLE.1 NJTP - ROAD EXPANSIONS

The	Scenario I		Scenario II		Scenario III		Scenario IV		Scenario V		Scenario VI	
	PRIMARY	SECONDARY	PRIMARY	SECONDARY	PRIMARY	SECONDARY	PRIMARY	SECONDARY	PRIMARY	SECONDARY	PRIMARY	SECONDARY
1-2	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion
2-3	2073	No Expansion	2074	No Expansion	2076	No Expansion	2086	No Expansion	2089	No Expansion	2102	No Expansion
3-4	2105	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion
4-5	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion
5-6	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion
6-7	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion
7-7A	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion
7A-8	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion
8-8A	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion
8A-9	2037	2080	2044	2092	2046	2095	2050	2102	2058	No Expansion	2065	No Expansion
9-10	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion
10-11	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion
11-12	2047	2075	2063	2090	2067	2095	2082	No Expansion	2092	No Expansion	2093	No Expansion
12-13	2035	2052	2046	2067	2048	2071	2064	2087	2079	2098	2081	2100
13-13A	2046	2080	2068	2100	2075	No Expansion	2095	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion
13A-14	2054	2089	2076	No Expansion	2083	No Expansion	2100	No Expansion	No Expansion	No Expansion	2082	2102
14-SMB	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion
14-14A	2056	No Expansion	2067	No Expansion	2075	No Expansion	2097	No Expansion	2097	No Expansion	No Expansion	No Expansion
14A-14B	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion
14B-14C	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion
SMB-15E E	2023	2092	2039	No Expansion	2047	No Expansion	2075	No Expansion	2092	No Expansion	2097	No Expansion
15E-15W E	2051	No Expansion	2075	No Expansion	2083	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion
15W-15X E	2015	2022	2020	2027	2021	2031	2023	2058	2025	2067	2029	2073
15X-16E E	2015	2023	2020	2030	2021	2035	2023	2060	2026	2071	2032	2076
18E-NMB E	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion
SMB-15E W	2075	No Expansion	2098	No Expansion	2106	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion
15E-15W W	2074	No Expansion	2078	No Expansion	2082	No Expansion	2098	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion
15W-16W W	2037	No Expansion	2042	No Expansion	2046	No Expansion	2062	No Expansion	2079	No Expansion	2088	No Expansion
16W-18W W	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion
18W-NMB	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion	No Expansion