NEW JERSEY TRAFFIC AND REVENUE STUDY

Atlantic City Expressway Asset Appraisal

Final Report

January 2008

Prepared for:

State of New Jersey
Department of Treasury
State House
125 West State Street
Trenton, NJ 08625

Prepared by:

Steer Davies Gleave in association with CRA International and EDR Group

28-32 Upper Ground
London
SE1 9PD

+44 (0)20 7919 8500
www.steerdaviesgleave.com

Contents

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)
- New Jersey Department of Transportation (NJDOT)
- New Jersey Highway Authority (NJHA)
- 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)
- South Jersey Transportation Authority (SJTA)
- 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 report 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 ACE 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 provides an overview of the ACE and presents 2006 traffic and revenues;
- Chapter 3 presents an overview of our forecasting methodology, discusses key forecasting issues and summarizes key forecasting assumptions;
- Chapter 4 discusses how future traffic growth rates have been derived and defined; and
- Chapter 5 presents traffic and revenue forecasts for the facility.

2. THE ATLANTIC CITY EXPRESSWAY

Project Overview

2.1 The ACE, officially designated Route 446, is a 44 mile tolled facility in southern New Jersey, linking Atlantic City at its eastern extremity to the urban areas of Camden and Philadelphia at its western end (via a connection in Tumersville to Route 42). Along its length it serves the intermediate populated areas of Pleasantville, Hammonton, Williamstown and Berlin Cross Keys.

2.2 The ACE was opened in 1965 and has been managed and operated by the South Jersey Transportation Authority (SJTA) since 1991. In 2001 the road was extended to its present level of operation with the completion of the Atlantic City Brigantine Connector. An overview of the road is provided in Figure 2.1 below.

FIGURE 2.1 ACE OVERVIEW

2.3 As can be seen in Figure 2.1, the ACE's major connectivity to other routes is with the GSP in Egg Harbor Township and Route 9 in Pleasantville. It has further interchanges with State Routes 42, 50, 54 and 73.

2.4 A significant amount of traffic using the ACE is generated by tourism activities such as the casinos and beaches located in and around Atlantic City. The Atlantic City International Airport, located approximately 10 miles from Atlantic City, is also an important driver of traffic on the ACE. In 2003 airport passenger traffic totaled over 1 million.

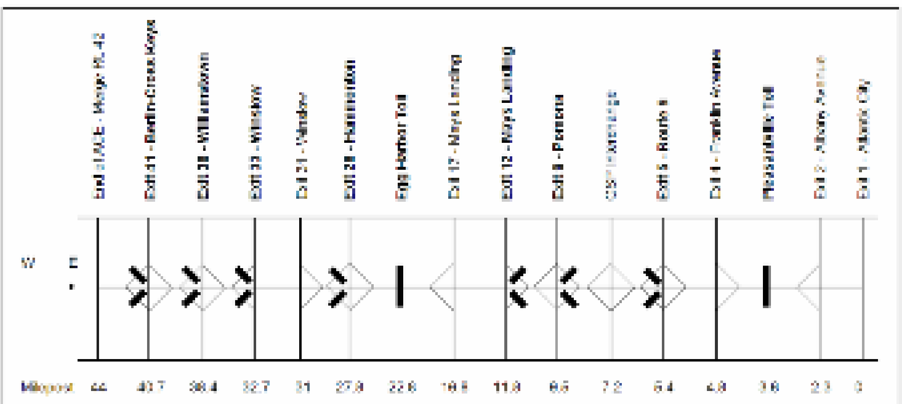
Tolling Regime

2.5 The ACE operates an 'open' tolling system, where users pay a fixed toll at set points on the road and its approach ramps. There are two barrier and seven ramp tolling points along the ACE as follows (West to East):

- Berlin Cross Keys (ramp plaza)
- Williamstown (ramp plaza)
- Winslow (ramp plaza)
- Hammonton (ramp plaza)
- Egg Harbor (barrier toll plaza)
- Mays Landing (ramp plaza)
- Pomona (ramp plaza)
- Route 9 (ramp plaza)
- Pleasantville (barrier toll plaza)

2.6 As shown in Figure 2.2 not every entrance and exit to the ACE is tolled. It is therefore possible, although unlikely, that a journey may not pass a tolling point. In reality the system operates as a closed system with very few "free" journeys as the vast majority of trips pass a minimum of one or a maximum of two tolling points.

FIGURE 2.2 ACE TOLLING SYSTEM



2.7 Since November 1998, SJTA, along with many other highway authorities in the north eastern US, has operated an Electronic Toll Collection (ETC) system called E-ZPass. E-ZPass allows vehicles equipped with E-ZPass tags mounted on the windshield to drive through designated toll lanes without the need to stop and manually pay a toll. All vehicles using E-ZPass receive a discount.

2.8 Tolls vary based on vehicle type with seven vehicle categories at the two barriers and two vehicle categories at each ramp. At each barrier vehicles are split into Car, Limo, Dual Tire, Three-Axle, Four-Axle, Five-Axle, Six-Axle groupings with differential tolls for each group. The barrier toll rates are shown in Table 2.1.

TABLE 2.1 ACE - 2006 BARRIER TOLLS ($)

Location	Pleasantville		Egg Harbor	
Payment Method	Cash	E-ZPass	Cash	E-ZPass
Car	$0.50	$0.34	$2.00	$1.28
Limo	$1.00	$0.60	$3.00	$1.80
Dual Tire	$1.00	$0.90	$3.00	$2.70
Three-Axle	$1.50	$1.35	$4.50	$4.05
Four-Axle	$2.00	$1.80	$6.00	$5.40
Five-Axle	$2.50	$2.25	$7.50	$6.75
Six-Axle	$3.00	$2.70	$9.00	$8.10

Source: SJTA

2.9 At each tolled ramp vehicles are charged either as 'Cars' or 'Truck/Bus/Limo' with E-ZPass discount only offered to Cars. These rates are shown in Table 2.2.

TABLE 2.2 ACE - 2006 RAMP TOLLS ($)

Location	Pomona, Mays Landing, Hammonton, Winslow		Williamstown, Berlin-Cross Keys		Route 9	
Payment Method	Cash	E-ZPass	Cash	E-ZPass	Cash	E-ZPass
Car	$0.50	$0.30	$0.25	$0.15	$0.50	$0.34
Truck/Bus/Limo	$0.50	$0.50	$0.25	$0.25	$0.50	$0.50

Source: SJTA

2.10 The cash toll for an end-to-end journey by car is $2.50. A five-axle truck making the same trip would incur a total of $10 in toll charges. On a toll per mile basis these through trip rates equate to a rate of $0.06 per mile for cars and $0.23 cents per mile for five-axle trucks. On a toll/mile basis these rates are similar to the tolls charged for through trips on the NJTP ($0.055/mile and $0.22/mile respectively).

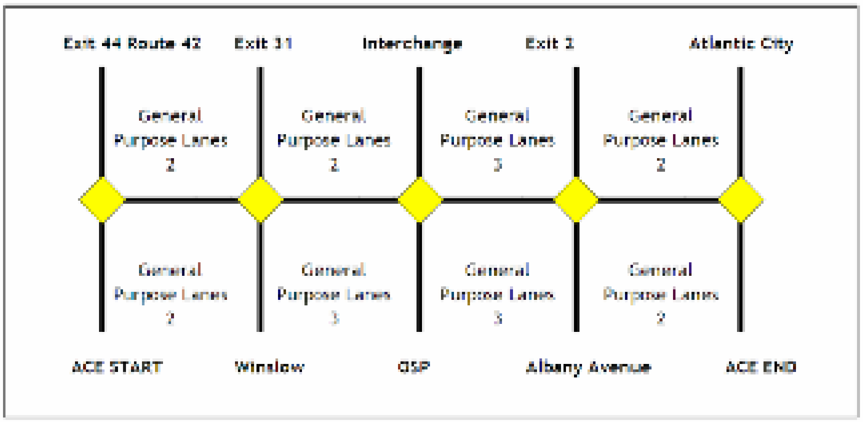
2.11 At present, discounts for cars using E-ZPass are between 32 – 40% at all tolling points while at the main line plazas limousines receive a 40% discount and heavier vehicles 10%. Limousines and commercial vehicles receive no E-ZPass discount at toll ramps. In contrast to the NJTP, these discounts are available at all times, including the peak hour.

2.12 Historically, toll rates have only been increased twice and this has been on an ad-hoc basis. The most recent toll increase occurred in 1998, the previous in 1966. There is currently no annual indexation of toll rates to price inflation.

Road Configuration

2.13 The ACE is a grade-separated limited access expressway with a speed limit of 65 mph west of Exit 7 of the GSP and 55 mph between Exit 7 and Atlantic City. A schematic summary of the lane geometry of the ACE is shown in Figure 2.3.

FIGURE 2.3 ACE LANE GEOMETRY



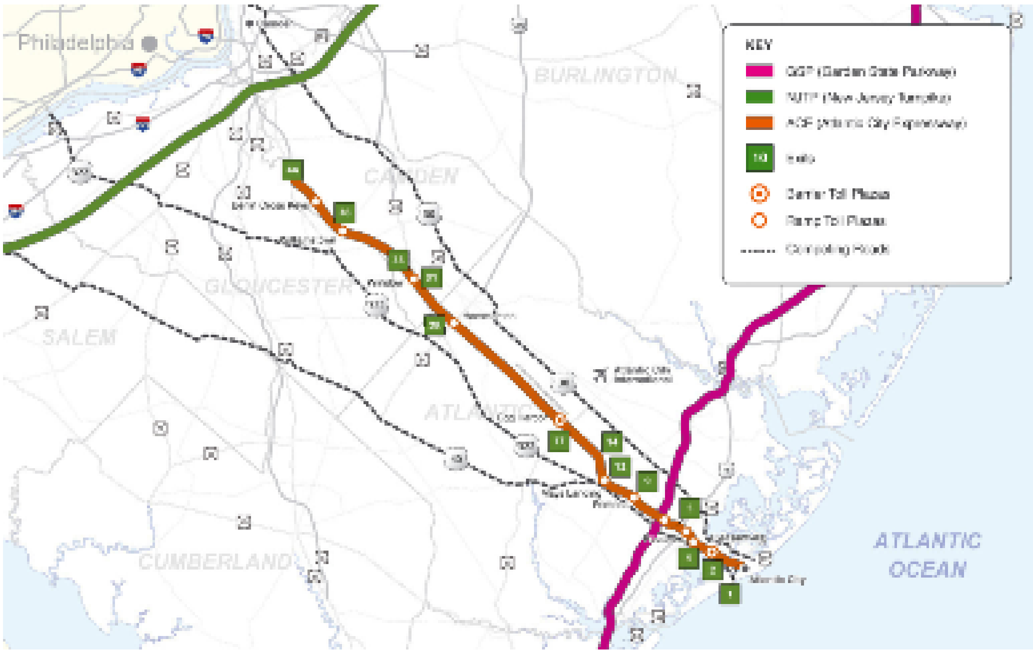
2.14 The lane geometry of the ACE can be summarized as follows:

- East of Exit 2, the ACE operates as a 4-lane highway (2 lanes per direction);
- From Exits 2 to 7, the facility operates as a 6-lane highway (3 lanes per direction);
- Between Exits 7 and 31, the ACE operates as a 5-lane highway (2 lanes westbound, 3 lanes eastbound); and
- From Exit 31 to where the ACE merges into Route 42, the facility operates as a 4-lane highway (2 lanes per direction).

Competing Routes

2.15 The ACE competes with two national highways, US-30 and US-322. These routes can be seen in the map in Figure 2.4.

FIGURE 2.4 ACE COMPETING ROUTES



2.16 The un-tolled US-30 runs to the north of the ACE in an almost parallel direction between Atlantic City and Hammonton. Beyond this point the US-30 turns further to the north towards Camden and from there via connecting roads to Philadelphia and other nearby urban areas. The speed limit across the length of the route ranges from 30 to 55 mph on a township or borough basis. The route is largely free flowing especially in its eastern and central sections. However, towards the western end, from the Hammonton area to Camden, there is a significant number of traffic signals. Largely for this reason it only competes effectively for journeys between Atlantic City and the Hammonton area, and short distance journeys between Hammonton and Camden.

2.17 The un-tolled US-322 runs to the south of the ACE in an almost parallel direction linking Atlantic City with Williamstown and Route 42. As such it provides an equivalent route to the ACE although with a reduced lane geometry specification and lower average speed. It has at-grade intersections, and although free flowing for the majority of its length, in urban area it passes through signaled and non-signaled intersections. The speed limit ranges from 30 to 55 mph depending on the borough or township. This route provides the most direct alternative to the ACE in terms of distance but, due to congestion at key points in populated areas, is unlikely to offer journey times close to those on the ACE. However, for local and off-peak through journeys, it may provide a viable un-tolled alternative to the ACE.

2.18 The specification and lane geometry of these two competing un-tolled alternatives is summarized in Table 2.3.

TABLE 2.3 ACE - SUMMARY OF COMPETING ROUTES

Route	Designation	Lane Geometry	Speed Limit (mph)	Toll (Per Mile)
US-30	National Highway	4-lane (2 per direction)	30-55	Un-tolled
US-322	National Highway	4-lane (2 per direction)	30-55	Un-tolled

Source: SDG Analysis / NJDOT

Planned Infrastructure Improvements

2.19 Figure 2.5 displays planned improvement projects in New Jersey. To alleviate traffic congestion, the ACE is to be widened to three lanes from milepost 7 (GSP) to milepost 31 (Rt. 73). Express E-ZPass at the Egg Harbor Toll Plaza is to be implemented. The project is scheduled to be completed by 2010.

2.20 The following projects have not yet been scheduled but will provide additional ingress and egress points to the ACE:

- The upgrading of Exit 17 to a full, four-ramp interchange allowing access in both directions on Route 50; and
- The implementation of a direct ramp connection from Exit 9 to Atlantic City International Airport.

FIGURE 2.5 PLANNED INFRASTRUCTURE IMPROVEMENTS IN NEW JERSEY

2006 Traffic and Revenue Levels

2.21 Wilbur Smith and Associates (WSA) have worked for many years for SJTA, monitoring the development of traffic and revenue. From their 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. Further, SJTA has provided us directly with up-to-date 2006 Transaction and Revenue Data for the ACE. Based on this data, and on our own analysis of the characteristics of the road, we have established an overview of the following:

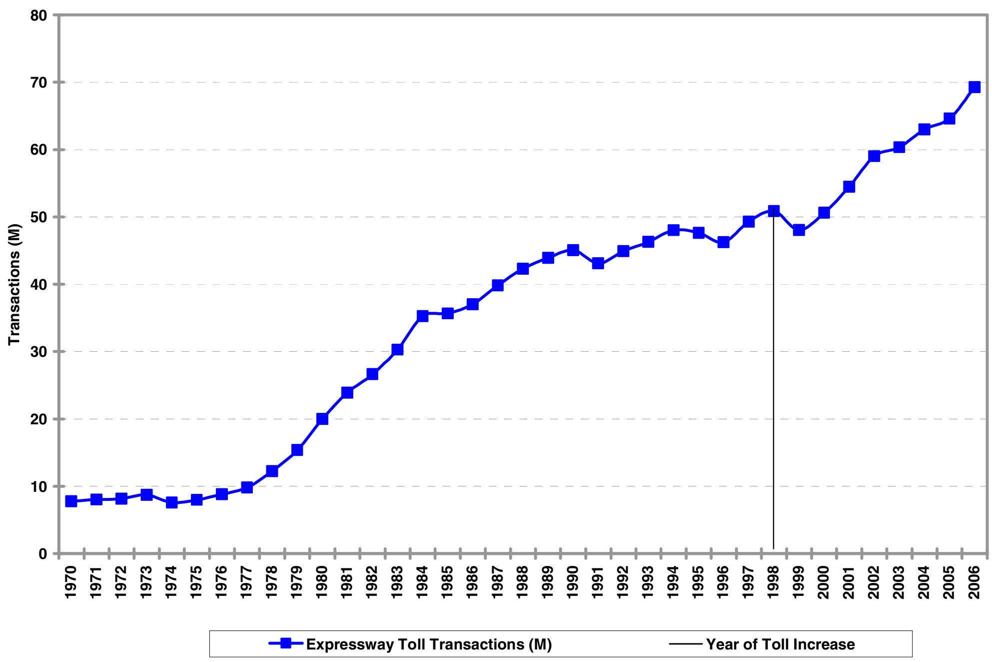
- General traffic volumes and characteristics;
- Transactions and revenue by vehicle type;
- Time of day transactions profiles;
- Analysis and observations of traffic patterns on different sections of each road; and
- Capacity constraints.

2.22 Data from the South Jersey Transportation Planning Organization's travel demand forecasting model enabled us to develop a picture of trip patterns on the ACE.

2006 Toll Transactions

2.23 In 2006 there were over 69 million toll transactions on the ACE, equivalent to approximately 190,000 transactions per day. Cars accounted for 97.5% of transactions. Figure 2.6 below shows the number of ACE toll transactions for the period 1970-2006.

FIGURE 2.6 ACE TOLL TRANSACTIONS: 1970–2006 (M)



Source: SJTA / SDG Analysis

2.24 In 1970, there were just under 8 million toll transactions. From 1971 to 1975, the period including the 1973 'oil shock', transactions dropped on average by 0.1% per year. However, the beginning of casino development in Atlantic City in 1978 resulted in a sharp increase in transactions to reach nearly 20 million in 1980. This growth trend continued to 1985 by which time almost 36 million transactions were recorded on the ACE. After 1985, the growth rate fell - with traffic growing between 1985 and 2000 1.8% per annum. The 1999 increase in ACE tolls, the first since 1969, caused a fall in transactions the same year. Table 2.4 below shows that in the past five years (2001-2006) traffic has grown rapidly at 4.9% per annum.

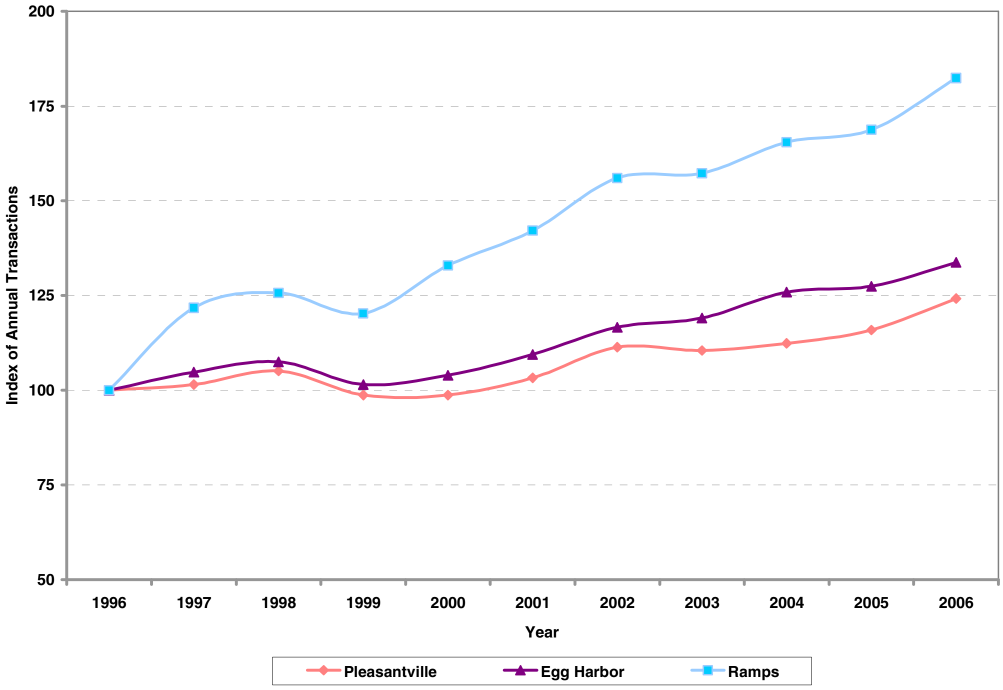
TABLE 2.4 ACE - ANNUAL TRAFFIC GROWTH (TRANSACTIONS)

Period	Beginning of Period (M)	End of Period (M)	Average Annual Growth
1970 – 2006	7.8	69.3	8.8%
1996 – 2006	46.2	69.3	4.1%
2001 - 2006	54.5	69.3	4.9%

Source: SJTA / SDG Analysis

2.25 Figure 2.7 shows the development of transactions at the toll barriers and ramps between 1996 and 2006. In general, ramp transactions grew at a faster rate than barrier transactions suggesting an increase in local traffic. Barrier transactions indicate consistent growth over the period and are the best indicators of the development of through traffic. The toll barriers at Pleasantville and Egg Harbor account for the majority of transactions on the ACE and grew at an average rate of 1.5% and 2.5% respectively between 1996 and 2006.

FIGURE 2.7 ACE BARRIER AND RAMP TRANSACTIONS: 1996–2006 (1996 = 100)



Source: SJTA / SDG Analysis

2.26 Table 2.5 shows that ramps have grown at a greater rate than the barriers, reflecting infrastructure improvements and changes in local traffic. This rate ranges from 4.0% at Hammonton to 9.6% at Pomona.

TABLE 2.5 ACE - ANNUAL TRANSACTION GROWTH BY TOLL LOCATION

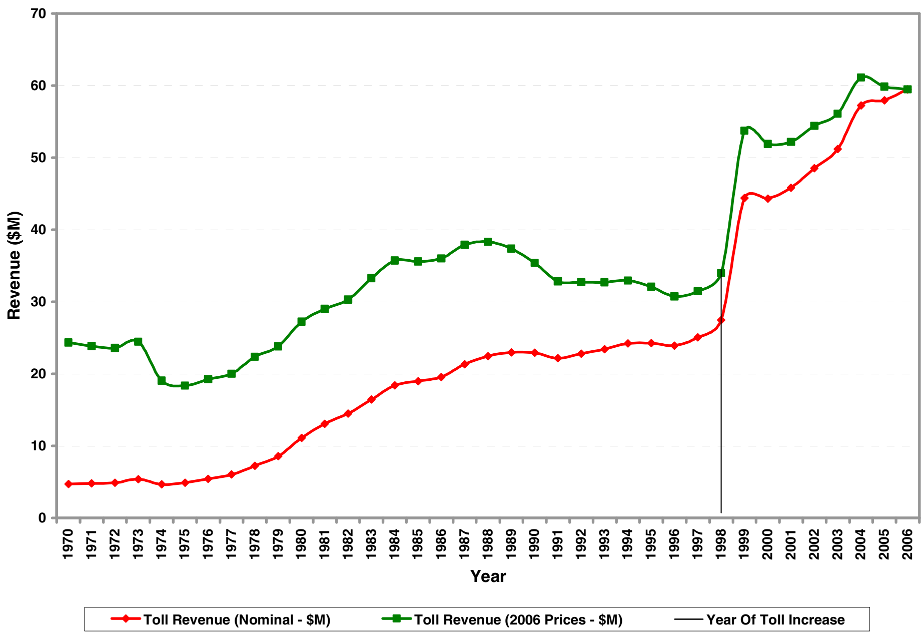
Location	Total Transactions 1996 (M)	Total Transactions 2006 (M)	Average Annual Percentage Growth
Pleasantville	22.2	27.6	1.5%
Mays Landing	3.2	5.7	5.5%
Egg Harbor	14.8	19.8	2.5%
Hammonton	1.2	1.8	4.0%
Winslow	0.5	0.9	4.9%
Williamstown	3.1	5.0	4.1%
Pomona	1.3	3.4	9.6%
Berlin Cross-keys	2.1 (2000)	3.5	8.1%
Exit 5, Route 9	1.0 (2003)	1.5	8.1%
Total		69.3	

Source: SJTA / SDG Analysis

Revenue

2.27 Figure 2.8 below shows revenue development between 1970 and 2006 both in real and nominal terms. Nominal toll revenue for this period grew from $4.7 million to approximately $60 million in 2006, an annual growth rate of over 7.0% per annum. Expressed in 2006 prices revenue grew by 2.5% per year on average over the same period. Revenue in real terms has fallen in recent years as tolls are not indexed and inflation outstripped traffic growth.

FIGURE 2.8 ACE TOLL REVENUE: 1970-2006 ($M)



Source: SJTA / SDG Analysis

2.28 Of these transactions a large proportion are now collected through the ETC system, E-ZPass. Table 2.6 shows, in 2006, E-ZPass accounted for 48% of transactions while 80% of trucks paid by this method.

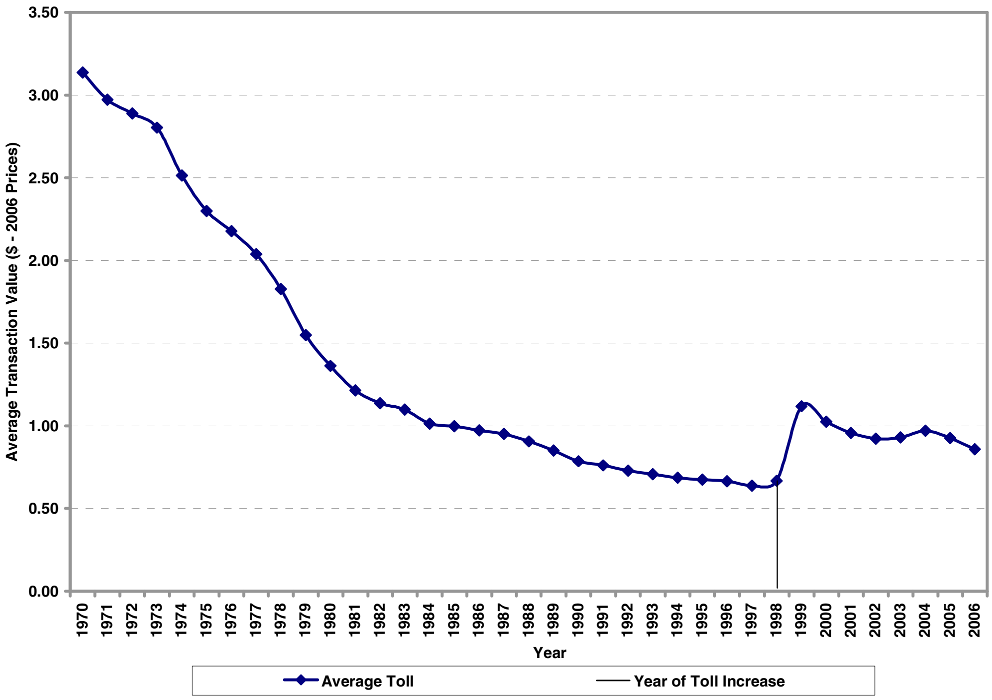
TABLE 2.6 ACE - 2006 PAYMENT TYPE BY VEHICLE TYPE

Vehicle Type	Payment Method		
	Automated Cash Machines	E-ZPass	Manual
Car	29%	48%	23%
Truck	5%	80%	15%

Source: SJTA / SDG Analysis

2.29 Figure 2.9 shows the average value per toll transaction for the period 1970-2006 (in 2006 prices). This value fell from $3.14 in 1970 to $0.64 in 1997, a drop of 80%. The main reason for this is the lack of toll indexation and to a lesser extent the proportionally larger share of local traffic using the ramp plazas, where toll rates are lower.

FIGURE 2.9 ACE AVERAGE TRANSACTION VALUE ($, 2006 PRICES)



Source: SJTA / SDG Analysis

2.30 The effect of the 1998 doubling of tolls at the Egg Harbor barrier is clear with average transaction values increasing by around 80%. This, combined with the insignificant long term effect of the toll rise on transactions, suggests traffic is overall relatively inelastic in the long term.

Traffic and Revenue by Vehicle Type

2.31 The vast majority of usage of the ACE is by passenger cars who, in 2006, accounted for 97.2% of vehicles using the facility. Heavy vehicles account for just 2.8% of transactions of total vehicle miles. Due to the relatively higher tolls paid by heavy vehicles, however, these vehicles actually accounted for 7.5% of 2006 toll revenues. Table 2.7 summarizes the relative traffic and revenue shares of light and heavy vehicles on the ACE.

TABLE 2.7 ACE - 2006 TRANSACTIONS AND REVENUE BY VEHICLE TYPE

Vehicle Type	Transactions (M)	% of Total	Revenue ($M)	% of Total
Car	67.31	97.2%	$55.02	92.5%
Truck/Bus/Limo	1.93	2.8%	$4.45	7.5%
2006 Total	69.25	100.0%	$59.47	100.0%

Source: SJTA / SDG Analysis

Traffic and Revenue by Tolling Point

2.32 Table 2.8 lists 2006 transactions and revenue by tolling point. The busiest tolling points are at the barriers at Pleasantville and Egg harbor, which together account for over 65% of 2006 transactions and 85% of 2006 revenue. The most significant ramp is Mays Landing with 8.3% of transactions and 4.5% of revenue. Egg Harbor is the largest source of toll revenue on the ACE with 63% although it only accounts for 29% of the transactions. Pleasantville is busier with 40% of 2006 transactions but the lower toll rate produces only 23% of the year's revenue.

TABLE 2.8 ACE - 2006 TRANSACTIONS AND TOLL REVENUE BY TOLLING POINT

Location	Transactions (M)	% of Total	Revenue ($M)	% of Total	Average Value
Pleasantville	27.6	39.8%	$13.6	22.8%	$0.49
Egg Harbor	19.8	28.5%	$37.6	63.3%	$1.90
Exit 5 - Route 9	1.5	2.2%	$0.7	1.2%	$0.46
Pomona	3.4	4.9%	$1.6	2.6%	$0.46
Mays Landing	5,.7	8.3%	$2.7	4.5%	$0.47
Hammonton	1.8	2.6%	$0.9	1.4%	$0.47
Winslow	0,.9	1.4%	$0.4	0.7%	$0.47
Williamstown	5.0	7.2%	$1.2	2.0%	$0.24
Berlin - Cross Keys	3.5	5.1%	$0.8	1.4%	$0.23
Total	69.3	100.0%	$59.5	100.0%	$0.86

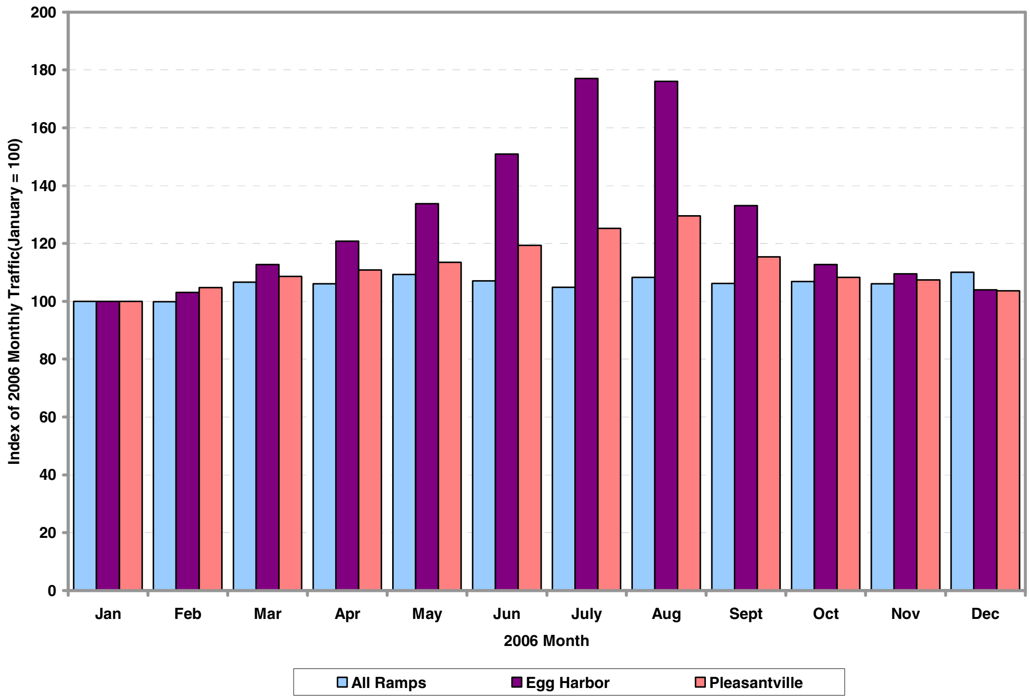
Source: SJTA / SDG Analysis

2.33 The ramps with the highest yield are from Exit 5 to Winslow at $0.46 or $0.47 with the most western two ramps, Williamstown and Berlin – Cross Keys recording $0.24 and $0.23 respectively.

Monthly Traffic Profile

2.34 The ACE's annual demand profile in Figure 2.10 shows a distinct pattern in the behavior of local, compared to through traffic. The seasonal variance at Egg Harbor is high with July and August transactions in 2006 reaching over 175% of the January and December figures, showing the impact of summer tourism traffic.

FIGURE 2.10 ACE INDEX OF 2006 MONTHLY TRANSACTIONS (JANUARY = 100)



Source: SJTA / SDG Analysis

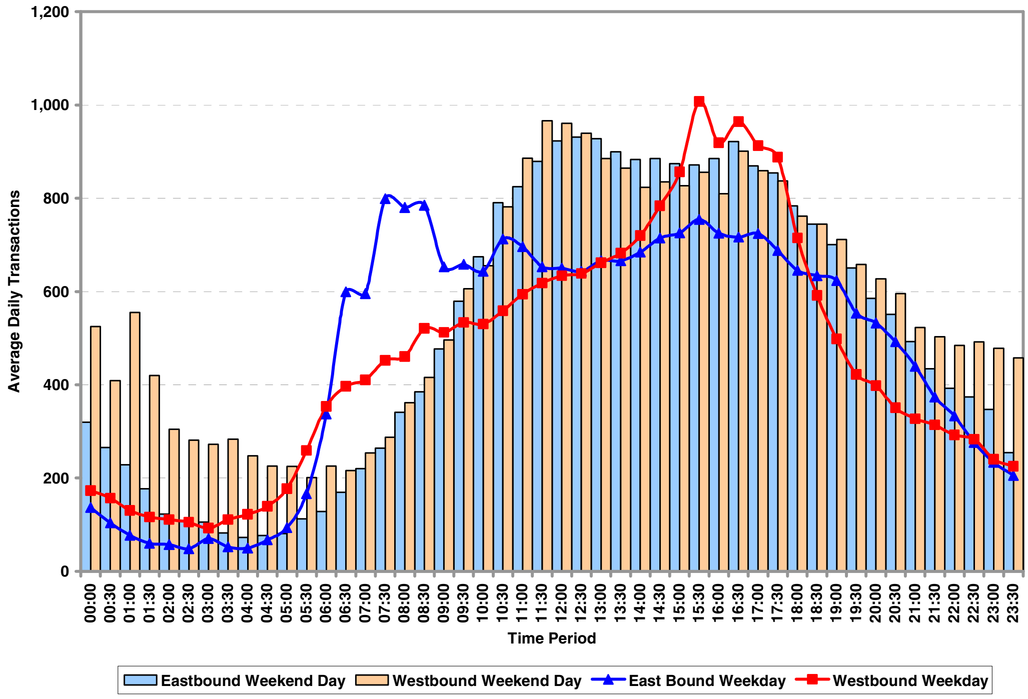
2.35 As previously explained, Egg Harbor is the best indicator of through traffic as it is a barrier located midway along the ACE. Pleasantville's annual profile supports this summer rise in through traffic although with a lower variance due to a higher proportion of local commuter traffic. The "All Ramps" grouping, including all tolling points except the two barriers, shows a flat annual profile indicating that local traffic remained at a consistent level across the year.

Hourly Traffic Profiles

2.36 Figure 2.11 also shows the marked difference between through and local traffic that is also apparent in the hourly profiles at tolling points on the ACE. Egg Harbor, as expected, shows a higher level of traffic at the weekend as this is driven by the tourist attractions in and around Atlantic City. This traffic is of a recreational nature with a smooth peak of around 2,200 vehicles per half hour period between 12 noon and 5 pm in the afternoon.

2.37 Weekday traffic is generally lower except for the AM peak hours where there is evidence of some, although insignificant, commuter traffic. At 1,880, the traffic volume in the PM peak (3:30 pm to 4:00 pm) also suggests some commuter traffic, although this is still less than weekend day afternoon flows.

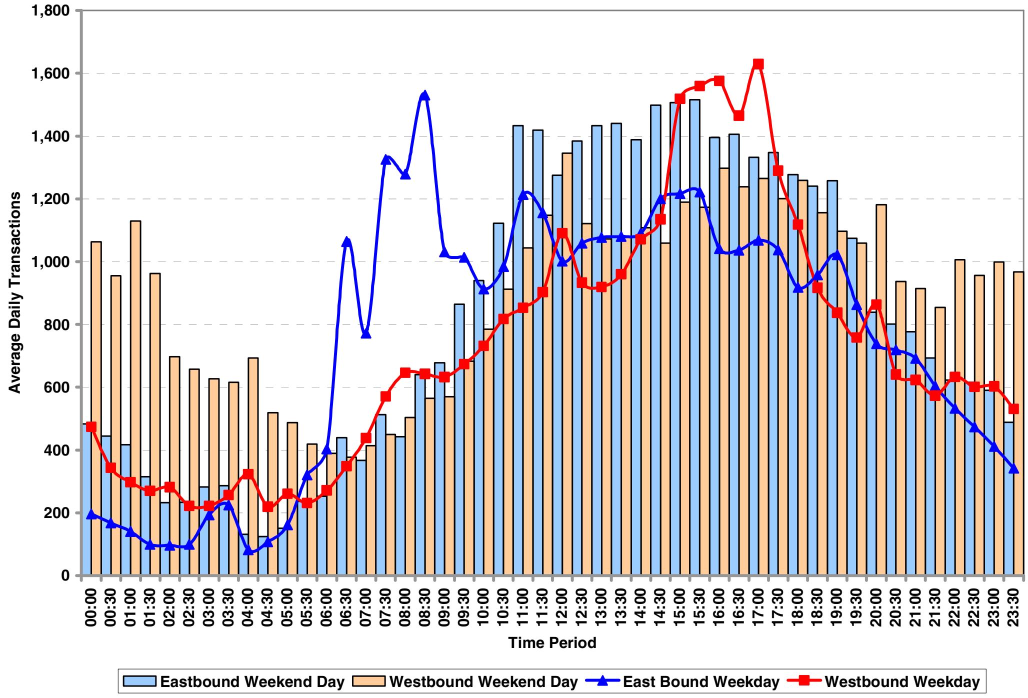
FIGURE 2.11 ACE 2006 DAILY BARRIER TRANSACTIONS: EGG HARBOR



Source: SJTA / SDG Analysis

2.38 Pleasantville, located on the edge of Atlantic City, shows a similar daily profile as Egg Harbor with greater traffic on weekend days than on week days at all times except the AM peak. The weekend peak is wider running from 12 pm to 8 pm at between 2,000 and 2,800 vehicles per half hour period. Figure 2.12 shows Pleasantville to have less variance than Egg Harbor between week and weekend days due to the increased proportion of commuter traffic accessing the urban area from surrounding residential areas for reasons other than tourism. The apparent existence of a commuter flow is supported by the presence of clearer traffic volumes, although this is still insignificant when compared to that on roads such as the NJTP or GSP, in both the AM and PM peak.

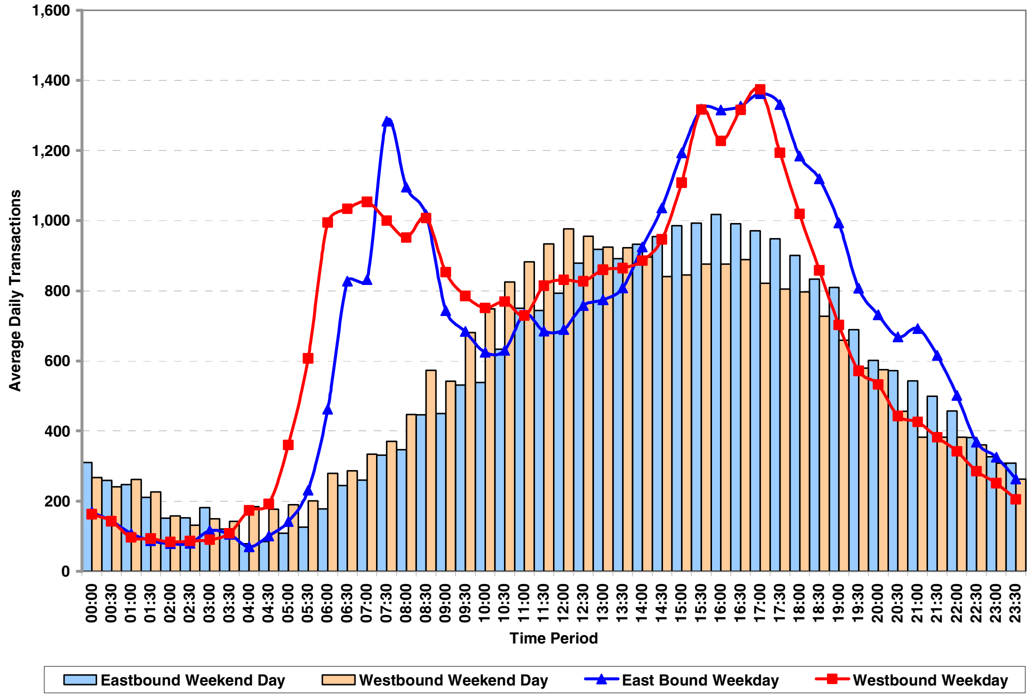
FIGURE 2.12 ACE 2006 DAILY BARRIER TRANSACTIONS: PLEASANTVILLE



Source: SJTA / SDG Analysis

2.39 Figure 2.13 shows the daily transactions by time period for all the ramps on the ACE. As mentioned before these flows are generally of a more local nature than the traffic passing Egg Harbor barrier. This fact is supported by the clear AM and PM weekday peaks as local residents commute to work. In contrast to the barrier flows, the weekend day is lower by number of transactions for all but three hours from 11 am to 2 pm. The shape of the weekend profile is similar to Egg Harbor suggesting recreational through traffic. It is likely that some, but not all, this recreational traffic is created by the tourist activities in Atlantic City.

FIGURE 2.13 ACE 2006 DAILY RAMP TRANSACTIONS: ALL RAMPS



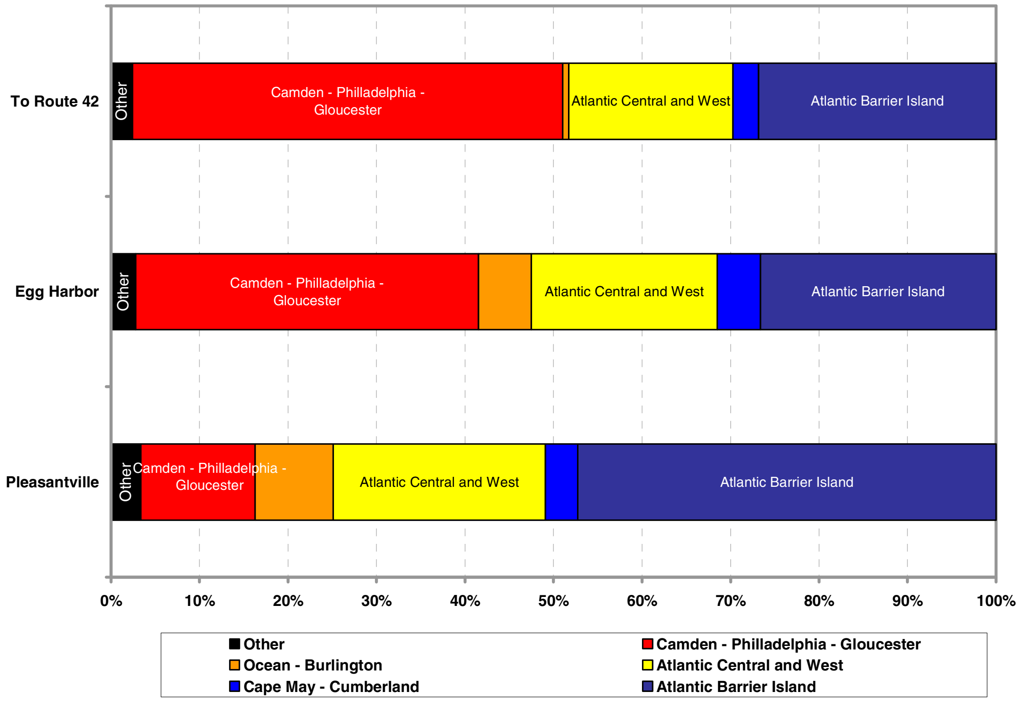
Source: SJTA / SDG Analysis

ACE Traffic Patterns

2.40 The New Jersey Department of Transportation (NJDOT) State-wide model was used to analyze traffic trip patterns on the ACE – in particular to provide an indication of origin and destination patterns. A summary of this analysis is provided in Figure 2.14 overleaf.

2.41 The analysis clearly shows how the majority of traffic is traveling to one of the two urban areas at either end of the ACE. The exit to Route 42 and Egg Harbor show similar through traffic traveling to the Camden, Ocean or Atlantic Barrier Island areas. This suggests that this section is largely used by cars on through journeys rather than short, local journeys. Pleasantville shows a higher proportion of traffic heading to the nearby Atlantic Barrier Island area showing, as commented on further below, that this barrier experiences higher local traffic flows than Egg Harbor.

FIGURE 2.14 ACE TRAFFIC PATTERNS



Source: State-wide Model / SDG Analysis

Traffic Congestion

2.42 To develop an understanding of the levels of congestion on the ACE we have compared observed traffic flows with benchmark service volumes from the U.S. Highway Capacity Manual (HCM). The 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.

2.43 On a multi-lane highway like ACE, 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 traffic incidents can create queuing. Table 2.9 compares observed AM peak hour directional volumes across a number of sections of the ACE with 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 2.9 ACE - 2006 AM PEAK HOUR SERVICE LEVELS

Section	Observed Peak Hour Volumes	LOS D Service Volumes	Volume/LOS D Service Volume (%)
Atlantic City - Egg Harbor	911	4,500	20%
Egg Harbor - Pleasantville	1,190	4,500	26%

Source: SJTA / HCM / SDG Analysis

2.44 As can be seen, average peak hour traffic flows are currently not at critical levels and there appears to be very few or no capacity issues in the peak period. However, as we have already mentioned, ACE traffic flow is extremely seasonal and these average traffic flows may mask some of the capacity issues that may exist closer to Atlantic City during the peak summer months.

Behavioral Research

2.45 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.

2.46 A survey was undertaken to provide fresh evidence on certain key issues of relevance to the study. As part of the survey, 80 ACE 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.

2.47 Despite the smaller sample size, it is quite clear that ACE users tend to have different opinions and characteristics compared to the users of the two larger roads. The ACE tends to be used more often for leisure purposes than the two larger roads. Using the ACE is less stressful and people are significantly less likely to experience congestion. For the ACE users, the ACE is less likely to be essential in their lives, they are less worried about the cost of the tolls, and they are less likely to say that the tolls represent poor value for money.

2.48 The household income profile of ACE users suggested that they are more likely to have medium-low household incomes compared to the users of the other roads, although the difference is not dramatic. Of the ACE users, slightly more lived in Pennsylvania (45%) than New Jersey (43%), with the remainder being split between the states of New York and Delaware.

2.49 ACE users were much less likely to describe their recent trips on the road as important, and almost half of them described their recent trip as being “not very” or “not at all” important. Compared to users of the other roads, the ACE users were more likely to use alternative routes. The main alternatives given to making that particular trip on the ACE as and when they did were to still use the ACE, but at a different time of day, or to use an alternative route.

2.50 ACE users were more likely to spend a bit less on road tolls than the users of the other roads, and of those that used the EZ-Pass system, as many as 70% said they did not normally think about the cost of the tolls at all. The evidence on the values of time showed that the ACE users had a similar distribution of values of time to the GSP users; with a tendency towards lower values of time compared to NJTP users. The responses to the direct questions about toll changes showed significantly less don’t knows – more people seemed to answer the questions directly, and the answers suggest that the demand for the ACE is likely to be somewhat more elastic in response to changes to the toll.

2.51 In common with the users of the other roads, individuals did not report big changes in their usage of the ACE. The evidence suggests that there has been a slight worsening in congestion on the ACE over the last two years, but less than for the other roads, and there is also evidence that the deterioration of conditions on alternative routes has been at least as bad over the same time period.

2.52 When asked about changes to the tolls over the past 2 years (there have not been any significant changes), only about 63% of the ACE users correctly answered that the tolls had not changed - most of the rest responded that the tolls had gone up, with 3% saying that “tolls are now much higher” compared to 2 years ago. This adds to the impression that many ACE users do not have a clear idea of how much they are paying and whether or not it has been changing.

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

Summary

- The ACE is a 44 mile tolled facility in southern New Jersey linking Atlantic City to Camden and Philadelphia;

- The ACE's major connectivity to other routes is with the GSP in Egg Harbor Township and Route 9 in Pleasantville. It has further interchanges with State Routes 42, 50, 54 and 73;

- A significant amount of traffic using the ACE is generated by tourism activities such as the casinos and beaches located in and around Atlantic City. The Atlantic City International Airport, located approximately 10 miles from Atlantic City, is also an important driver of traffic;

- The ACE operates as an 'open' tolling system, whereby users pay a fixed toll at set points on the road and its approach ramps. There are two barrier and seven ramp tolling points along the ACE;

- The ACE 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 ACE and past economic growth has been;

- The ACE competes with two National Highways, the US-30 and US-322. These facilities provide a lower level of service than the ACE and only compete effectively for local and short distance journeys;

- The ACE is a grade-separated limited access expressway with a speed limit of 65 mph west of Exit 7 of the GSP and 55 mph between Exit 7 and Atlantic City. The ACE operates as a mixture of 4-lane highway (2 lanes per direction) and 6-lane highway (3 lanes per direction);

- In 2006 there were over 69 million toll transactions on the ACE, equivalent to approximately 190,000 transactions per day on average. Cars accounted for 97.5% of transactions;

- Between 1996 and 2006 traffic grew strongly by 4.1% on average. In general ramp transactions grew at a faster rate than barrier transactions suggesting an increase in local traffic;

- Expressed in 2006 prices revenue grew by 2.5% per year on average between 1970 and 2006. Revenue in real terms has fallen in recent years as tolls are not indexed and inflation outstripped traffic growth;

- A large proportion of transactions are now collected through the ETC system, E-ZPass. In 2006, on the ACE, E-ZPass accounted for 48% of transactions while 80% of trucks paid by this method;

- The busiest tolling points are at the barriers at Pleasantville and Egg Harbor, which together account for over 65% of 2006 transactions and 85% of 2006 revenue on the ACE. The most significant ramp is Mays Landing with 8.3% of transactions and 4.5% of revenue; and

- The seasonal variance at Egg Harbor is high with July and August transactions in 2006 reaching over 175% of the January and December figures, showing the impact of summer tourism traffic.

- A key issue for the ACE 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.

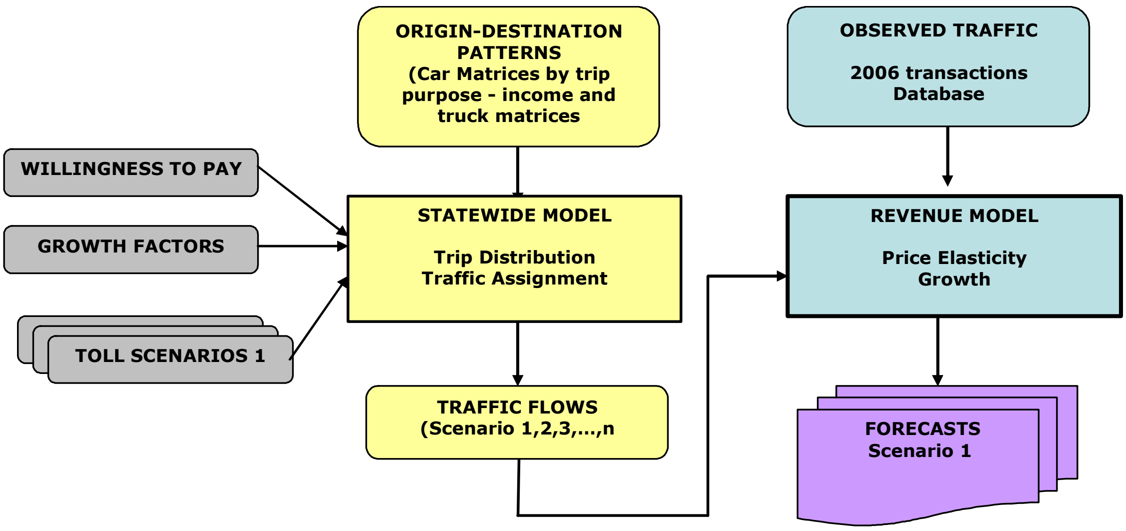
3. THE FORECASTING METHODOLOGY

Introduction

3.1 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 ACE 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.

3.2 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 factors such as growth rates, values of time and changes in trip distribution. Our forecasting methodology is illustrated in Figure 3.1 below.

FIGURE 3.1 FORECASTING METHODOLOGY



3.3 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).

3.4 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.

3.5 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*.

3.6 The *trip tables* were updated with the information on trip patterns (Origin-Destination and Journey Purpose split by time of the day) from the North Jersey (NJTPA) and South Jersey Models (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.

3.7 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.

3.8 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.

3.9 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

3.10 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 significant difference in the cost of the trip or congestion levels; and
- Activity - some people might offset the higher costs of travel by undertaking the activity less often, or not at all.

3.11 Recent research by Ozbay et al. 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.

3.12 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.

Existing and Future Capacity Constraints

3.13 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 99 year forecast period of the project facility. The basis for this was the requirement specified by the State that Service Levels should not fall below “LOS D”. Our method for estimating capacity constraints is outlined below.

3.14 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.

3.15 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.

3.16 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[1].

3.17 When forecast traffic levels exceeded the Service Level D definition capacity constrains are believed to be binding and an expansion of one lane per direction has been assumed. However, forecasted traffic levels did not exceed the Service Level D for the ACE, and so no road expansions were necessary.

[1] 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.

4. TRAFFIC GROWTH

Introduction

4.1 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, matrices containing vectors at the county level have been developed 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.

4.2 As discussed in this chapter, observed economic and traffic growth in New Jersey have been extremely robust and 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

4.3 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.

4.4 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.

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

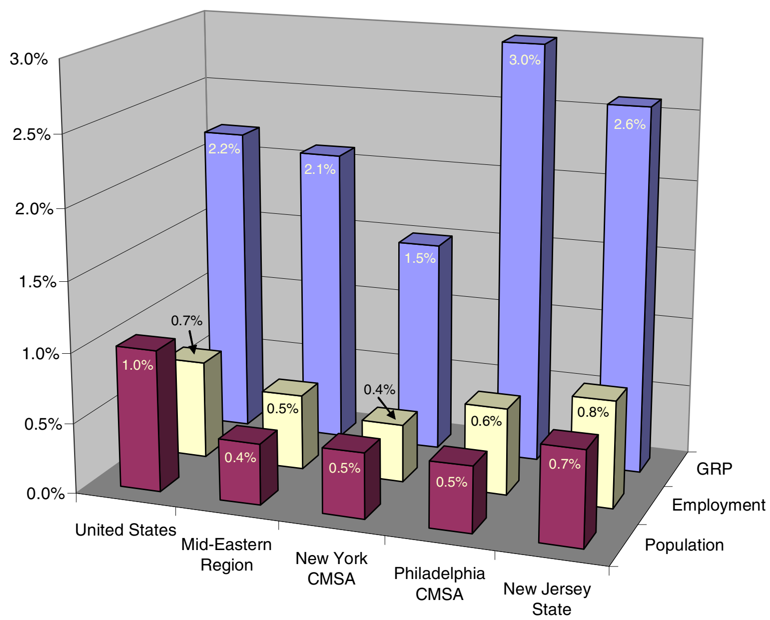
- The Port Newark-Elizabeth Marine Terminal is one of the world's largest container ports while Newark Liberty International Airport is ranked seventh among the nation's busiest airports and among the top 20 busiest airports in the world;

- 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; and
- Its agricultural outputs are numerous and include nursery stock, horses, vegetables, fruits and nuts, seafood and dairy products.

4.6 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.

4.7 Figure 4.1 below is based on historic 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 4.1 ANNUAL GRP, POPULATION & EMPLOYMENT GROWTH, 2000 - 2005



Source: Woods & Poole

4.8 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 year, 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.

4.9 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.

4.10 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.

4.11 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

4.12 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.

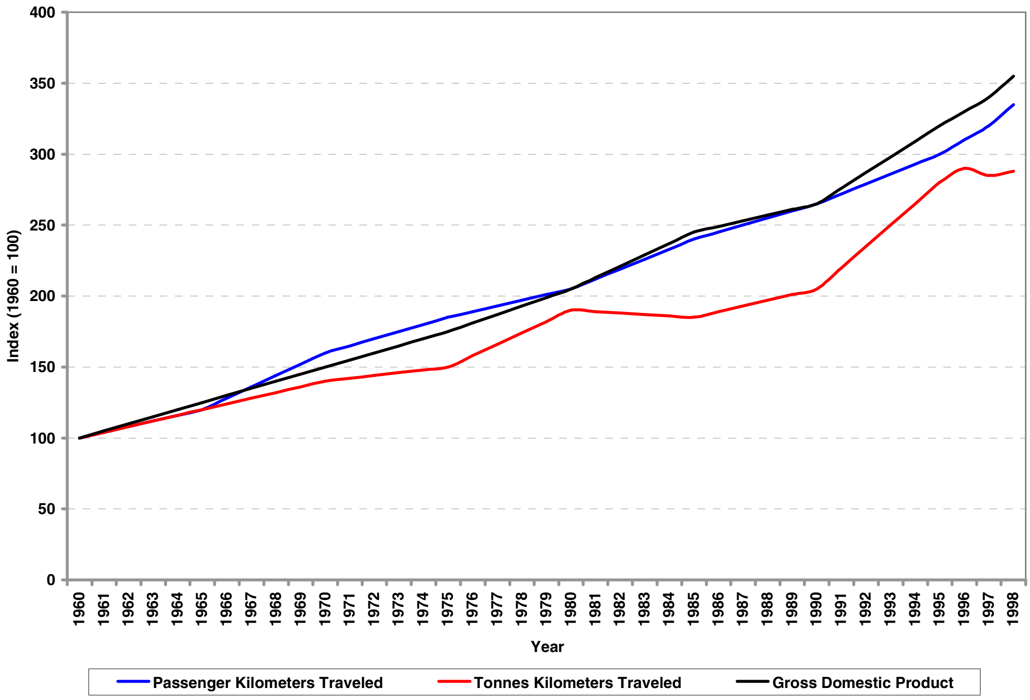
4.13 These are important parameters since they provide guidance as to whether the demographic growth-based vectors should be adjusted to reflect observed changes in trip making and vehicle mileage.

4.14 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

4.15 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 the figure below (albeit with data only available up to 1998).

FIGURE 4.2 DECOUPLING OF ECONOMIC & TRAFFIC GROWTH 1960 - 1998

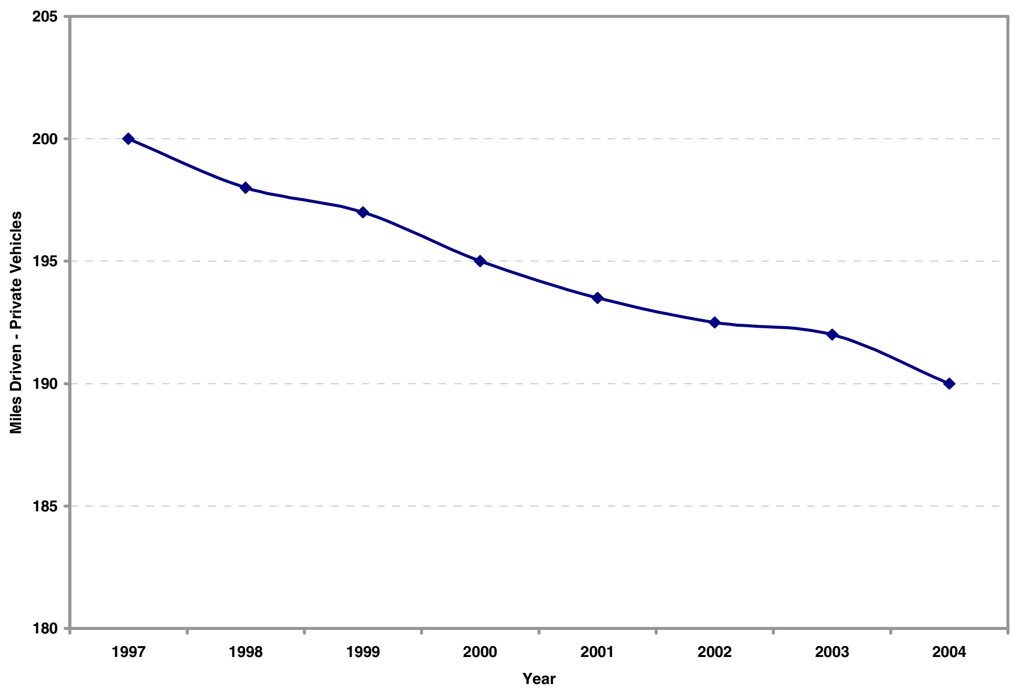


Source: PKM/TKM data: US Bureau of Transport Statistics ('National Transport Statistics'), GDP data: US Bureau of Economic Analysis ('Current Account Data')

4.16 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.

4.17 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 4.3 overleaf.

FIGURE 4.3 PRIVATE VEHICLE MILES DRIVEN PER $1,000 GROSS STATE PRODUCT, NEW JERSEY, 1997-2004



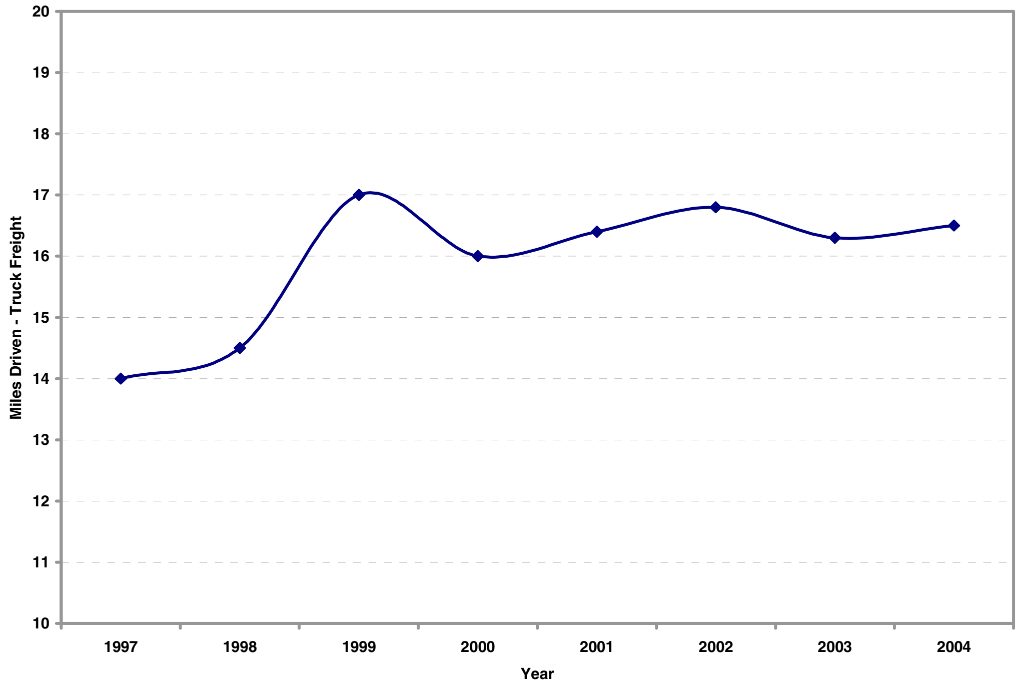
Source: NJ Dept of Labor & Workforce Development, FTA National Transit Database, 1997-2004

4.18 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 State-wide 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.

4.19 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.

4.20 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 4.4 overleaf indicates this trend, including the two years where the volume of mileage per Gross State Product decreased.

FIGURE 4.4 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

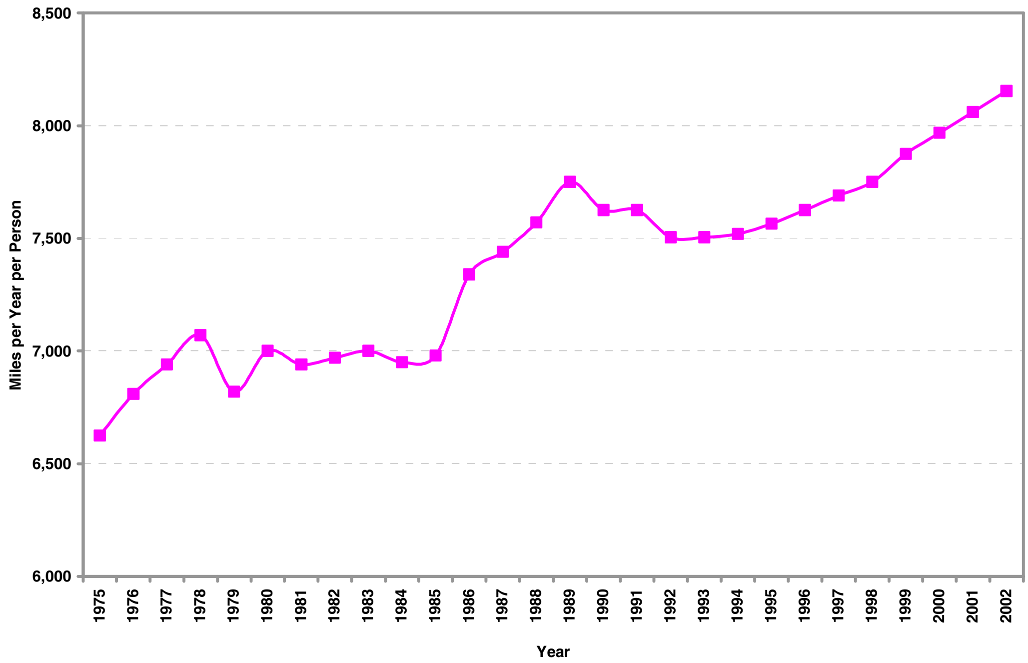
4.21 For truck traffic, although we have not made a direct upward adjustment to reflect this increased level of mileage per unit of economic activity, the growth vectors derived for this traffic category are higher than those for other traffic types are due, in part, to this phenomenon.

4.22 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

4.23 Data collected for New Jersey indicates that there has been a steady increase in VMT per capita over time. Using both FHA 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 4.5 overleaf.

FIGURE 4.5 SUMMARY OF VEHICLE MILES TRAVELED PER CAPITA, 1975 - 2002



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

4.24 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.

4.25 The most important conclusion to be drawn from the data in Figure 4.5 above 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.

4.26 Over the last five years, 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.

4.27 Figure 4.6 below 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 4.6 VEHICLE MILES TRAVELED PER CAPITA, 2000 - 2005

Source: Vehicle miles data = NJDOT, Population data = US Census Bureau

4.28 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.

4.29 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.

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

WSA Forecasts

4.31 WSA produced transactions and revenue projections in 2005 for the ACE. These estimates were based on historic data and covered the period 2006 – 2015. The results of this report are summarized below.

4.32 The projections were based on a number of assumptions. The most significant are the following:

- 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

4.33 The report projected steady increases in population, employment and the positive trend in the region's residential building permits. It expected redevelopment at Atlantic City to continue through casino expansions and residential populations of suburbs such as Burlington and Gloucester to grow as the city of Philadelphia continues to decline. Residential construction in Atlantic, Cape May and Ocean counties was projected to increase to provide retirement communities and accommodation for the users of Atlantic City.

4.34 WSA projects total transactions to rise from 64.5 million in 2005 to over 74.8 million by 2010 and over 82.8 million by 2015. Toll revenue is expected to rise from approximately $58.2 million in 2005 to just over $67.6 by 2010 and approximately $74.7 million by 2015. With no toll increases assumed this infers an average annual growth rate of 2.5% in toll revenue[2].

[2] Updated forecast occurred after data collection and verification

TABLE 4.1 ACE - WSA TRAFFIC AND REVENUE PROJECTIONS (2006 - 2015)

Year	Transactions (M)	Observed Transactions (M)	Toll Revenue (Nominal $M)	Observed Toll Revenue (Nominal $M)
2005	64.6	64.6	58.2	58.0
2006	66.5	69.3	60.1	59.5
2007	68.5		61.9	
2008	70.5		63.8	
2009	72.7		65.7	
2010	74.8		67.6	
2011	76.6		69.1	
2012	78.3		70.6	
2013	79.9		72.0	
2014	81.5		73.4	
2015	82.8		74.7	
Average Annual Growth	2.51%		2.53%	

Source: WSA / SJTA / SDG Analysis

Steer Davies Gleave Forecasts

4.35 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 historic 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

4.36 Before discussing how the growth vectors 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.

4.37 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); and
- Truck.

4.38 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 in Table 4.2 below.

TABLE 4.2 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				

4.39 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.

4.40 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); and

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.

4.41 If appropriate, matrix 'Furnessing'[3] is undertaken for those traffic types where origin vectors (e.g. based on 'population' growth) are different from 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.

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

Car - Work

4.43 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.

4.44 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.

4.45 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.

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

TABLE 4.3 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

4.46 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'.

4.47 The employment forecasts for the 21 New Jersey counties represent growth in six different sectors of the labor market. The reason for using growth in different employment sectors is that '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.

4.48 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.

4.49 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.

4.50 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 4.4.

TABLE 4.4 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%

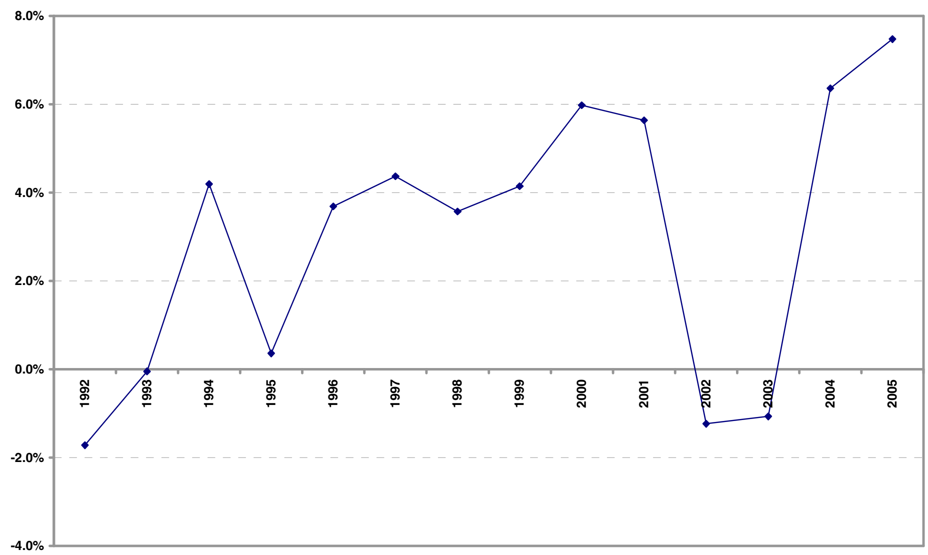
Trucks

4.51 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.

4.52 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 New Jersey Turnpike Authority (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 4.7 NJTP - YEAR ON YEAR TRUCK TRAFFIC GROWTH 1992-2006



Source: NJTA / SDG Analysis

4.53 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.

4.54 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.

4.55 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;

4.56 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.

4.57 Similar to the 'Car – Work' and 'Car – Other' traffic categories, annual truck growth is adjusted by the same profile of adjustments given in Paragraph 4.48.

5. FORECASTS

Introduction

5.1 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.

5.2 The revenues presented in the report are "real" rather than nominal values – the price base for the results is 2006. Table 5.1 below summarizes the main assumptions underlying the forecast.

TABLE 5.1 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 State-wide model. Matrices updated with NJTPA and SJTPO (including DVRPC) model 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 & Poole 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 observed increased in VMT per capita.
Traffic Growth - Trucks	Based on analysis of historic & forecast truck traffic trends throughout New Jersey, truck growth is based on forecast State-wide 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 NJTP). 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 will include tolls in 2006 dollars, and values of time in 2006 dollars. Value of Time (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% 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' methodology as set out in paragraphs 3.13 through 3.17 – No additional lanes were required for the ACE.

Toll Scenarios

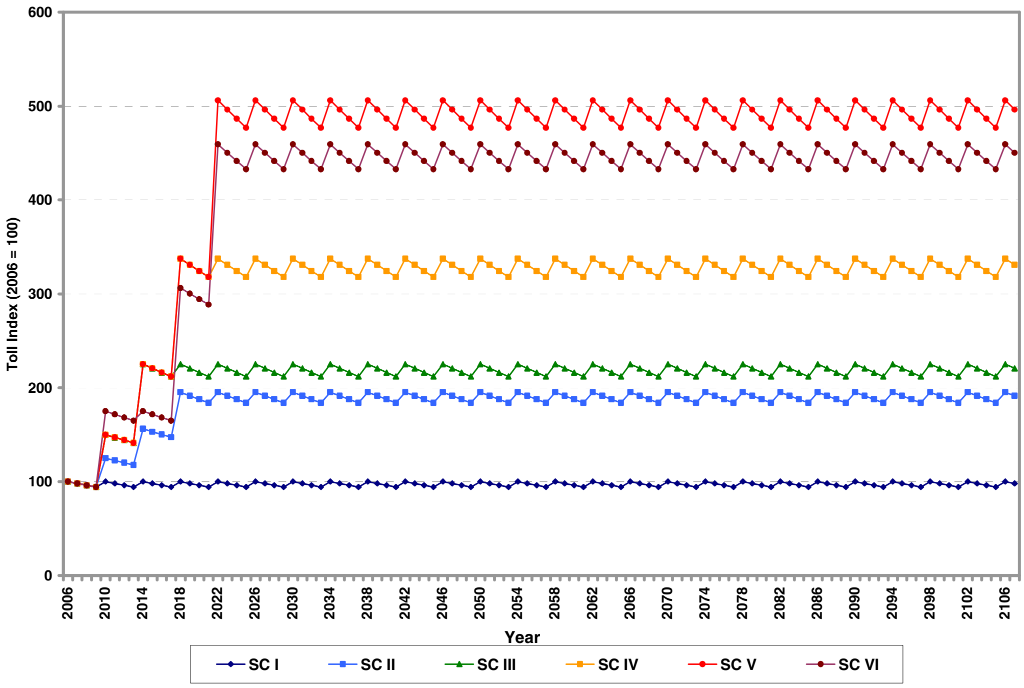
5.3 For the Phase 2 traffic and revenue forecasts, a number of toll scenarios have been defined by the State, as follows.

- 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).

5.4 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.

5.5 Figure 5.1 below shows the index of real ACE 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 5.1 ACE TOLL SCENARIOS



ACE Traffic and Revenue Forecasts

5.6 Tables 5.2 and 5.3 present a summary of the traffic and revenue forecasts for a selection of forecasting years, for each of the six toll scenarios.

TABLE 5.2 ACE - REVENUE FORECAST SUMMARY ($M, 2006 PRICES)

Year	SC I	SC II	SC III	SC IV	SC V	SC VI
2008	60.6	60.5	60.5	60.6	60.5	60.6
2010	66.5	76.6	84.1	84.2	84.1	89.1
2014	73.6	97.4	113.9	114.2	113.8	99.2
2018	80.6	121.9	132.1	159.2	158.5	152.6
2022	87.7	137.4	150.2	188.0	223.5	215.1
2026	94.8	152.8	168.4	216.8	266.9	254.6
2036	102.2	169.1	186.1	243.4	305.1	290.0
2046	115.0	189.6	209.8	275.1	348.4	328.4
2066	125.0	213.5	237.0	313.9	402.9	378.0
2086	132.9	232.8	261.1	350.2	454.2	424.6
2106	140.7	249.8	280.7	385.5	504.2	469.8

TABLE 5.3 ACE -TRAFFIC FORECAST SUMMARY (2008 =100)

Year	SC I	SC II	SC III	SC IV	SC V	SC VI
2008	73.3	73.3	73.3	73.4	73.3	73.3
2010	77.4	71.3	65.3	65.5	65.3	59.5
2014	85.6	72.3	58.8	59.1	58.7	71.3
2018	93.7	72.0	67.7	54.8	54.3	57.8
2022	101.9	80.7	76.5	64.1	50.9	54.2
2026	110.0	89.5	85.4	73.3	60.2	63.6
2036	122.5	102.1	97.2	84.6	70.5	74.3
2046	131.2	109.1	104.6	91.1	76.6	80.2
2066	140.2	122.6	117.8	103.7	88.4	92.1
2086	147.7	132.8	129.8	115.9	100.0	103.8
2106	155.0	140.8	137.8	127.8	111.3	115.3

5.7 Traffic growth over the life of the concession for Scenario I equals 0.8% per year on average, although average growth in the early years (until 2022) is much higher at 2.4% per year.

5.8 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.

5.9 The average growth over the life of the concession for the other toll scenarios equals 0.7% per year for Scenario II, 0.6% for Scenario III, 0.6% for Scenario IV, 0.4% 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 ACE.

5.10 In 2022 traffic levels are predicted to be 21%, 25%, 37%, 50% and 47% lower than in Scenario I.

5.11 Revenue growth for Scenario I equals 0.9% per year on average over the life of the concession. This increases to 1.5%, 1.6%, 1.9%, 2.2% and 2.1% 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 57%, 71%, 114%, 155% and 145% higher than in the control case.

5.12 Figures 5.2 and 5.3 below 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 5.2 ACE REVENUE FORECASTS ($M, 2006 PRICES)

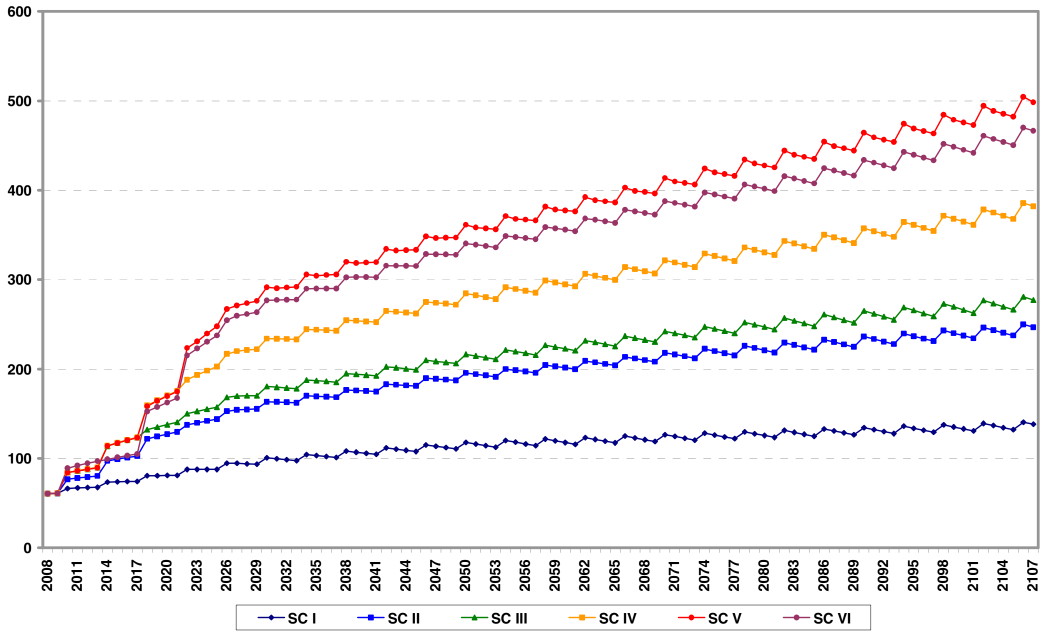
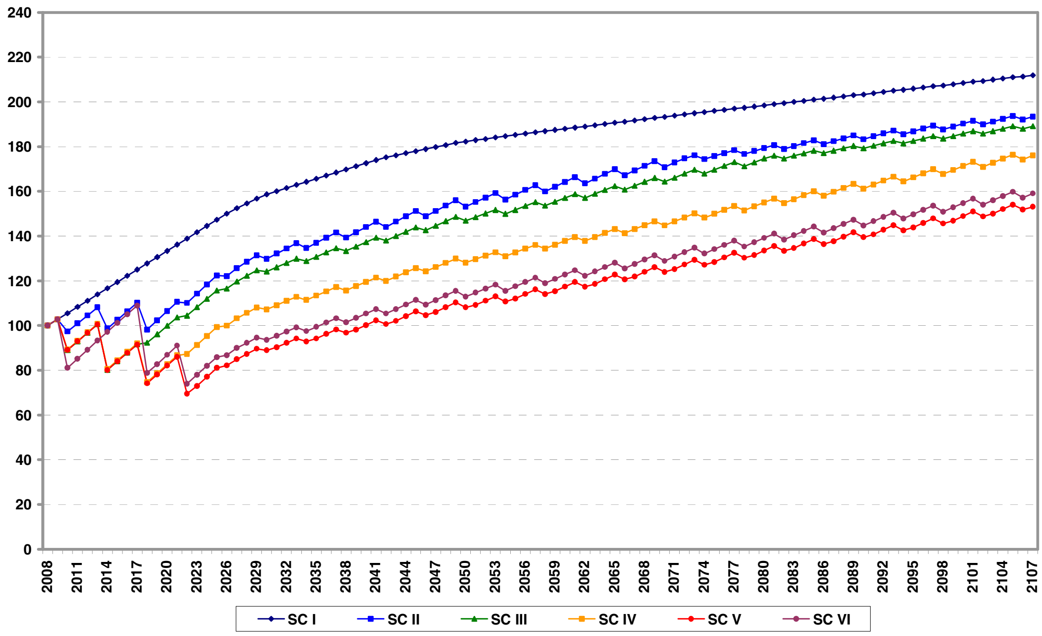


FIGURE 5.3 ACE TRAFFIC FORECASTS (2008 = 100)



5.13 Tables 5.4 – 5.8 provide a summary of demand and revenue forecasts for each toll scenario, disaggregated by vehicle type.

TABLE 5.4 ACE - 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	55.5	-	100	5.1	-
2010	106	60.8	4.6%	104	5.8	6.9%
2014	117	66.8	2.4%	113	6.8	4.2%
2018	128	72.8	2.2%	121	7.9	3.6%
2022	139	78.8	2.0%	130	8.9	3.2%
2026	150	84.8	1.9%	138	9.9	2.8%
2036	167	90.6	0.7%	166	11.6	1.5%
2046	178	101.3	1.1%	189	13.7	1.7%
2066	190	109.6	0.4%	211	15.4	0.6%
2086	200	116.5	0.3%	226	16.4	0.3%
2106	210	123.3	0.3%	240	17.4	0.3%

TABLE 5.5 ACE - 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	55.5	-	100	5.1	-
2010	97	69.7	12.1%	101	6.9	16.8%
2014	98	87.7	5.9%	105	9.7	8.8%
2018	98	108.8	5.5%	108	13.2	8.0%
2022	110	122.3	3.0%	116	15.1	3.5%
2026	122	135.8	2.7%	124	17.0	3.0%
2036	139	148.6	0.9%	153	20.4	1.9%
2046	148	165.1	1.1%	177	24.5	1.8%
2066	166	184.9	0.6%	206	28.6	0.8%
2086	179	201.2	0.4%	225	31.6	0.5%
2106	190	215.4	0.3%	242	34.4	0.4%

TABLE 5.6 ACE - 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	55.5	-	100	5.1	-
2010	89	76.2	17.2%	97	7.9	24.8%
2014	80	101.7	7.5%	95	12.2	11.6%
2018	92	117.7	3.7%	104	14.4	4.3%
2022	104	133.6	3.2%	112	16.6	3.6%
2026	116	149.5	2.9%	120	18.9	3.2%
2036	132	163.3	0.9%	149	22.8	1.9%
2046	141	182.5	1.1%	172	27.3	1.8%
2066	159	204.9	0.6%	202	32.1	0.8%
2086	175	225.4	0.5%	223	35.8	0.5%
2106	186	241.7	0.4%	240	39.1	0.4%

TABLE 5.7 ACE - 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	55.5	-	100	5.1	-
2010	89	76.3	17.3%	97	7.9	24.8%
2014	80	102.0	7.5%	95	12.2	11.6%
2018	74	142.4	8.7%	87	16.8	8.3%
2022	87	167.9	4.2%	95	20.0	4.5%
2026	100	193.5	3.6%	104	23.3	3.8%
2036	115	213.8	1.0%	133	29.5	2.4%
2046	123	239.7	1.2%	154	35.3	1.8%
2066	140	271.8	0.6%	183	42.2	0.9%
2086	156	302.6	0.5%	205	47.6	0.6%
2106	172	332.7	0.5%	227	52.9	0.5%

TABLE 5.8 ACE - 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	55.5	-	100	5.1	-
2010	89	76.2	17.2%	97	7.9	24.8%
2014	80	101.6	7.5%	95	12.2	11.6%
2018	74	141.8	8.7%	87	16.8	8.3%
2022	69	203.2	9.4%	73	20.3	4.9%
2026	82	242.8	4.6%	79	24.1	4.3%
2036	96	271.8	1.1%	107	33.3	3.3%
2046	104	306.4	1.2%	128	42.0	2.4%
2066	119	350.6	0.7%	157	52.3	1.1%
2086	135	393.6	0.6%	181	60.6	0.7%
2106	150	435.5	0.5%	204	68.7	0.6%

TABLE 5.9 ACE - 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	55.5	-	100	5.0	-
2010	81	80.4	20.3%	94	8.7	31.5%
2014	97	89.3	2.7%	104	9.9	3.2%
2018	78	135.8	11.1%	93	16.8	14.2%
2022	74	195.2	9.5%	77	20.0	4.4%
2026	87	230.9	4.3%	84	23.7	4.3%
2036	101	258.5	1.1%	112	31.6	2.9%
2046	108	289.7	1.1%	132	38.7	2.1%
2066	124	330.3	0.7%	161	47.7	1.1%
2086	140	369.4	0.6%	184	55.2	0.7%
2106	155	407.4	0.5%	207	62.4	0.6%

Review of Responses in Demand to Toll Changes

5.14 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.

5.15 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.

5.16 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 tolls 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.

5.17 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.

5.18 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.

5.19 In the Phase II analysis, however, we employed the State-wide network assignment model to estimate directly the impact of toll increases on ACE 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.

5.20 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 $ 0.0208/mile and $ 0.0729/mile. 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.

5.21 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.

5.22 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.

5.23 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 the State and broadly in line with the behavior of travelers elsewhere.

APPENDIX A

FORECASTS

APPENDIX: TABLEA.1 ACE - REVENUE FORECAST SUMMARY ($M, 2006 PRICES)

Year	SC I	SC II	SC III	SC IV	SC V	SC VI
2008	60.6	60.5	60.5	60.6	60.5	60.6
2009	61.0	61.0	61.0	61.1	61.0	61.0
2010	66.5	76.6	84.1	84.2	84.1	89.1
2011	67.0	77.9	86.1	86.2	86.1	91.9
2012	67.3	79.2	88.0	88.1	87.9	94.5
2013	67.7	80.3	89.7	89.8	89.6	96.9
2014	73.6	97.4	113.9	114.2	113.8	99.2
2015	73.9	99.3	117.3	117.6	117.2	101.2
2016	74.1	101.0	120.4	120.8	120.3	103.2
2017	74.3	102.6	123.3	123.7	123.2	104.9
2018	80.6	121.9	132.1	159.2	158.5	152.6
2019	80.8	124.7	135.0	165.0	164.3	157.6
2020	80.9	127.3	137.8	170.5	169.7	162.6
2021	81.0	129.6	140.3	175.6	174.8	167.4
2022	87.7	137.4	150.2	188.0	223.5	215.1
2023	87.7	139.8	152.8	193.2	230.9	223.0
2024	87.7	142.0	155.1	198.1	239.6	230.5
2025	87.7	144.0	157.3	202.7	247.8	237.5
2026	94.8	152.8	168.4	216.8	266.9	254.6
2027	94.5	154.2	169.8	220.0	271.0	259.5
2028	94.0	154.8	170.1	221.1	273.7	261.5
2029	93.5	155.3	170.3	222.1	276.3	263.4
2030	100.6	163.4	180.4	234.0	291.4	276.8
2031	99.6	163.1	179.7	233.8	290.3	277.1
2032	98.6	162.7	179.0	233.5	291.1	277.4
2033	97.5	162.3	178.2	233.0	291.8	277.5
2034	104.4	170.0	187.8	244.3	305.6	289.7
2035	103.3	169.5	187.0	243.9	304.3	289.9
2036	102.2	169.1	186.1	243.4	305.1	290.0
2037	101.1	168.5	185.2	242.7	305.7	290.1
2038	108.2	176.5	195.1	254.5	319.9	302.6
2039	107.0	176.0	194.2	253.9	318.4	302.7
2040	105.8	175.4	193.2	253.2	319.0	302.7
2041	104.6	174.7	192.2	252.4	319.5	302.6
2042	111.9	183.1	202.4	264.8	334.1	315.5
2043	110.5	182.4	201.4	264.0	332.4	315.5

2044	109.1	181.7	200.3	263.1	332.9	315.4
2045	107.7	181.0	199.2	262.1	333.3	315.1
2046	115.0	189.6	209.8	275.1	348.4	328.4
2047	113.6	188.9	208.6	274.1	346.5	328.3
2048	112.1	188.1	207.5	273.0	346.8	328.0
2049	110.6	187.2	206.2	271.8	347.1	327.7
2050	117.9	195.6	216.5	284.5	361.4	340.2
2051	116.1	194.2	214.7	282.5	358.2	338.9
2052	114.3	192.8	212.8	280.4	357.3	337.5
2053	112.6	191.4	210.9	278.3	356.3	336.0
2054	120.0	200.0	221.4	291.3	370.9	348.8
2055	118.1	198.6	219.6	289.4	367.8	347.7
2056	116.1	197.1	217.7	287.3	367.1	346.4
2057	114.3	195.6	215.7	285.3	366.1	345.0
2058	121.7	204.5	226.6	298.9	381.6	358.5
2059	119.7	203.0	224.6	296.8	378.2	357.2
2060	117.7	201.4	222.6	294.6	377.3	355.8
2061	115.8	199.8	220.6	292.4	376.2	354.2
2062	123.3	209.0	231.8	306.4	392.3	368.2
2063	121.3	207.4	229.7	304.2	388.7	366.7
2064	119.3	205.7	227.6	301.9	387.6	365.1
2065	117.4	204.0	225.5	299.6	386.3	363.3
2066	125.0	213.5	237.0	313.9	402.9	378.0
2067	122.9	211.8	234.8	311.6	399.1	376.3
2068	120.9	210.0	232.6	309.2	397.8	374.5
2069	118.9	208.2	230.4	306.8	396.4	372.5
2070	126.6	218.0	242.2	321.5	413.6	387.7
2071	124.6	216.2	239.9	319.0	409.6	385.8
2072	122.5	214.2	237.6	316.5	408.1	383.8
2073	120.5	211.9	235.3	314.0	406.4	381.7
2074	128.3	222.5	247.3	329.0	424.2	397.4
2075	126.1	220.1	244.9	326.3	419.9	395.2
2076	124.1	217.6	242.4	323.6	418.1	392.8
2077	122.0	215.2	240.0	320.8	416.0	390.4
2078	129.8	226.0	252.2	336.1	434.2	406.4
2079	127.7	223.5	249.7	333.3	429.7	404.1
2080	125.5	220.9	247.1	330.4	427.7	401.6
2081	123.5	218.4	244.1	327.5	425.5	399.0

2082	131.4	229.4	257.1	343.1	444.2	415.5
2083	129.2	226.8	254.1	340.2	439.5	413.0
2084	127.0	224.2	251.0	337.3	437.3	410.3
2085	124.9	221.6	247.9	334.2	434.9	407.5
2086	132.9	232.8	261.1	350.2	454.2	424.6
2087	130.7	230.1	258.0	347.2	449.3	421.9
2088	128.5	227.4	254.8	344.1	446.9	419.0
2089	126.4	224.7	251.6	341.0	444.4	416.1
2090	134.5	236.2	265.1	357.3	464.2	433.6
2091	132.2	233.5	261.8	354.1	459.1	430.7
2092	130.0	230.7	258.5	350.9	456.5	427.8
2093	127.9	227.9	255.3	347.7	453.8	424.7
2094	136.0	239.6	269.0	364.3	474.2	442.7
2095	133.7	236.8	265.6	361.1	468.9	439.6
2096	131.5	233.9	262.3	357.8	466.2	436.5
2097	129.3	231.1	259.0	354.4	463.3	433.2
2098	137.6	243.0	272.9	371.4	484.2	451.7
2099	135.3	240.1	269.5	368.0	478.7	448.5
2100	133.0	237.2	266.1	364.6	475.8	445.2
2101	130.8	234.3	262.6	361.2	472.7	441.8
2102	139.1	246.4	276.8	378.5	494.2	460.8
2103	136.8	243.4	273.3	375.0	488.5	457.4
2104	134.5	240.5	269.8	371.4	485.4	453.9
2105	132.3	237.5	266.3	367.8	482.2	450.3
2106	140.7	249.8	280.7	385.5	504.2	469.8
2107	138.3	246.7	277.2	381.9	498.3	466.2