Maryland Transportation Authority

I-95 Express Toll Lanes

Comprehensive Traffic and Toll Revenue Study

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Maryland Transportation Authority

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Executive Summary

The Maryland Transportation Authority (MDTA) retained Jacobs Engineering Group (Jacobs) to develop traffic and toll revenue estimates for the Express Toll Lanes (ETL) constructed as part of the I-95 Improvement Project. Jacobs' assignment was to quantify traffic volumes, prepare potential appropriate toll rate ranges[1] and specific toll rates reflecting traffic demand and operational goals, and to project anticipated revenues for the I-95 ETL, based on these potential toll rates.

It is important to note that the toll rates which form the basis of the revenue projections included in this study are recommendations. The actual toll rates to be used are yet to be determined by MDTA and could differ from those used in this study. Accordingly, revenues could differ from those predicted. Actual traffic experience will ultimately determine the toll rates used to manage traffic volumes.

MDTA currently operates eight toll facilities within the State of Maryland consisting of two expressways, two tunnels and four bridges that provide critical transportation infrastructure links for both local and regional movement of people and goods. The John F. Kennedy Memorial Highway, one of the expressways the MDTA operates, is a 50-mile section of I-95 from the northeastern Baltimore City line to Delaware. Currently tolls are collected one mile north of the Millard E. Tydings Memorial Bridge over the Susquehanna River in northeastern Maryland in the northbound direction only. This stretch of roadway serves local and regional travel as both a conduit for commuters from areas north of Baltimore into Baltimore City and for longer distance trips for both personal and commercial vehicles as part of the I-95 corridor that stretches from Maine to Florida.

The I-95 ETL is constructed as part of a series of improvements to I-95 northeast of Baltimore intended to improve safety and reduce congestion. In its current configuration, the ETL extends approximately 8 miles within the median of I-95. (Potential future northward extensions of the project are not considered in this report.) The shortest travel distance on the facility is between MD 43 and Moravia Road, therefore this distance, 7 miles, is used to calculate toll rates. The full ETL stretches from north of MD 43 to south of the split of I-95 and I-895, south of Pulaski Highway and Moravia Road, respectively.

The I-95 ETL will operate as a price-managed toll facility with similar features to many other express toll lane facilities throughout the United States such as along a portion of the Capital Beltway in the Washington D.C. area. The distinguishing feature of a price-

[1] On its variable priced facilities (the Intercounty Connector and the ETL project) MDTA sets toll rate ranges which define the lower and upper limits of potential toll rates that can be used to manage demand and congestion on the facilities. The MDTA Executive Secretary then sets, and can subsequently adjust, specific toll rates, provided that they remain within the approved toll rate range.

managed toll facility is the control of traffic levels through toll rates. One goal of the I-95 ETL is to provide reliable travel time for motorists. To achieve this goal, the MDTA will charge different levels of tolls depending on the traffic demand in the corridor, which changes over the course of a day and is different by day of the week as well. In the AM period the southbound direction experiences very heavy traffic. This requires a toll that is higher than the off-peak time period to achieve a consistent travel time in the ETL.

The introduction of additional toll-free general purpose lanes in congested, growing areas, while often offering a short-term solution to traffic delay, typically does not reduce congestion in the long term. Managed lane facilities, on the other hand, provide a long-term option for a congestion-free trip using pricing to provide motorists reliable travel times at a market-driven toll rate.

A standard work flow of traffic and toll revenue forecasting for managed lanes was employed to forecast traffic and toll revenue as well as develop toll schedules appropriate to manage traffic demand. First, basic assumptions were developed and documented. Then data was collected regarding motorists' current travel patterns and willingness to pay, historical traffic data, socioeconomic data in the corridor, and projected traffic and traffic patterns in the corridor. These data were used as input into multiple modeling platforms to provide forecasted traffic volumes in the corridor, operational characteristics of the corridor, toll schedules needed to manage peak and off-peak traffic and finally traffic and toll revenue estimates. Multiple sensitivity tests were run within those multiple models to quantify overall risk to revenue projections.

In undertaking this work, MDTA staff and Jacobs have assumed that toll rates for the ETL would be set at a level which would regulate demand for the ETL so that ETL users could operate at or near 55 mph. (For a complete list of the basic T&R study assumptions, see Table ES-2.) When traffic volume in adjacent untolled lanes is generally light and uncongested, fewer people would be willing to use the ETL lanes, thus, toll rates are accordingly lower at those times of day. When traffic volume in adjacent untolled lanes is generally higher and more congested, more drivers are willing to use the ETL lanes, thus, toll rates in the ETL lanes are accordingly higher at those times of day, thus regulating the number of persons who will choose to use the ETL, and thus maintaining a congestion free 55 mph operating speed in the ETL.

Existing traffic conditions in the corridor provide an empirical snapshot of how traffic functions today. This combined with the historical experience in the corridor, year over year, and forecasted traffic volumes provide key input into the traffic and toll revenue forecasting model.

From 1980 to 1990, traffic along the I-95 ETL project corridor grew at an average annual rate of 9.7% and from 1990 to 2000 at an annual rate of 1.0%. Over the last decade, traffic increased at an annual rate of 0.9% with the segments just south of the I-695 interchange and north of MD 43 growing at an annual rate of 1.1% and 1.3%, respectively. Historical Traffic Volumes for the corridor are illustrated in Table ES-1.

Table ES-1: Historical Traffic Volumes (1980-2011)

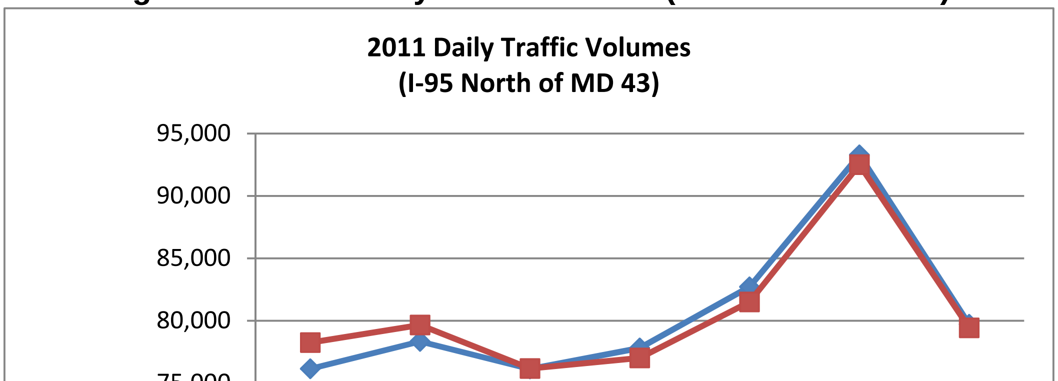
	Average Annual Daily Traffic Trends				
Year	**I-895 N of Pulaski Hwy**	**I-95 N of Pulaski Hwy**	**S of I-95/I-695 Interchange**	**N of I-95/I-695 Interchange**	**I-95 N of MD 43/Whitemarsh Blvd**
1980	9,985	16,050	65,685	62,250	56,700
1990	46,550	74,830	133,950	155,020	119,500
2000	55,950	89,950	161,000	141,175	139,575
2001	57,125	91,875	147,537	150,150	142,450
2002	58,375	98,375	134,075	151,725	143,925
2003	58,450	98,450	151,175	157,675	171,975
2004	59,025	99,425	152,750	159,350	173,750
2005	59,975	98,875	161,775	159,425	173,825
2006	59,981	98,881	168,020	162,770	161,780
2007	59,982	98,882	168,021	162,771	161,781
2008	57,660	95,823	162,812	157,722	157,742
2009	58,241	96,784	164,443	159,303	160,880
2010	58,472	97,175	165,104	159,943	161,521
2011	58,480	97,275	165,275	160,109	161,682
Average Annual Percent Change					
2001-2006	1.00%	1.53%	2.78%	1.68%	2.71%
2006-2011	-0.50%	-0.32%	-0.33%	-0.33%	-0.01%
2001-2011	0.24%	0.59%	1.20%	0.66%	1.35%

Source: Maryland State Highway Administration Traffic Volume Maps

In 2011, average daily traffic volumes for the I-95 ETL project corridor ranged from approximately 160,000 vehicles per day north of I-695 to 165,000 vehicles per day south of I-695. The section south of the I-95/I-895 split experienced average daily traffic volumes of approximately 97,000 vehicles per day on I-95 and approximately 58,000 vehicles per day on I-895.

The I-95 ETL T&R Study requires a more detailed review of traffic patterns so each day of the week and its hourly volumes are analyzed. Daily traffic volumes by day of the week for 2011 are shown in Figure ES-1. More important for the setting of appropriate pricing, however, is the pattern of hourly volumes shown in Figure ES-2.

Figure ES-1: 2011 Daily Traffic Volumes (I-95 North of MD 43)



	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Northbound	76,141	78,332	76,132	77,813	82,707	93,288	79,706
Southbound	78,252	79,659	76,168	77,012	81,501	92,502	79,422

Hourly traffic profiles provide the peaking characteristics of corridor, illustrating the congested time periods. Those congested time periods are key to the development of estimates of traffic, toll schedules and toll revenues for managed lane facilities. Hourly traffic profiles for the corridor by direction are illustrated in Figure ES-2 and Figure ES-3.

Traffic on this portion of the I-95 corridor is essentially free-flow at traffic volumes less than 6,500 vehicle per hour by direction. In review of the graphs, it is evident that these levels typically occur on weekdays during AM and PM peak periods for the southbound and northbound directions, respectively. However, during the weekends, while traffic levels are lower, it is sometimes the case that free-flow traffic will be disrupted and congestion will ensue at lower traffic volumes. This occurs in part because infrequent users of the I-95 corridor unfamiliar with the area effectively reduce the throughput capacity of the corridor, as compared to weekday peak periods.

Figure ES-2: 2011 Daily Total Traffic Volumes by Hour – Northbound (I-95 South of I-695)

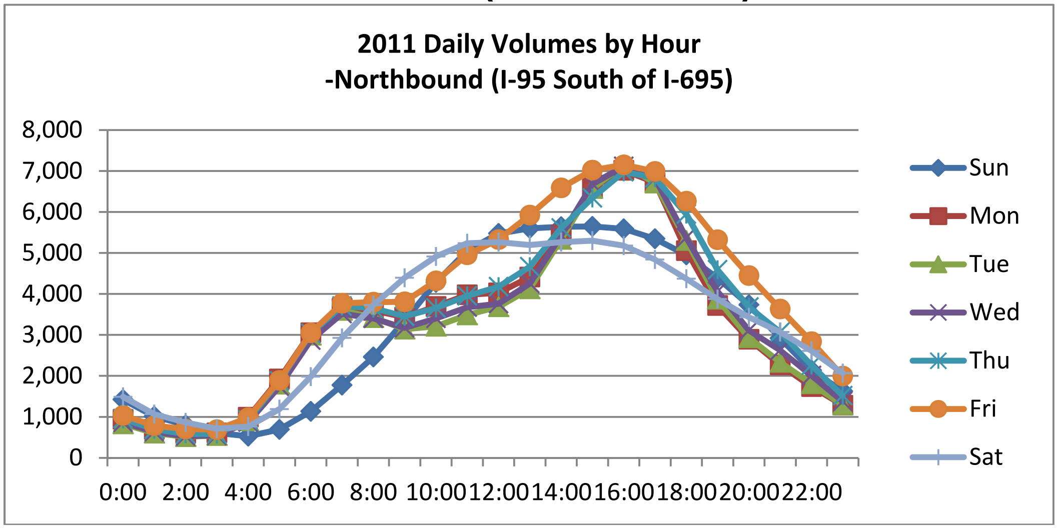


Figure ES-3: 2011 Daily Total Traffic Volumes by Hour – Southbound (I-95 South of I-695)

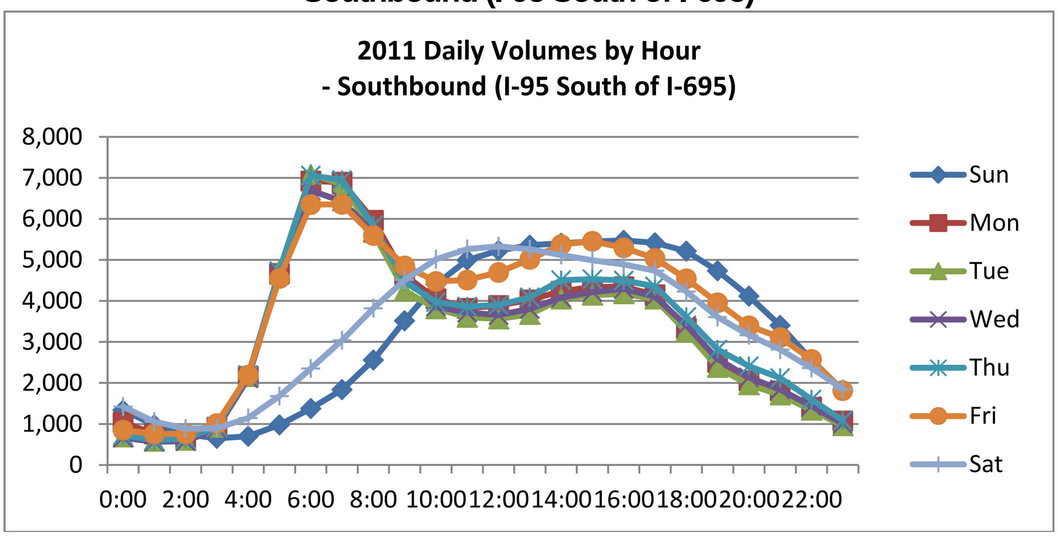
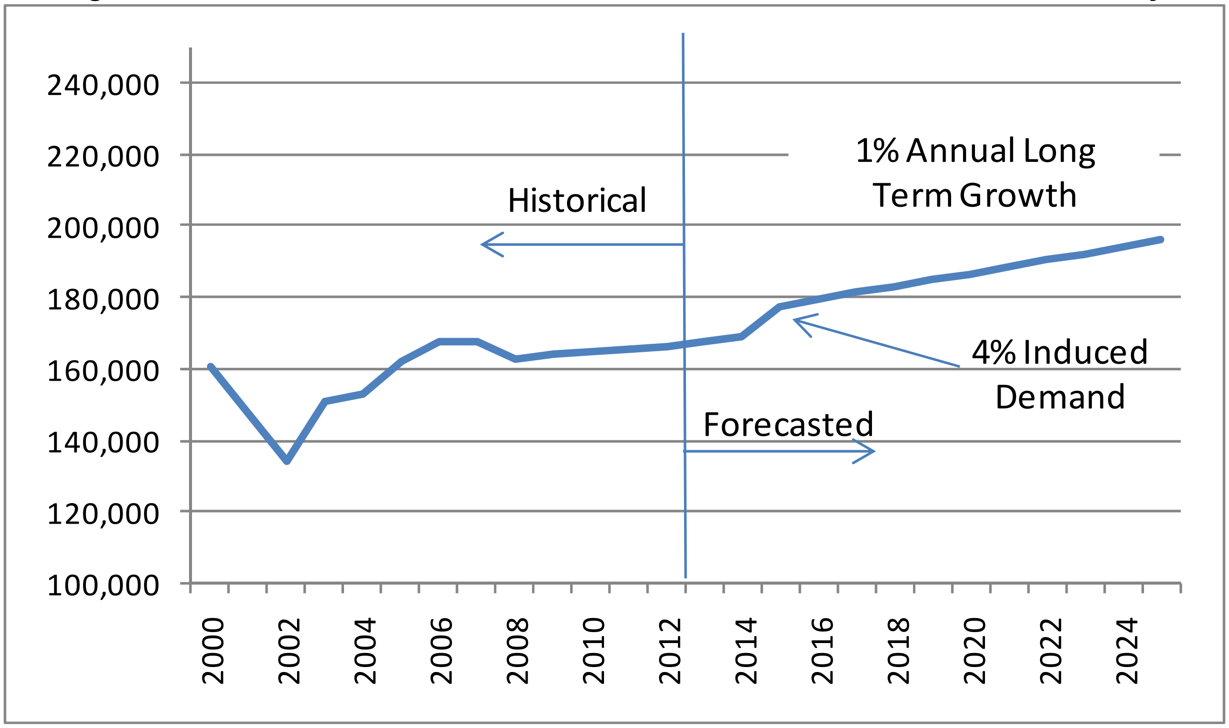


Figure ES-4 presents the historical and projected average daily traffic volumes on I-95 south of I-695 after completion of the I-95 improvement project including the ETL. The induced demand attracted by the additional capacity in the corridor is estimated to create a one-time 4 percent increase in traffic in addition to the projected long-term traffic growth rate of one percent.

Figure ES-4: I-95 Historical and Forecasted Corridor Demand at ETL Toll Gantry



The basic T&R study assumptions are outlined in Table ES-2 and the full project will be opened on December 1, 2014.

For southbound traffic, there will be ingress points between MD 43 and E. Joppa Road and from MD 43 and egress points on I-895 to Moravia Road and south of Moravia Road and on I-95 south of Pulaski Highway. The northbound infrastructure will be symmetric to the southbound infrastructure with ingress points on I-895 south of Moravia Road, from Moravia Road and on I-95 south of Pulaski Highway and egress points to MD 43 and between MD 43 and E. Joppa Road. The toll gantry will be between I-695 and the split of I-95 and I-895. There will only be one toll gantry per direction because all trips are almost the same length.

Table ES-2: I-95 ETL T&R Study Basic Assumptions

Assumptions for I-95 T&R Study - Operator Controlled	
Variable	Assumption
Infrastructure	
Project Limits/Access Points/Typical Section	See Stick Diagrams
Length	7 miles
Opening Date	12/1/2014
Toll Policy	
Toll Collection	All Electronic Toll Collection (AETC) with E-ZPass and Video Toll (No Cash Collection)
2 axle Base Toll Rate (E-ZPass)	As needed to manage congestion by time period using ICC toll rate ranges (distance * mileage rate for pre-determined pricing periods)
2 axle Video Toll Rate	50% surcharge on base rate with $1 minimum and $15 maximum surcharges
Toll Escalation	There is no annual toll escalation, only escalation based on the need to manage traffic in the peak periods
Congestion Pricing	Pre-determined time-of-day pricing intended to maintain 55 mph in the ETL, adjustable with ten days notice
Axle Multiplier from 2 axle	Based on Current MDTA policy on ICC, which is different than the current policy at the JFK toll plaza
Assumptions for I-95 T&R Study - Market Driven	
Variable	Assumption
Corridor Demand	Adjusted TDM results, following BHT, FMT and JFK forecasts
Value of Time	$7.79 to $16.90 per hour by Hour and Payment Type
Hourly Traffic Profile	By Day of Week from 2011 permanent count station
Percentage of Video	5-10% by Hour
Percentage of Trucks	Corridor Rate by Day of Week and Hour (6% to 30%)
Ramp-up	2 years, 85%, 95%
Axle Factor	Corridor Rate by Day of Week and Hour (3.1 to 4.7)
Violation Rates	2% for Transponders; 20% for Video
Annualization Factor	Modeled Days of Week Individually (each times 52)
Holiday Schedules	Not accounted for in the T&R Estimates
Lane Capacity (a function of driver familiarity)	
Monday - Thursday	1800 vplph
Friday, Saturday, Sunday	1750 vplph

The forecasting of traffic, toll schedules, and toll revenue for managed lane facilities requires the use of multiple forecasting models on multiple modeling platforms. This analysis uses the Baltimore Metropolitan Council travel demand model (BMC Model), the I-95 ETL VISSIM micro-simulation model (VISSIM model) and the I-95 ETL traffic, toll schedule and toll revenue forecasting model (T&R Model).

Multiple tolling periods and toll rates within those periods were analyzed including the use of shoulder peak toll rates for time periods between the heights of the peak period and off-peak. Time increments were disaggregated to the half hour to estimate needed toll rates and resulting operations under a changing toll rate every half hour. Through the course of the analysis, it was evident toll rates needed to manage traffic in the peak time periods were coincident with the current toll rate ranges for the ICC toll facility. Table ES-3 and Table ES-4 present the southbound and northbound tolling periods, toll rate ranges per period and estimated toll rates needed to manage traffic in 2015 and 2025. Note that while the toll rate ranges are identical to the ICC, the time periods are specific to the I-95 corridor by direction. Additionally, the estimated toll rates within those ranges are specific to the estimated I-95 travel demand and unique characteristics therein.

Table ES-3: Assumed E-ZPass Passenger Car Toll Schedule for Southbound I-95 ETL for 2015 and 2025

(Actual toll rates are yet to be determined by MDTA)

Period/Day	Time	Rate Range	2015		2025	
			Rate per Mile	Toll	Rate per Mile	Toll
Peak						
Mon-Fri	6:00 am-9:00 am	$0.25-$0.35	$0.25	$1.75	$0.35	$2.45
Sat	12:00 pm-2:00 pm	$0.25-$0.35	$0.25	$1.75	$0.35	$2.45
Sun	2:00 pm-5:00 pm	$0.25-$0.35	$0.25	$1.75	$0.35	$2.45
Off-Peak						
Mon-Fri	5:00 am-6:00 am	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Mon-Fri	9:00 am-9:00 pm	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Sat	5:00 am-12:00 pm	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Sat	2:00 pm-9:00 pm	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Sun	5:00 am-2:00 pm	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Sun	5:00 pm-9:00 pm	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Overnight						
Mon-Sun	9:00 pm-5:00 am	$0.10-$0.30	$0.10	$0.70	$0.10	$0.70

Table ES-4: Assumed E-ZPass Passenger Car Toll Schedule for Northbound I-95 ETL for 2015 and 2025

(Actual toll rates are yet to be determined by MDTA)

Period/Day	Time	Rate Range	2015		2025	
			Rate per Mile	Toll	Rate per Mile	Toll
Peak						
Mon-Fri	6:00 am-9:00 am	$0.25-$0.35	$0.25	$1.75	$0.35	$2.45
Sat	12:00 pm-2:00 pm	$0.25-$0.35	$0.25	$1.75	$0.35	$2.45
Sun	2:00 pm-5:00 pm	$0.25-$0.35	$0.25	$1.75	$0.35	$2.45
Off-Peak						
Mon-Fri	5:00 am-6:00 am	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Mon-Fri	9:00 am-9:00 pm	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Sat	5:00 am-12:00 pm	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Sat	2:00 pm-9:00 pm	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Sun	5:00 am-2:00 pm	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Sun	5:00 pm-9:00 pm	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Overnight						
Mon-Sun	9:00 pm-5:00 am	$0.10-$0.30	$0.10	$0.70	$0.10	$0.70

During the forecast period it is estimated that only peak period toll rates will need to be increased to manage traffic levels and the maximum toll rates will be needed by 2023. Table ES-5 presents the estimated peak period tolls from 2015 to 2025. The analysis indicated that peak period toll rates would need to be adjusted about four times beginning in 2020.

Table ES-5: Estimated Peak Period E-ZPass Passenger Car Tolls for I-95 ETL, 2015 to 2025

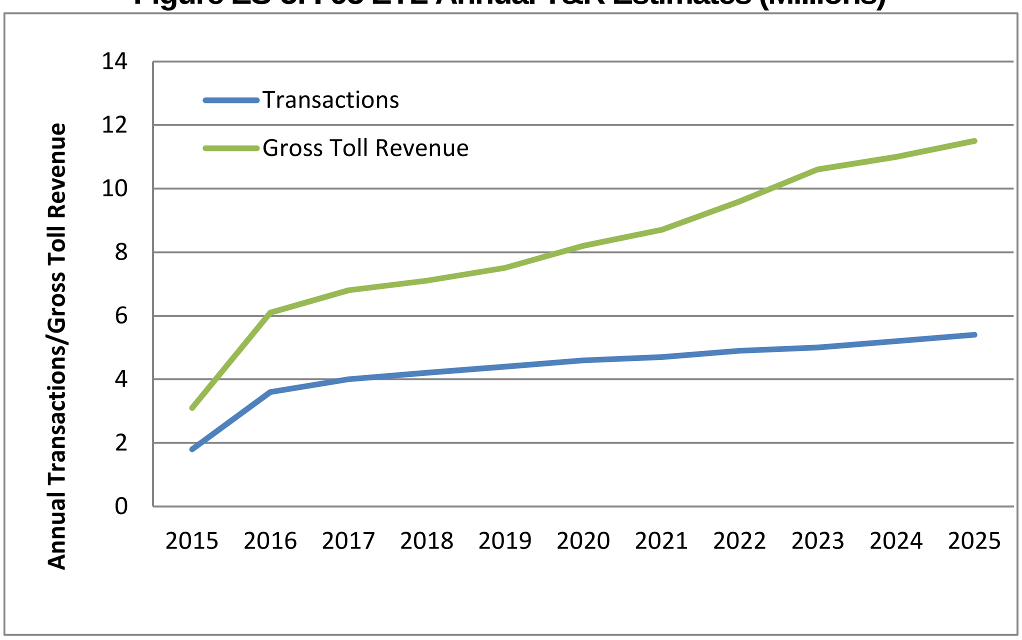
Year	Peak Period Toll
2015	$1.75
2016	$1.75
2017	$1.75
2018	$1.75
2019	$1.75
2020	$1.90
2021	$2.05
2022	$2.15
2023	$2.45
2024	$2.45
2025	$2.45

These toll schedules, in combination with the assumptions presented in Table ES-2, yield the projections of annual traffic and gross toll revenue presented in Table ES-6 and Figure ES-5.

Table ES-6: I-95 ETL Annual T&R Estimates (Millions)

Fiscal Year	I-95 ETL Estimated Annual T&R	
	Transactions	Gross Toll Revenue
2015	1.8	$3.1
2016	3.6	$6.1
2017	4	$6.8
2018	4.2	$7.1
2019	4.4	$7.5
2020	4.6	$8.2
2021	4.7	$8.7
2022	4.9	$9.6
2023	5	$10.6
2024	5.2	$11.0
2025	5.4	$11.5

Figure ES-5: I-95 ETL Annual T&R Estimates (Millions)



1.0 Introduction

The Maryland Transportation Authority (MDTA) currently operates eight toll facilities within the State of Maryland consisting of two expressways, two tunnels and four bridges that provide critical transportation infrastructure links for both local and regional movement of people and goods. The John F. Kennedy Memorial Highway, one of the expressways the MDTA operates, is a 50-mile section of I-95 from the northern Baltimore City line to Delaware. Currently, tolls are collected one mile north of the Millard E.Tydings Memorial Bridge over the Susquehanna River in northeast Maryland in the northbound direction only. This stretch of roadway caters to both local and regional travel as both a conduit for commuters from areas north of Baltimore into Baltimore City and longer distance trips for both personal and commercial vehicles as part of the I-95 corridor that stretches from Maine to Florida.

The I-95 ETL is constructed as part of a series of improvements to I-95 northeast of Baltimore intended to improve safety and reduce congestion. The ETL extends approximately 8 miles within the median of I-95. The shortest travel distance on the facility is between MD 43 and Moravia Road, therefore this distance, 7 miles, is used to calculate toll rates. The full ETL stretches from north of MD 43 to south of the split of I-95 and I-895, south of Pulaski Highway and Moravia Road, respectively.

Jacobs Engineering Group (Jacobs) was retained by the MDTA to develop traffic and toll revenue estimates for the I-95 ETL, quantifying traffic, toll schedules and toll revenue. In this section, the purpose and scope of the analysis is further explored, the methodology to complete that analysis is explained, the outline of the presentation of the analysis as contained in this report is provided including a more detailed description of the I-95 ETL project.

1.1 Study Purpose and Scope

The I-95 ETL will operate as a price-managed toll facility with similar features to many other express toll lane facilities throughout the United States such as the Capital Beltway in the Washington D.C. area. The distinguishing feature of a price-managed toll facility is the control of traffic levels through toll rates. One goal of the I-95 ETL is to provide reliable travel time for motorists. In order to achieve this goal, the MDTA will charge different levels of tolls depending on the traffic demand in the corridor, which changes over the course of a day and is different by day of the week as well. In the AM period the southbound direction experiences very heavy traffic. This requires a toll that is higher than the off-peak time period to achieve a consistent travel time in the ETL.

Jacobs was tasked with developing projections of traffic and toll revenue for the I-95 ETL for a forecast period of 10 years. Based on the nature of managed toll facilities, a significant part of the analysis within a traffic and toll revenue study is to develop appropriate time-of-day toll schedules to manage traffic levels on the ETL that provide reliable travel times on both opening day and the 10^{th} year of the forecast. The following section describes the process by which the traffic, toll revenue and toll schedules are developed in a logical, linear manner.

1.2 Study Methodology

A standard work flow of traffic and toll revenue forecasting for managed lanes was employed to forecast traffic and toll revenue as well as develop toll schedules appropriate to manage traffic demand. Figure 1 presents a simplified version of the work flow.

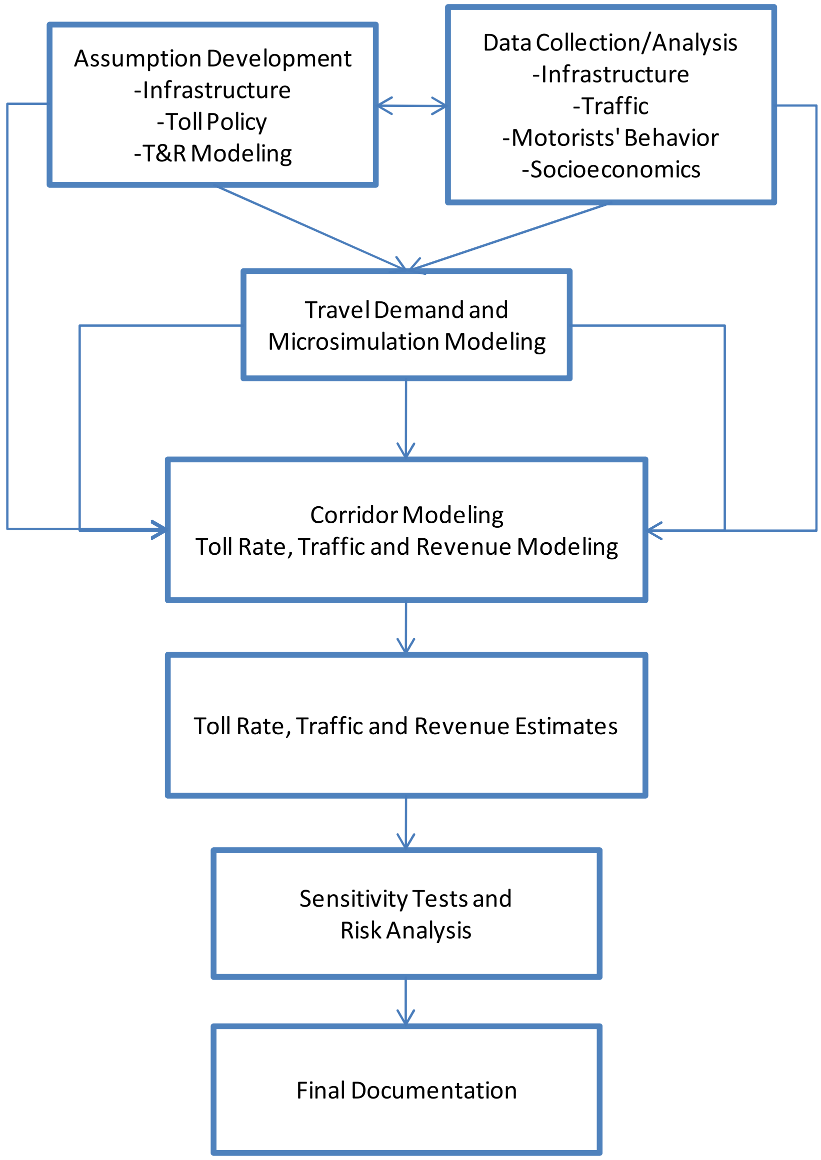
The first step was to develop some basic assumptions including what the project would look like once built, what the tolling policy would be and what are the factors that would determine motorists' usage of the lanes at given toll rates. The first two sets of assumptions were developed by MDTA with input from Jacobs and the final set of assumptions, those that determine usage of the I-95 ETL, were developed through the next step, the data collection and analysis effort. Data collection included existing traffic patterns, motorists' willingness to pay, and socioeconomic factors.

The collected data was input into the modeling processes which included the use of the Baltimore Metropolitan Council's travel demand model (BMC Model), an I-95 ETL VISSIM micro-simulation model (traffic operation model) (VISSIM Model), and a I-95 ETL traffic, toll schedule and toll revenue model which was developed specifically for this analysis (T&R Model).

The result of the modeling, which was based upon the assumptions supported by the data collection effort, was the base case traffic, toll schedule and toll revenue estimates for I-95 ETL for a 10 year period. Tests were run to understand the sensitivity of traffic and toll revenue to changes in toll rates as well as various toll policies, including those which would maximize throughput of traffic in the corridor and policies that would maximize toll revenue for the facility. In addition to sensitivity tests, a risk analysis was conducted on the base case to understand potential ranges of traffic and toll revenue as a function of consumer demand that varies from our base assumptions.

The final step of the analysis was documentation of results reflected by this comprehensive traffic and toll revenue report.

Figure 1: I-95 ETL T&R Study Work Flow



1.3 Report Structure

The report structure follows the study methodology and logically walks through the steps in the development of the traffic, toll revenue and toll schedules for the I-95 ETL.

Section 1: Introduction, describes the I-95 ETL project, the purpose of this study and the methodology employed to complete the analysis.

Section 2: Tolling Policy, reviews the toll policies that provide the foundation for the development of the traffic, toll revenue and toll schedule estimates. First the current toll policies on existing MDTA facilities are reviewed. Then toll policies for other managed lane facilities across the United States are presented. Finally the proposed I-95 ETL toll policy is presented which combines the standard toll policies that are in effect on the MDTA existing toll facilities and the additional policies needed to provide reliable travel times on the ETL.

Section 3: Corridor Traffic Conditions, reviews historical and existing traffic conditions in the I-95 corridor. These data include average annual traffic, recent daily traffic, hourly traffic and speed profiles. Additionally the relationship between traffic volume and speed in the corridor is analyzed as this is a key component of the forecasting model.

Section 4: Stated Preference Survey provides a cursory review of the stated preference survey that was conducted for this analysis. The survey provides data regarding motorists' willingness to pay as function of time savings, essentially their stated desire to trade time for money or their value of time (VOT). Motorists' VOT is critical in determining their likelihood of paying tolls when faced with potential time savings.

Section 5: Socioeconomic Conditions and Forecasts summarizes national and regional demographic and economic trends and analyzes the relationship between these data and trip making. This provides the support for future traffic growth estimates.

Section 6: Traffic and Toll Revenue Modeling and Estimates presents the modeling methodology, the assumptions of the analysis, toll sensitivity analyses, estimates of traffic, toll revenue and toll schedules by year and risk analysis. This section is the culmination of the previous sections using the data collected as input into the development and assumptions of the modeling effort to determine necessary toll schedules and estimates of traffic and toll revenue for a 10 year period.

Section 7: Disclaimers/Limitations provides the basic limitations of the analyses, the overall study and the report.

1.4 Project Description

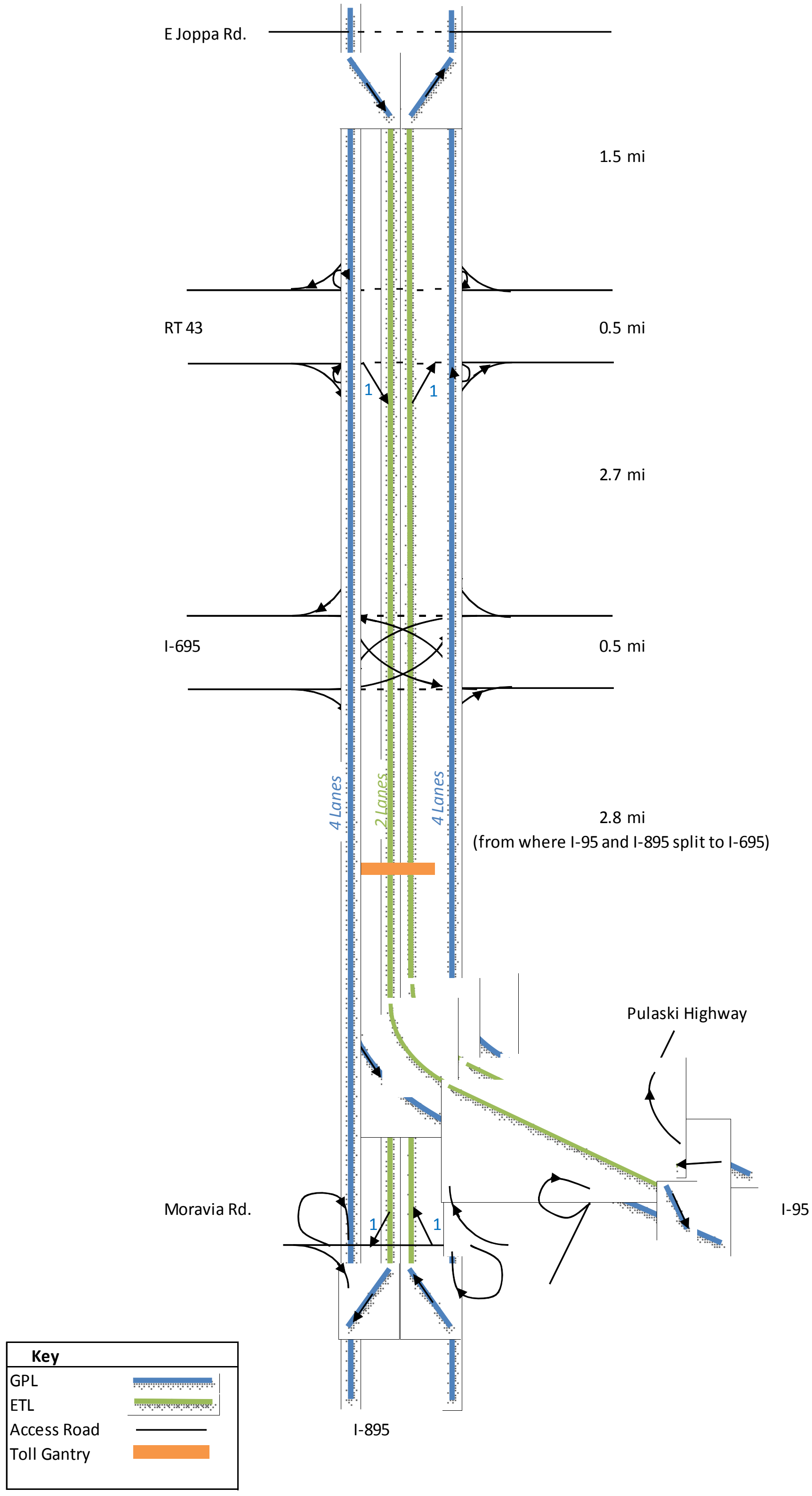
The I-95 ETL project extends approximately eight miles. The shortest travel distance on the project is seven miles between MD 43 and Moravia Road; therefore, this distance is used as the tolling distance when calculating toll rates for the facility. The full ETL stretches from north of MD 43 to south of the split of I-95 and I-895, south of Moravia Road and Pulaski Highway, respectively. Figure 2 shows the extent of the ETL.

Figure 2: I-95 ETL Location Map

The I-95 ETL will consist of two lanes in each direction for the full extent of the project, constructed to the left of the existing general purpose lanes in each direction. There will be four parallel general purpose lanes in each direction with additional auxiliary lanes as needed for ingress/egress points and only three general purpose lanes through the I-695 interchange. A stick diagram of the corridor is presented in Figure 3.

The I-95 ETL will have only one mainline gantry in each direction and will be a closed toll system providing no toll-free movements. All motorists using the I-95 ETL will pay a toll. For southbound traffic ingress to the I-95 ETL will be provided at two points: the origination between E. Joppa Road and MD 43; and directly from MD 43. Egress for southbound traffic will be provided directly to Moravia Road and at the two southern termini, I-95 south of Pulaski Highway and I-895 south of Moravia Road. Northbound traffic will have identical access points as southbound simply switching egress and ingress points per directional flow. Again Figure 3 provides illustration of the basic infrastructure for the project. It should be noted that the toll gantry will be in different specific locations by direction but for traffic and toll revenue forecasting purposes it is only important that the gantries be between the access at MD 43 and the split of I-895 and I-95 as indicated in the diagram.

Figure 3: I-95 ETL Toll Stick Diagram



2.0 Tolling Policy

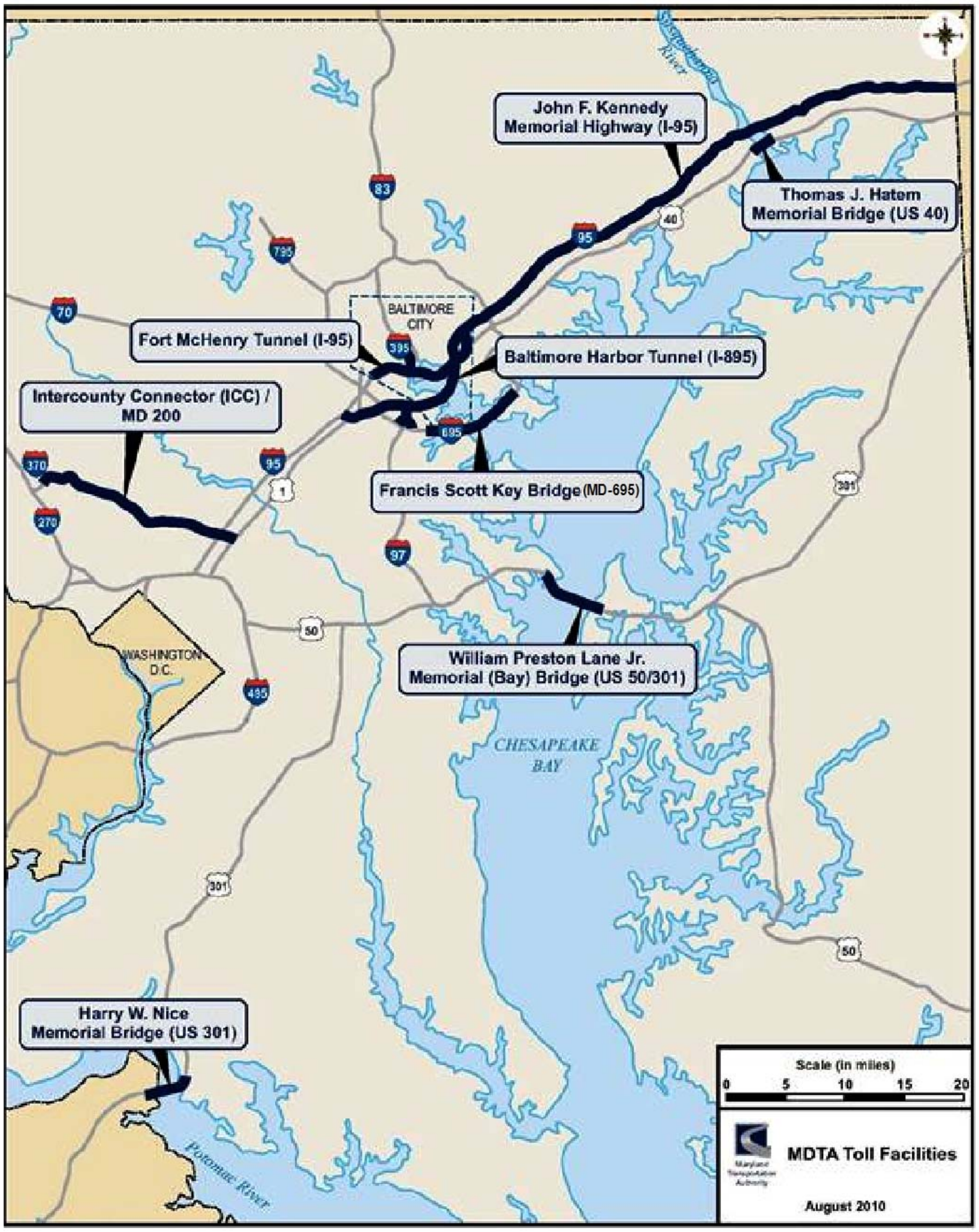
Tolling policy for the I-95 ETL is a key driver of traffic and toll revenue estimates for the project. Toll policy leads to the development of a tolling plan that includes toll rate schedules by vehicle and payment classes. MDTA vehicle classes are largely defined by the number of axles. Payment classes reflect the type of payment ranging from cash given to a toll collector at a traditional toll booth to electronically accepted tolls via E-ZPass for a pre-use billing option or video tolling for a post-use billing option. Toll policy also reflects business rules for video tolls, discount programs, special permits and the like. Unlike traditional bridge or expressway fixed toll facilities, the toll policy for tolled managed lanes, such as the I-95 ETL, often has performance standards by which the travel experience in the tolled lanes can be evaluated, leading to changes in the toll rates.

To provide a foundation for the proposed toll policy for the I-95 ETL, this section first reviews the tolling policy of the existing MDTA facilities. Then a review of the toll policy of existing managed lane facilities across the United States is undertaken. Finally, the proposed toll policy for the I-95 ETL is presented which reflects a combination of both existing MDTA toll policy and standard managed lane toll policy.

2.1 Existing MDTA Toll Policy

As discussed previously, the MDTA currently operates eight toll facilities within the State of Maryland consisting of two expressways, two tunnels and four bridges. For toll policy purposes the seven legacy facilities (excluding the ICC) can be grouped into three categories corresponding to geographic regions of the state: Northern, Central and Southern. These facilities along with the ICC are shown in Figure 4.

Figure 4: MDTA Toll Facilities Map



As shown in the figure, all of the seven legacy facilities are on either Interstates or major US routes that cross bodies of water with very limited competing alternatives. In the Northern Region, the John F. Kennedy Memorial Highway (JFK) and Thomas J. Hatem Memorial Bridge (Hatem) provide regional and local connectivity across the Susquehanna River including critical east coast interstate travel connection. In the Central Region, the Fort McHenry Tunnel (FMT), the Baltimore Harbor Tunnel (BHT) and the Francis Scott Key Bridge (FSK) offer access under or over the Baltimore Harbor and are known collectively as the Baltimore Harbor Crossings. In the Southern Region, the William Preston Lane Jr. Memorial (Bay) Bridge, commonly known as the Bay Bridge crosses the Chesapeake Bay providing access between the metropolitan areas to the west and recreational areas on the eastern shore. The Governor Harry W. Nice Memorial Bridge (Nice), also in the Southern Region, provides movement between Maryland and Virginia across the Potomac River. The newest facility in the Southern Region is the Intercounty Connector (ICC/MD 200) which opened in December 2011 and connects I-370 (Gaithersburg) to I-95 (Laurel). With the exception of the ICC (which offers variable pricing to manage congestion), all other MDTA facilities have fixed toll rates that are a function of vehicle and payment classes. Table 1 illustrates some of the toll policy elements for each MDTA facility. There are various programs that are excluded from the table for the sake of simplicity and the goal of comparison.

Table 1: MDTA Toll Policy by Facility

MdTA Facility	Toll Collection (Composites based on FY12)	Commuter 2 Axle E-ZPass Rate	2 Axle Base E-ZPass Rate	2 Axle Base Cash Rate	5 Axle Base Cash Rate	Video Surcharge
Northern Region						
John F. Kennedy Memorial Highway (I-95)	Tag (60.90%), Video (4.27%), Cash (34.83%)	$1.50 (Current)/$2.80 (07/01/13)	$5.40 (Current)/$7.20 (07/01/13)	$6.00 (Current)/$8.00 (07/01/13)	$36.00 (Current)/$48.00 (07/01/13)	50% over E-Zpass Rate
Thomas J. Hatem Memorial Bridge (US 40)	Tag (15.21%), Video (0.95%), Cash (83.84%)	$1.50 (Current)/$2.80 (07/01/13)	$6.00 (Current)/$8.00 (07/01/13)	$6.00 (Current)/$8.00 (07/01/13)	N/A	50% over E-Zpass Rate
Central Region						
Baltimore Harbor Tunnel (I-895)	Tag (67.08%), Video (2.85%), Cash (30.07%)	$0.75 (Current)/$1.40 (07/01/13)	$2.70 (Current)/$3.60 (07/01/13)	$3.00 (Current)/$4.00 (07/01/13)	$18.00 (Current)/$24.00 (07/01/13)	50% over E-Zpass Rate
Fort McHenry Tunnel (I-95)	Tag (66.12%), Video (4.47%), Cash (29.41%)	$0.75 (Current)/$1.40 (07/01/13)	$2.70 (Current)/$3.60 (07/01/13)	$3.00 (Current)/$4.00 (07/01/13)	$18.00 (Current)/$24.00 (07/01/13)	50% over E-Zpass Rate
Francis Scott Key Bridge (I-695)	Tag (70.60%), Video (6.10%), Cash (23.30%)	$0.75 (Current)/$1.40 (07/01/13)	$2.70 (Current)/$3.60 (07/01/13)	$3.00 (Current)/$4.00 (07/01/13)	$18.00 (Current)/$24.00 (07/01/13)	50% over E-Zpass Rate
Southern Region						
William Preston Lane Jr. Memorial (Bay) Bridge (US 50/301)	Tag (61.77%), Video (3.34%), Cash (34.89%)	$1.00 (Current)/$2.10 (07/01/13)	$3.60 (Current)/$5.40 (07/01/13)	$4.00 (Current)/$6.00 (07/01/13)	$24.00 (Current)/$36.00 (07/01/13)	50% over E-Zpass Rate
Harry W. Nice Memorial Bridge (US 301)	Tag (47.32%), Video (1.89%), Cash (50.78%)	$1.00 (Current)/$2.10 (07/01/13)	$3.60 (Current)/$5.40 (07/01/13)	$4.00 (Current)/$6.00 (07/01/13)	$24.00 (Current)/$36.00 (07/01/13)	50% over E-Zpass Rate
Intercounty Connector (ICC)/MD 200) Peak Period Mon–Fri: 6am-9am; 4pm-7pm ($0.25/mile – $0.35/mile) Off-Peak Period Mon-Fri: 5am–6am; 9am-4pm; 7pm–11pm Sat & Sun: 5am–11pm ($0.20/mile – $0.30/mile) Overnight Period Sun-Sat: 11pm–5am ($0.10/mile – $0.30/mile)	Tag (86.46%), Video (13.54%)	N/A	$0.40 (Overnight) to $4.00 (Peak Period)	N/A	N/A	50% over E-Zpass Rate

The I-95 ETL is a unique situation for the MDTA as it offers tolled travel adjacent to a limited access roadway, I-95. The most similar facility that the MDTA operates is the ICC which offers time of day pricing to manage congestion. The details of the ICC toll schedule and policy are shown in Table 2: ICC Toll Policy. The time periods for the ICC are a function of hourly traffic flows in the ICC corridor. Because of the differing travel patterns on the two facilities, peak pricing periods will likely be different. Similarly the actual rates per mile by time period may vary over time since the growth in traffic on the two facilities may differ.

Table 2: ICC Toll Policy

Period/Day	Time	Rate Range	Rate per Mile
Peak			
Mon-Fri	6:00 am-9:00 am	$0.25-$0.35	$0.25
Mon-Fri	4:00 pm-7:00 pm	$0.25-$0.35	$0.25
Off-Peak			
Mon-Fri	5:00 am-6:00 am	$0.20-$0.30	$0.20
Mon-Fri	9:00 am-4:00 pm	$0.20-$0.30	$0.20
Mon-Fri	7:00 pm-11:00 pm	$0.20-$0.30	$0.20
Sat	5:00 am-11:00 pm	$0.20-$0.30	$0.20
Sun	5:00 am-11:00 pm	$0.20-$0.30	$0.20
Overnight			
Mon-Sun	11:00 pm-5:00 am	$0.10-$0.30	$0.10

2.2 Managed Lane Toll Policies across the United States

The term managed lane facility is applied to a wide range of transportation infrastructure. Any lane of traffic that is restricted in some way can be considered a managed lane since there is some level of management of traffic. This traffic restriction can range from restricting trucks in the left lane, which is a common practice on many interstates that are three lanes or wider, to highly complex systems of access to lanes as a function of vehicle occupancy, time of day, congestion in the corridor, toll and others. This review is focused on the policies most applicable to the I-95 ETL, time of day pricing to manage congestion levels in the managed lanes and payment options.

Historically, some managed lanes have charged constant rates but, increasingly as technology advances and motorists become more knowledgeable of toll facility operation, managed lane operations are using time-of-day and real-time dynamic pricing approaches, which adjust tolls based on traffic conditions. Tolls are highest during peak travel periods and lowest in the off-peak, with the rates designed to maintain free-flowing traffic conditions. Currently, the ICC uses time of day pricing, which will also be employed on the I-95 ETLs.

The earliest example of a tolled-managed lane is the State Route (SR) 91 Express Lanes in Orange County, California, which involves toll lanes in the median of a 10-mile section of one of the most heavily congested highways in the U.S, the Riverside SR 91 freeway. The toll lanes are separated from the general purpose lanes by a painted buffer and dividers. In the toll schedule currently in effect, tolls on the express lanes vary between $1.25 and $9.55, with the tolls set by time of day and by direction to reflect the level of delay avoided in the adjacent general purpose lanes, and most importantly, to maintain free-flowing traffic conditions in the toll lanes. Toll rates can be increased as often as every six (6) months. The $9.55 toll during the “super peak” represents $0.96 per mile, the highest toll rate for any toll road in the country. Under this toll schedule, revenues have been adequate to pay for construction and operating costs.

Currently, the I-15 Express Lanes in San Diego are being extended to create a 20-mile "Managed Lanes" facility in the median of I-15 between SR 163 and SR 78. When complete, there will be a four-lane facility in the median with a moveable barrier, multiple access points from the regular highway lanes, and direct access ramps for buses from five (5) transit centers. A high frequency bus rapid transit (BRT) system is under development and will replace the existing express buses that serve the corridor.

The technological capability to vary the price for the use of these facilities throughout the day has given transportation agencies a powerful tool for maintaining a certain level of service in the managed lanes. While there have been concerns about equity impacts, research on the demographic and economic profile the customers on the 91 Express Lanes has shown that “…users from all income groups regularly make use of the facility.” More recent experience confirms this usage pattern; in the Seattle area, it was noted of the SR 167 managed lanes that “they are more like "Ford Lanes," reflecting the most common make of vehicle that used the lanes from May through July of 2008. Drivers view the managed lanes as a choice when the value of time savings outweighs the cost of using the facility, in effect as a form of congestion insurance.

Figure 5 illustrates all operating tolled managed lane facilities in the United States.

Figure 5: Toll Policy on Existing U.S. Managed Lane Facilities

State	Region	Facility	Years in Operation	Length in Miles	Operating Hours	Pricing	Peaking Characteristics	Max 2 Axle Tag Toll	Min 2 Axle Tag Toll	Max 2 Axle Tag Toll Rate	Min 2 Axle Tag Toll Rate	Toll Collection	Regional Operator
CA	Orange County	SR-91	17	10	Continuous	Static Schedule	6:00 am to 8:00 am WB, 4:00 pm to 6:00 pm EB	$9.55	$1.35	$0.96	$0.14	Tag Only (FasTrak)	OCTA
CA	San Diego	I-15	1	20	Continuous	Static Schedule	N/A	$8.00	$0.50	$0.40	$0.03	Tag Only (FasTrak)	SANDAG
CA	San Francisco	I-680 SB	2	14	Mon-Fri: 5:00 am to 8:00 pm Weekends: Open	Static Schedule	N/A	$7.50	$0.30	$0.54	$0.02	Tag Only (FasTrak)	BATA
CA	San Jose	SR-237/I-880	1	11	I-880 to SR-237: 5:00 am to 10:00 am; 3:00 pm to 7:00 pm SR-237 to I-880: 5:00 am to 9:00 am; 3:00 pm to 7:00 pm	Static Schedule	I-880 SB to SR 237 WB: 5:00 am to 10:00 am; 3:00 pm to 7:00 pm SR 237 EB to I-880 NB: 5:00 am to 9:00 am; 3:00 pm to 7:00 pm	$7.50	$0.30	$0.68	$0.03	Tag Only (FasTrak)	VTA (SR-237), ACTC/VTA (I-880)
CO	Denver	I-25	6	7	SB: 5:00 am to 10:00 am NB: 12:00 pm to 3:00 am	Static Schedule	N/A	$4.00	$0.50	$0.57	$0.07	Tag Only (EXpressToll)	E-470
FL	Miami	I-95	3	9.5	Continuous	Static Schedule	Weekdays - AM Peak 6:00 am to 9:00 am; PM Peak 4:00 pm to 7:00 pm	$7.10	$0.25	$0.75	$0.03	Tag Only (SunPass)	FTE
GA	Atlanta	I-85	1	15.5	Continuous	Static Schedule	N/A	$5.00	$0.15	$0.32	$0.01	Tag Only (Peach Pass)	SRTA
MN	Minneapolis	I-35W	3	16	6:00 am to 10:00 am; 2:00 pm to 7:00 pm	Dynamic	N/A	$8.00	$0.25	$0.50	$0.02	Tag Only (MnPass)	MnDOT
MN	Minneapolis	I-394	7	11	6:00 am to 10:00 am; 2:00 pm to 7:00 pm	Dynamic	N/A	$8.00	$0.25	$0.73	$0.02	Tag Only (MnPass)	MnDOT
TX	Houston	I-10	3	12	Continuous	Static Schedule	Weekdays - AM Peak 6:00 am to 8:00 am; PM Peak 4:00 pm to 6:00 pm	$5.00	$0.30	$0.42	$0.03	Tag Only	HCTRA
TX	Houston	I-45S	1	15.5	Mon-Fri: 5:00 am to 11:00 am; 1:00 pm to 8:00 pm Weekends: Closed	Static Schedule	N/A	$4.50	$1.00	$0.29	$0.06	Tag Only	METRO
TX	Houston	I-45N	1	20.6	Mon-Fri: 5:00 am to 11:00 am; 1:00 pm to 8:00 pm Weekends: Closed	Static Schedule	N/A	$4.50	$1.00	$0.22	$0.05	Tag Only	METRO
	Houston	US-59S	1	23.3	Mon-Fri: 5:00 am to 11:00 am; 1:00 pm to 8:00 pm Weekends: Closed	Static Schedule	N/A	$4.50	$1.00	$0.19	$0.04	Tag Only	METRO
UT	Salt Lake City	I-15	2	40	Continuous	Static Schedule	N/A	$4.00	$0.25	$0.10	$0.01	Tag Only (Express Pass)	UDOT
WA	Seattle	SR-167	4	9	5:00 am to 7:00 pm	Static Schedule	NB 7:00 am to 8:00 am, SB 4:00 pm to 5:00 pm	$9.00	$0.50	$1.00	$0.06	Tag Only (Good To Go!)	WSDOT

2.3 I-95 ETL Toll Plan

The proposed I-95 ETL toll plan blends the traffic management aspects of the ICC and operational and successful managed lane facilities in the United States with existing toll policy on the MDTA system. Figure 6 presents the salient toll plan elements for the I-95 ETL that apply to traffic and toll revenue forecasting.

Like the ICC, the I-95 ETL is a cashless toll facility. The video toll rate is set at the minimum surcharge of $1.00 or 50% above the base toll rate. The driving element of the toll plan is the policy to maintain speeds of 55 miles per hour in the ETL. Meeting this goal requires increasing the toll rates during high-congestion times in order to limit the amount of traffic entering the ETL. The significance of this feature of the toll policy becomes more apparent in the analysis section of this report. To provide consistency across MDTA facilities, the mileage rate ranges are consistent with the current ICC mileage rate ranges.

Figure 6: I-95 ETL Proposed Toll Plan

Element	Policy
Toll Collection	All Electronic Toll Collection (AETC) with E-ZPass and Video Toll (No Cash Collection)
2 axle Base Toll Rate	As needed to manage congestion by time period within ICC toll rate ranges
2 axle Image Toll Rate	50% surcharge on base rate with $1 minimum and $15 maximum surcharges
Annual Toll Escalation	There is no annual toll escalation, only escalation based on the need to manage traffic in the peak periods
Congestion Pricing	Maintain 55 mph
Axle Multiplier from 2 axle	Based on current MDTA policy on ICC, which is different than the axle multiplier for 3 and 4 axle vehicles at the seven legacy facilities.

3.0 Corridor Traffic Conditions

Existing traffic conditions provide an empirical snapshot of how traffic functions today. This combined with the historical experience in the corridor, year over year, and forecasted traffic volumes provide key inputs to the traffic and toll revenue forecasting model.

The I-95 ETL extend approximately eight miles, between the I-95/I-895 split from the Baltimore city line (mile marker 62) to just north of MD 43/Whitemarsh Boulevard (mile marker 70).

3.1 Historical Traffic Conditions

Table 3 presents average annual traffic counts from 1980 through 2011for the portion of I-95 to be served by the ETL. From 1980 to 1990, traffic along the project corridor grew at an average annual rate of 9.7% and from 1990 to 2000 at an annual rate of 1.0%. Over the last decade, traffic increased at an annual rate of 0.9% within the segments just south of the I-695 interchange and north of MD 43/Whitemarsh Boulevard growing at an annual rate of 1.1% and 1.3%, respectively.

For the 2011 calendar year, average daily traffic volumes in the mid-section of the corridor ranged from 160,100 north of the I-695 interchange to 165,300 south of the I-695 interchange. Average daily traffic volumes for the southern termini locations ranged from 58,500 on I-895 north of US 40/Pulaski Hwy to 97,300 on I-95 north of US 40/Pulaski Hwy. The northern terminius north of MD 43/Whitemarsh Boulevard experienced average daily traffic of 161,700.

Table 3: Historical Traffic Volumes (1980-2011)

Year	Average Annual Daily Traffic Trends				
	I-895 N of Pulaski Hwy	I-95 N of Pulaski Hwy	S of I-95/I-695 Interchange	N of I-95/I-695 Interchange	I-95 N of MD 43/Whitemarsh Blvd
1980	9,985	16,050	65,685	62,250	56,700
1990	46,550	74,830	133,950	155,020	119,500
2000	55,950	89,950	161,000	141,175	139,575
2001	57,125	91,875	147,537	150,150	142,450
2002	58,375	98,375	134,075	151,725	143,925
2003	58,450	98,450	151,175	157,675	171,975
2004	59,025	99,425	152,750	159,350	173,750
2005	59,975	98,875	161,775	159,425	173,825
2006	59,981	98,881	168,020	162,770	161,780
2007	59,982	98,882	168,021	162,771	161,781
2008	57,660	95,823	162,812	157,722	157,742
2009	58,241	96,784	164,443	159,303	160,880
2010	58,472	97,175	165,104	159,943	161,521
2011	58,480	97,275	165,275	160,109	161,682
Average Annual Percent Change					
2001-2006	1.00%	1.53%	2.78%	1.68%	2.71%
2006-2011	-0.50%	-0.32%	-0.33%	-0.33%	-0.01%
2001-2011	0.24%	0.59%	1.20%	0.66%	1.35%

Source: Maryland State Highway Administration Traffic Volume Maps

3.2 Existing Traffic Conditions

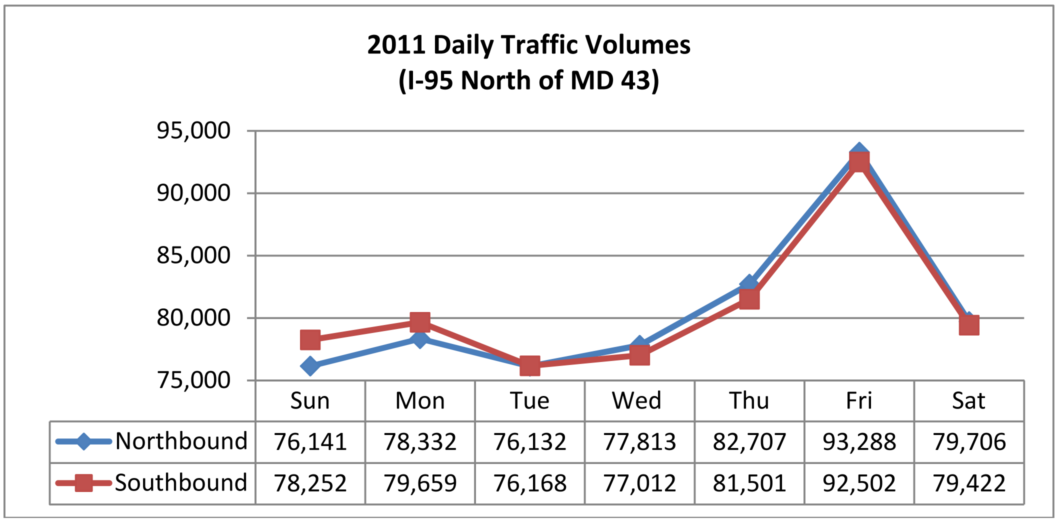
In 2011, average daily traffic volumes in the I-95 ETL project corridor ranged from approximately 160,000 vehicles per day north of I-695 to 165,000 vehicles per day south of I-695. The section south of the I-95/I-895 split experienced average daily traffic volumes of approximately 97,000 vehicles per day on I-95 and approximately 58,000 vehicles per day on I-895.

In this section, the annual average daily traffic volumes for the corridor are detailed by day of the week and hour as is the relationship between volume and speed. This detailed breakdown of traffic volume and the relationship to speed is critical to this analysis because time savings is the driver of motorists' behavior when choosing a tolled alternative.

3.2.1 Daily Traffic

Figure 7 illustrates average daily traffic volumes for 2011 recorded one-half mile north of MD 43/Whitemarsh Boulevard (mile marker 69.7 for NB counts and 73.4 for SB counts). Average daily traffic is evenly split between southbound and northbound general purpose lanes (49.9% and 50.1%, respectively). Average weekend traffic is slightly higher in the southbound direction with 50.3%. Friday experienced the highest traffic volumes during 2011 with average daily traffic of 92,895 vehicles total in both directions, or 16.5% of all daily traffic / 22.8% of all weekday traffic. Tuesday experienced the lowest volumes with average daily traffic of 76,150 vehicles total in directions, or 13.5% of all daily traffic / 18.7% of all weekday traffic.

Figure 7: 2011 Daily Traffic Volumes (I-95 North of MD 43)



	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Northbound	76,141	78,332	76,132	77,813	82,707	93,288	79,706
Southbound	78,252	79,659	76,168	77,012	81,501	92,502	79,422

3.2.2 Hourly Traffic

Hourly traffic profiles provide the peaking characteristics of corridor, which illustrate the congested time periods. Those congested time periods are the most important in the development of estimates of traffic, toll schedules and toll revenues for managed lane facilities. The hourly profiles for the corridor are provided by direction and by day of the week in Figure 8 through Figure 11.

For weekday travel in the I-95 ETL corridor, the northbound peak hour was identified from 5:00 pm to 6:00 pm with Friday peaking at 7,152 vehicles per hour. The southbound peak hour was from 6:00 am to 7:00 am with Thursday peaking at 7,084 vehicles per hour. The peak hour on Saturday is from Noon to 1:00 pm in both directions, with northbound experiencing 5,265 vehicles per hour and southbound 5,331 vehicles per hour.

For Sunday travel, the peak period for northbound traffic was identified between 3:00 pm to 4:00 pm with 5,638 vehicles per hour. In the southbound direction, the peak period was identified between 4:00 and 5:00 pm with 5,476 vehicles per hour.

Figure 8: 2011 Daily Total Traffic Volumes by Hour – Northbound (I-95 South of I-695)

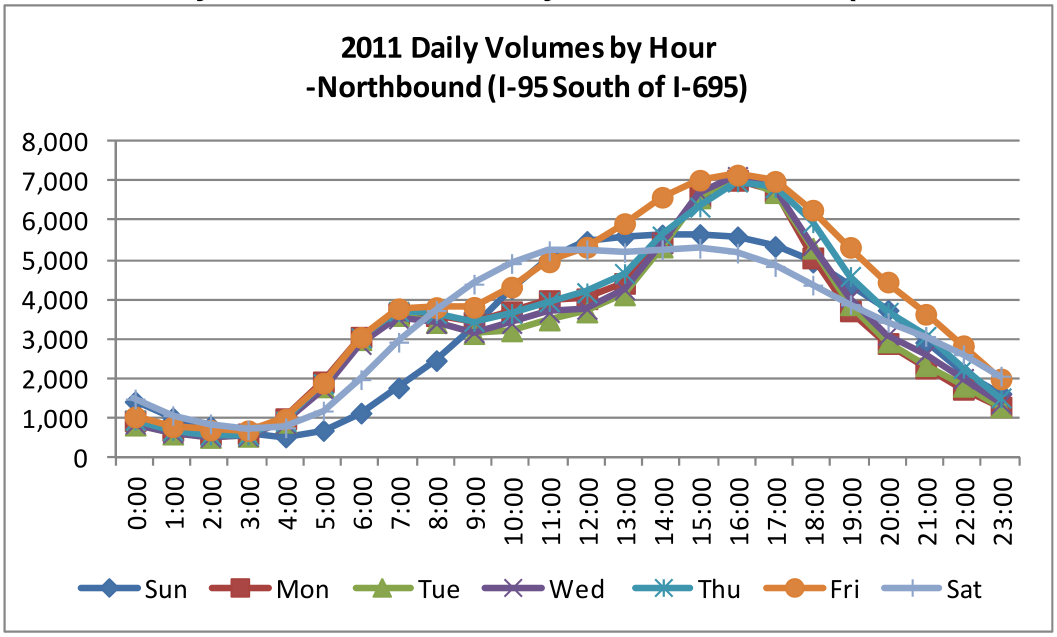


Figure 9: 2011 Weekday vs. Weekend Total Traffic Volumes by Hour – Northbound (I-95 South of I-695)

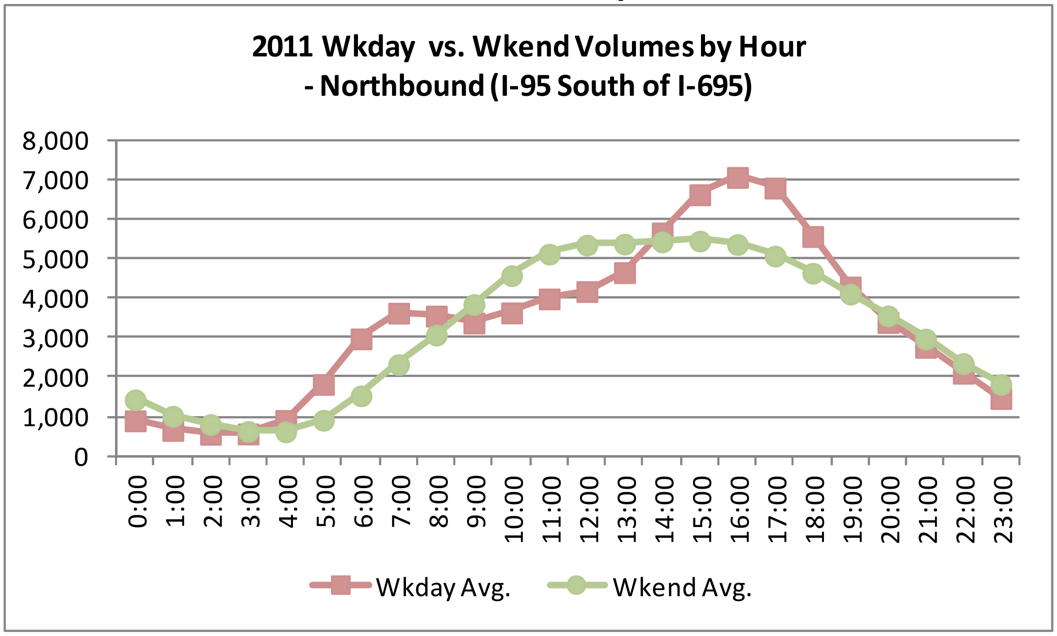


Figure 10: 2011 Daily Total Traffic Volumes by Hour – Southbound (I-95 South of I-695)

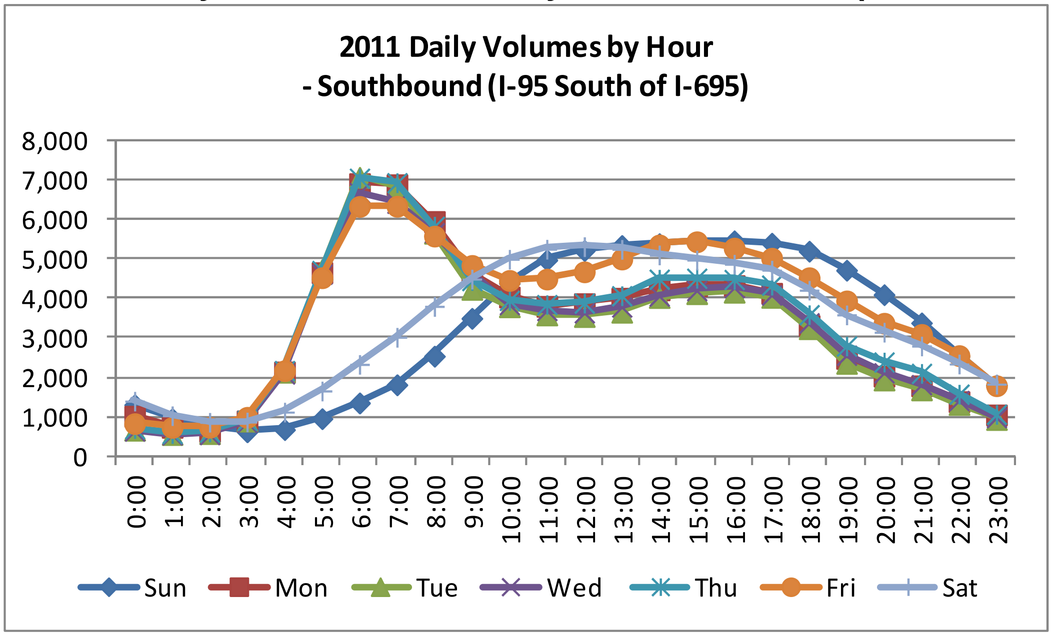


Figure 11: 2011 Weekday vs. Weekend Total Traffic Volumes by Hour – Southbound (I-95 South of I-695)

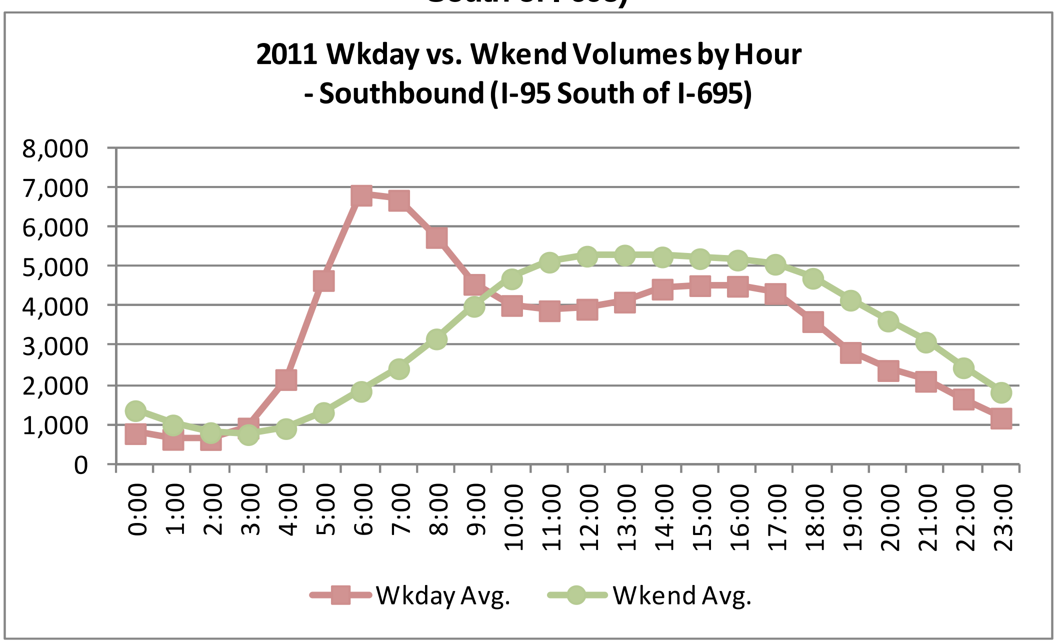


Figure 12 through Figure 19 illustrate the hourly profiles for the I-95 ETL corridor by vehicle class (passenger car and commercial vehicle). For northbound weekday travel, truck traffic comprised about 12.8% and for southbound travel about 11.2% of all total traffic for 2011 (recorded 0.5 miles north of MD 43).

Figure 12: 2011 Daily Car Traffic Volumes by Hour – Northbound (I-95 North of MD 43)

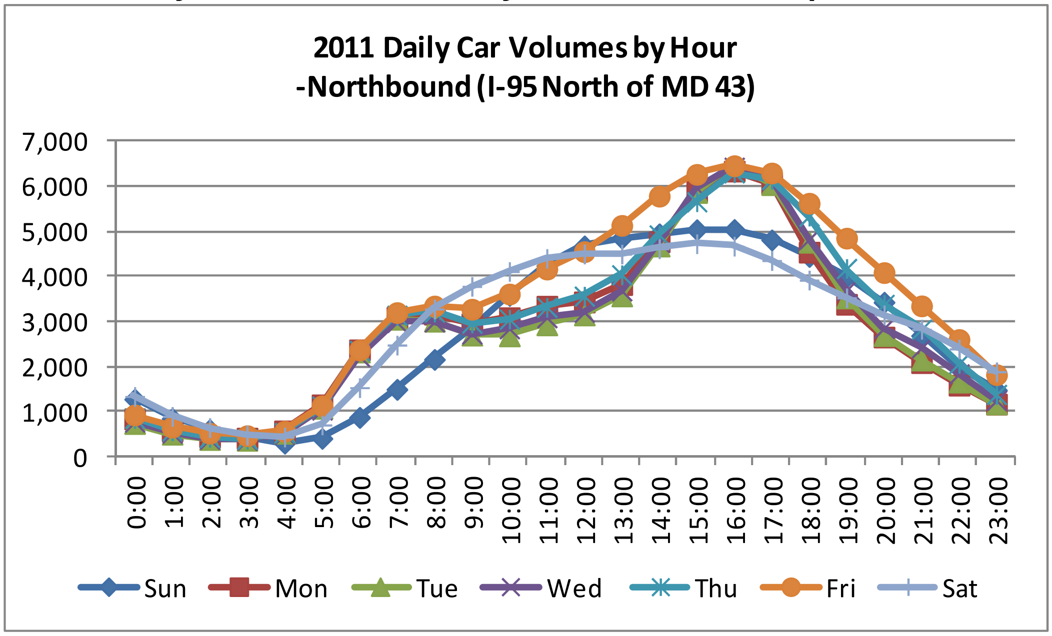


Figure 13: 2011 Weekday vs. Weekend Car Traffic Volumes by Hour – Northbound (I-95 North of MD 43)

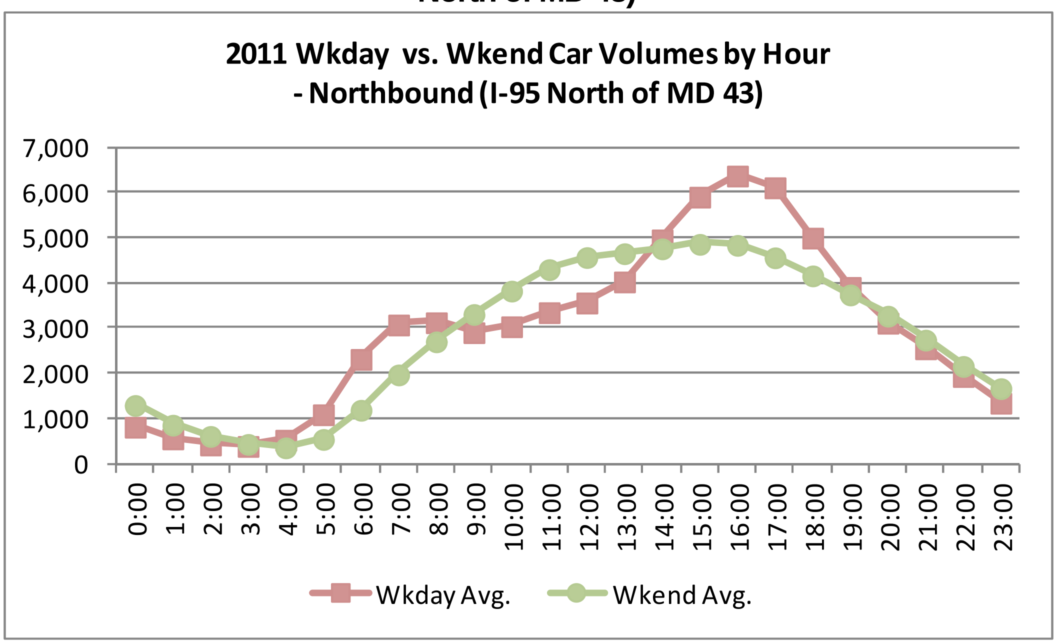


Figure 14: 2011 Daily Car Traffic Volumes by Hour – Southbound (I-95 North of MD 43)

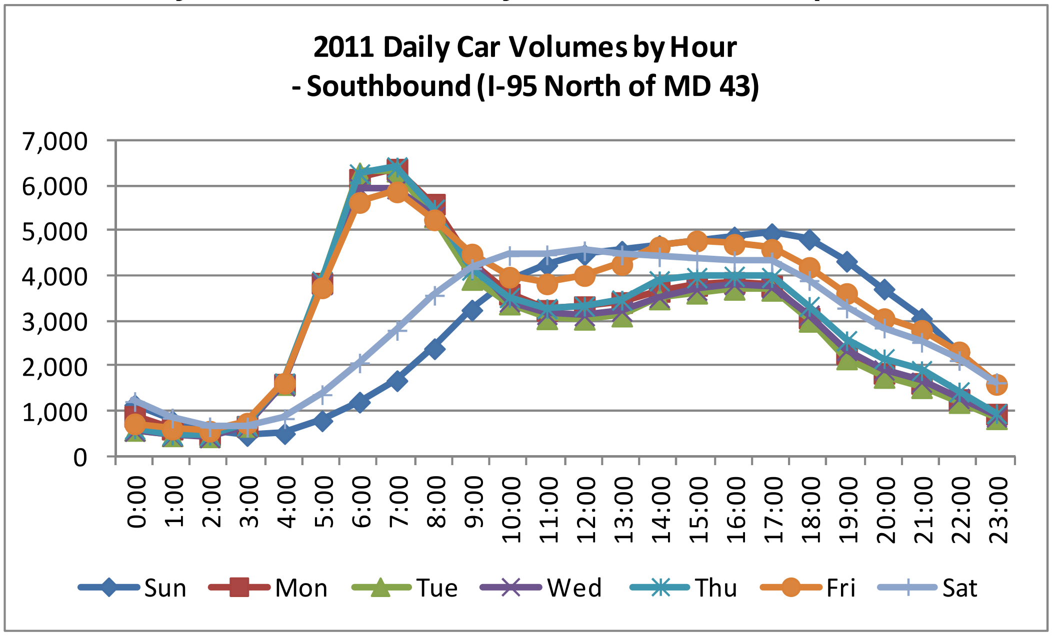


Figure 15: 2011 Weekday vs. Weekend Car Traffic Volumes by Hour – Southbound (I-95 North of MD 43)

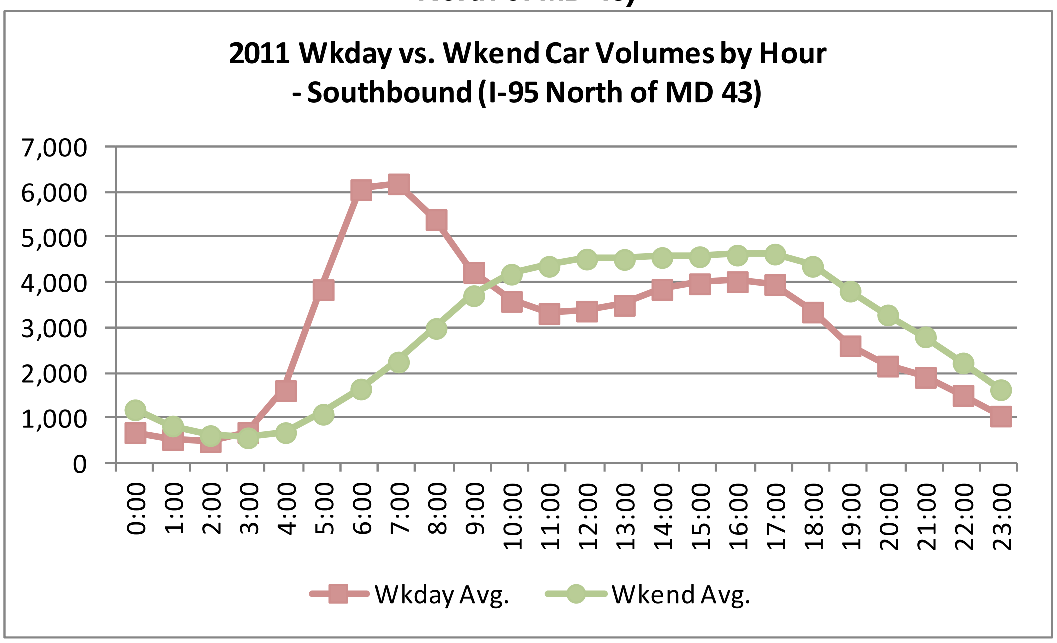


Figure 16: 2011 Daily Truck Traffic Volumes by Hour – Northbound (I-95 North of MD 43)

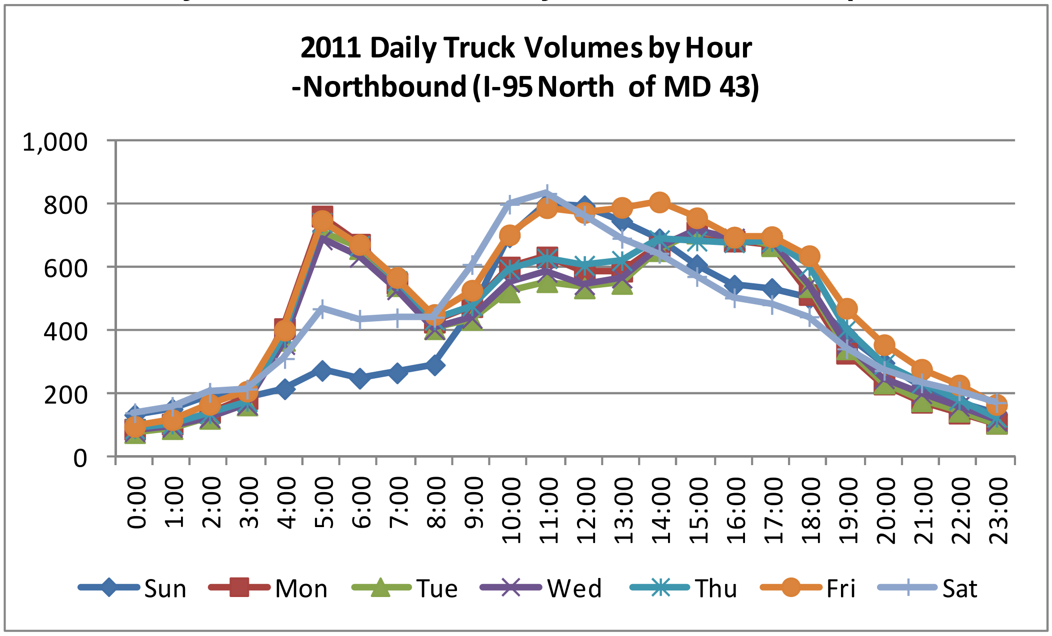


Figure 17: 2011 Weekday vs. Weekend Truck Traffic Volumes by Hour – Northbound (I-95 North of MD 43)

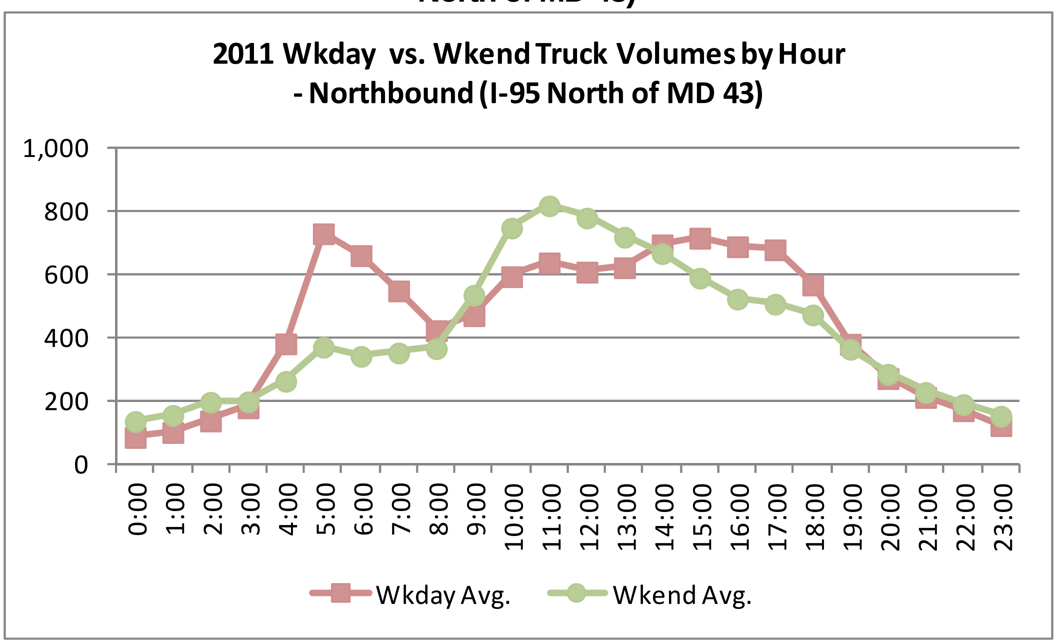


Figure 18: 2011 Daily Truck Traffic Volumes by Hour – Southbound (I-95 North of MD 43)

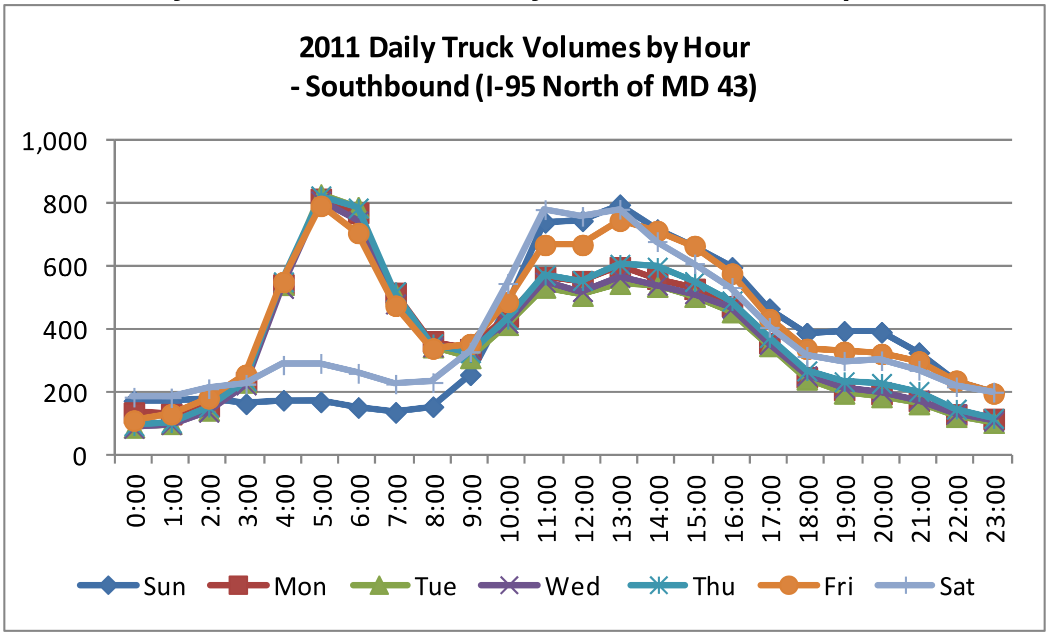
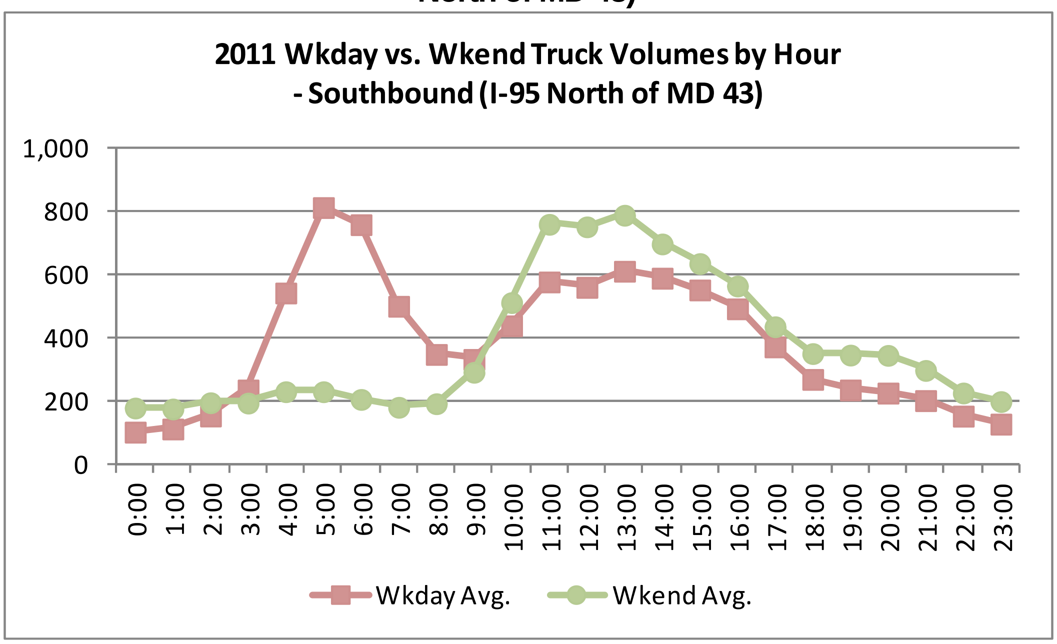


Figure 19: 2011 Weekday vs. Weekend Truck Traffic Volumes by Hour – Southbound (I-95 North of MD 43)



3.2.3 Speed Profiles

Speed data for the I-95 ETL project corridor was obtained through INRIX' I-95 traffic monitoring portal (http://i95.inrix.com/) for a representative week in October 2012 (October 21, 2012 through October 27, 2012). This data is analyzed for 18 speed probe locations (6 along I-95 and 3 along I-895 in each direction). Speed profiles for the 6:00 am to 9:00 am southbound morning peak period and 4:00 pm to 7:00 pm northbound afternoon peak period as well as the 7:00 am to 8:00 am southbound morning peak hour and 5:00 pm to 6:00 pm northbound afternoon peak hour are summarized in Figure 20 through Figure 23.

Average weekday speeds on I-95 during the southbound morning peak period are calculated at 52.9 mph and northbound afternoon speeds at 49.8 mph. During the peak morning and afternoon hours, speeds drop significantly with average southbound speeds during the 7:00 am to 8:00 am southbound morning peak hour calculated at 43 mph and during the northbound afternoon peak hour at 37.3 mph. This represents a 19% drop in morning southbound and 25% drop in afternoon northbound speeds between periods and hour, respectively.

Overall, average weekday southbound speeds along the I-95 ETL corridor are 62.3 mph and average weekday northbound speeds at 59.8 mph. Average weekend speeds were slightly higher at 65.6 mph southbound and 63.9 mph northbound.

Figure 20: I-95/I-895 Average Southbound Speeds During Morning Peak Period

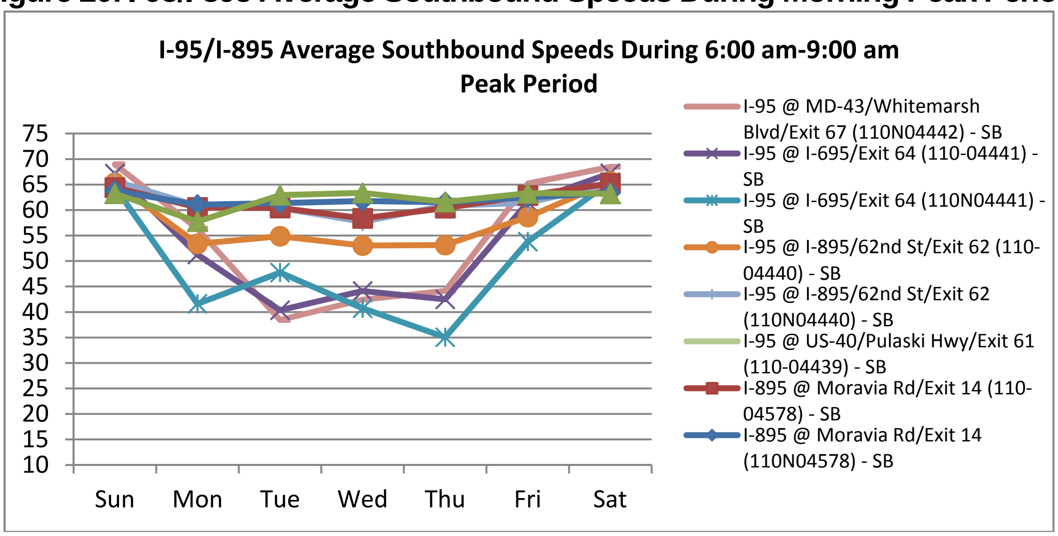


Figure 21: I-95/I-895 Average Southbound Speeds During Morning Peak Hour

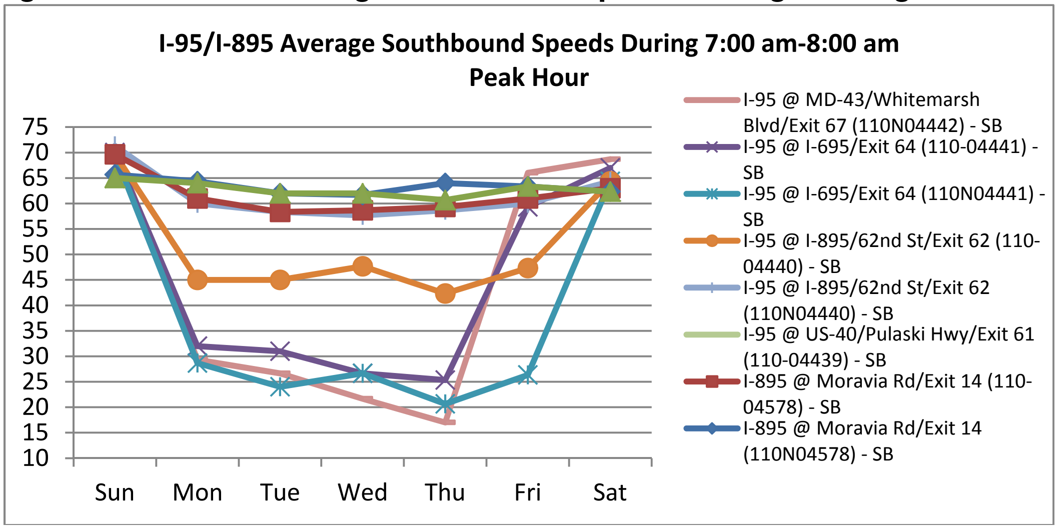


Figure 22: I-95/I-895 Average Northbound Speeds During Afternoon Peak Period

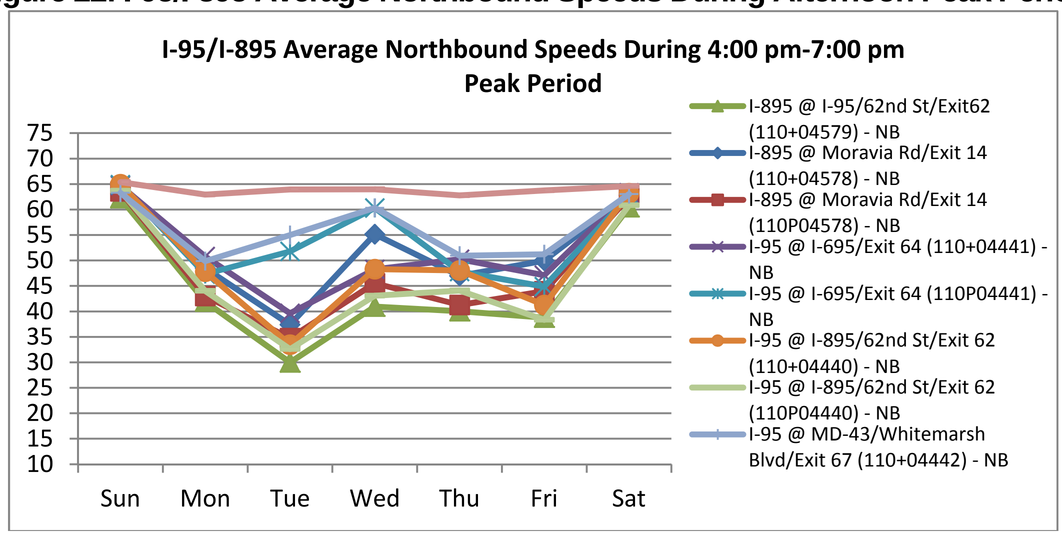
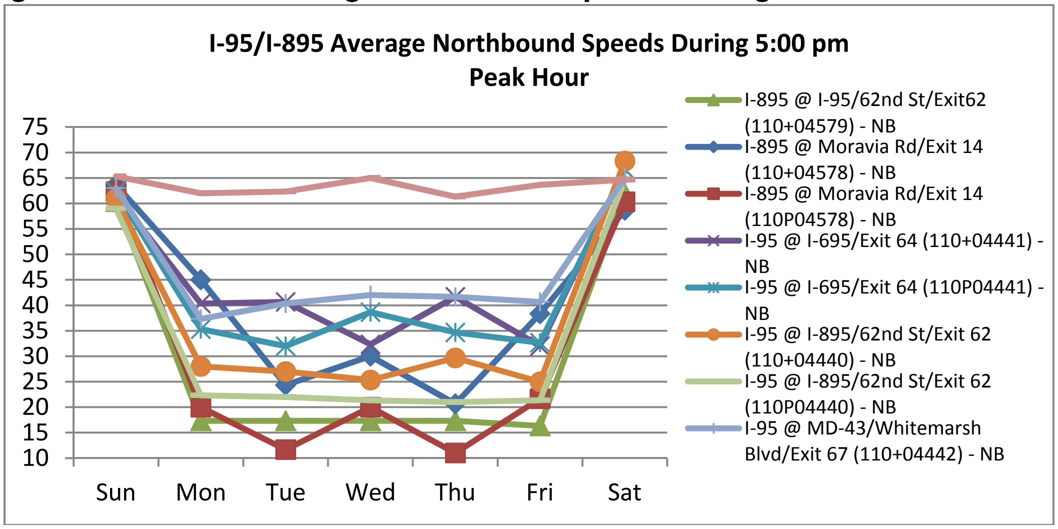


Figure 23: I-95/I-895 Average Northbound Speeds During Afternoon Peak Hour



3.2.4 Speed and Volume Relationships

Relationships between speed and traffic volumes for the I-95 ETL project corridor are analyzed by comparing traffic count data with INRIX speed data for a representative week in May 2012 (May 17, 2012 through May 23, 2012). Traffic counts are for I-95 (exit 62) north of US 40/Pulaski Hwy. As illustrated in Figure 24 and Figure 25, strong relationships between speed and traffic volumes can be observed. Data for Friday afternoon (May 18, 2012) shows a very strong relationship with sustained speeds under 20 mph between 3:00 pm and 6:00 pm. Average hourly volume during these 3 hours is 3,537 vehicles (Peaking at 3:00 pm with 4,197 vehicles and bottoming out at 6:00 pm with 3,070 vehicles).

Figure 24: INRIX Speed Data - I-95 @ I-895/Exit 62 - NB (05/17/2012-05/23/2012)

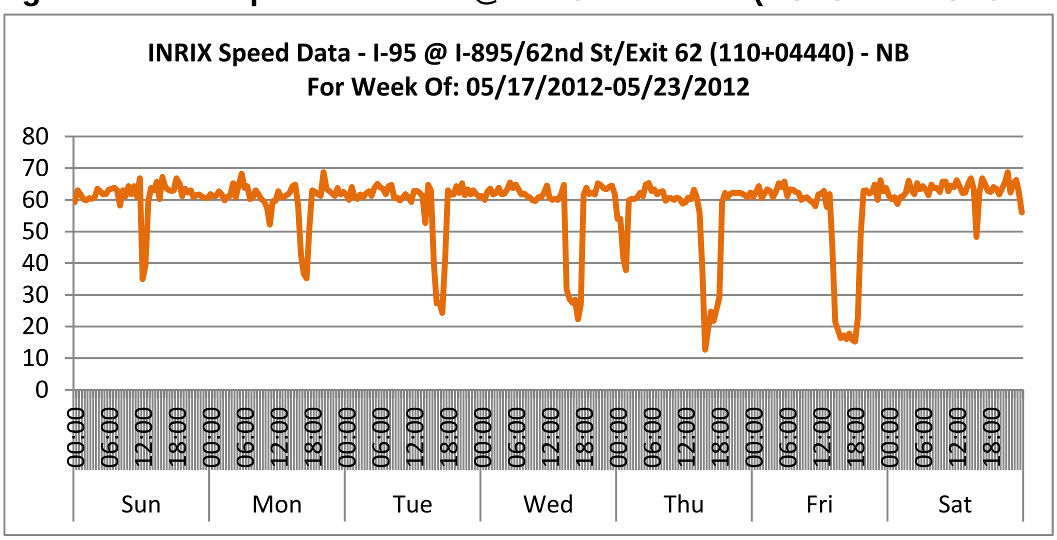
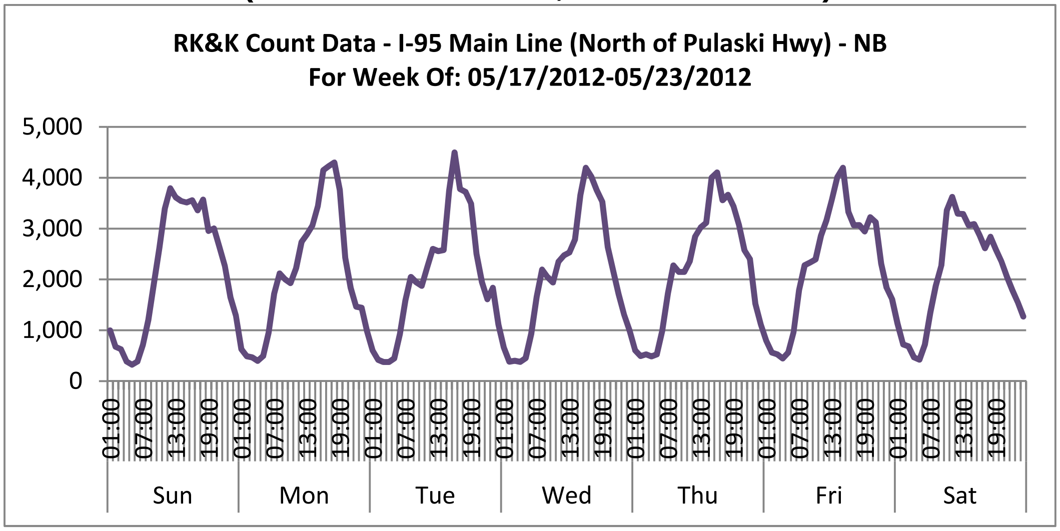


Figure 25: I-95 Main Line (North of Pulaski Hwy) - NB (05/17/2012-05/23/2012, RK&K Count Data)



To further illustrate the relationship between speed and traffic volumes, a scatter plot of the data points is analyzed to develop a speed deterioration curve for the corridor by day of the week. More specifically, the relationship is between speed and volume to lane capacity ratio. These curves provide insight into actual traffic operations in the corridor as opposed to traditional methods of analysis that rely upon theoretical curves.

Figure 26 and Figure 27 provide speed versus volume data for a Wednesday and Friday, respectively. As the traffic volume reaches capacity (V/C = 1.0), we find speeds deteriorating. This does not occur until volume to capacity ratios are between 0.8 and 0.9 and then speeds fall quickly as capacity is reached. Additionally, there is a slight difference in the two days with Friday speeds deteriorating at lower volumes. This is estimated to be because of driver unfamiliarity in the corridor on Fridays which has more regional trip making as compared to a typical weekday. These small nuances of driver familiarity were reflected in the modeling effort.

Figure 26: I-95 Traffic Count versus Speed Curve, Wednesday

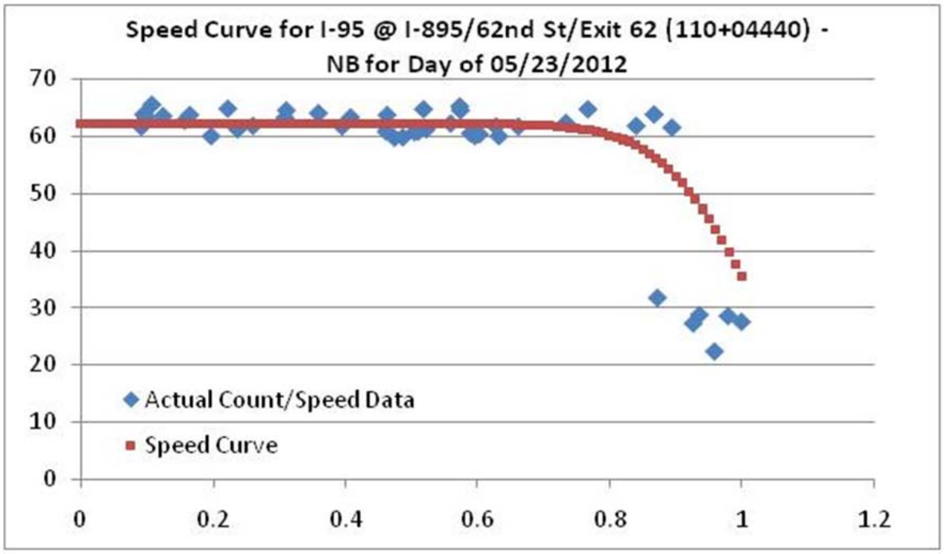
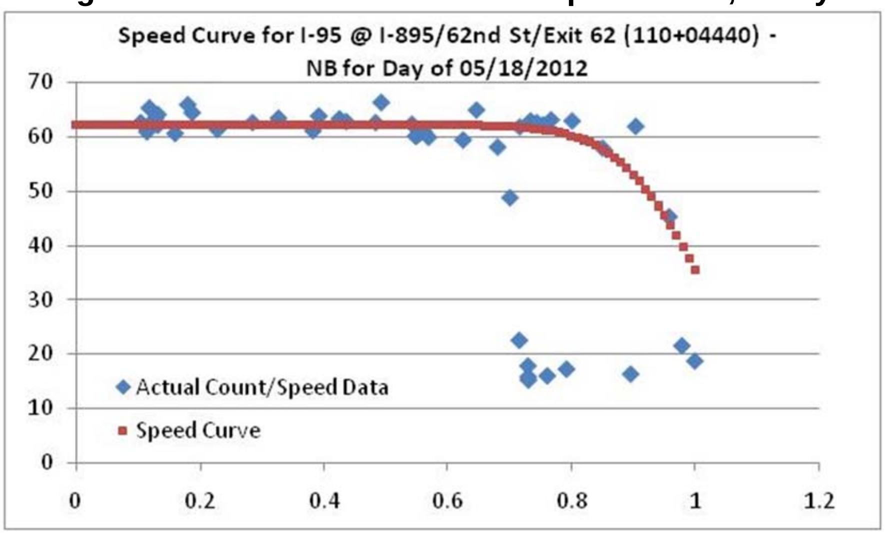


Figure 27: I-95 Traffic Count versus Speed Curve, Friday



4.0 Stated Preference Survey

A key element of the T&R study involved collecting information on motorists' sensitivity to paying tolls and their "values of time savings" through a stated preference survey. EurekaFacts conducted the survey and was tasked with gauging the perceptions of motorists' value of time regarding use of the ETL under various conditions.

The survey was required to be detailed enough to allow for the analysis of motorists' responses to different toll pricing structures and toll collection options. Responses were required from a cross section of travel segments to support the analysis of toll sensitivities by trip type and purpose.

4.1 Purpose

The objective of the stated preference survey was to collect data that allowed for the development of reliable estimates of travel time savings ("values of time" savings) of motorists using the I-95 ETL project corridor. This data was collected in support of T&R modeling and estimation by trip type and purpose.

4.2 Survey Development

EurekaFacts developed a computer-assisted, self-interview survey instrument with assistance from Jacobs. An online quantitative survey was conducted among E-ZPass and non EZ-Pass users of the I-95 ETL project corridor. The survey questionnaire contained roughly 63 questions and asked each respondent to describe their most recent trip within the study area. Origin and destination information were collected from each participant to customize the questions regarding the respondent's trip. These questions were followed with a series of stated preference experiments where respondents were asked to choose between using their current route and using express toll lanes.

The questionnaire included the following major components:

Trip Description – Respondents were asked to provide information regarding their most recent trip within the I-95 ETL corridor; including: day of the week, trip purpose, trip frequency, travel time, and E-ZPass usage.

Stated Preference Experiments - Respondents were asked to choose between two ways of making their trip in the future: their current route or a new route that included use of the I-95 ETL.

Debrief Questions – Respondents were given the opportunity to provide open-ended comments on why they do not have or do not want to use E-ZPass.

Demographics – The survey also contained a series of questions to collect demographic data such as gender, employment status and income that EurekaFacts used to determine different segments.

4.3 Survey Results

A brief summary of survey results is presented here. More detailed information is provided in the full stated preference survey report in Appendix B. Data collection took place between November 1, 2012 and November 16, 2012 and EurekaFacts obtained responses from 3,390 respondents. The survey yielded an overall response rate of 19% which was within the expected target range. Responses by group were: 22% among commercial vehicles, 43% among E-ZPass users and 5% among non E-ZPass users.

EurekaFacts conducted statistical analysis and multinomial logit model estimation to derive value of time results for E-ZPass and non EZ-Pass users by trip type and purpose.

The following summarizes the key value of time findings:

Value of time for E-ZPass users during peak hours was estimated at $16.90; 37% of E-ZPass users stated a clear preference for the I-95 ETL.

Value of time for E-ZPass users during off-peak hours was estimated at $10.46; 27% of E-ZPass users stated a clear preference for the I-95 ETL.

Value of time for non E-ZPass was estimated at $7.79; 25% of non E-ZPass users stated a clear preference for the I-95 ETL.

Value of time for E-ZPass users during peak hours for commuting to / from work or work-related travel was estimated at $17.51; 37% of E-ZPass users stated a clear preference for I-95 ETL.

Value of time for E-ZPass users during off-peak hours for commuting to / from work or work-related travel as estimated at $11.57; 29% of E-ZPass users stated a clear preference for I-95 ETL.

Value of time for E-ZPass users during peak hours for non-work-related travel was estimated at $10.93; 26% of E-ZPass users stated a clear preference for the I-95 ETL.

Value of time for E-ZPass users during off-peak hours for non-work-related travel was estimated at $10.46; 27% of E-ZPass users stated a clear preference for the I-95 ETL.

Figure 28 summarizes the value of time estimates for each scenario.

Figure 28: Value of Time Estimates

Scenario		Percentage with ETL Preference	Value of Time ($/hr)
E-ZPass users	Commuting to / from work or work-related travel - off-peak hours	29%	$11.57
	Commuting to / from work or work-related travel - peak hours	37%	$17.51
	Not work-related travel - off-peak hours	36%	$11.77
	Not work-related travel - peak hours	26%	$10.93
	Off-Peak Hours	27%	$10.46
	Peak Hours	37%	$16.90
	Overall	32%	$13.99
Non-E-ZPass users - Overall		25%	$7.79

5.0 Economic and Demographic Factors

During the course of this analysis, Jacobs analyzed several key socio-economic factors relevant to the growth in traffic and related toll revenues for the MDTA tolled facilities. Factors relevant to the long term background growth of traffic on the facilities were studied, as was the relationship of traffic to specific economic indices for passenger car and truck traffic. Jacobs also conducted extensive background research into the specific dynamics of past economic recessions and recovery from those recessions in order to better understand the current phenomenon and to aid in giving context to the most recent economic downturn when compared with past recessions.

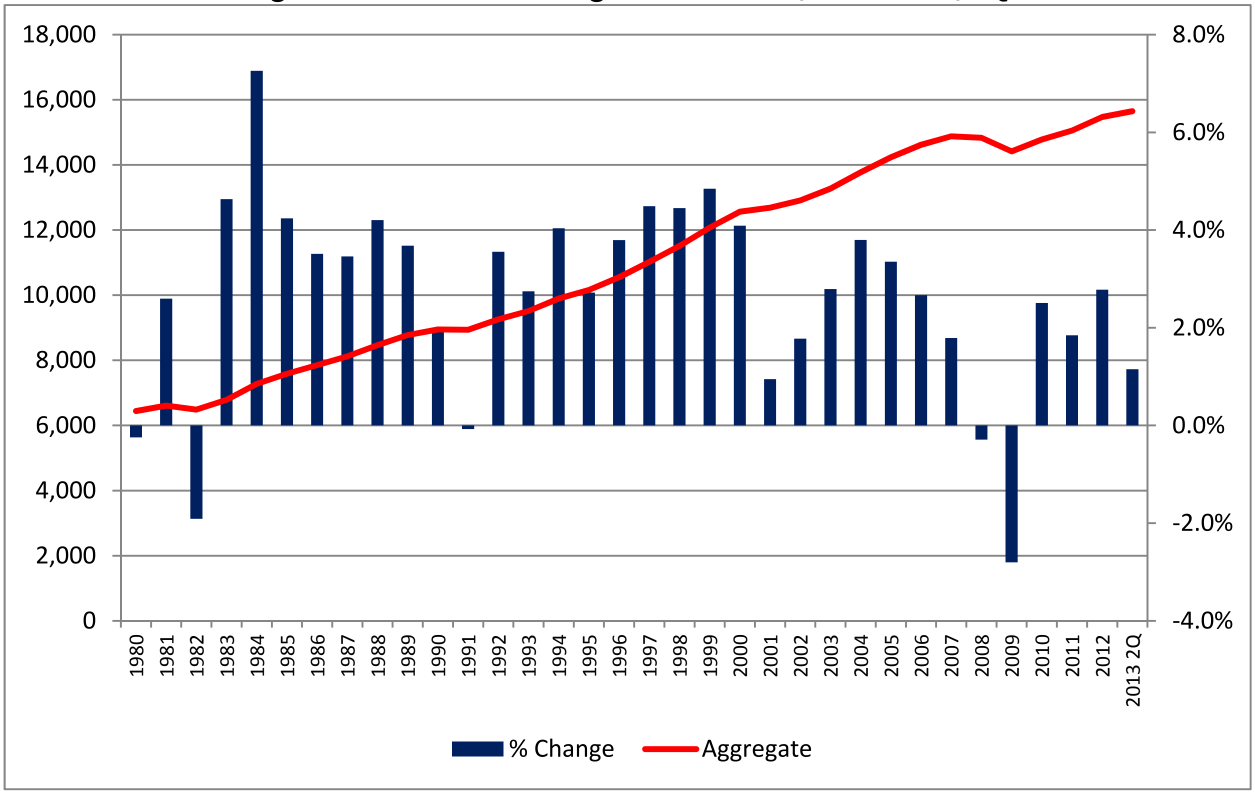
5.1 Review of Regional and National Socio-economic Factors

This section discusses historical and forecasted national economic conditions with an emphasis on the projected growth in output. Moreover, this section provides a review and summary of local economic factors, such as the change in fuel costs, population, employment, housing, and commuter patterns in Maryland and in neighboring states.

5.1.1 General National Economic Conditions

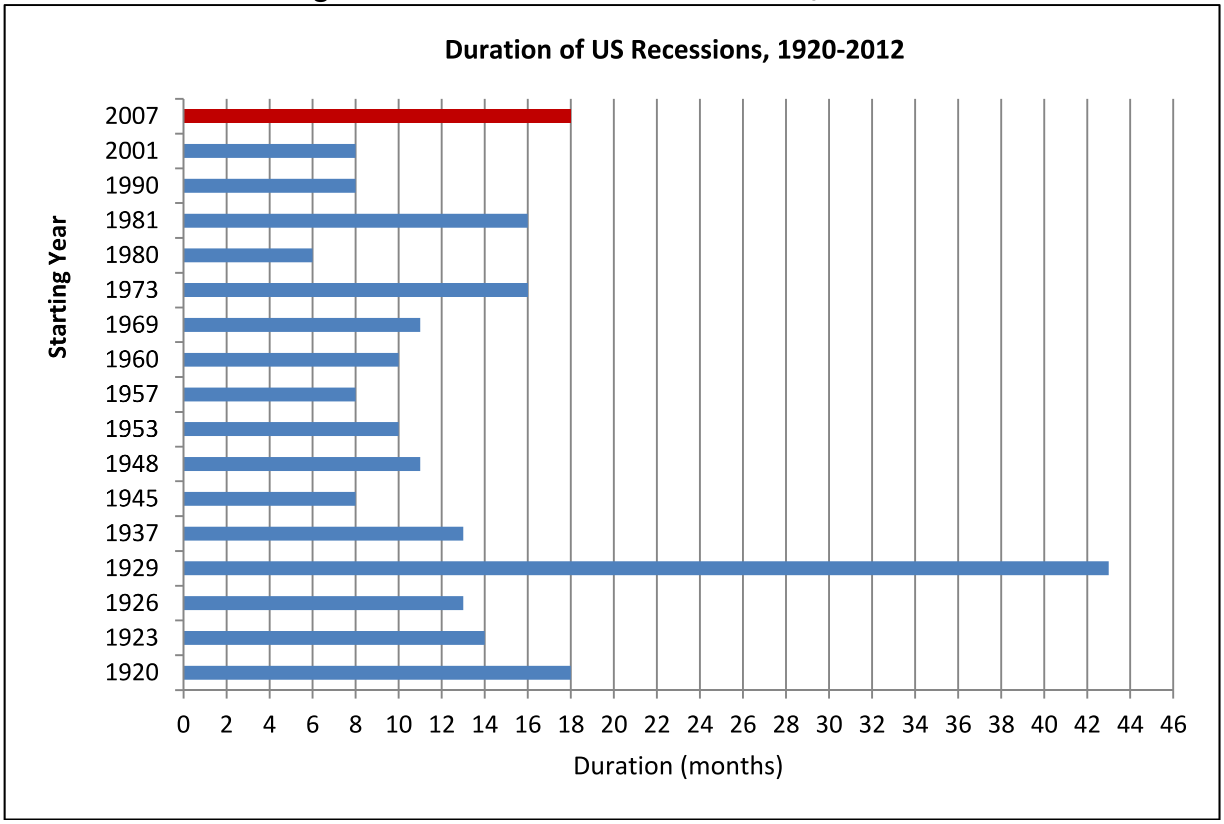
From 2000 to 2012, real Gross Domestic Product (GDP) and the Industrial Production Index in the U.S. increased by an annual average of 1.9 percent and 0.4 percent per year, respectively. This included the recession that began and ended in 2001 and the most recent recession, which began in December 2007 and officially ended in June 2009. This recent recession was more severe than previous recessions, resulting in zero growth in real GDP and a 3.3 percent decrease in industrial production in 2008. Real GDP decreased by an additional -2.6 percent in 2009, but recovered in 2010 with a 2.9 percent annual increase. Due to a lag in economic activity, industrial production decreased by -9.3 percent in 2009, but rebounded solidly in 2010, with over 3 percent annual growth. Real GDP increased by 2.8 percent in 2012 and by an annualized rate of 1.3 percent and 1.6 percent in Q1 and Q2 of 2013, respectively. Figure 29 compares year-over-year changes in real GDP since 1980.

Figure 29: Percent Change in Real GDP, 1980-2013, 2Q



Recessions are technically defined as two consecutive quarters of negative growth. In determining whether a recession has taken place, the National Bureau of Economic Research (NBER) can include other factors in its analysis. According to the NBER, the 2007-2009 recession lasted 18 months, making it the longest economic downturn since the Great Depression, as shown in Figure 30. Additionally, this recession is comparable to and may possibly exceed the recessions of the early 1970s and early 1980s in duration and severity. Economic downturns occurring after the Great Depression were typically triggered by a contracting monetary supply (typified by higher interest rates) or an external shock (e.g. sudden rise in oil prices, political turmoil, etc.) resulting in decreased consumer confidence, economic growth, and employment. Once expansionary conditions were in place, then post-recessionary periods were typically characterized by rapid, strong and sustained increases in GDP and employment.

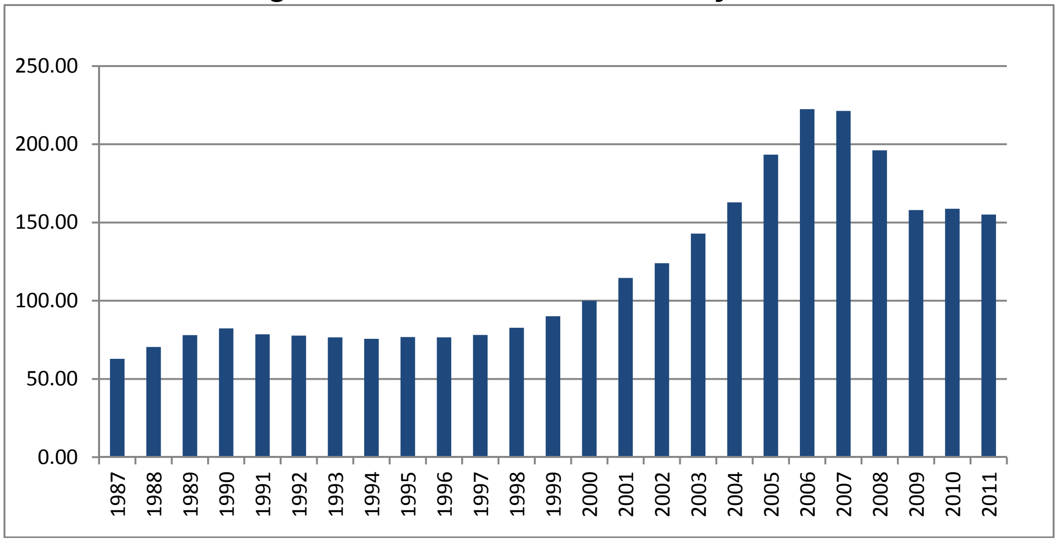
Figure 30: Duration of US Recessions, 1920-2012



In contrast, the recent recession was caused by the near collapse of the financial sector, the lack of available credit, a rapid decline in the price of real estate assets, and high consumer debt levels. The subsequent deleveraging by consumers and businesses tended to have a more severe, longer-term impact on the economy. Indications of credit tightening and deleveraging included the following:

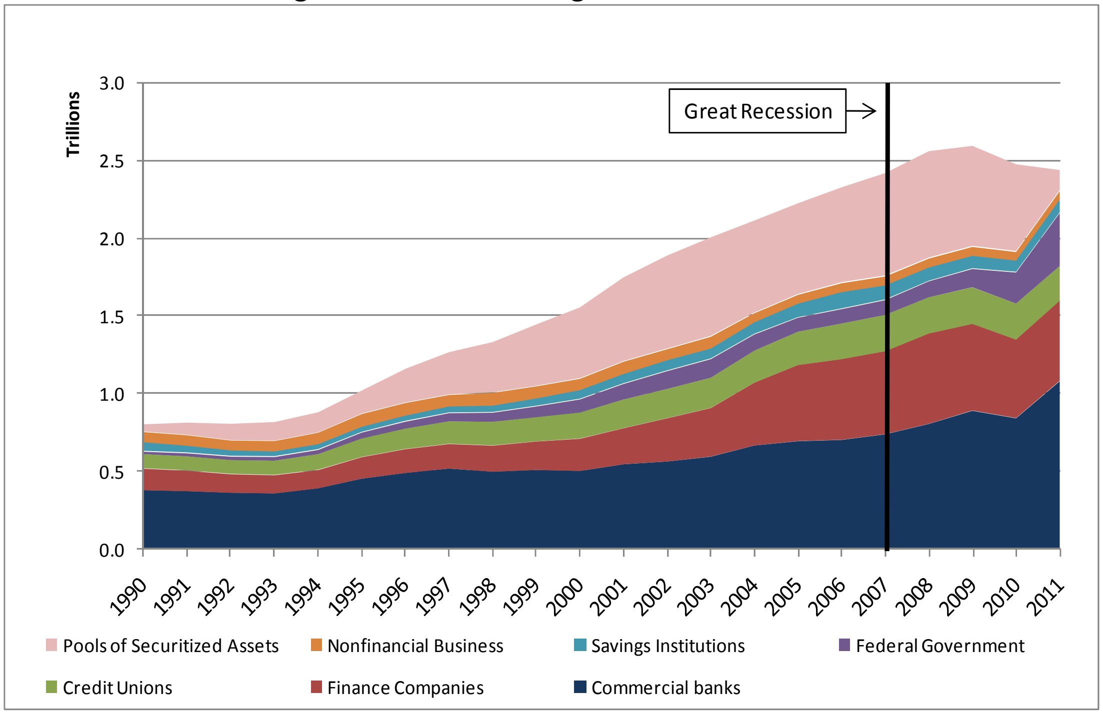
- Housing prices tracked by the S&P/Case-Shiller Index decreased by 11% in 2008 and 19% in 2009, respectively, as shown in Figure 31.
- Outstanding consumer credit declined by 6% from $2.6 trillion to $2.4 trillion from 2009 to 2011, as shown in Figure 32.
- Securitized asset pools decreased precipitously—from $682 billion to $127 billion from 2008 to 2011.

Figure 31: S&P/Case-Shiller 10 City Index



These conditions are more similar to the underlying causes and impacts of the Great Depression. Recent economic research indicates that the root causes of these contractions lead to weaker and fragile recoveries until the financial sector stabilizes, asset prices recover, and deleveraging by consumers and businesses is concluded. Consequently, economic growth is expected to be sluggish with high unemployment over longer periods of time. Recent forecasts anticipate that sustained economic growth in the United States will resume in 2014 or 2015, depending on local conditions.

Figure 32: Outstanding Consumer Credit



5.1.1.1 Long-Term Structural Trends

The recent recession has coincided with a number of long-term structural trends in the U.S. and internationally which have encumbered economic growth and employment creation. First, there have been significant productivity improvements in the form of advances in information technology, computing power, transportation, and communications. These advances encouraged the transfer of manufacturing facilities and jobs to areas with higher unemployment and lower wages. This has also shifted the engine for economic growth in the U.S. from manufacturing (from 31 percent of GDP in 1970 to 23 percent GDP in 2010) to services (from 32 percent of GDP in 1970 to 47 percent of GDP in 2010). The technology boom of the 1990s and the subsequent bust in the early 2000 intensified these trends, encouraged the expansion of inexpensive communications technologies, and further flattened factor and wage costs, internationally. Increasingly, this has led to the outsourcing of professional services. For example, X-rays can be evaluated or financial statements can be prepared cheaply and rapidly almost anywhere in the world where technical capacity exists.

Second, there has been a restructuring of the international economy with traditional trading partners (Europe and Japan) generating a decreasing share of global GDP, while other economies, including Brazil, Russia, India and China ("the BRIC countries"), comprising a larger share of the global economy. For the U.S., this has resulted in greater competition not just in manufacturing, but also in professional services, reducing direct and indirect employment.

A third trend has been the aging of the U.S population. The median age has increased from 27.9 in 1970 to 37.2 in 2010. This trend has also taken hold in Europe and Japan and is expected to eventually impact China due to its one-child policy.

Finally, there has been a rapid and significant expansion in consumer credit, which has reached unsustainable levels. As a result, consumers have reduced or deferred large discretionary purchases, such as vehicles and appliances, until debt levels have decreased to more manageable levels. These factors tend to further dampen economic growth and employment over the short-term.

5.1.1.2 Short-Term Economic Forecast

In early 2012, there was modest enthusiasm with respect to economic growth and employment, which has decreased slightly as the year has progressed. Forecasts prepared in August 2012 have reduced the forecasted growth in real GDP. The median of selected economic forecasts developed by financial institutions and industry analysts for real GDP in August 2012 (see Figure 12) was 1.7 percent, down from 2.2 percent at the start of the year. The spread among forecasts (50+ observations) is relatively small, ranging from 1.9 percent to 2.5 percent. For 2013, the consensus forecast was that real GDP would increase by 2.1 percent, albeit with a wider range—0.9 percent to 3.7 percent. Factors that may negatively impact real GDP in the short-term include the following:

- Recessionary conditions in Europe due to the weak fiscal position of Greece, Portugal, Spain, and Italy and concerns about the stability of the Euro;
- Signs of decreased economic growth in Brazil and China;
- The currently scheduled $500 billion budget cuts and/or tax increases at the end of 2012. The U.S. Congressional Budget Office (CBO) warned that the upcoming “fiscal cliff” could result in a return to recessionary conditions; and
- Increased tensions in the Middle East.

The previous and revised forecast of Real GDP for 2012 and 2013 are presented in Figure 33 and Figure 34, respectively. (As of this writing, the U.S. Federal Reserve Bank (FRB) and the International Monetary Fund (IMF) have not yet revised their forecasts.) Factors cited in these revised forecasts include slower than expected economic growth, higher than expected unemployment, flattened consumer spending, weakness in the housing market and new construction, stock market volatility, and the recent downgrade in the U.S. credit rating by Standard and Poor's. The revised forecasts, especially for 2011, barely exceed population growth, which increased by an average of 0.9% per year from 2000 to 2010.

Figure 33: Real GDP Forecasts for 2012, Previous and Revised

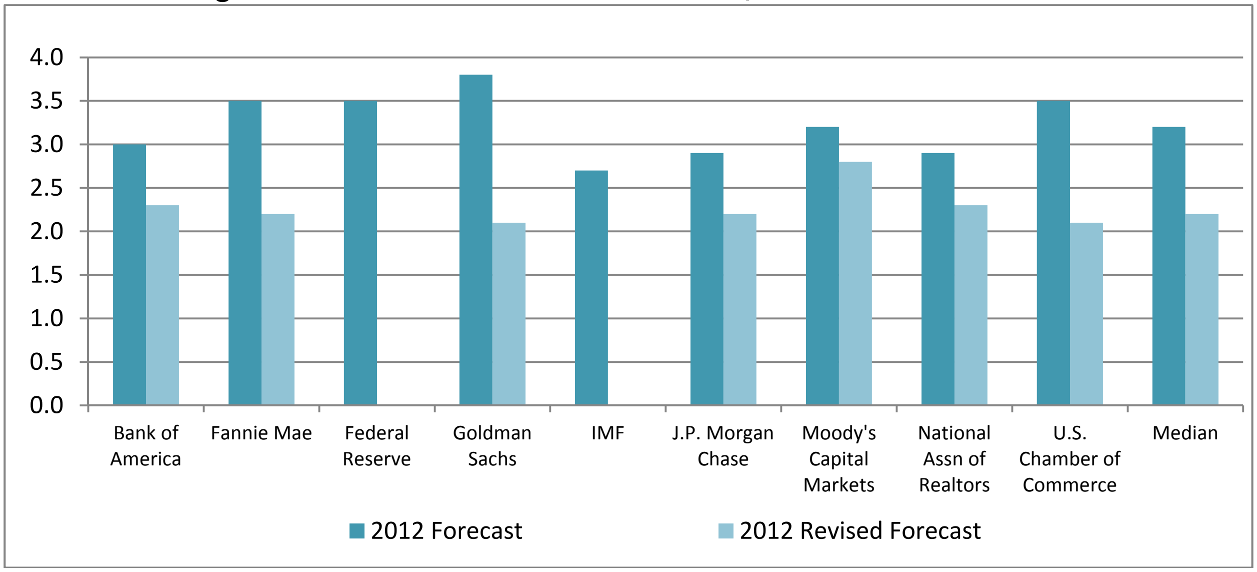
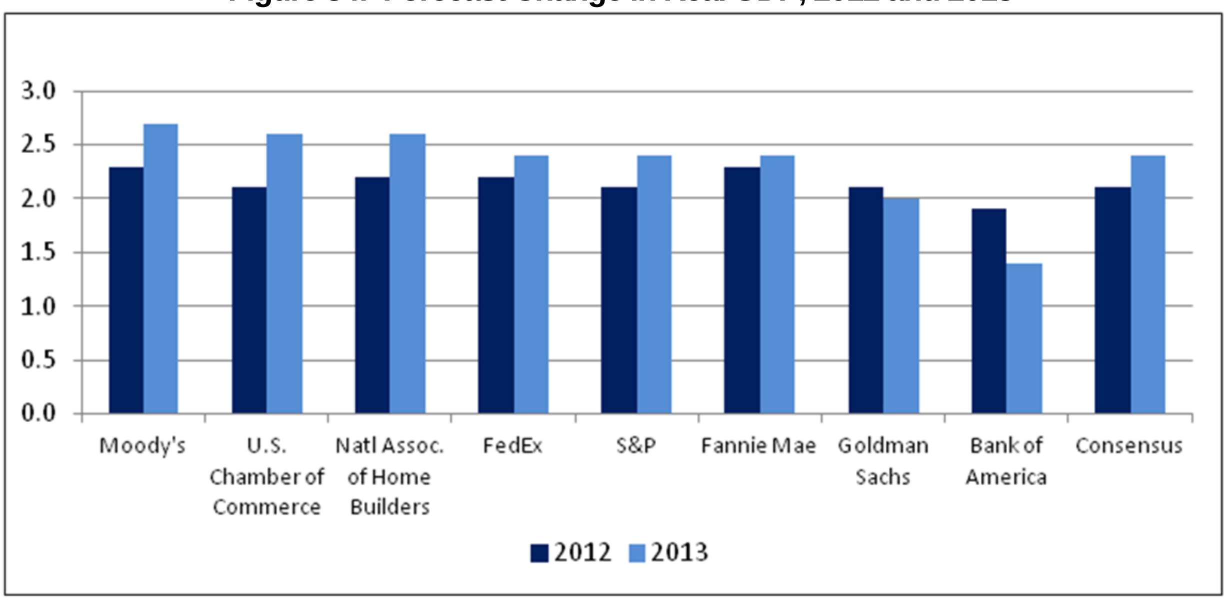


Figure 34: Forecast Change in Real GDP, 2012 and 2013



Source: Blue Chip Economic Indicators (BCIE)

These factors have renewed concerns of the possibility of a second or "double-dip" recession within the next 2-3 years, which last occurred in the early 1980s. As of this writing, none of the revised forecasts are predicting a return to recessionary conditions. Moreover, the Federal Reserve is planning to maintain its policy of low interest rates and possibly conduct another round of quantitative easing to spur economic growth. Revised forecasts are generally calling for sluggish economic growth and weak labor market conditions in 2011 with a slight improvement in 2012. Possible signs of a second recession have also not yet materialized. For example, the yield curve remains positive with short term interest rates (0-12 months) on U.S. Treasuries trading at or near zero and the interest rates on 30-year U.S. Treasuries trading at 3.75%, as of August 23, 2011. Additionally, the market for crude oil remains strong with the price expected to be close to $100/barrel for this year and next. In comparison, the price during 2009, which corresponded to the steepest part of the recession, averaged approximately $62/barrel.

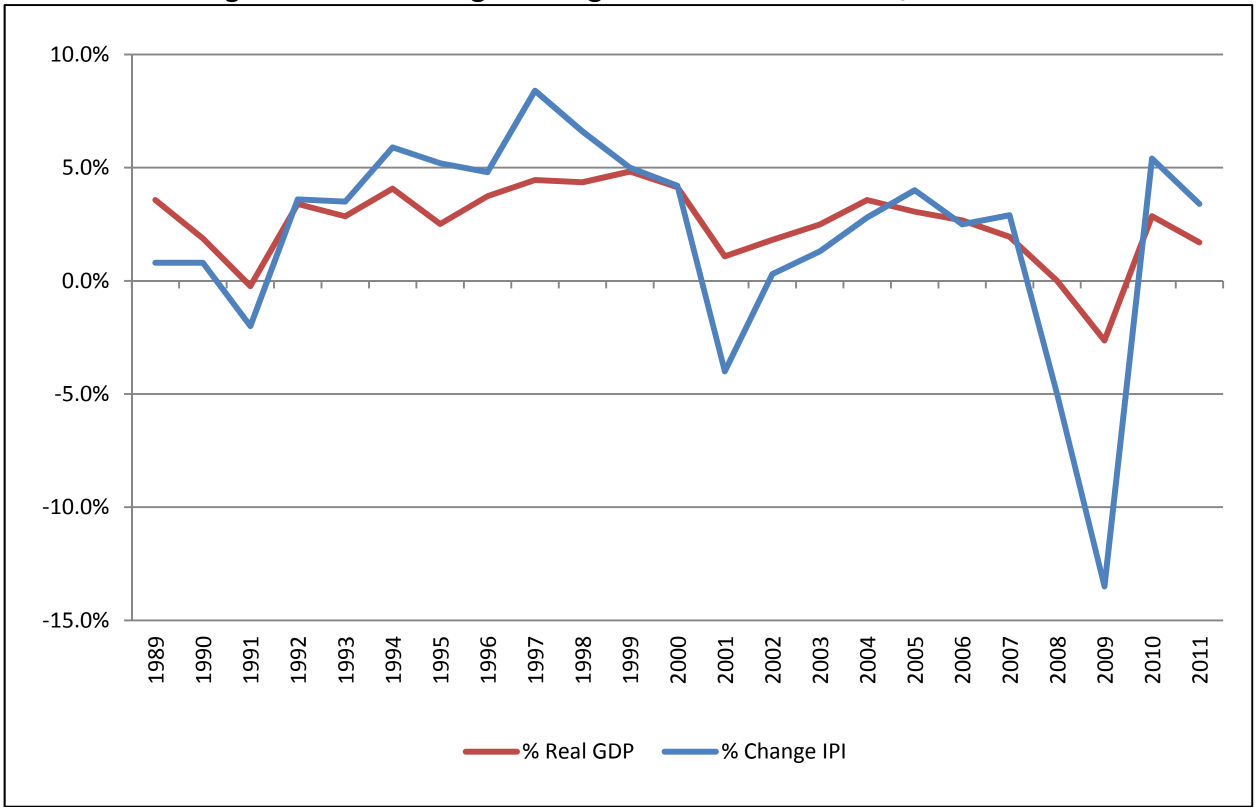
If the forecasts calling for continued slow growth materialize, then the economy will remain vulnerable to exogenous risks, which could potentially drive the U.S. economy back into recession. External events that could bring on a second recession include the ongoing European debt crises, continued volatility in the stock market which reduces investor and consumer confidence, continued instability in the Middle East, or a natural disaster (e.g. the 2011 earthquake in Japan). In particular, the European debt situation represents a key external risk that could affect economic recovery in the U.S. At the present time, there are concerns that Ireland, Portugal or Spain may join Greece in requiring assistance from the European Union or the IMF in order to avoid default. French banks are particularly exposed, which could result in a second round of financial contagion, further retrenchment in the financial sector, and another recession.

The consensus outlook of macroeconomic analysts at financial institutions and business associations is that real U.S. GDP is expected to increase on an annualized basis by 1.5 percent and 2.6 percent during 2013 and 2014, respectively. The consensus forecast for the industrial production index is a 2.5 percent increase in 2013 and 3.2 percent increase in 2014. It is anticipated that a slow recovery will emerge in the medium term in contrast to robust recoveries of previous recessions. This fits with the current base case forecast provided by Jacobs for the MDTA facilities.

5.1.1.3 Industrial Production

Changes in U.S. industrial production have historically moved in tandem with GDP, albeit with steeper decreases during recessions and larger increases during recovery periods. During the lowest point of the 2001 recession, the Industrial Production Index (IPI) decreased by 4.0 percent as shown in Figure 35. Due to the severity of the 2007-2009 recession, IPI declined -13.5 percent in 2009. Since then, IPI has recovered increasing by 5.4 percent and 3.4 percent during 2010 and 2011, respectively. Despite this recovery, the gross value of the IPI for “Final Products and Non-Industrial Supplies” is at 97 percent of its 2007 peak.

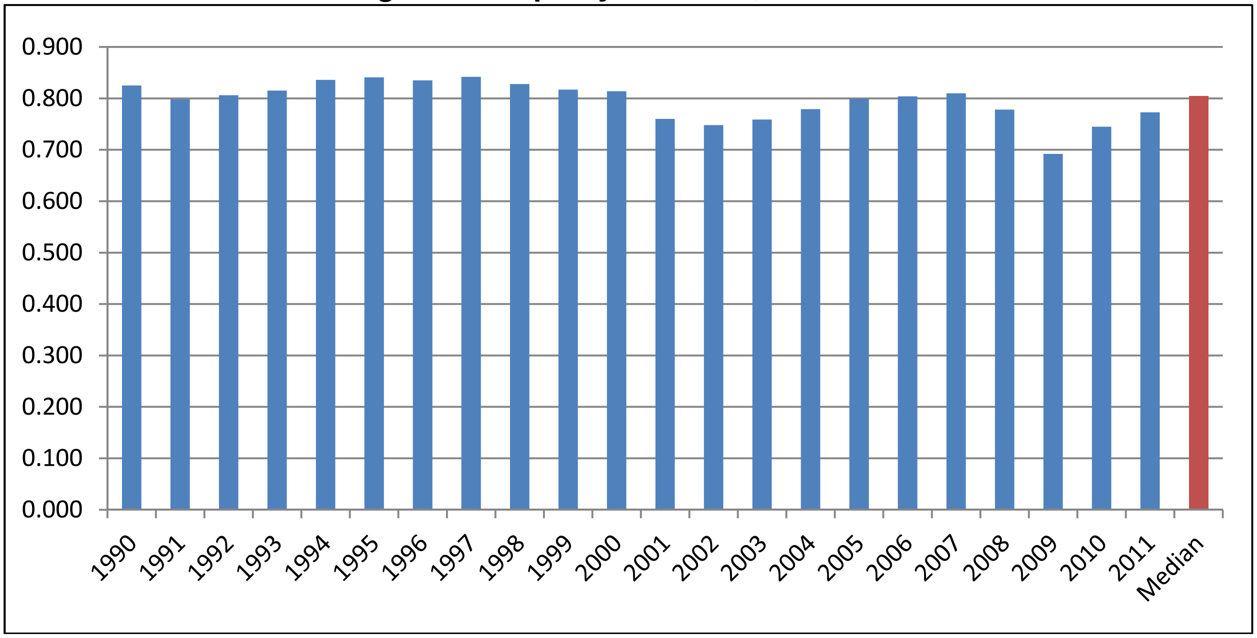
Figure 35: Percentage Change in Real GDP and IPI, 1989-2011



Source: U.S. Federal Reserve Bank

Similar to the IPI, the use of U.S manufacturing capacity also decreased significantly in 2009, as seen in Figure 36, declining to 0.692. Since then, capacity utilization has recovered to 0.773. Notwithstanding, capacity usage is currently 95 percent of the historical median value, 0.805, from 1990 to 2011.

Figure 36: Capacity Utilization, 1990-2011

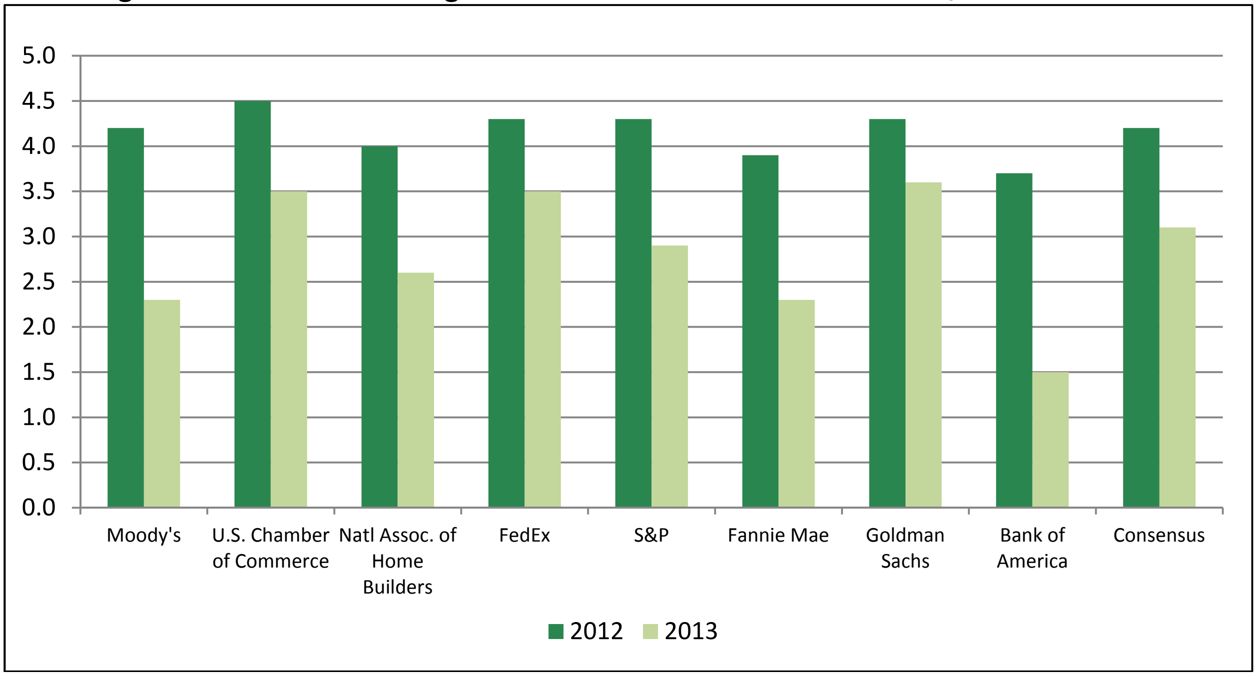


Source: U.S. Federal Reserve Bank

5.1.1.4 Industrial Production Forecasts

Based on forecasts developed by financial institutions and industry analysts, the Industrial Production Index (IPI) is forecasted to increase by 4.1 percent in 2012 and 2.8 percent in 2013. This slower forecast likely captures the decrease in exports due to the recessionary conditions in Europe and slower growth in emerging markets, including Brazil and China. Selected forecasts are shown in Figure 37.

Figure 37: Forecast Change in the Industrial Production Index, 2012 and 2013



Source: Blue Chip Economic Indicators (BCIE)

5.1.1.5 Employment

At the beginning of 2008, the national unemployment rate was 5.0 percent. By October 2009, unemployment peaked at around 10.0 percent. During 2008 and 2009, total employment decreased by 3.2 percent each year. Total employment started to recover in subsequent months with a 0.9 percent increase in 2010 and a 1.5 percent increase in 2011. The unemployment rate has decreased gradually to 7.4 percent by July 2013. Long-term forecasts of employment tend to differ, depending on varying considerations of the potential impact of long-term structural trends, such as advances in information technology, outsourcing of jobs, and an aging population.

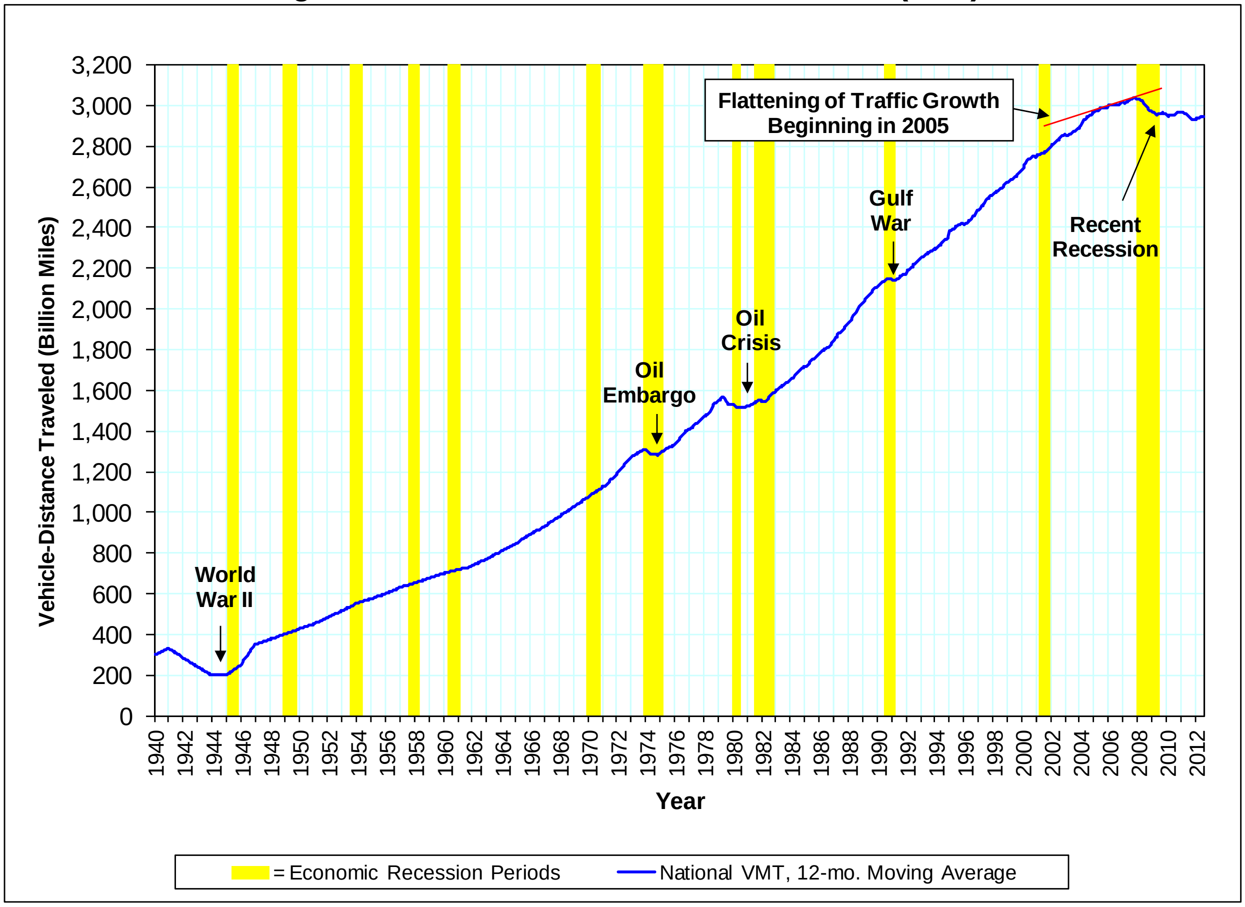
The U.S. Congressional Budget Office (CBO) has forecasted that employment would return to historical levels by 2015. However, other institutions and economic analysts are predicting historically high levels of unemployment in the U.S. through 2015 and beyond. In any event, the most recent recession has had a more severe impact on employment, especially compared to previous downturns other than the Great Depression. Similar to the Great Depression, the decrease in employment levels has been steeper and the recovery has taken a relatively long time to take hold.

5.1.2 National Trends in Vehicle Miles Traveled (VMT)

The United States has experienced a never-before-seen flattening, then drop, in vehicle-miles traveled (VMT) on its highways over the past several years. A reduction in VMT means less revenue – in the form of gas tax or tolls - for funding transportation projects. Jacobs reviewed and compiled available reports and data to investigate the possible factors contributing to this phenomenon.

Figure 38 depicts the 12-month moving total of national travel mileage from 1940 through July 2012 on all U.S. highways. As seen in this figure, there were temporary reductions in VMT during World War II, oil crises and economic recessions. Despite these temporary "dips", the VMT continued to grow rapidly over the years. It shows that, in recent years, with the exception of short, flat periods during the 1991 and 2001 recessions (each less than one year), VMT grew at a steady pace through about 2005. VMT then grew at a much slower pace through 2008. The increase in gas prices and the downturn in economic activity that took hold in late 2008 resulted in a significant reduction in total national travel mileage after December 2007 peak. While VMT declined throughout 2008, it has remained flat in 2009 until the summer months, when there was a slight increase of 0.9 percent over the previous year. This perceived growth was due in part to the large reduction in summer gas prices from 2008 to 2009. Since the recession ended, there have been slight increases and decreases in VMT from month to month with an average annual increase of about 0.9 percent between 2010 and 2012. For the first two quarters of 2013, VMT remained unchanged during Q1 and decreased slightly by 0.2 percent in Q2 over the previous year.

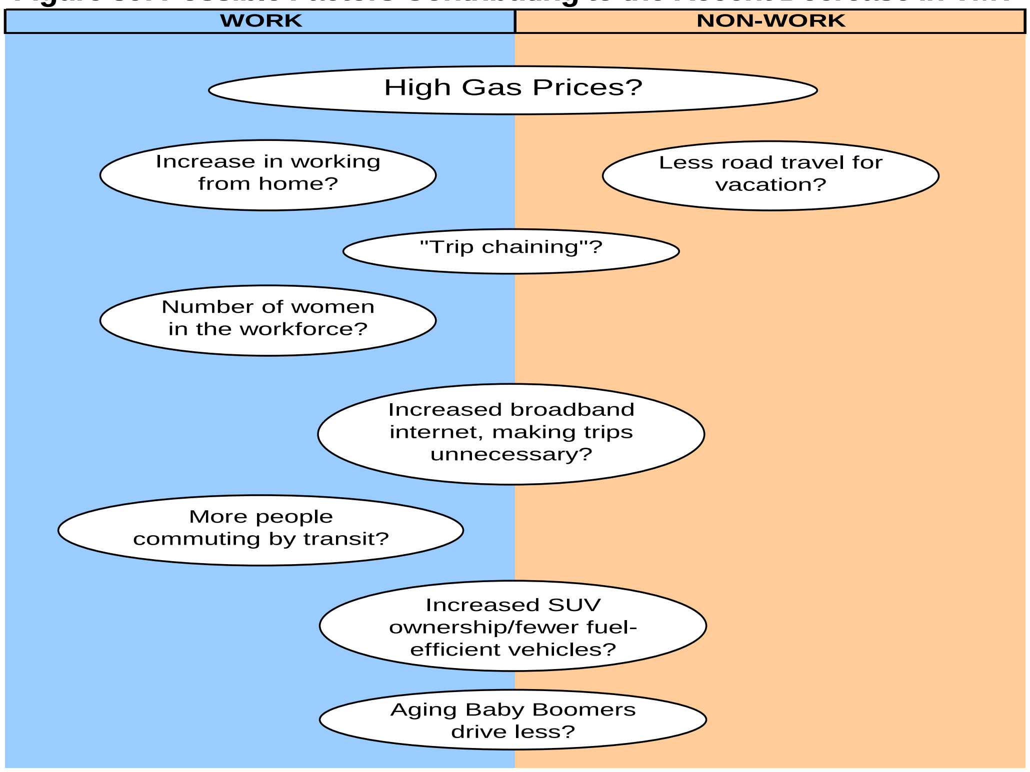
Figure 38: US Annual Vehicle Miles Traveled (VMT)



Source: Federal Highway Administration (FHWA)

Figure 39 lists some of the economic, demographic, and behavioral factors outside of the direct impact of the recession that may have caused the recent drop in VMT. The purpose of identifying these non-economic factors, is to isolate changes in travel characteristics that change the historical relationship between economy (and employment) and travel. This list includes the factors that impact work and non-work related trips. It should be noted that some factors affect both trip types.

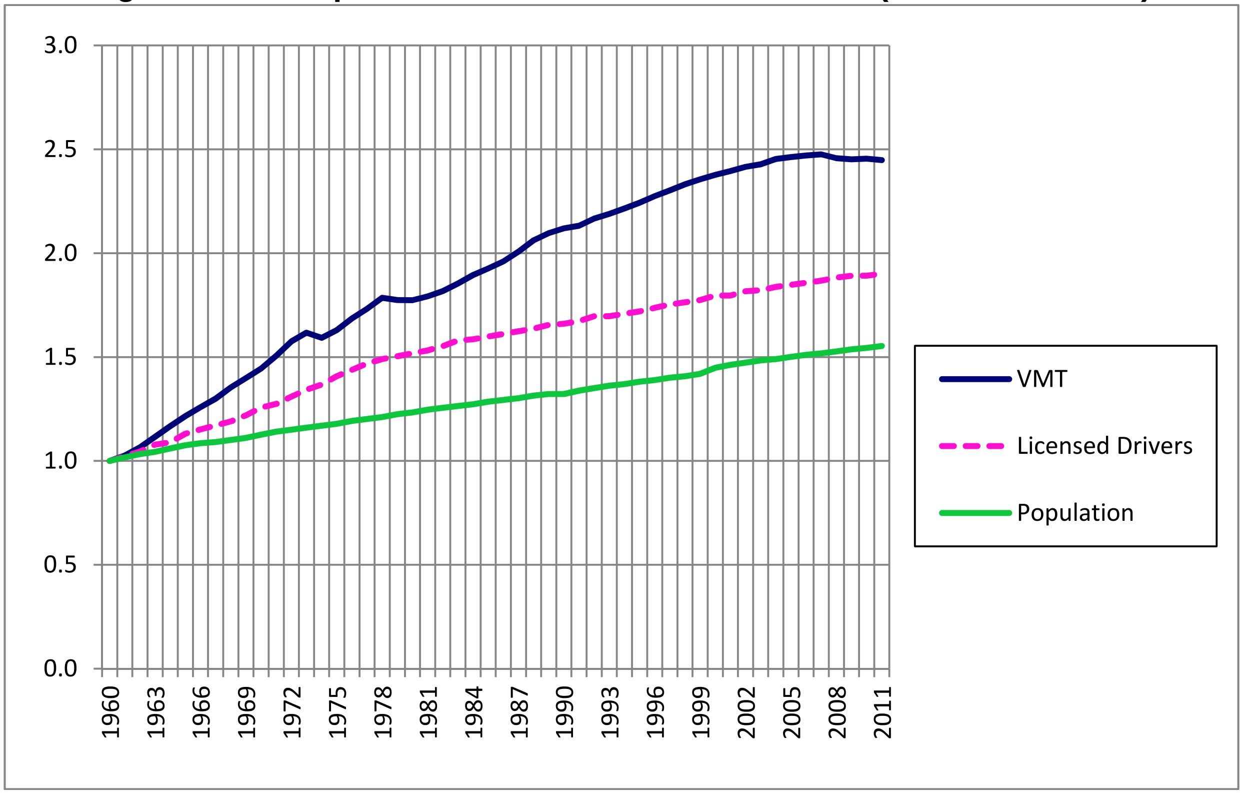
Figure 39: Possible Factors Contributing to the Recent Decrease in VMT



Source: Jacobs Consultancy

Figure 40 compares the annual change in VMT to the annual increase in total population and the number of licensed drivers in the U.S. Historically, total VMT in the U.S. has increased at a higher average annual rate compared to population and the total number of licensed drivers.

Figure 40: US Population and Licensed Drivers vs. VMT (Indexed to 1960=1)



Sources: FHWA; U.S. Census

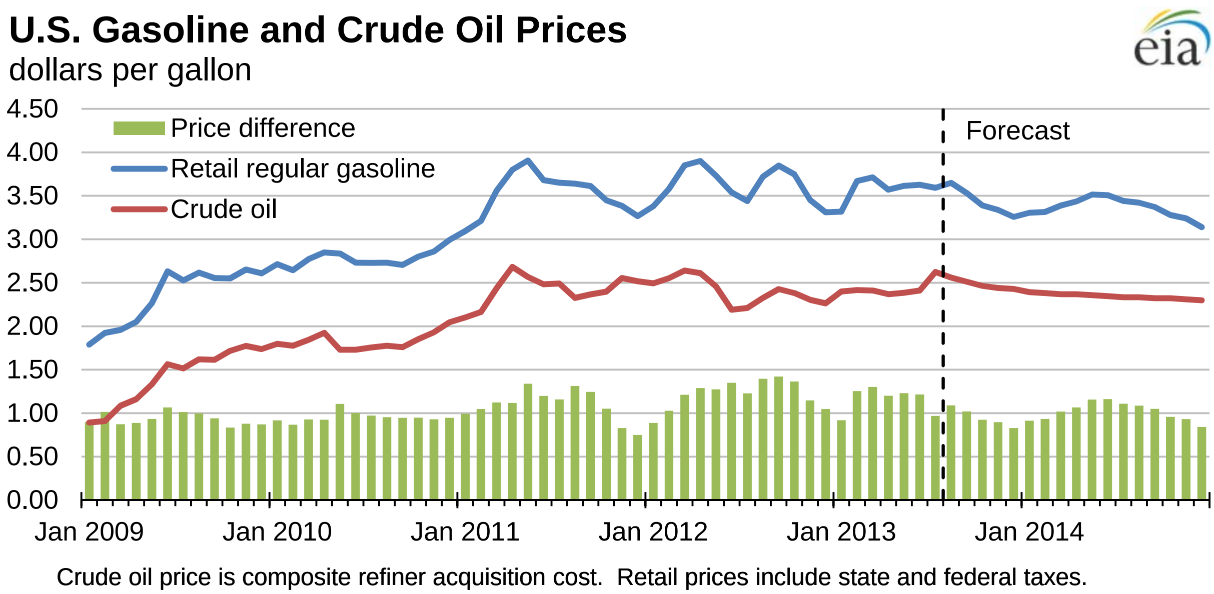
5.1.2.1Fuel Costs

A number of factors may have caused the recent drop in VMT; the jump in gas prices is often cited as a key factor. During the period of rapid oil and gasoline price increases in the summer of 2008, experts in the toll forecasting field tried to bring some perspective to the phenomenon by formulating opinions as to how motorists would modify their driving habits in lock step with price escalations. This same exercise is currently being conducted once again as the wildly fluctuating prices take hold of the economy. This is particularly important to toll road agencies as they attempt to plan for the future. In this section, we will take a look at historical and forecasted gasoline prices, our view of the motorists' perception of the fluctuating prices, historical traffic data in the face of such fluctuations and finally what the future may hold for motorists and toll road operators.

Figure 41 presents the historical and projected gasoline and crude prices from the US Energy Information Administration (EIA). The graph illustrates the peaking of gasoline prices in the summer of 2008, the precipitous drop in late 2008, and the subsequent rise to another price spike in May 2011. Prices declined throughout the summer and fall of 2011, reaching a low point in December 2011, followed by a sharp increase in April 2012. In recent months, average prices have fluctuated between about $3.32 (January 2013) and

$3.71 (March 2013). In their August 2013 report, the U.S. Energy Information Administration projects prices to continue declining to about $3.31 in early 2014, with a seasonal peak of about $3.51 in May 2014.

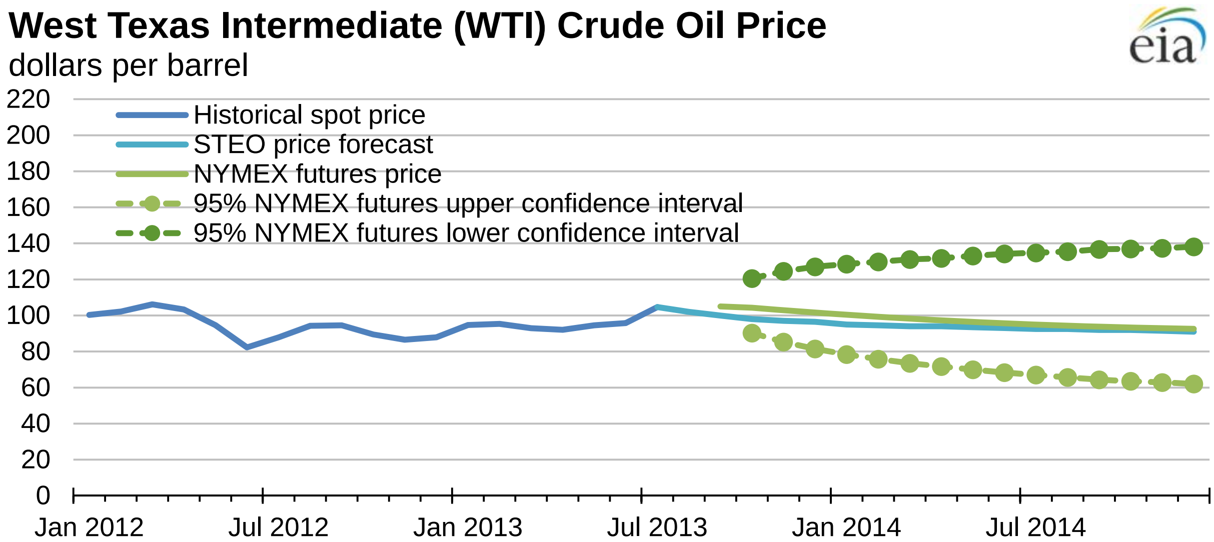
Figure 41: Historical and Projected US Gasoline and Crude Oil Prices, EIA



Source: Short-Term Energy Outlook, August 2013

This relatively static forecast of future oil and gas prices may be re-assuring; however, what this graph does not show is the level of uncertainty in these projections. Figure 42 presents the projection of West Texas Intermediate Crude Oil Price (WTI). The base projection is obviously similar to that of Figure 41, but it is the possible range of this price that is disconcerting. Based on the options markets, the 95 percent confidence interval for WTI is between 76 percent more to 38 percent less than current estimates for December 2014. With a wide range of possible future prices of oil and gasoline, projecting traffic volumes has become an increasingly difficult task.

Figure 42: Historical and Projected Crude Oil Prices with Confidence Range, EIA



Note: Confidence interval derived from options market information for the 5 trading days ending August 1, 2013. Intervals not calculated for months with sparse trading in near-the-money options contracts.

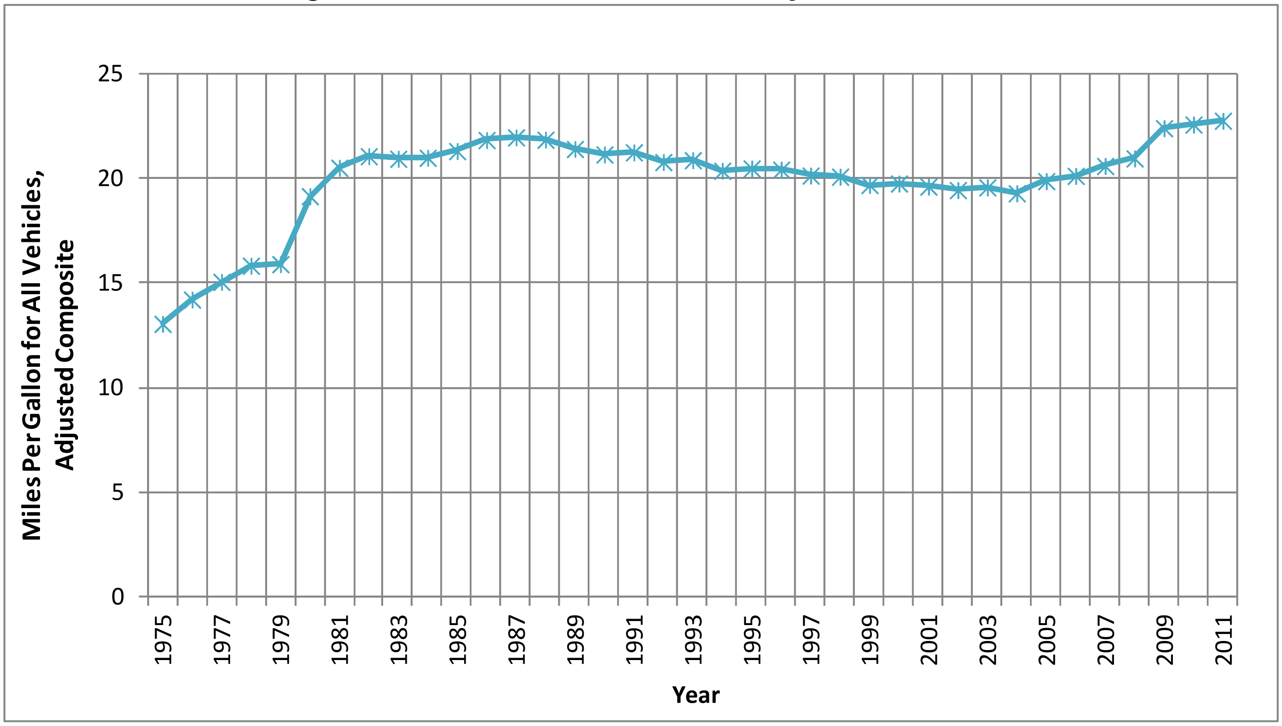
Source: Short-Term Energy Outlook, August 2013

Another consideration is the decreasing reliance on oil and gasoline as the fuel for our vehicles with the increasing fuel efficiency of vehicles, as shown in Figure 43. The sharp increase in fuel efficiency in the late 1970s was caused by the oil crisis and the trend toward buying smaller, more fuel-efficient vehicles. A gradual decline in average MPG from 1987 through 2004 occurred as larger vehicles and SUVs became more popular. From 2005 through today, that trend was again turned around, and today vehicles are more fuel-efficient than ever. This means that, generally speaking, gas prices today do not have as large an effect on drivers as it did ten years ago.

Also to consider in this discussion is the emergence and growth of hybrid and electric vehicles in the marketplace. These alternate fuel vehicles, while they of course rely on some sort of fuel source, may not be so dependent on oil in the future and a wider range of energy options from natural gas, coal, nuclear and possibly renewable sources such as solar and wind. It has been estimated that electric vehicles could constitute up to 35 percent of the market by 2025. Though these predictions vary widely by source, what is important to understand is the potential for mitigation of rising oil prices by motorists.

Also important to note is that the U.S. crude oil production has increased since 2008, reversing a decline that began in 1986. From 5 million barrels per day in 2008, U.S. crude oil production increased by 30 percent to 6.5 million barrels per day in 2012. Improvements in advanced crude oil production technologies continue to lift domestic supply, with the U.S. Energy Information Administration projecting production to increase at an annual rate of 1.9% to 7.5 million barrels per day by 2020. The net import share of U.S. petroleum grew steadily from the mid-1980s to 2005, but has fallen every year since then and the U.S. Energy Information Administration forecasts net imports of petroleum to further decline through 2019, while still providing approximately one-third of total U.S. supply.

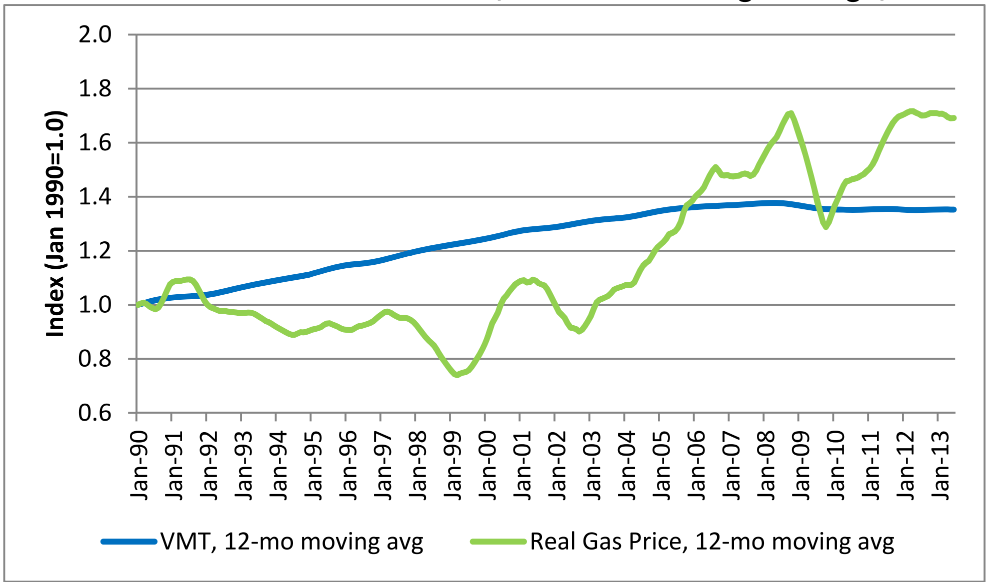
Figure 43: Historical Fuel Efficiency, 1975-2011



Source: epa.gov

To understand the potential impact of future gas prices on traffic we can look at historical reactions. Figure 44 presents historical VMT across the United States as compared to gasoline prices from 1990 through June 2013. Both the VMT and real gas prices represent a 12-month moving average to remove any seasonality factors; all data are indexed to the 12 months ending January 1990. While the Great Recession began in the fall of 2008, there was still a flattening, then decline, in vehicle miles that started several years before. This may be partially attributed to rising gas prices. The continuation of the decline, post-fall 2008, would be more attributable to the economic meltdown, as gas prices dropped significantly by early 2009. Gas prices have generally increased since then, and VMT has slightly declined. Due to the recession and slow recovery period, it has been difficult to pinpoint the elasticity of travel as it relates to gas price; however, we can roughly estimate about a five percent loss in VMT nationwide due to the doubling in gas prices from 2003 through today.

Figure 44: National VMT vs. Real Gas Prices, 12-Month Moving Average, 1990-June 2013



Continuously high gas prices could permanently modify the typical American's perception of our assumed right to drive our vehicles in the manner to which we are accustomed. There are, of course, a number of longer term strategies that could be undertaken to help offset the effects of oil/gasoline price peaking, including some of the following:

- Mandatory, as well as voluntary, increases in fuel efficiency
- Increased transportation mode choice shifts
- Regulation of pricing
- Increased taxation
- Rationing
- Increased production and use of non-petroleum fuels

In addition, there are a number of new technologies that might help replace oil consumption in transportation thus mitigating the continued dependence on oil and the resultant price rises on gasoline. These include some of the following:

- The use of Ethanol and Biodiesel fuels
- Coal and Biomass Gas-to-liquid (GTL)
- Natural Gas
- Advanced Vehicle Technologies which should include:
    - o increasing the efficiency of the internal combustion engine,

- continued proliferation of hybrid electric and plug-in hybrid electric vehicles,
- continued ongoing work to improve the efficiency of conventional vehicles, and
- continued work on the use of Hydrogen Fuel Cell Vehicles.

All of these envisioned efforts depend on the continued subtle changes in the market forces on the speculation of futures related to oil prices; gradual, less dramatic rises in the price of oil crude per barrel; already anticipated resources which dictate supply and demand, and finally, the mitigation of all the natural forces of weather and other "acts of God" on the availability of crude oil on which to run our economic engines. What is not envisioned, and cannot be sustained for a very long period of time, is that nothing is done to mitigate our oil dependency while waiting for one or more of the changes mentioned above to become anything more than a "subtle change" and enter the realm of dramatic, unavoidable or unanticipated.

What is equally certain is that the future continues to be unknown, and that over the next few years, increases in oil prices caused by disruptions to supply and demand, natural disaster or artificially speculative market forces, will not only change our driving behavior, but ultimately become a very significant challenge to an increasingly global economy. The measurement of how dramatically each rise in the price per barrel of oil makes on travel beyond the currently-known relationships is, of course, related to the specifics of individual markets.

5.1.2.2 Work vs. Non-Work Travel

The 2009 National Household Travel Survey converted the number of trips by purpose and distance into VMT, which is summarized in Table 4. According to the 2009 survey, trips commuting to/from work and work related trips accounted for almost 28 percent of total VMT. The next highest categories were trips related to social/recreational activities and family/personal business, which accounted for 24 percent and 18 percent of total VMT, respectively. In addition, shopping related trips accounted for 15 percent of VMT. Finally, other trips, which include medical and religious related trips, accounted for about 15 percent of total VMT in 2009.

Table 4: Share of VMT by Trip Purpose, 2009

Purpose	Percentage of Total VMT
Commuting and Work Related Business	27.8%
Social/Recreational	24.4%
Family/Personal Business	17.7%
Shopping	15.0%
Other	15.1%

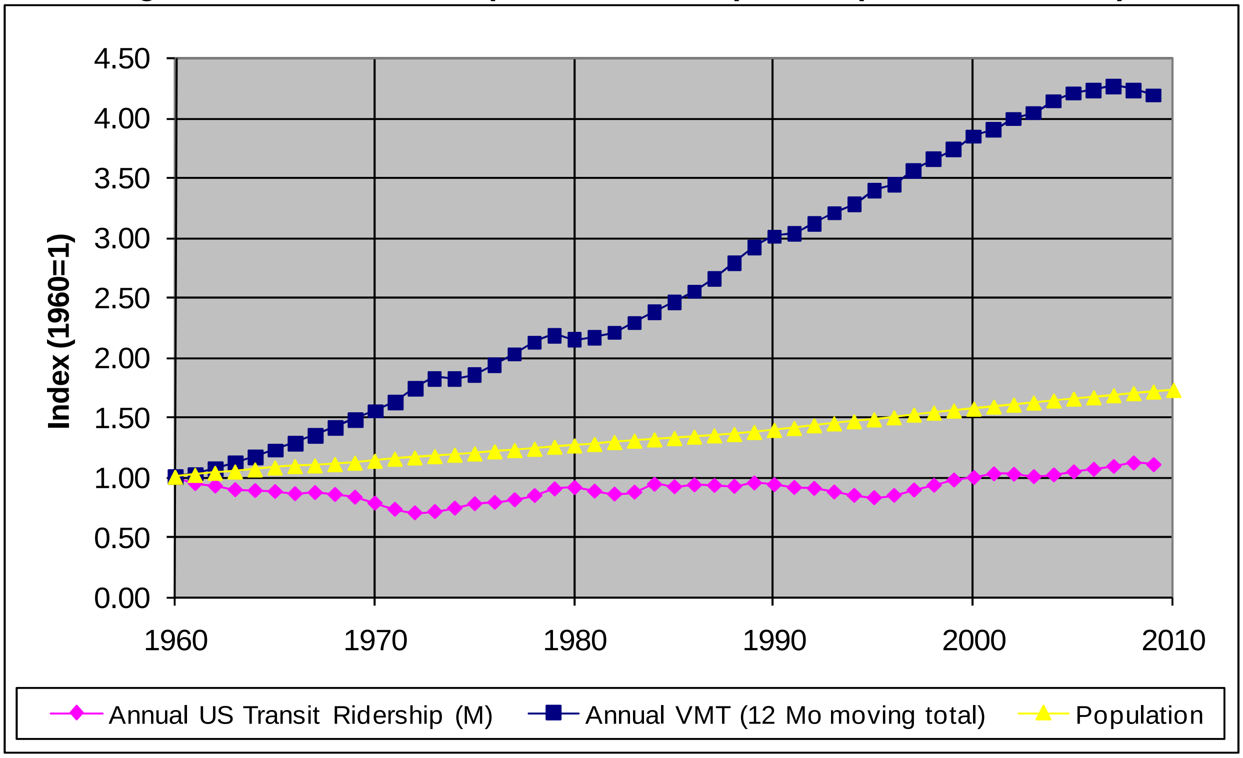
Source: 2009 National Household Travel Survey, U.S. Department of Transportation

5.1.2.3 Transit

The ease, widespread availability, and comparative cost of using passenger cars compared to other transportation modes increased dramatically throughout the 20th century. Changes in land-use patterns, increased development in suburban areas, and the relatively higher allocation of funding to highway projects has resulted in a relatively sustained decline in transit ridership levels from 1960 onward. During the 1970s, transit ridership decreased to approximately 60 percent of 1960 levels. Based on data published by the American Public Transportation Association (APTA), transit ridership returned to 1960 levels in 1990, decreased again during most of the decade, and then bounced back to historical levels in 2000. Since 2000, transit ridership has continued to grow, with a small decrease in 2009. This decrease is likely due to job losses.

Figure 45 compares the annual growth in transit ridership in relation to VMT and population. Transit ridership includes both work and non-work trips. Although there has been a 10 percent increase in transit trips from 1960 to 2009, population has increased by 72 percent and VMT has increased by over 300 percent.

Figure 45: Transit Ridership vs. VMT and Population (Indexed to 1960=1)



Source: APTA 2011 Public Transportation Fact Book

However, passenger miles traveled (PMT) has kept pace with or exceeded highway VMT since 1995. This trend encompasses the slight decrease in transit PMT that occurred from

2002 to 2005 possibly as a result of post-9/11 fears. The growth in transit PMT may be attributed to the following factors:

(i) the improved/expanded transit service in urban and suburban areas;

(ii) the increased growth of suburban areas which has supported the development of long-distance bus and rail commuter lines;

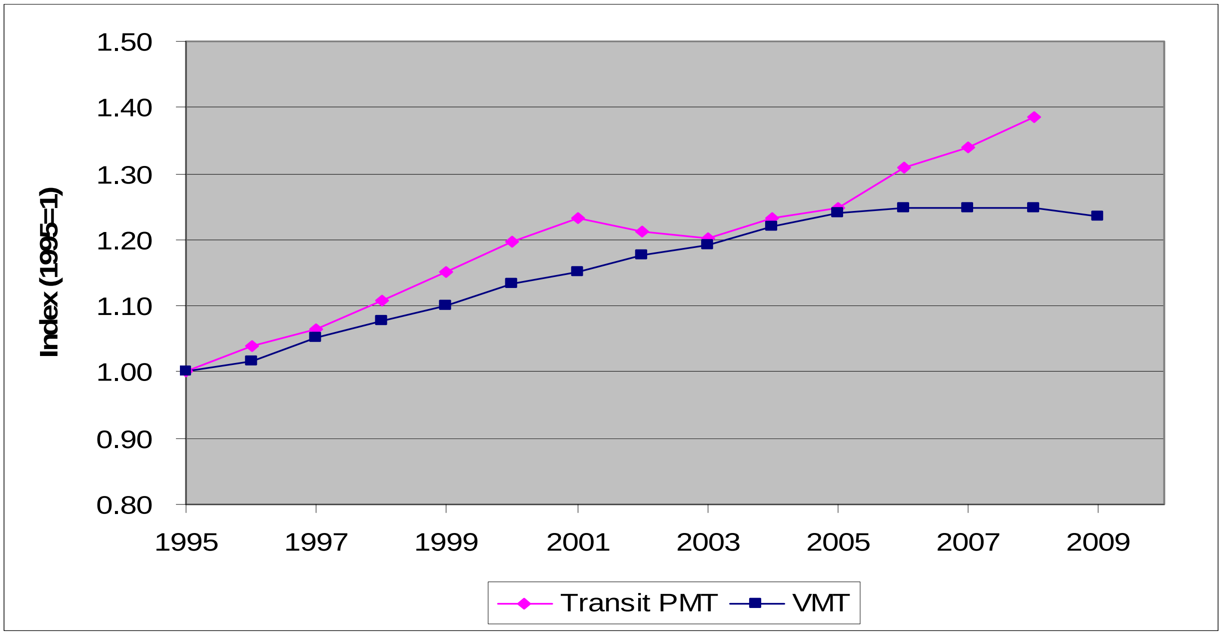
(iii) the increase in congestion on urban and suburban roadways, particularly to/from major employment centers;

(iv) the recent increase in gasoline prices which has made transit a potentially more cost-effective means for some individuals; and

(v) the increase in the number of individuals over the age of 65, who are less likely to drive.

Figure 46 compares the annual change in transit PMT and highway VMT from 1995 to 2009.

Figure 46: Transit PMT vs. Highway VMT (Indexed to 1995=1)



Sources: APTA 2010 Public Transportation Fact Book

5.1.2.4 Discretionary Travel, Telecommuting and the Internet

The advent and widespread usage of the internet more than 15 years ago has brought about a whole new information age, whereby, many people now use it as the main tool for the retrieval and exchange of information, social communication, entertainment, and the purchase of goods and services. In theory, increased internet usage would make some vehicle trips unnecessary. According to the Pew Research Center, the share of U.S. households with broadband internet increased from 4 percent in 2000 to 70 percent in May

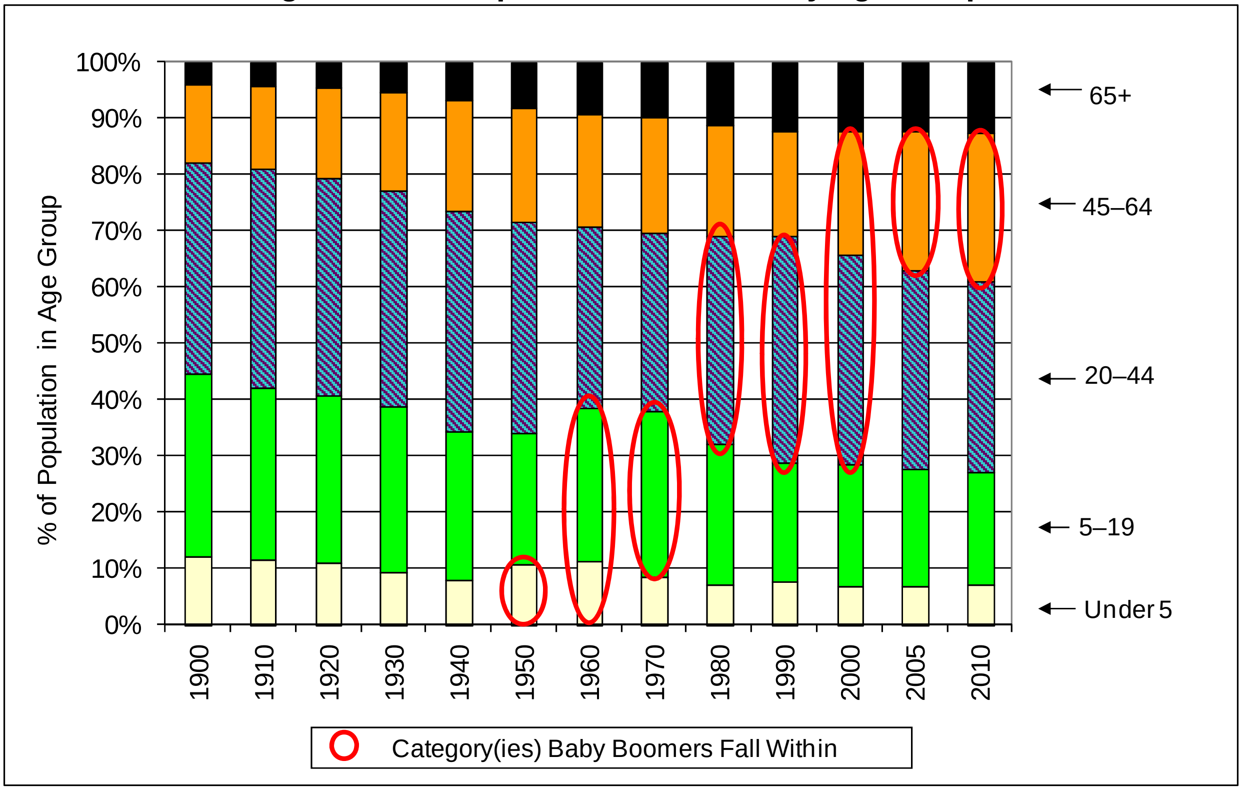
2013. According to Nielsen Online, Americans currently spend an average of nearly 60 hours per month on the internet or about two hours per day. A 2000 study by the Stanford Institute for the Quantitative Study of Society (SIQSS) included a survey of more than 4,000 adults nationwide, which sought to evaluate how the internet has affected society. This study revealed that with more time spent online, there is a decrease in social contact, time spent commuting, and time spent shopping. These studies suggest that increases in internet usage and speed may have caused a decrease in discretionary travel.

An increase in telecommuting may have also caused a small decrease in national VMT. Individuals who work from home save on the time and expense of commuting. With the widespread availability of cell phones, high-speed internet service, and laptop computers, it has become increasingly easier for work in certain employment sectors, e.g. sales, management, professional services, and information technology, to be conducted from home. The Dieringer Research Group, Inc. in their June 2011 survey brief, *"Telework 2011,"* found that the number of employees telecommuting at least once a month decreased by 22 percent from 33.7million in 2008 to 26.2 million in 2010. Nearly 12 million workers in 2010, which constituted 9 percent of the labor force, telecommute almost every day. The decrease in trips to the office likely had a small effect on the decline in VMT.

5.1.2.5 Age

Shifts in the age of the U.S. population will also impact VMT. Figure 47 shows how the population within each age group changed from 1900 to 2010. The post-World War II baby boom brought about a significant spike in birth rates between 1946 and 1964. However, the percentage of the population in the 20 to 44 age group, which typically produces the most VMT, has declined since 1990. At the same time, the 45 to 64 age group and the 65+ age groups have steadily increased in size.

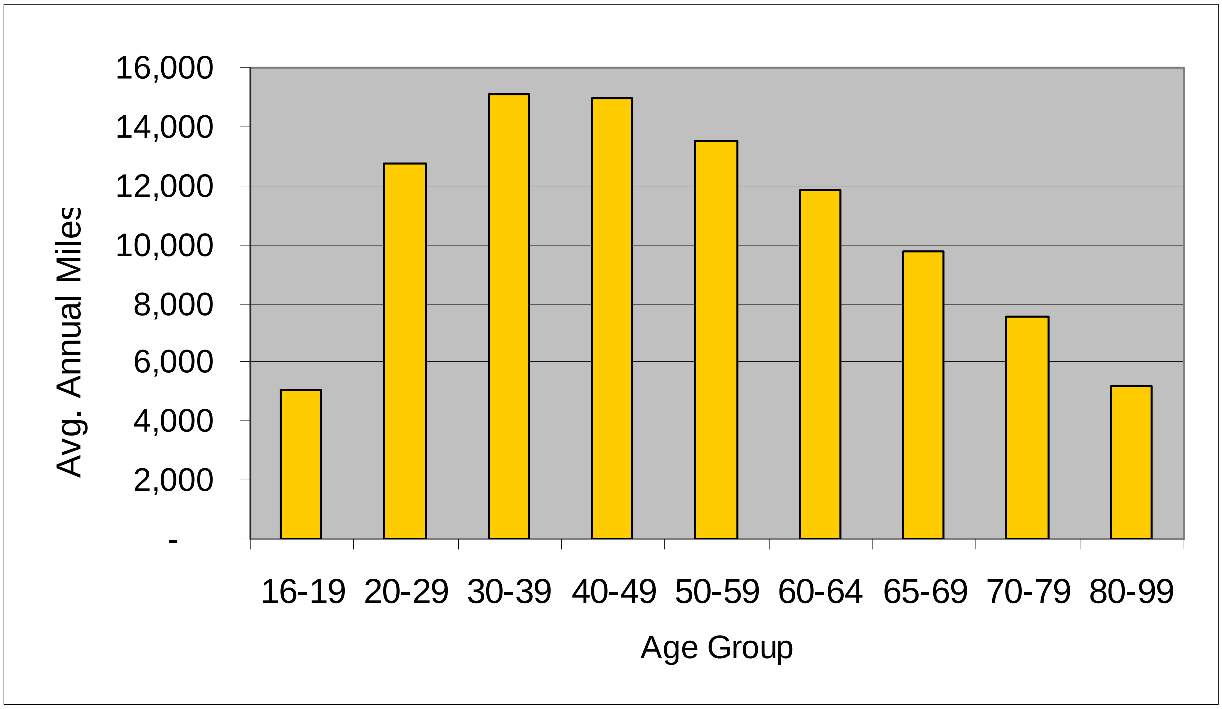
Figure 47: US Population Distribution by Age Group



Source: US Census Bureau

Based on previous studies, individuals tend to gradually drive less as they age, especially after the age of 40. Figure 48 summarizes the results from the 2009 National Household Travel Survey and the number of VMT per person by age group. This data highlights the impact of an aging population on national VMT. In 2009, the 30-39 age group recorded the highest average VMT per person; approximately 15,100 for the year. The next highest groups were the 40-49 age group and the 50-59 age group which recorded slightly less than 15,000 VMT/person and 13,500 VMT/person, respectively. The 60-64 age group recorded about 11,800 VMT/person in 2009, while those in the 65-69, 70-79 and 80-99 age groups averaged about 9,800, 7,600 and 5,200 miles in 2009, respectively. With the aging of the Baby Boomer population, as shown in the previous chart, the average VMT per person had been decreasing over the past decade. This, plus increased longevity, is expected to have a long-term effect on VMT; traffic growth is not expected to return to the rates achieved in the 1980s and 1990s.

Figure 48: Average VMT per Person by Age Range, 2009

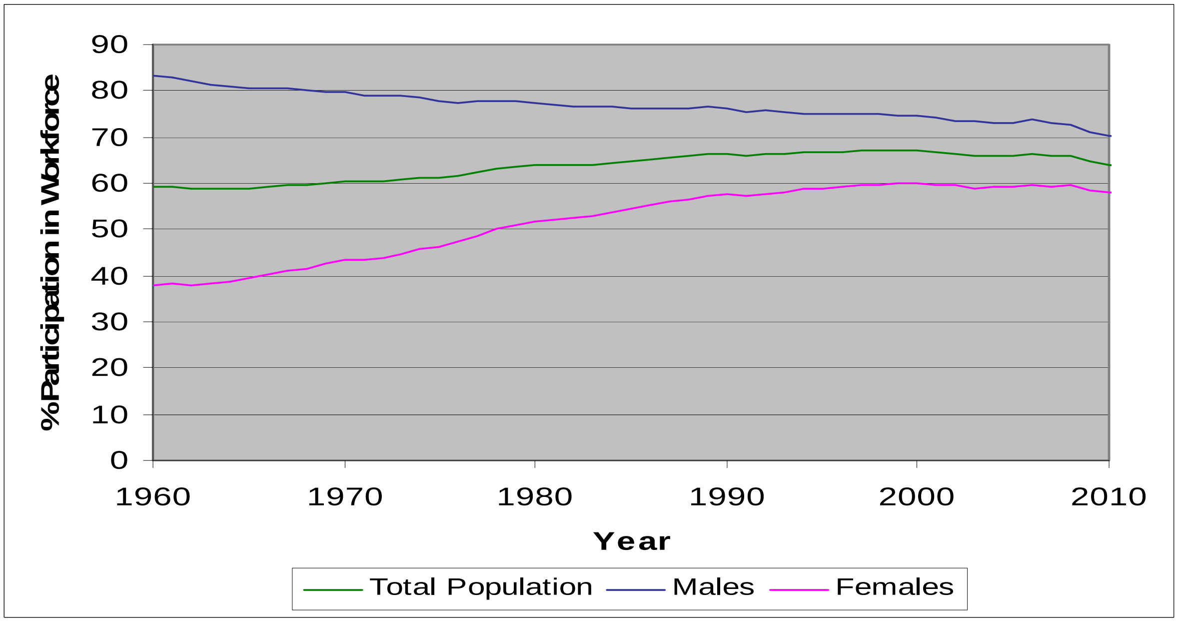


Source: 2009 National Household Travel Survey, U.S. Department of Transportation

5.1.2.6 Women in the Workforce

Female participation in the workforce rose dramatically from the mid-1960s to around 2000, increasing from 38 percent to 60 percent of the total workforce. This trend has also contributed to the historical growth in VMT. As a result of the recent economic downturn, the participation in the workforce for each gender as a percentage of the total population has decreased. Approximately 59 percent of women and 71 percent of men currently participate in the workforce. These rates are expected to decrease with the continued aging and retirement of the Baby Boomer generation. Figure 49 summarizes the historical participation of each gender in the U.S. labor force.

Figure 49: Participation in the Workforce by Gender



Source: US Department of Labor Bureau of Labor Statistics

5.2 Regional Socio-Economic Trends

The previous section reviewed national indicators of both economic and VMT growth. In the following section, trends in regional socio-economic factors are reviewed including population, employment, income, travel patterns and a comparative review of VMT and MDTA transaction trends during the most recent recessions.

In comparison with the rest of the United States, the 2007-09 recession impacted Maryland at a much later date and has been relatively shallow. Real Gross State Product (GSP) in Maryland expanded by 1.6% in 2007 and 1.3% in 2008 before contracting by -1.3% in 2009. Economic output subsequently recovered, increasing by 3.3% in 2010, but slowed to 2.4% in 2012. Unemployment in Maryland has remained relatively low with a 7.0% unemployment rate reported for June 2013. Factors that have been encouraging for economic growth in the State include the following:

- The Federal government has helped to buoy employment in the Washington, D.C., area which includes Montgomery and Prince George's County. The government sector accounted for 18% of Maryland's Gross State Product (GSP) in 2011. This amount was split evenly between Federal/military and state/local government;
- Other leading sectors of Maryland's economy include finance, insurance, and real estate (21% of real GSP), professional/management services (14%), and wholesale and retail trade (10%), and health care (8%), and manufacturing (7%); and

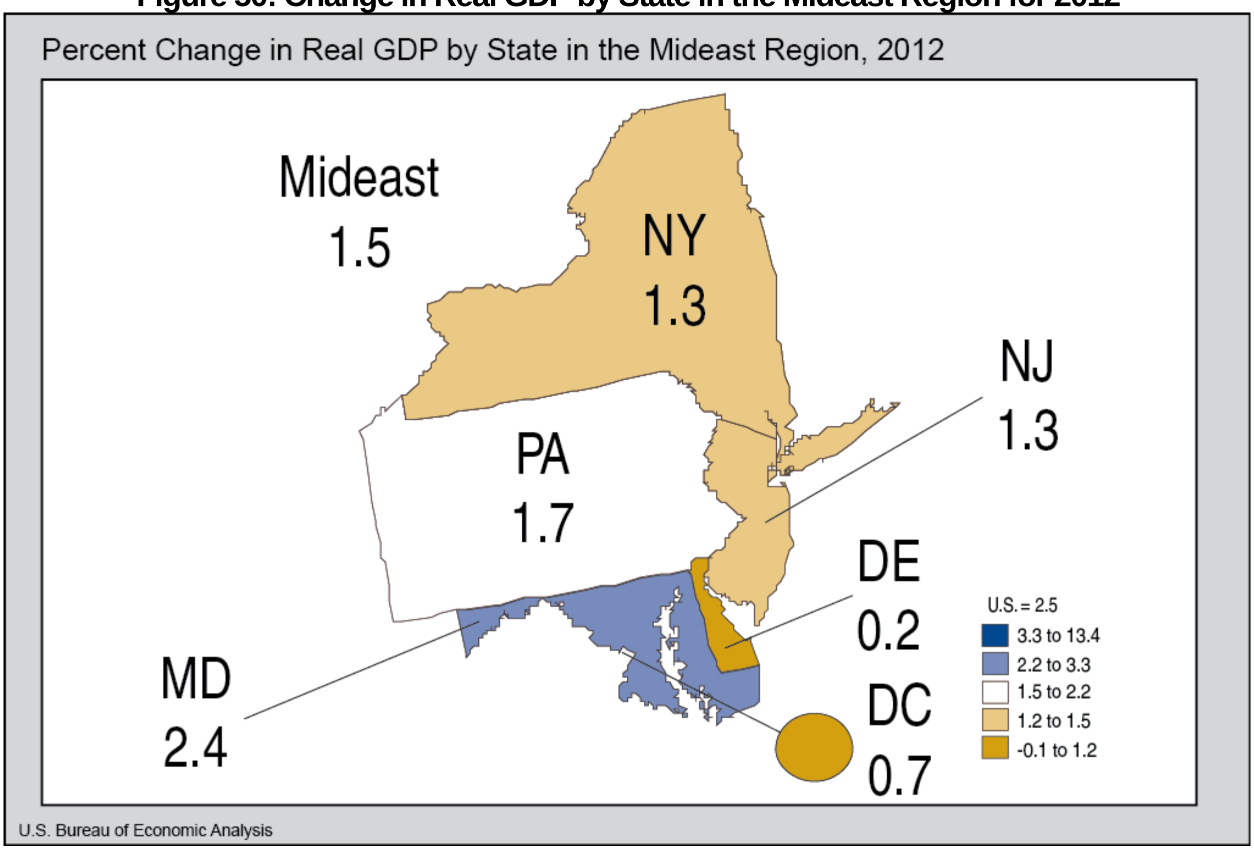
- Maryland had the 3rd highest median household income ($64,025) in 2010, behind only New Hampshire ($66,707) and Connecticut ($66,452)

Despite the 2007-09 Recession, the two largest Metropolitan Statistical Areas (MSAs)—Washington, D.C. and Baltimore MSA—located in or adjacent to Maryland exhibited relatively strong economic growth. Real Gross Regional Product (GRP) in the Baltimore MSA increased by 3.6 percent and 1.1 percent in 2010 and 2011, respectively. The Washington D.C. MSA experienced even less of an impact from the 2007-09 recession, as real GRP increased every year except in 2009, which remained flat from the previous year.

The Baltimore MSA followed similar growth patterns as Maryland as a whole with real GDP growing by 1.5 percent in 2011 and 2.4 percent in 2012 as illustrated in Figure 50.

Important to note is that the sequester cuts that went into effect March 1, 2013 with the objective of reducing federal spending by $85 billion during FY 2013, are projected to reduce the nation's GDP by $158 billion, an amount equivalent to one percentage point in projected GDP growth for 2013. According to the Center of Regional Analysis at George Mason University, Maryland could be impacted with up to 84,000 direct, indirect and induced job losses as a result of the sequester cuts or roughly 2% of its labor force.

Figure 50: Change in Real GDP by State in the Mideast Region for 2012



5.2.1 Population Trends

Between 2000 and 2012, population in the state of Maryland increased from approximately 5.3 million to 5.9 million residents, representing an average annual increase of 0.9 percent. Maryland's population is highly urbanized with sixteen of twenty-two counties forming part of a larger metropolitan area, accounting for almost 85 percent of the total population.

Population growth has been somewhat uneven as there have been stronger increases in suburban areas, while there have population decreases in Western Maryland and in Baltimore City. In particular, eight counties experienced annual growth rates in population of 1.5 percent or greater between 2000 and 2010. These counties include Calvert County, Worchester County, Howard County, Frederick County, Carroll County, Cecil County, Harford County, Queen Anne's County, Charles County, and Montgomery County.

From 2000 to 2012, the Baltimore MSA increased at an average annual rate of 0.6%, while the Maryland counties located in the Washington, D.C. MSA increased by 1.2%. The table below summarizes historical and forecast population growth for Maryland as well as five regions within Maryland defined by the Maryland Department of Planning. Table 5 shows historical population and forecast population growth for regions within Maryland and for the state as a whole.

Table 5: Historical and Projected Population in Maryland, 1990-2040

Year	Baltimore Metro	Washington D.C. Metro	Southern Maryland	Western Maryland	Eastern Shore	Total	CAGR (1)
1990	2,348,219	1,635,788	228,500	224,477	343,769	4,780,753	1.03%
2000	2,512,431	1,870,133	281,320	236,699	395,903	5,296,486	0.87%
2010	2,662,691	2,068,582	340,439	252,614	449,226	5,773,552	0.64%
2015	2,725,650	2,145,350	362,850	259,350	468,800	5,962,000	0.84%
2020	2,816,250	2,235,750	395,100	269,450	499,600	6,216,150	0.67%
2025	2,875,500	2,318,500	426,200	280,450	527,600	6,428,250	0.56%
2030	2,919,450	2,398,800	451,100	290,500	552,050	6,611,900	0.37%
2040	2,973,600	2,502,050	485,650	305,650	594,950	6,861,900	N/A

Sources: Maryland Department of Planning, Planning Data Services, March 2012.
(1) Compound Annual Growth Rate for Maryland

Road usage on Maryland's seven legacy toll facilities will also be impacted as by population growth in neighboring states. In particular, traffic coming from the Philadelphia and Washington, D.C. Metropolitan areas will likely have an effect on the John F. Kennedy Memorial Highway (I-95) as well as on the toll bridges and tunnels in Baltimore. Additionally, the William Preston Lane Jr. Memorial (Bay) Bridge (US50/301) represents a critical entry point to the tourist areas on the Eastern Shore. Finally, the Governor Harry W. Nice

Memorial Bridge (US 301) in Charles County, MD is another entry point to King George and Stafford counties in Virginia. Table 6 summarizes the historical and forecasted population increases in Maryland, Delaware, Washington, D.C. and its Northern Virginia suburbs, and the Philadelphia metropolitan area. In all, this region had a total population of about 13.6 million inhabitants in 2010. By 2040, total population in the region is expected to increase to beyond 16.4 million, representing a 0.6 percent annual average increase.

Table 6: Historical and Projected Population in Maryland and in Adjacent States and Major Metropolitan Areas, 2000-2040 (in thousands)

Year	Maryland	District of Columbia	Delaware	Northern Virginia	Southern Penn.	Total	CAGR (1)
1990	4,780,753	606,900	666,168	1,527,636	3,728,909	11,310,366	0.93%
2000	5,296,486	572,053	786,408	1,908,100	3,849,664	12,412,711	0.93%
2010	5,773,552	601,723	899,773	2,334,423	4,008,994	13,618,465	0.77%
2020	6,216,150	676,326	989,170	2,693,694	4,128,746	14,704,086	0.67%
2030	6,611,900	722,763	1,064,393	2,984,479	4,340,620	15,724,155	0.42%
2040	6,861,900	771,165	1,125,742	3,172,228	4,469,538	16,400,573	N/A

Sources: Maryland Department of Planning, Planning Data Services, Metropolitan Washington Council of Governments, Delaware Valley Regional Planning Commission and the Delaware Office of State Planning Coordination

(1) Compound Annual Growth Rate for Total

5.2.2 Labor Force and Employment Trends

The growing population in Maryland has had a direct influence on the state's labor force and employment. From 1990 to 2010, total employment in Maryland increased by approximately 627,000, which translates into an average annual growth rate of 1.0% during this period. Recent projections prepared by the Maryland Department of Planning estimate that total employment will increase by approximately 1.21%/year through 2015, decreasing to an estimated 1.05%/year from 2015 to 2020. This would represent the addition of approximately 209,000 and 190,000 net new employment from 2010 to 2015 and from 2015 to 2020, respectively. Employment growth has been projected to gradually taper down to 0.42%/year from 2030 to 2040. The table below summarizes the historical and forecast labor force in Maryland and for the five regions defined by the Maryland Department of Planning.

Table 7: Historical and Projected Potential Labor Force in Maryland, by Region 1990-2040

Year	Baltimore Metro	Washington, DC Suburbs	Southern Maryland	Western Maryland	Eastern Shore	Total	CAGR (1)
1990	1,781,317	1,379,195	177,903	147,933	250,482	3,736,830	
2000	1,905,321	1,498,033	221,824	163,115	297,649	4,085,942	0.93%
2010	2,078,308	1,721,433	269,777	179,392	335,201	4,584,110	1.22%
2015	2,143,414	1,790,484	290,331	186,445	351,226	4,761,900	0.78%
2020	2,220,791	1,871,288	317,799	196,091	375,431	4,981,400	0.92%
2025	2,270,995	1,947,662	343,693	206,582	397,667	5,166,600	0.74%
2030	2,311,337	2,019,135	363,870	215,974	417,513	5,327,830	0.62%
2035	2,346,337	2,069,858	379,046	223,439	435,990	5,454,670	0.48%
2040	2,375,319	2,102,102	393,592	229,895	454,652	5,555,560	0.37%

Source: Maryland Department of Planning, Planning Data Services, March 2012
(1) Compound Annual Growth Rate for Maryland

From 2000 to 2005, it is estimated that almost 250,000 net new jobs were created in Maryland; a growth of 1.6 percent per year. Employment growth has been fairly strong across most regions in the state. This strong growth was tempered from 2005 to 2010, with an estimated addition of only 50,000 net new jobs. Table 8 summarizes the total number of full- and part-time jobs in the five Maryland regions.

With the end of the recession, employment is forecasted to return to previous growth rates of between one and two percent per year depending on the region. Over the longer term, growth rates are expected to slow slightly as the employment markets become more saturated.

Table 8: Number of Total Jobs by Maryland Region, 1990-2025

Year	Baltimore Metro	Washington, DC Suburbs	Southern Maryland	Western Maryland	Eastern Shore	Maryland	Maryland CAGR (1)
1990	1,391,299	957,334	92,345	116,821	179,450	2,737,249	
2000	1,514,491	1,087,993	124,138	130,198	208,382	3,065,202	1.14%
2005	1,608,651	1,182,606	146,974	137,353	233,192	3,308,776	1.54%
2010	1,638,800	1,196,800	157,000	135,900	231,300	3,359,800	0.31%
2015	1,742,800	1,280,400	172,600	141,600	251,900	3,589,300	1.33%
2020	1,826,800	1,350,500	185,500	147,000	268,400	3,778,200	1.03%
2025	1,873,700	1,388,800	195,300	151,100	277,900	3,886,800	0.57%

Source: Maryland Department of Planning, Planning Data Services, May 2011
(1) Compound Annual Growth Rate for Maryland

Between 2000 and 2010, employment growth in Maryland has been extremely strong in the education and health services, professional services, government, technology, and tourism industries. The Maryland Department of Business and Economic Development has forecasted that employment in these sectors will continue to remain strong in the short-term. According to the 2010 Census, Maryland had the second highest percentage (26.1 percent) of professional and technical workers as a percentage of the total employment. In particular, the technology sector currently employs an estimated 87 out of every 1,000 private sector workers, ranking 4th in the United States. Additionally, employment in the construction and natural resources sector increased 2% from 2011 to 2012. Similar to other regions in the U.S., the manufacturing sector has experienced a reduction in total employment in recent years. The table below summarizes the 15 largest employers in Maryland during 2011.

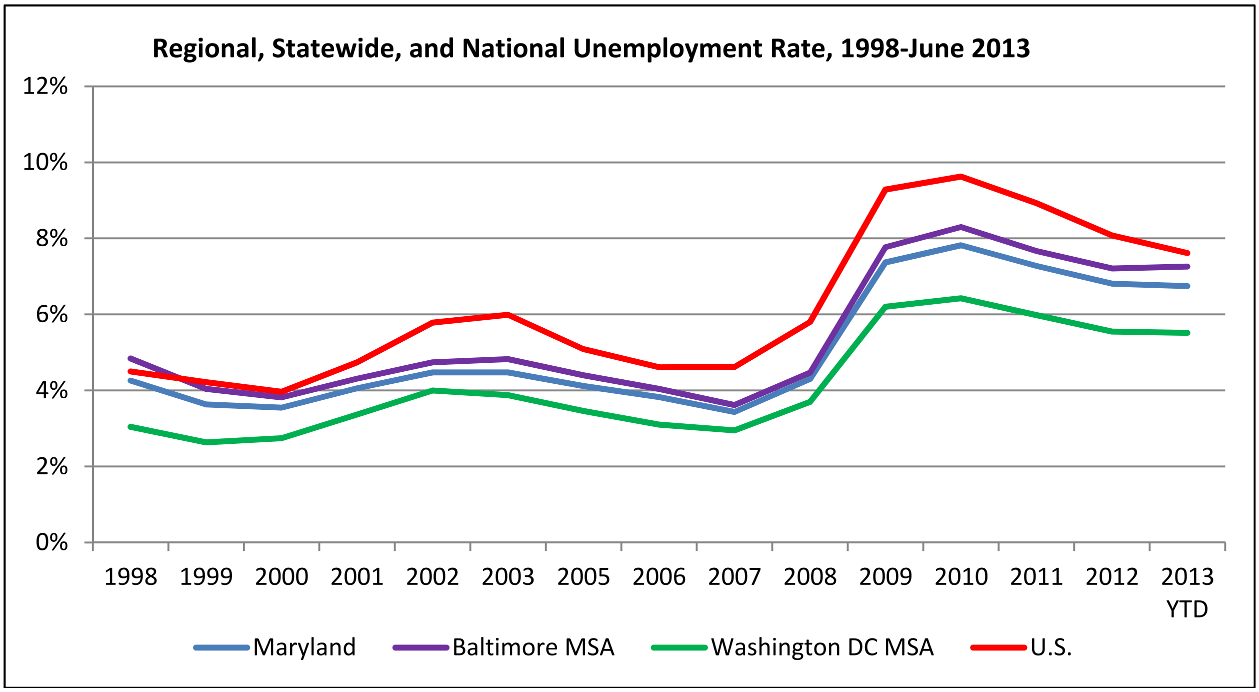
Table 9: Largest 25 Employers in State of Maryland, 2011

Employer	Employment	Industry
Fort George G. Meade	44,540	Military installation/intelligence
University System of Maryland	36,380	Higher education
Johns Hopkins University	27,000	Higher education
Johns Hopkins Hospital & Health System	20,100	Hospitals; health services
National Institutes of Health	18,800	Federal agency
Walmart	17,420	Consumer goods
Aberdeen Proving Ground	15,580	Military installation
University of Maryland Medical System	15,000	Hospitals; health services
MedStar Health	14,600	Hospitals; health services
Giant Food	13,260	Groceries
U.S. Social Security Administration	13,000	Federal agency
Walter Reed National Military Medical Center	11,000	Hospital; health services
Northrop Grumman	10,980	Electronic systems
Naval Air Station Patuxent River	10,960	Military installation
Marriott International	10,000	Food and lodging services

Source: Maryland Department of Business and Economic Development, 2010

While tracking national trends, unemployment in Maryland has remained below that of the U.S. Unemployment increased during the 2001 recession and during 2007-09 recession. Unemployment is not uniform across the state as the unemployment rate in the Washington, D.C. MSA was 6.0%, but 7.9% in the Baltimore MSA, as of June 2013. Figure 22 summarizes regional, state, and national unemployment rates tracked by the Bureau of Labor Statistics (BLS) from 1998 to June 2013.

Figure 51: Baltimore MSA, Maryland and National Unemployment Rates, 1998 to June 2013



Source: Bureau of Labor Statistics

5.2.3 Wages and Income

Real income is a key indicator of the direction and strength of the local economy. The table below presents actual and forecast real per capita income for each of the Maryland planning regions. Statewide, real per capita income increased by an average of 1.7%/year from 1990 to 2010. The Maryland Department of Planning has forecasted that income growth will remain relatively strong with an average annual increase of 2.0%/year from 2010 to 2020.

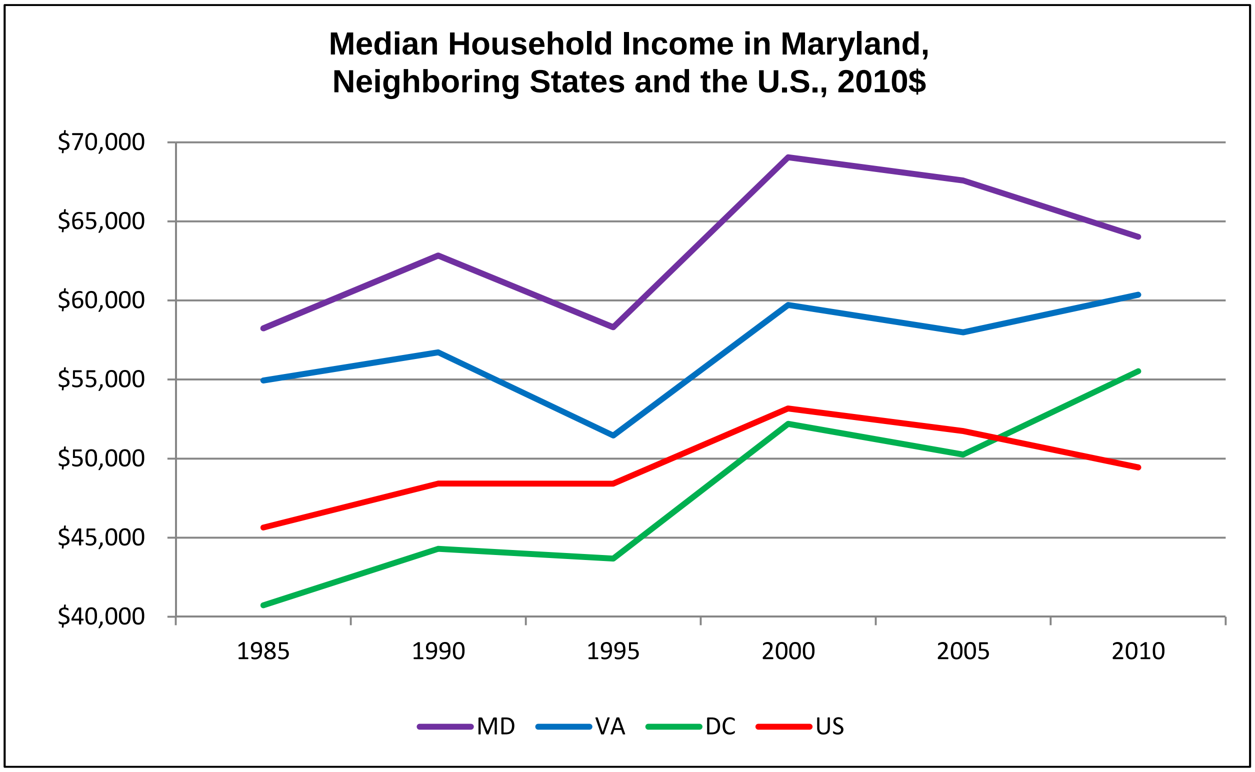
Table 10: Real Personal Income Per Capita, by Maryland Regions, 1990 to 2040, (2005 Dollars)

Year	Baltimore Metro	Washington, DC Suburbs	Southern Maryland	Western Maryland	Eastern Shore	Maryland	Maryland CAGR (1)
1990	30,018	36,658	27,467	21,598	25,059	31,423	2.1%
2000	37,448	43,951	34,384	26,352	30,836	38,609	1.3%
2010	44,254	48,177	39,774	31,412	34,847	44,121	2.0%
2020	54,340	57,970	49,040	38,505	43,095	53,753	0.9%
2030	59,625	62,638	54,547	42,579	47,117	58,629	0.8%
2040	64,489	52,059	60,010	46,164	50,642	63,251	N/A

Source: Maryland Department of Planning, Planning Data Services, April 2011
(1) Compound Annual Growth Rate for Maryland

In 2010, Maryland ranked 3rd out of 51 states and the District of Columbia with a median household income of $64,025. In real terms, median household income increased by an average annual rate of 0.4% from 1985 to 2010. This growth rate takes into account the statewide decline in real household income during the 1990s as well as national economic trends. The average annual growth rate of median household income in Maryland was above that the U.S. (0.3%/year) and commensurate to Virginia and Pennsylvania (0.4%/year) during the same period. Median household income in the District of Columbia has increased by 1.2%/year. With the onset of the 2007-09 recession, real household income in Maryland declined by an aggregate of -7.2% since 2007 (-3.1%/year). Nationally, real median household income has decreased steadily since 2000. Additionally, Maryland has the second lowest poverty rate for 2011, with 10.1% of the population living in poverty, compared with 15.9% for the U.S.

Figure 52: Median Household Income, 2010$



Source: U.S. Census Bureau, Current Population Survey, Annual Social and Economic Supplements

5.2.4 Commuting Patterns in Maryland

According to the Maryland Department of Planning, nearly 470,000 Maryland residents commuted to employment areas outside of the state in 2010, the most recent year in which data was available. Approximately 85% of these commuters work in either Washington, D.C. or Virginia. Another 9% of out-of-state commuters work in either Pennsylvania or Delaware with remaining commuting to work in other states. In comparison, approximately 270,000 out-of-state residents commute to work in Maryland. The number of commuters who come to work into Maryland is greatest from Virginia (31% of total commuters), Pennsylvania (25%) and Washington, D.C. (19%). Overall, the percentage of Maryland residents who work within the state was estimated to be 39.3%, out-of-state commuters accounted for 60.7% of total commuters. The average commuting time was 31.8 minutes in 2010 (up from 31.2 minutes in 2000).

Similar patterns have been recorded for the Baltimore MSA and Washington, D.C. MSA as 39.0% and 39.6% of commuters, respectively, work in the same jurisdiction (or county) in which they reside. In the two largest counties in terms of population and employment within the Baltimore MSA—Baltimore County and Anne Arundel County—this percentage was roughly 41%. In both counties, there was an estimated of 79.4% of total commuters who drive alone to work and 9.7% of commuters who carpooled. Baltimore County had a slightly higher percentage of commuters who used public transit in 2010. Compared to 2000, average travel times increased to 28.5 minutes for Baltimore County and 29.3 minutes for Anne Arundel County.

At a county level, a somewhat different distribution exists in the Washington, D.C. MSA. In Montgomery County, an estimated 49.4% of residents commute within the county, which is significantly higher than the statewide average. In contrast, this percentage is 28.8% in Prince George's County. In 2010, an estimated 64.8% of Montgomery County commuters drove alone, 11.1% carpooled, and 15.1% used public transit. Average commuting time increased from 32.8 minutes in 2000 to 34.0 minutes in 2010. In Prince George's County, an estimated 64.7% of commuters drove alone, 12.8% carpooled, and 17.0% used public transit in 2010. The mean commuting time decreased slightly from 35.9 minutes in 2000 to 34.7 minutes in 2010. Based on data compiled for the 2000 and 2010 census, the table below summarizes the percentage of commuters by transportation mode and mean travel time to work for 2000 and 2010 for the four most populous counties and for the entire state.

Table 11: Commuting Patterns for Workers in Baltimore County, 2000

Area	Total	Drove Alone		Carpool		Public Transit/Other		Mean Travel Time
Baltimore County	196,915	153,815	78.1%	19,875	10.1%	20,395	10.4%	22
Baltimore City	59,060	37,215	63.0%	9,380	15.9%	11,885	20.1%	33
Harford County	26,645	23,955	89.9%	2,495	9.4%	189	0.7%	39
Carroll County	15,365	13,880	90.3%	1,370	8.9%	100	0.7%	39
Anne Arundel County	13,400	12,185	90.9%	1,075	8.0%	140	1.0%	34
Howard County	11,350	10,460	92.2%	825	7.3%	45	0.4%	29
York County (PA)	7,970	7,030	88.2%	900	11.3%	25	0.3%	45
Prince George's County	1,800	1,380	76.7%	300	16.7%	109	6.1%	51
Montgomery County	1,560	1,285	82.4%	240	15.4%	35	2.2%	53
Frederick County	950	760	80.0%	160	16.8%	10	1.1%	54
Cecil County	875	770	88.0%	110	12.6%	-	0.0%	57
All Other	5,758	4,370	75.9%	989	17.2%	365	6.3%	NA
Total	341,648	267,105	78.2%	37,719	11.0%	33,298	9.7%	NA

Source: Maryland Department of Planning

To augment the year 2000 data available from the Maryland Department of Planning, general commuting patterns for the Baltimore region were collected from the 2010 U.S. Census and presented in Table 12. It is interesting to note that the lower public transit percentages of the suburban communities of Baltimore are supplemented by increased percentage of people working from home. This is less demonstrated in the counties that are suburban to Washington D.C.

Table 12: Commuting Patterns in Baltimore Region

Area	Drive Alone	Carpool	Public Transit	Work From Home	Other
Baltimore County	79.4%	9.7%	4.3%	3.5%	3.1%
Baltimore City	60.0%	11.4%	17.6%	2.6%	8.4%
Harford County	84.0%	8.8%	0.9%	4.4%	1.9%
Carroll County	82.8%	8.2%	0.7%	5.7%	2.6%
Anne Arundel County	79.4%	9.7%	3.2%	5.0%	2.7%
Howard County	80.9%	7.6%	3.7%	5.5%	2.3%
Prince George's County	64.7%	12.8%	17.0%	2.9%	2.6%
Montgomery County	64.8%	11.1%	15.1%	5.9%	3.1%
Frederick County	74.6%	12.2%	3.7%	5.4%	4.1%
Cecil County	80.7%	11.2%	1.1%	4.6%	2.4%
Total	71.8%	10.7%	9.8%	4.3%	3.4%

5.2.5 Statewide Economic Forecast

Economic growth and employment in Maryland has historically followed national trends, but overall economic conditions have tended to be stronger due to the large number of professional employees, the state's close proximity to the Federal government offices in Washington, D.C., and relatively high median house income. Additionally, the value of exports transported through the Port of Baltimore has increased by 135% from 2006 to 2011.

These strengths also represent potential vulnerabilities. Proposed reductions in federal spending in 2013, particularly in the defense industry, could impact Maryland more deeply relative to other states. Moreover, a potential slowdown in global economic conditions would lead to a decrease in exports, particularly to China and Europe.

Absent these uncertainties, Maryland economy is expected to grow at a relatively healthy rate. An economic forecast prepared by Chase and JP Morgan in early 2013 forecasted that statewide real GDP would increase by 2.7% and total employment would increase by 1.2% in 2013. A two-year forecast of the annual change in statewide economic output and employment is provided in the table below. In 2014, statewide GDP and employment is anticipated to grow at even greater rates.

Table 13: Maryland Economic Forecast, 2012-14

	2013	2014
Real GDP	2.7%	3.8%
Employment	1.2%	1.6%

Source: Chase/JP Morgan, Maryland Economic Outlook, 2012

6.0 Traffic and Toll Revenue Modeling and Estimates

In this section, the traffic and toll revenue modeling methodology, assumptions and estimates are presented. First, the methodology of the traffic, toll schedule and toll revenue modeling is reviewed including the use of the Baltimore Metropolitan Council travel demand model (BMC Model), the I-95 ETL VISSIM microsimulation model (VISSIM Model) and development of the I-95 ETL traffic, toll schedule and toll revenue forecasting model (T&R Model).

The basic assumptions used for the analysis include those controlled by the MDTA such as I-95 ETL limits, access points and tolling points and tolling policy as well as those determined by motorists including corridor demand, hourly traffic profiles, values of time, payment and vehicle class mixes and other consumer-driven assumptions that lay outside of the control of the toll facility operator.

The forecasts of toll schedule, tolled traffic and toll revenue are presented for the multiple cases run. The base case assumes the toll policy presented in the assumptions portion of this section. The maximum throughput case provides maximum traffic flow through the corridor constrained only by minimum toll considerations on the ETL. The maximizing revenue case provides estimates assuming the operator would like to maximize toll revenue for the corridor without consideration to traffic flow outside of when it affects revenue potential.

The final step in the forecasting process is the conduct of risk analysis. The risk analysis allows for the base case traffic and toll revenue forecasts to be placed within the range of all potential forecast outcomes for the I-95 ETL providing a comfort level regarding the probability of attaining forecasted revenues.

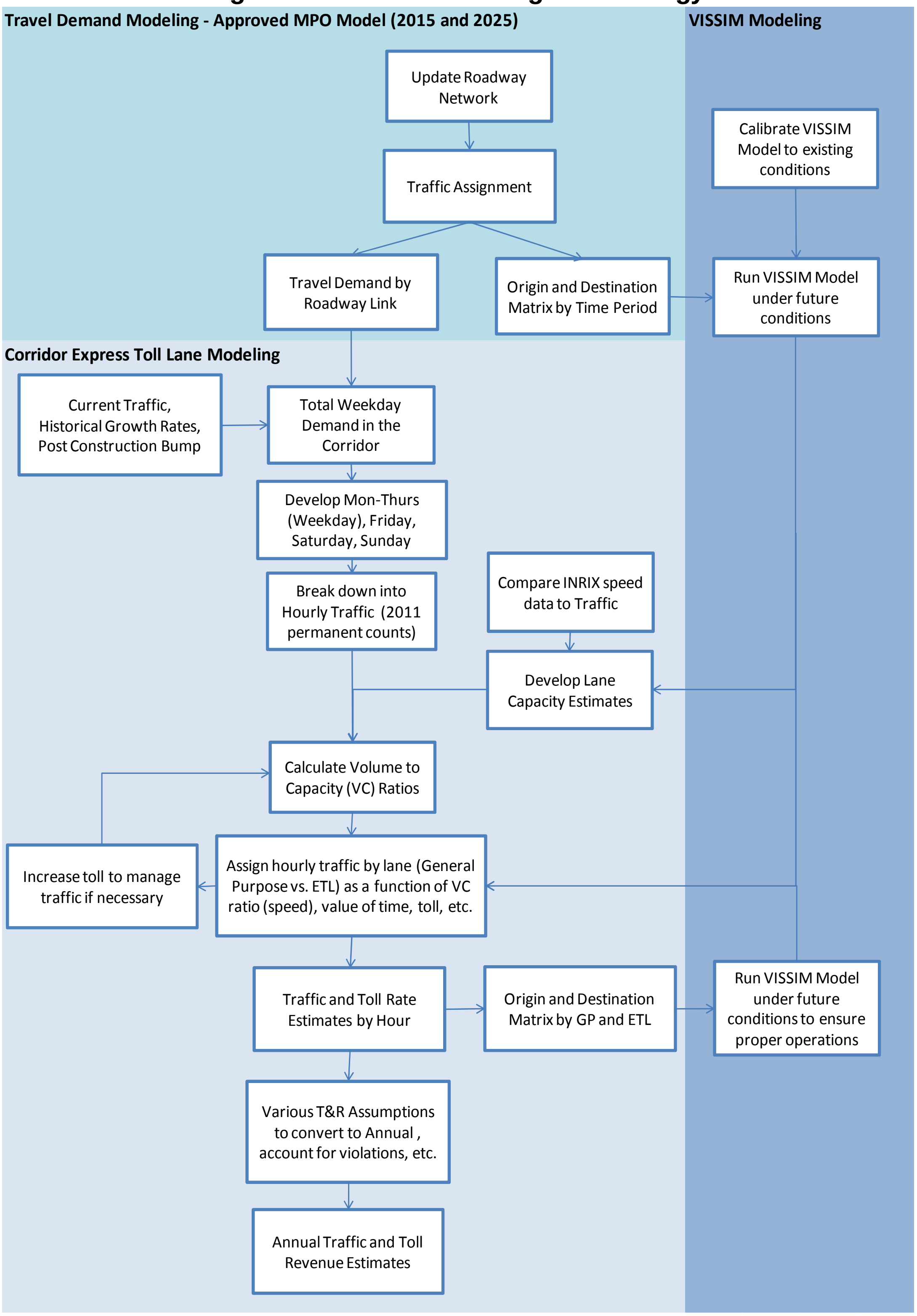
6.1 Modeling Methodology

The forecasting of traffic, toll schedules, and toll revenue for managed lane facilities requires the use of multiple forecasting models on multiple modeling platforms. This includes the Baltimore Metropolitan Council travel demand model (BMC Model), the I-95 ETL VISSIM micro-simulation model (VISSIM model) and the I-95 ETL traffic, toll schedule and toll revenue forecasting model (T&R Model).

Figure 53 presents the general work flow for the forecasting effort with each model separated by color coding. The first step is the use of the BMC model to provide forecasted average weekday traffic volumes in the corridor for 2015 and 2025 to the T&R model. This data combined with historical traffic data provides forecasted levels of corridor demand for the T&R model. Additionally origin and destination matrices from the BMC model are provided to the VISSIM model to develop an understanding of operational characteristics of the corridor, which also feed into the T&R model. The T&R model then estimates the toll schedule needed to manage traffic in the ETL in half hour increments. This is then subject to an adjustment to the toll schedule to accommodate peak, off-peak and overnight pricing periods by day of the week to be consistent with current MDTA toll policies on the ICC. The T&R model is then re-run with toll schedule as the input and traffic and toll revenue estimates as the output. This output is then provided to the VISSIM model to ensure that traffic can operate efficiently within the corridor based on the estimates of traffic by half hour in the general purpose and ETL for each forecast year.

The details of each model, the inputs and outputs, are provided in the following sections.

Figure 53: I-95 ETL Modeling Methodology Flow Chart



6.1.1 Travel Demand and Microsimulation Modeling

The BMC Travel Demand Model, the regional travel forecasting model and a corridor specific VISSIM model, and a micro-simulation model, were used to provide input into the T&R forecasting model. This section provides an overview of the process and use of these two modeling platforms. More detailed modeling results are provided in Appendix B of this report.

The BMC Model provides estimates of travel demand for each major roadway link in the Baltimore region as a function of population and employment centers and estimated trip making characteristics and roadway network capacity to handle travel movements. For this analysis, the model years of 2011 (base year), 2015 and 2025 were used. First, the roadway network in the corridor was reviewed to make sure the model was appropriately coded to model current year conditions. Then the resulting 2011 traffic estimates were compared to actual counts in the corridor to determine the accuracy of the base year calibration in the corridor. The model produced results that were approximately 4.5 percent below actual traffic counts on I-95, considered reasonable for this step in the process. Future year model runs were conducted for 2015 and 2025 with the inclusion of the I-95 ETLs as defined within this document. Those results fed into the T&R forecasting model that is described in the subsequent section as well as the VISSIM model described below.

The I-95 ETL VISSIM model is a corridor specific model that dynamically assigns traffic to the I-95 corridor to allow operational analysis to be conducted. The BMC travel demand model provided the needed origin and destination matrices as input to the VISSIM model and various calibration techniques were employed to develop the base year model. Similar to the BMC model, the future roadway network was coded to reflect the proposed infrastructure, namely the I-95 ETLs and access points. The simulation models were run to assure that the ETLs and general purpose lanes would operate effectively, especially at merge points. Additionally, travel times and speeds as a function of volume in the corridor were used as input into the T&R Forecasting Model described in the next section. The VISSIM Model was also run upon completion of the T&R Forecasting Model to assure that the ETLs would operate as estimated from the T&R Forecasting Model.

More detail regarding this step in the analysis, including calibration techniques, assignment runs conducted, and results of those assignment runs are provided in Appendix B.

6.1.2 T&R Forecasting Model

The T&R Model was developed specifically for the I-95 ETL T&R Study to accommodate the unique aspects of the toll policies tested and the corridor for this project. Two different forecasting models were developed. The first used the basic assumptions of corridor demand by year, day of week, half hour, payment class, vehicle class, origin/destination pair, values of time and lane capacities to determine traffic by half hour for an eleven year period (2015-2025) as well as the toll schedule needed for that same time period to reflect the constraints of the toll plan. These constraints included the use of ICC toll rate ranges for the project and the maintenance of 55 miles per hour on the ETL during all times. The maintenance of speed on the ETL required time of day pricing for some half hour periods. The allocation of vehicles to the ETL in the model is a function of time savings between the toll free general purpose lanes and the tolled ETL. Again, the output of this model is the traffic and toll revenue for the ETL under certain assumptions, but more importantly, the estimated minimum toll schedule needed by half hour by day for the eleven year period to maintain travel speeds of 55 mph in the ETL.

The second model developed uses the same basic assumptions of values of time, lane capacities, corridor demand, etc., as presented for the first model, but this model also uses a set time-of-day toll schedule as an input. The reason for the development of this model is to forecast traffic and toll revenue constrained by six tolling periods to accommodate ease of use for the motorists in the corridor and align with current ICC toll policies. Under these sets of assumptions the toll schedule is sized by the first model, thus, ensuring maintenance of travel speeds on the ETL and the traffic allocation is reassigned based upon toll levels in the six tolling periods.

This two-step process allows for first, the sizing of the toll schedule to comply with toll policy and the implementation of actual operational toll policy to understand the reaction of traffic to such constraints.

Each day of the week was modeled individually to reflect the unique nature of traffic operations by day, most significantly corridor demand, hourly profile and driver behavior. The analysis and modeling did not take into account holiday events such as the Wednesday before Thanksgiving, the Christmas holiday rush period and the like. It is estimated that any inclusion of a holiday peak period toll rate schedule would be marginally beneficial to the overall traffic and toll revenue estimates. Due to the limited benefit, as compared to an entire year of traffic and toll revenue, this analysis was not incorporated into the estimates.

The final result of this modeling effort incorporates anticipated ramp-up, violation rates and other assumptions to arrive at estimates of traffic and toll revenue for the ETL for the forecast period. The various assumptions introduced in this section are presented in more detail in the next section.

6.2 Assumptions of Analysis

In this section, the basic assumptions of the analysis are presented starting with the assumptions that the MDTA controls including the infrastructure that is being built and the toll plan that will be implemented. This is in addition to those assumptions outside of the control of the MDTA such as motorists' behavior, corridor growth, traffic operational assumptions and the like. The results of variations on the first set of assumptions, those controlled by the MDTA, are presented in subsequent sections of this report defined as alternative analyses. The results of variations on the second set of assumptions, those outside of the control of the MDTA, are presented in the risk analysis section.

Figure 54 presents the basic assumptions of the analysis, detailed by those controlled by the MDTA and those outside of the control of the MDTA. Additionally, Figure 55 presents the assumed toll stick diagram for the I-95 ETL project. It is assumed the full project will be opened on December 1, 2014 for the MDTA. For southbound traffic there will be ingress points between MD 43 and E. Joppa Road and from MD 43 and egress points on I-895 to Moravia Road and south of Moravia Road and on I-95 south of Pulaski Highway. The northbound infrastructure will be symmetric to the southbound infrastructure with ingress points on I-895 south of Moravia Road, from Moravia Road and on I-95 south of Pulaski Highway and egress points to MD 43 and between MD 43 and E. Joppa Road. The toll gantry will be between I-695 and the split of I-95 and I-895. There will only be one toll gantry because all trips are of almost the same length.

The toll plan, as discussed previously, was determined by the MDTA as a combination of existing toll policies on MDTA facilities and leading trends of managed lane toll policy throughout the United States. The most salient policies to this analysis include the maintenance of speeds on the ETL at 55 miles per hour and adherence to current ICC toll rate ranges as presented in Figure 54. Additionally, the facility will offer collection of tolls through traditional E-ZPass as well as for motorists without E-ZPass via image collection and billing. The toll rates for image-based tolls or video tolls will be 50 percent more than the toll for E-ZPass with a minimum surcharge of $1.00 and a maximum surcharge of $15.00. This policy is consistent with the current operations of the MDTA facilities. Other toll plan assumptions include the use of current axle multipliers for the ICC for the tolling of trucks in the ETL and no standard toll escalation for the lanes over time, only as it relates to the need to raise tolls to maintain travel speeds on the facility.

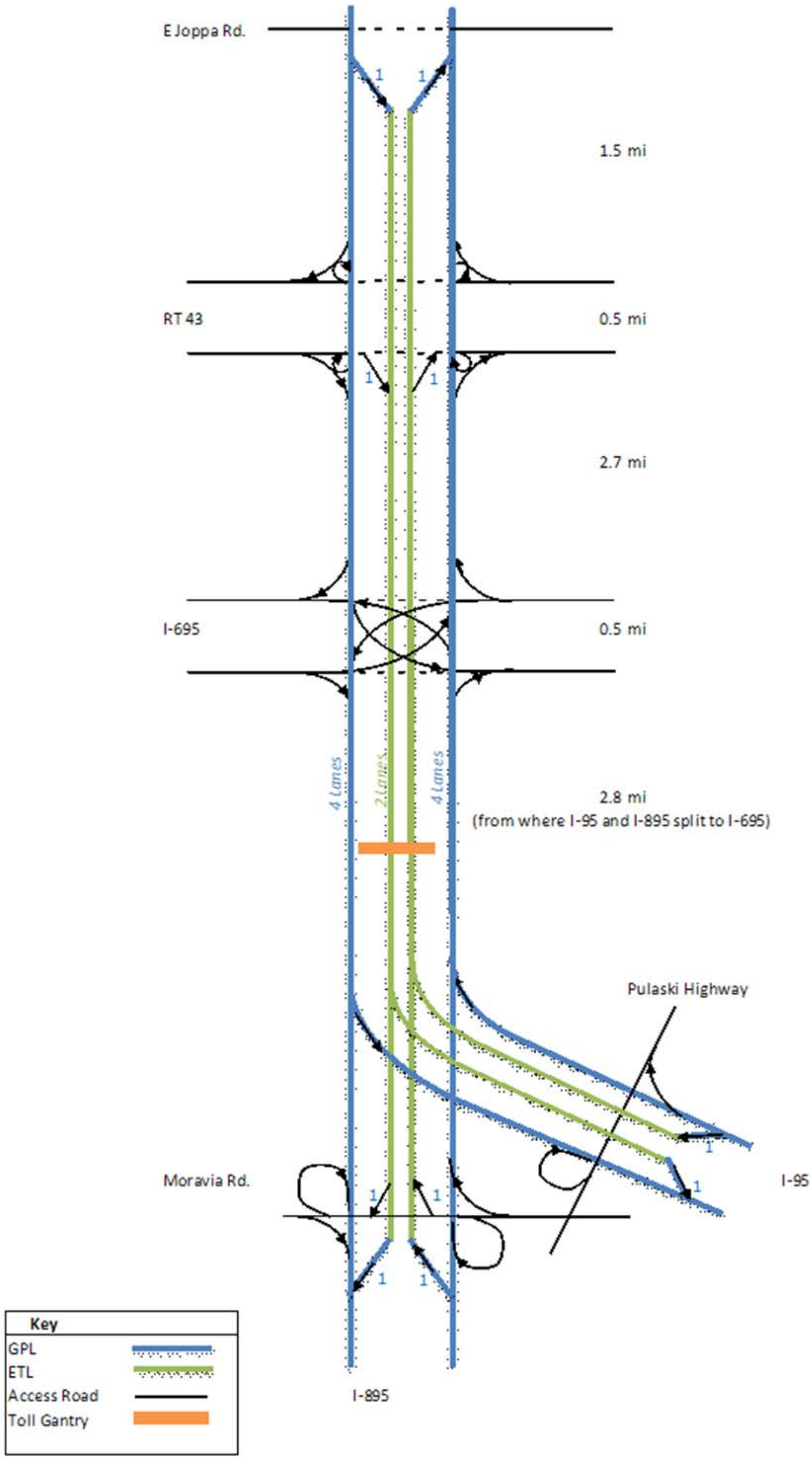
The remaining assumptions, which are beyond the control of the MDTA, are presented in the next section.

Figure 54: I-95 ETL T&R Study Basic Assumptions

Assumptions for I-95 T&R Study - Operator Controlled		
Variable		Assumption
Infrastructure		
	Project Limits/Access Points/Typical Section	See Stick Diagrams
	Length	7 miles
	Opening Date	12/1/2014
Toll Policy		
	Toll Collection	All Electronic Toll Collection (AETC) with E-ZPass and Video Toll (No Cash Collection)
	2 axle Base Toll Rate (E-ZPass)	As needed to manage congestion by time period using ICC toll rate ranges (distance * mileage rate for pre-determined pricing periods)
	2 axle Video Toll Rate	50% surcharge on base rate with $1 minimum and $15 maximum surcharges
	Toll Escalation	There is no annual toll escalation, only escalation based on the need to manage traffic in the peak periods
	Congestion Pricing	Pre-determined time-of-day pricing intended to maintain 55 mph in the ETL, adjustable with ten days notice
	Axle Multiplier from 2 axle	Based on Current MDTA policy on ICC, which is different than the current policy at the JFK toll plaza

Assumptions for I-95 T&R Study - Market Driven		
Variable		Assumption
	Corridor Demand	Adjusted TDM results, following BHT, FMT and JFK forecasts
	Value of Time	$7.79 to $16.90 per hour by Hour and Payment Type
	Hourly Traffic Profile	By Day of Week from 2011 permanent count station
	Percentage of Video	5-10% by Hour
	Percentage of Trucks	Corridor Rate by Day of Week and Hour (6% to 30%)
	Ramp-up	2 years, 85%, 95%
	Axle Factor	Corridor Rate by Day of Week and Hour (3.1 to 4.7)
	Violation Rates	2% for Transponders; 20% for Video
	Annualization Factor	Modeled Days of Week Individually (each times 52)
	Holiday Schedules	Not accounted for in the T&R Estimates
Lane Capacity (a function of driver familiarity)		
	Monday - Thursday	1800 vplph
	Friday, Saturday, Sunday	1750 vplph

Figure 55: I-95 ETL Toll Stick Diagram



6.2.1 Traffic and Toll Revenue Assumptions

In this section, the assumptions of the analysis that are outside of the control of the MDTA are presented. These assumptions include corridor demand, vehicle/payment composition, motorists' behavior and traffic operations. These are the major assumptions that are inputs for the T&R forecasting models described previously.

6.2.1.1 Corridor Demand

The forecasted corridor demand in the I-95 corridor that is input into the T&R forecasting models is a key driver of traffic and toll revenue in the ETL. As demand in the corridor increases, the attractiveness of the free-flowing ETL increases. This, in-turn, creates the need for congestion pricing during peak hours.

The projected corridor demand for this analysis was forecasted using output data from the BMC travel demand model, historical traffic volumes, projected growth in demographics and projected adjustments to trip making in the future. Figure 56 presents historical traffic volumes for the I-95 corridor between I-695 and the split of I-895 and I-95, the approximate location of the ETL toll gantry. The Figure also provides linear regression analysis for various time periods including 1980 to 2000, 1990 to 2000, 1980 to 2012, 1990 to 2012, 2000 to 2012 and 2005 to 2012. That analysis is provided in purple, yellow, red, green, dark blue and orange lines respectively. Linear regression of this data allows for an understanding of potential future year traffic volumes based on historical experience, which is provided in Table 14. In this table, the corridor traffic volumes used for this analysis are also presented to provide a comparison. These estimates remove the induced demand estimated that will be presented later in this section. Notice that generally the estimated future traffic volumes based on data from the 1980s presents quite high future estimates while with the inclusion of more recent data, the estimated future traffic is much lower. The base corridor traffic levels generally fall between the 2005 to 2012 and 2000 to 2012 regression and are very similar to the 1990 to 2012 regression. The estimates are significantly below the earlier data that incorporated 1980 to 2000 growth experience.

Figure 56: Historical Traffic and Linear Regression by Year

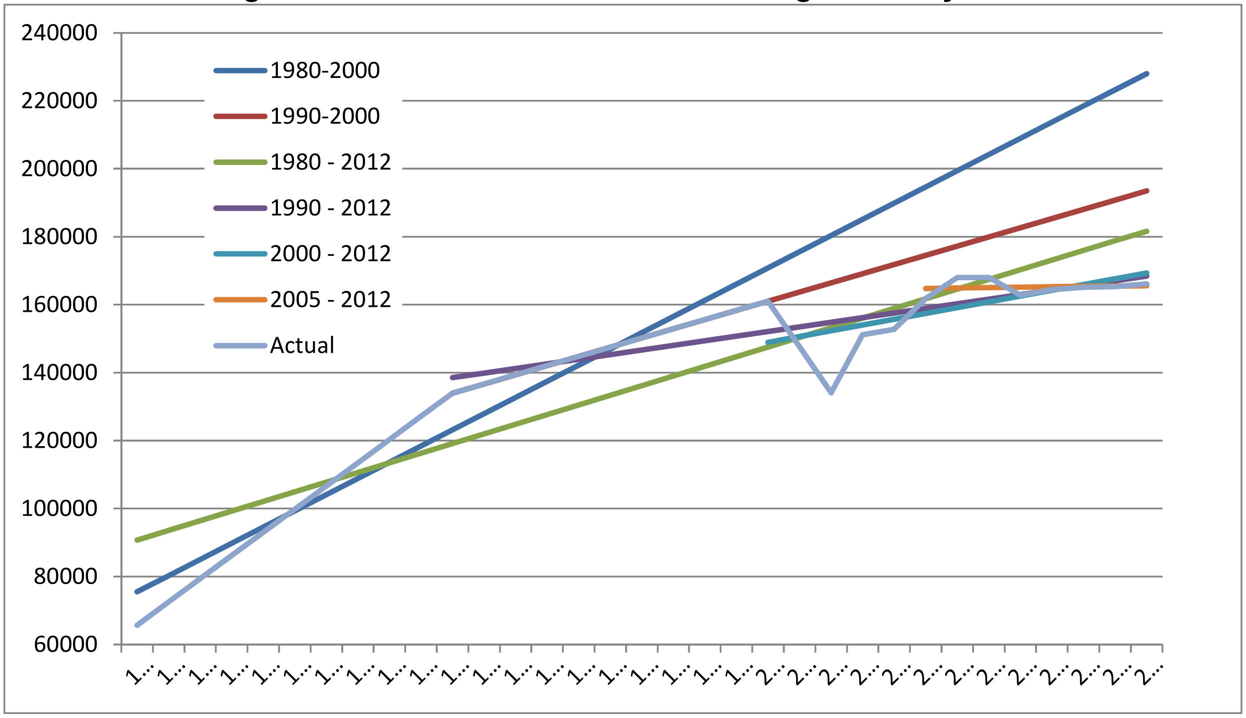


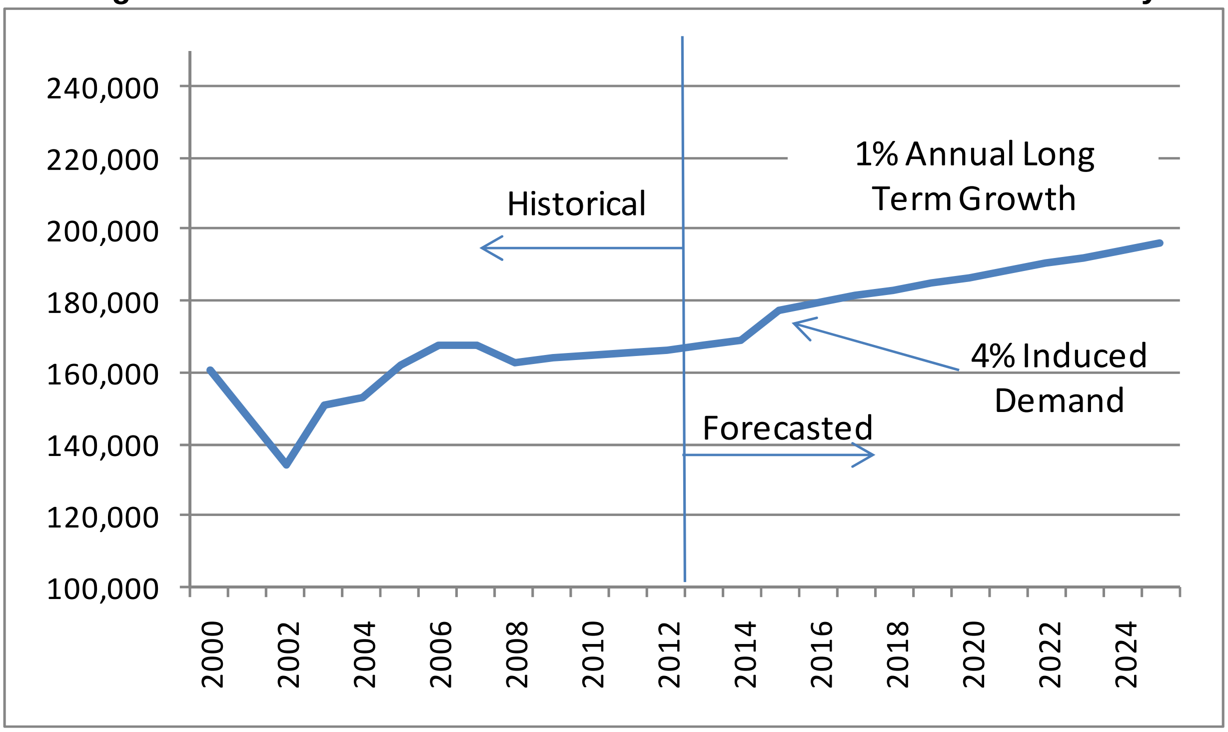
Table 14: Annual Traffic Growth Estimate based on Regression Analysis

Regression Basis	Average Weekday Traffic Estimates		
	2015	2020	2025
1980-2000	242,301	266,130	289,959
1990-2000	201,575	215,100	228,625
1980 - 2012	190,129	204,331	218,533
1990 - 2012	172,475	179,270	186,065
2000 - 2012	174,395	182,901	191,407
2005 - 2012	165,926	166,490	167,053
T&R Study (w/o Induced Demand)	170,733	179,442	188,596

In addition to historical traffic volume review, the results from the BMC travel demand model were incorporated into the corridor projections. One significant benefit of using the BMC travel demand model is the ability to estimate the induced demand in the corridor with the incorporation of the new capacity of the ETL. The BMC model estimated an approximately 11 percent increase in demand with the implementation of the I-95 ETL. This demand is pulled from other routes that have diverted from the corridor due to historical congestion issues. This induced traffic was tempered in the T&R study to remain conservative in our estimating process.

Figure 57 presents the historical and projected average daily traffic volumes on I-95 at the approximate location of the I-95 ETL toll gantry. The combination of historical traffic regression analysis, the use of the BMC travel demand model and projected growth in the corridor and relationship of that growth to trip making provided input into the projection process. The induced demand was estimated to provide a 4 percent increase in traffic with long term growth rates of one percent, similar to recent experience outside of the recent recession.

Figure 57: I-95 Historical and Forecasted Corridor Demand at ETL Toll Gantry



6.2.1.2Hourly Profile

The projected overall traffic demand was presented in the previous section. In this section, that traffic demand is disaggregated into half-hourly profiles by direction to provide input into the forecasting models. Figure 58 and

Figure 59 provide existing half hourly profiles by day of the week for northbound and southbound traffic, respectively. These represent the base half hourly traffic profiles by day of the week and are adjusted into the future as future hourly traffic levels warrant such movement of motorists' time of travel.

Figure 58: Northbound Half-Hour Profiles by Day of the Week

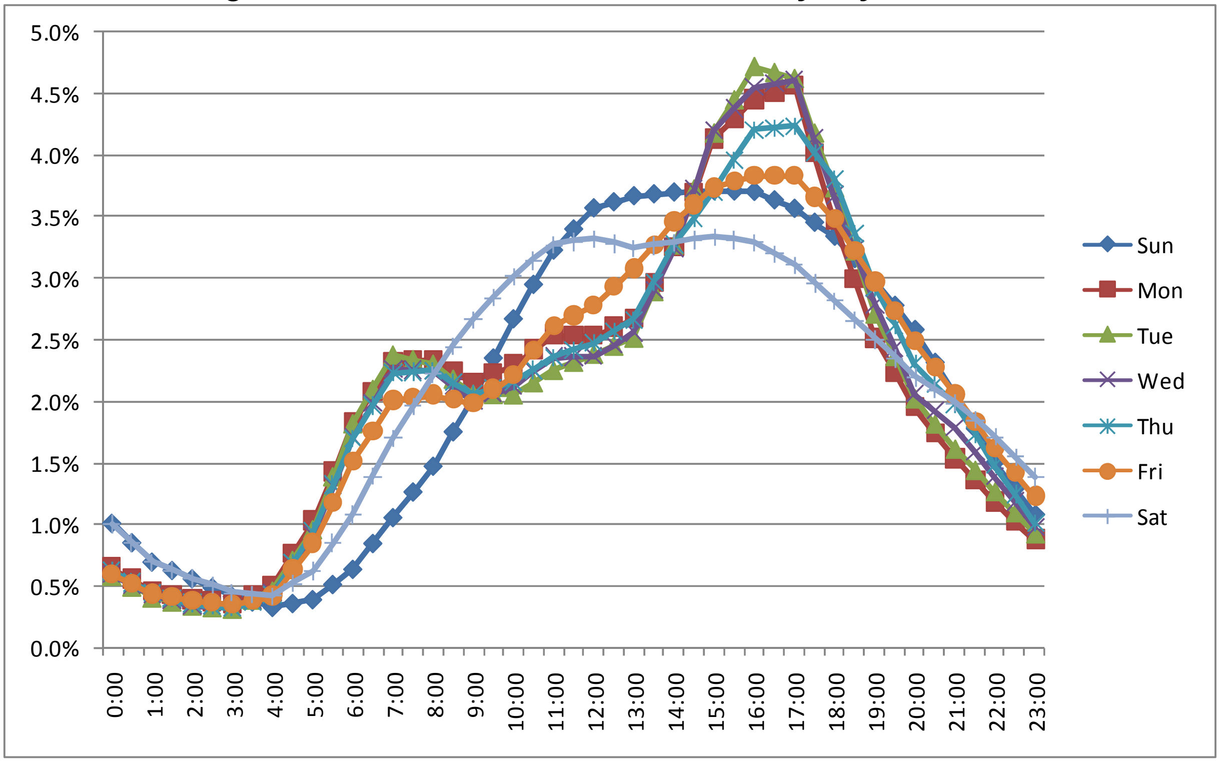
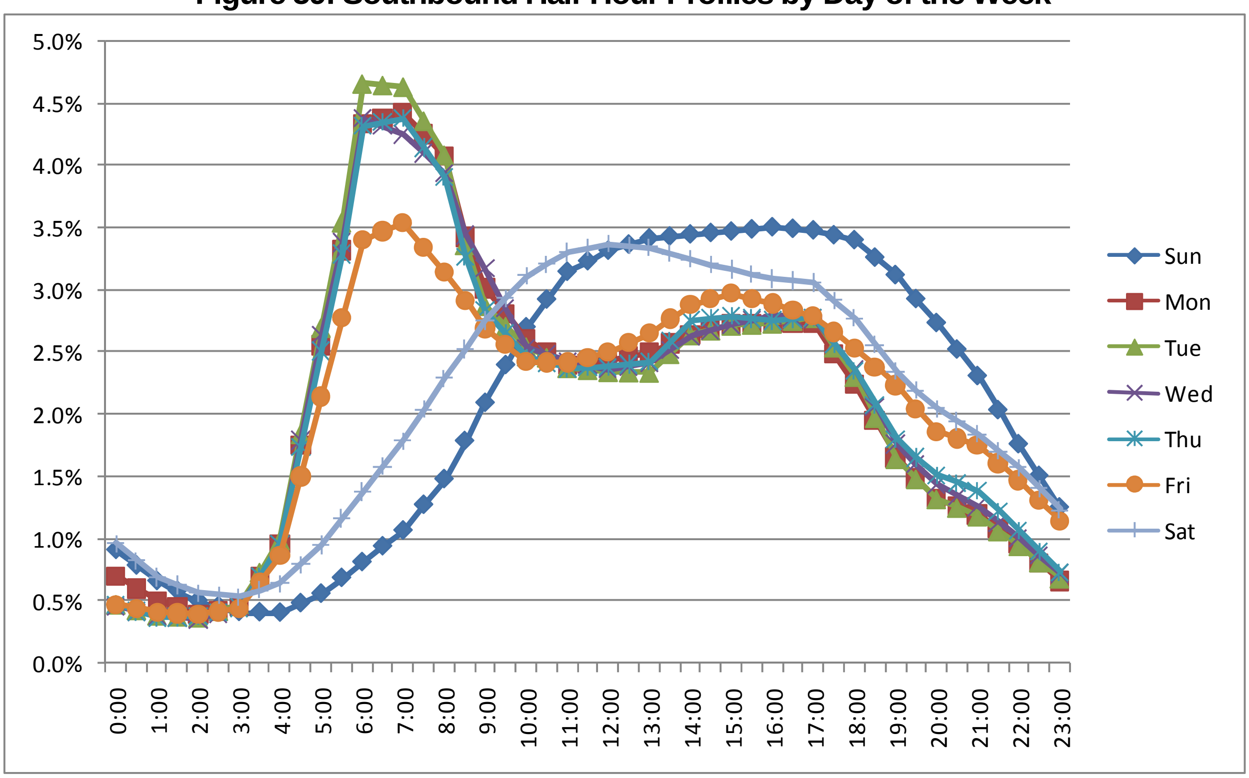


Figure 59: Southbound Half-Hour Profiles by Day of the Week



6.2.1.3 Other T&R Assumptions

In addition to the major assumptions affecting the T&R analysis of corridor demand and hourly profiles, there are a myriad of other assumptions, including vehicle class by hour, payment classes, violation rates and ramp-up that were presented previously in Figure 54.

The assumption of the percentage of trucks in the corridor is varied by day of the week and hour of the day based on existing traffic volumes. These percentages range from 6 to 30 percent in the corridor.

The values of time in the corridor were derived from stated preference survey conducted and documented within this report which uses a range of values of time from $7.79 to $16.90 depending on time period and payment method. These stated values of time were combined in the model with revealed values of time on managed lane facilities across the United States as people are making real decisions in the lanes.

The percentage of transactions collected by E-ZPass was developed as a function of day of the week and hour of the day as seen on other facilities. The I-95 ETL will be fully electronic so transactions outside of E-ZPass will be collected via capture of license plate. It is anticipated these video rates will range from 5 to 10 percent as a function of time of day.

Ramp-up is a phenomenon in toll road forecasting that relates to the amount of time it takes motorists to fully understand the location and operation of the new toll facility and use it. The modeling that is conducted assumes full knowledge of the toll facility and the value it provides. On fully Greenfield facilities, those toll facilities that are on new ground, ramp-up is up to five years with discounts to modeled traffic up to 50 percent. The I-95 ETL is in the existing I-95 corridor and motorists have seen the construction for a number of years. The opening of the toll lanes will require some adjustment period, but is estimated to be rather quick. For this analysis it is assumed the ramp-up period will be two years with discounts to traffic and toll revenue of 15 and 5 percent by year, respectively.

The final assumption is related to violation rates. The forecasted transactions assume a level of loss due to either bad reads of an E-ZPass, two percent loss, or inability to collect a video toll, 30 percent loss. These losses are incorporated into the forecasts provided.

6.3 Toll Sensitivity Analyses

Toll sensitivity analyses were conducted to provide insight into the relationship between ETL traffic, toll rate, and toll revenue. For the I-95 ETL, this relationship is rather complicated since it is also a function of corridor demand as the toll schedule will necessarily change to manage traffic in the ETL. This being the case, toll sensitivity analyses were first conducted for various corridor demands to illustrate the potential toll revenue across any year or time period. Then toll sensitivity analyses were conducted for peak, off-peak and overnight time periods.

In this section, first the toll sensitivity of passenger cars is presented and then the same is presented for commercial vehicles.

6.3.1 Passenger Cars

Figure 60 presents the relationship between hourly traffic on the ETL and toll rate as a function of corridor demand. For instance, assuming a corridor demand of 8,500, it is estimated that there are approximately 2,500 vehicles in the ETL at a per mile toll rate of $0.10. This volume decreases as the toll rate increases. Similarly, the volume also decreases as the corridor demand decreases. For instance, at $0.20 per mile, assuming a corridor demand of 8,000 vehicles, it is estimated only 2,000 vehicles will choose the ETL as compared to 2,500 for 8,500 corridor demand and $0.20 per mile toll rate. As the corridor demand decreases, the estimated volumes of motorists choosing the ETL decrease. This is because time savings in the ETL is a function of congestion on the toll-free general purpose lanes which is a function of overall corridor demand.

Figure 60: ETL Hourly Traffic Volumes as a Function of Toll Rate and Corridor Demand

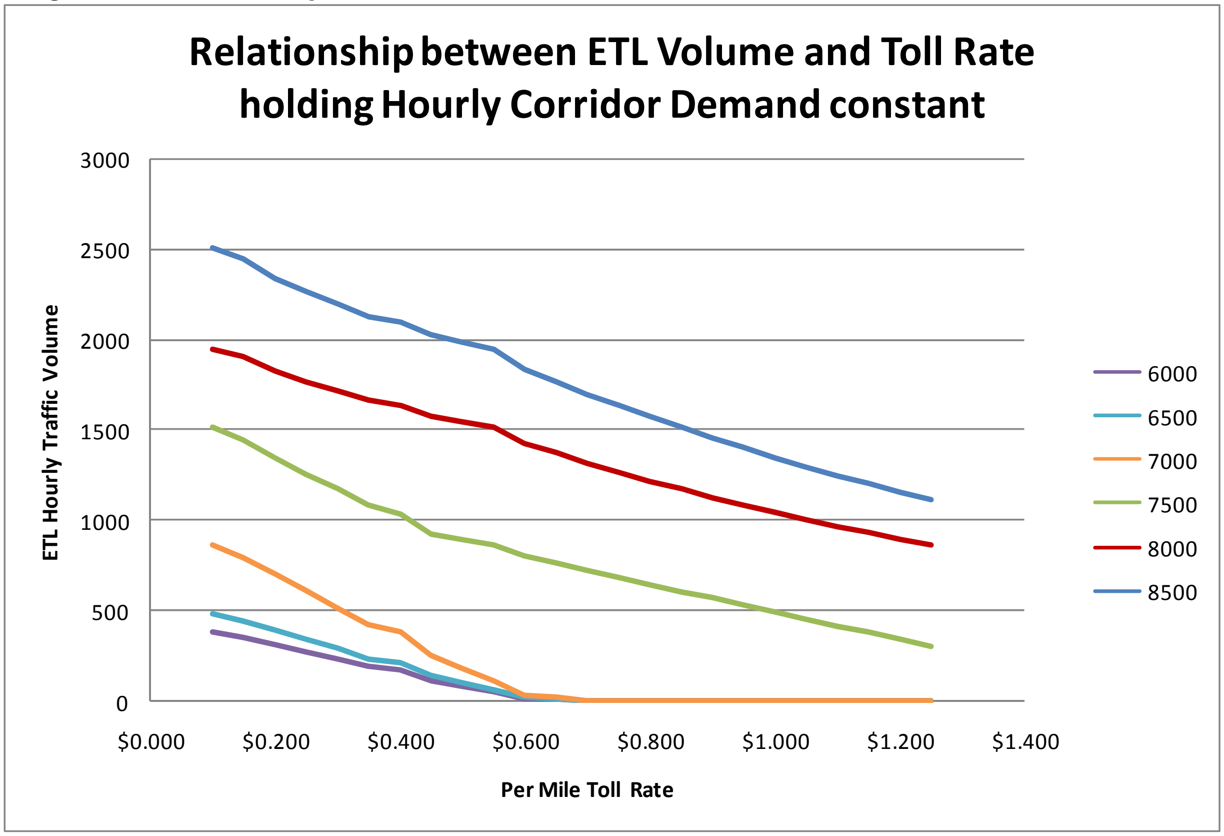


Figure 61 uses the same analysis that is presented in Figure 60 and provides estimated hourly toll revenue as a function of toll rate and hourly corridor demand. As traffic decreases with an increase in toll rate, there is a point when toll revenue will stop increasing as it is estimated that the loss in traffic cannot be made-up by the increase in the toll rate. These maximum points in the curves are defined as the toll revenue maximizing toll rates. As corridor demand increases, it is apparent that the toll revenue maximizing toll rates increase as well. For low corridor volumes of 7,000 and below the toll revenue maximizing toll rates are estimated to be between $0.20 and $0.40 cents per mile. At these low levels of corridor demand, the time savings is minimal and such that the toll rate can only increase a limited amount until it is estimated no motorists would choose the ETL. For higher levels of corridor demand, the toll revenue maximizing toll rates are estimated to be quite high, with corridor demand of 8,500, the revenue maximizing toll rate of $1.20 is estimated. At these levels of corridor demand, time savings is significant.

Figure 62 presents the estimated potential hourly revenue as a function of corridor demand for the ETL. The salient point of this graph is the quick increase in potential toll revenue as corridor demand rises. There is very limited revenue potential until congestion hits the corridor, which is evident in this graph. It mirrors the speed deterioration curves presented in the data collection portion of this document. There is a steep relationship between speeds and volume, with no speed implications up to 80 to 85 percent of capacity and then steep deterioration of speeds as you reach maximum capacity of the roadway. This is the same concept in potential revenue for the ETL, as shown in this graphic.

Figure 61: ETL Hourly Toll Revenue as a Function of Toll Rate and Corridor Demand

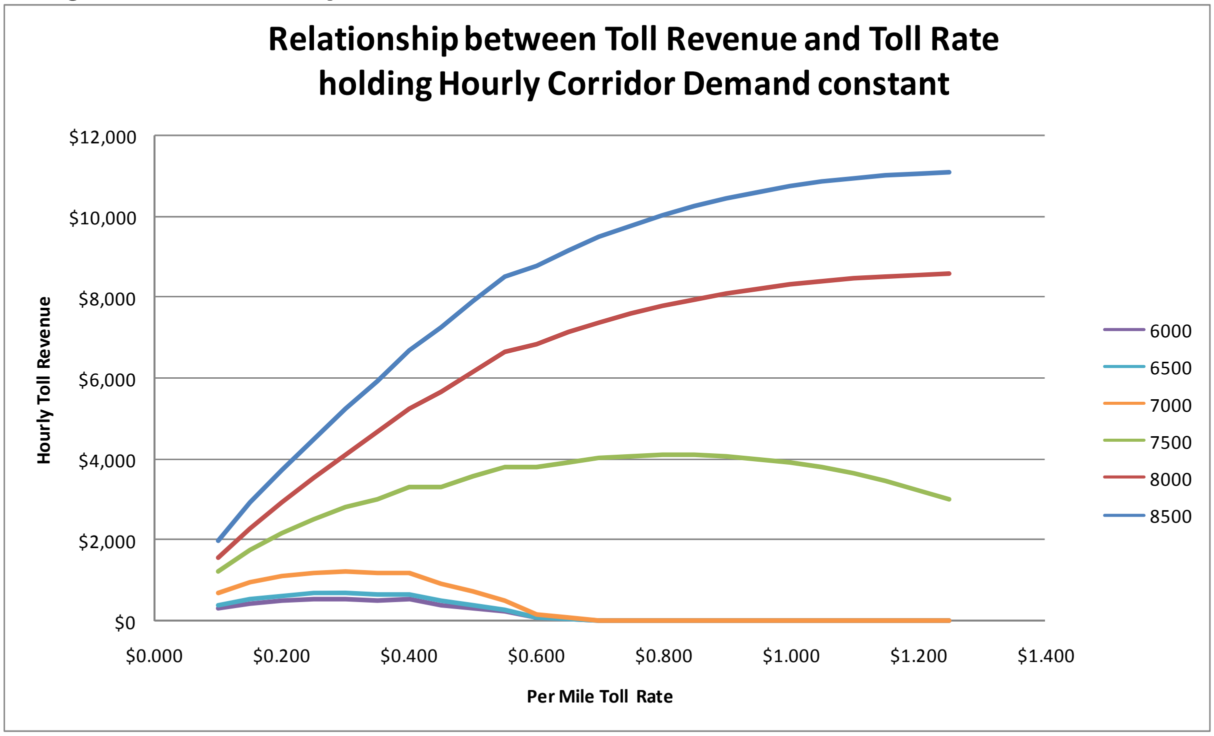
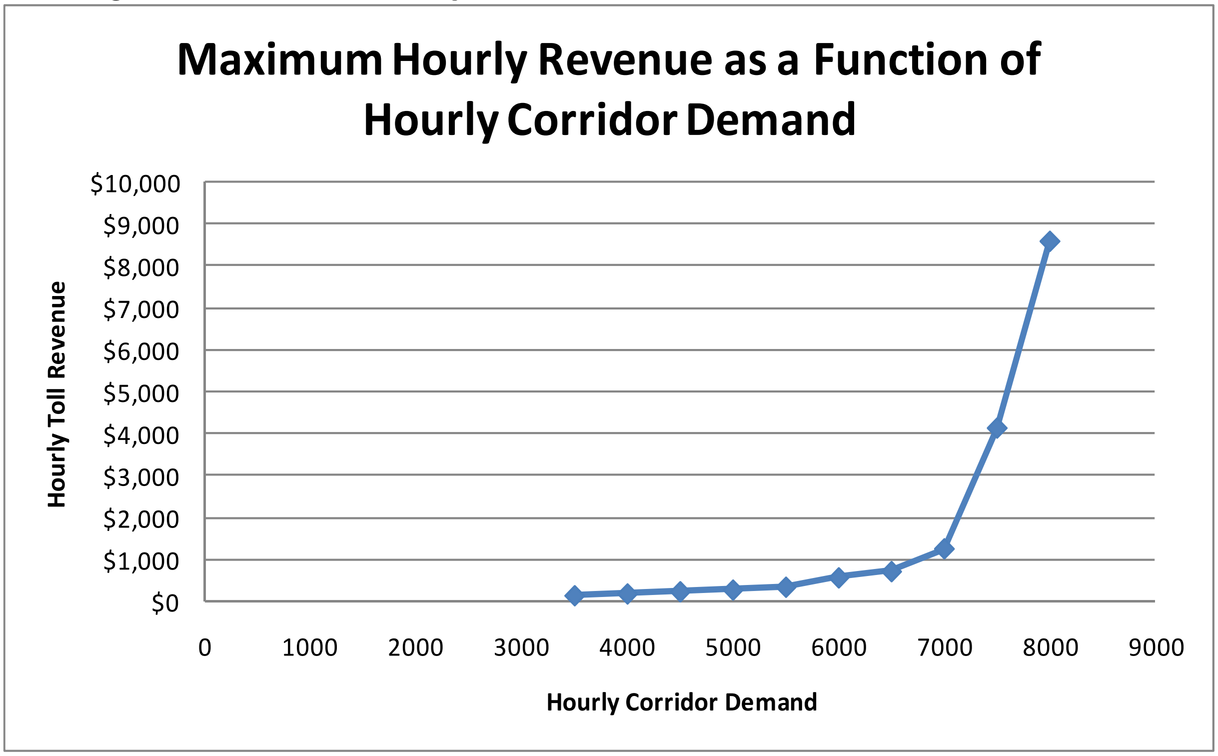


Figure 62: Maximum Hourly Car Toll Revenue as a Function Corridor Demand



6.3.2 Trucks

The previous section reviewed the toll sensitivity of passenger cars. In this section, the toll sensitivity of trucks is analyzed. The same graphics are presented to show the relationships between truck traffic, truck toll revenue and maximum truck toll revenue as a function of corridor demand and truck per mile toll rates. Figure 63, Figure 64 and Figure 65 present these data. Note the shapes of the curves are very similar with only the axis changing to represent lower volumes, higher toll rates and appropriately calculated levels of toll revenue.

Since the shapes of the curves are the same it could be inferred that the sensitivity to tolls is identical to that of passenger cars, however, that is not quite the case. While it is estimated that trucks have the same sensitivity to toll increases generally (as a function of higher toll rates), trucks are not expected to choose managed lane facilities at the same rates as passenger cars at any toll rate. It is estimated that the participation of trucks in the I-95 ETL will be approximately 25 percent that of passenger cars. This means that with all other things equal, such as congestion on the toll-free lanes and existing toll plan in place as described previously, then drivers of trucks are 25 percent as likely to choose the ETL as drivers of passenger cars. This is due to the minimal benefit for trucks in saving small amounts of time for a more expensive toll on what is typically a much longer trip.

Figure 63: ETL Hourly Truck Traffic Volumes as a Function of 5 Axle Truck Toll Rate and Corridor Demand

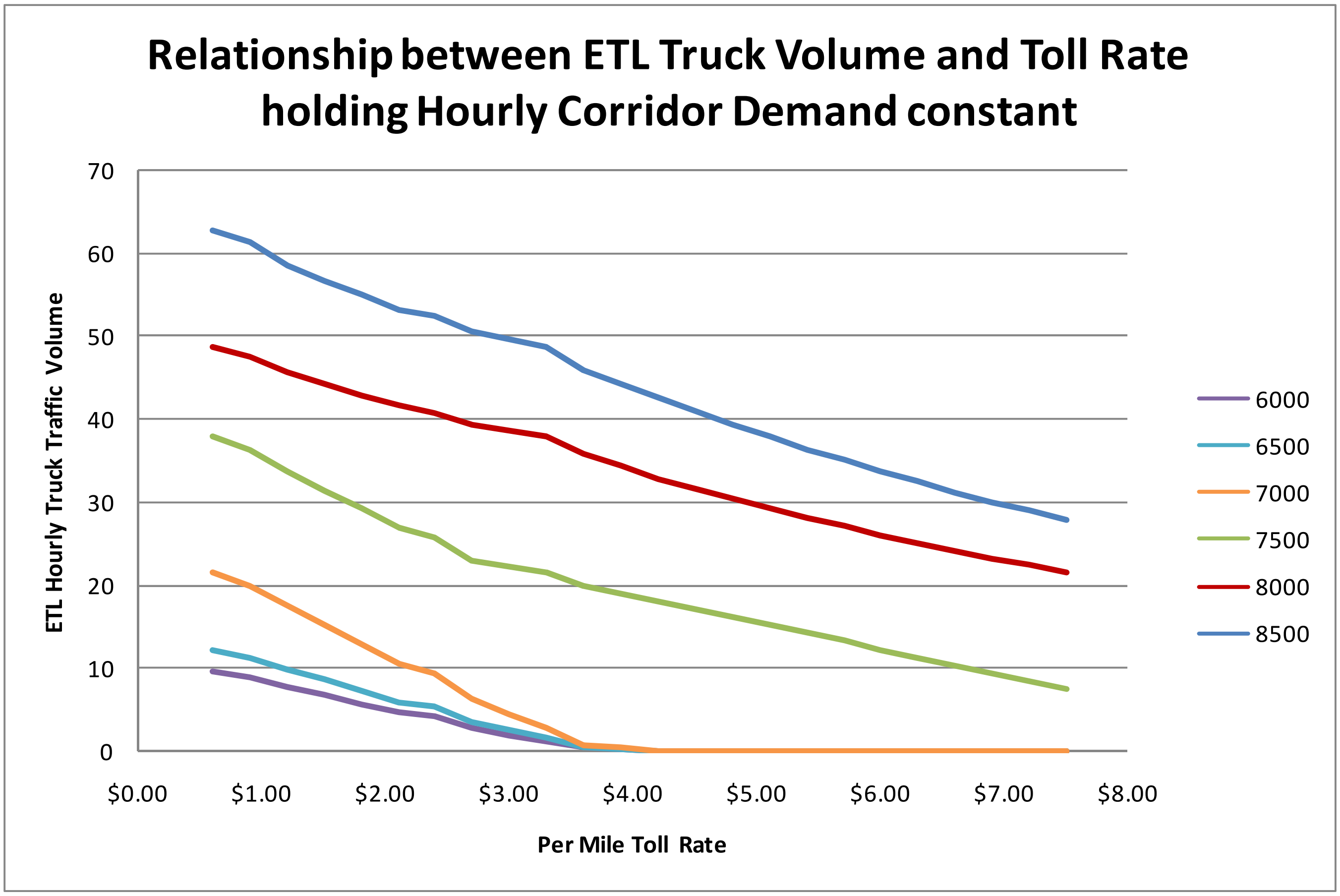


Figure 64: ETL Hourly Truck Toll Revenue as a Function of 5 Axle Truck Toll Rate and Corridor Demand

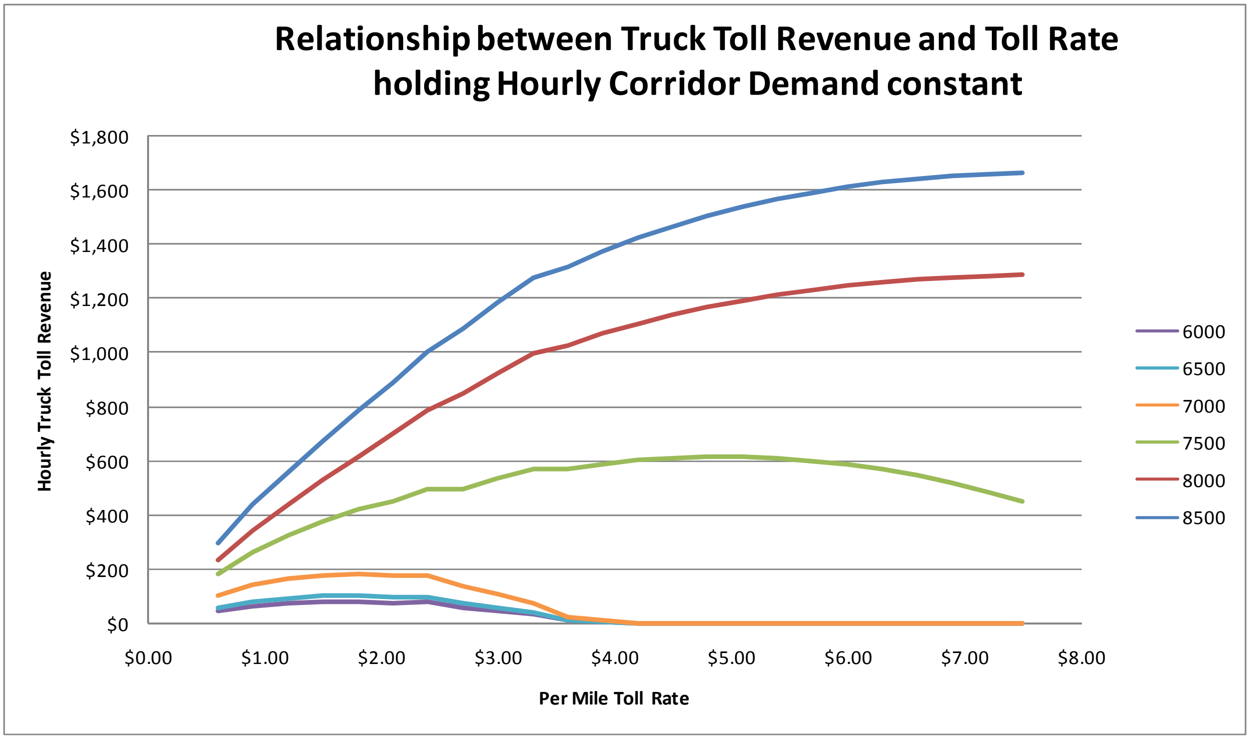
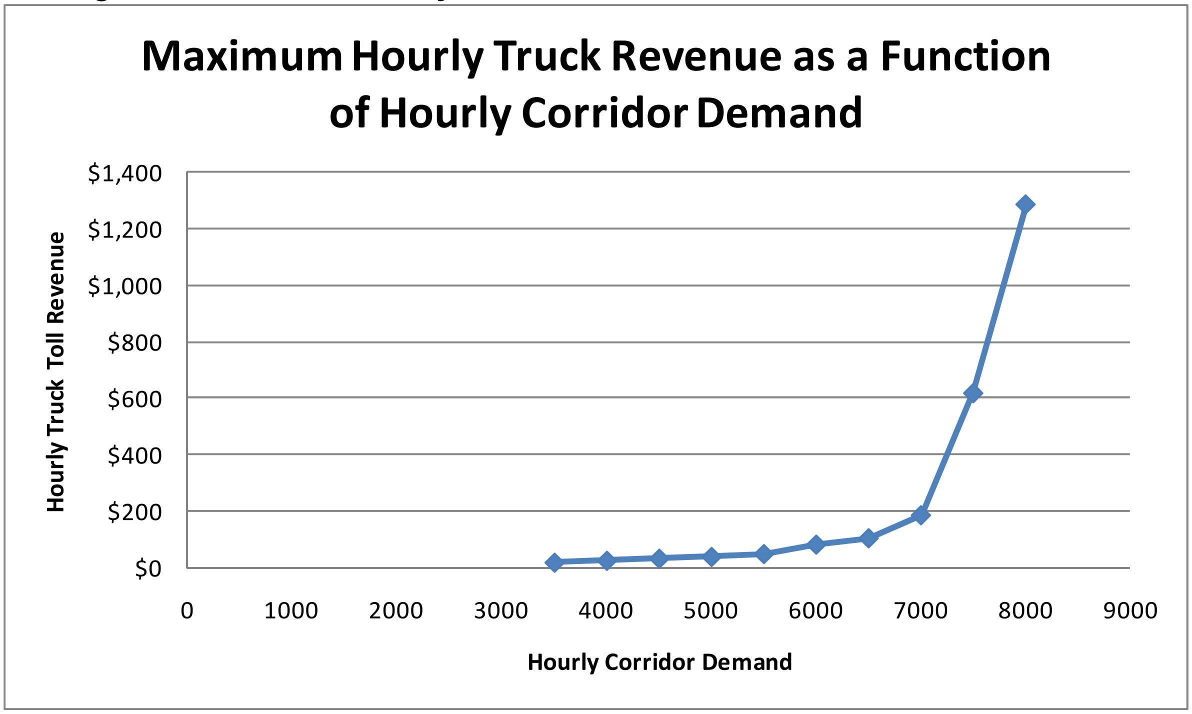


Figure 65: Maximum Hourly Truck Toll Revenue as a Function Corridor Demand



6.3.3 Toll Sensitivity by Time Period

The previous section presented toll sensitivity as a function of corridor demand which fluctuates during the course of a day. In this section, toll sensitivity is presented by a specific time period that relates to tolling periods for the I-95 ETL. These time periods are a function of corridor demand as presented in the hourly profiles previously such that traffic flows within each time period are at a similar level requiring similar toll rates for management of traffic. Table 15 presents these time periods by direction. Time periods differ by day of week (weekday versus weekend) and direction (northbound versus southbound).

Table 15: I-95 ETL Tolling Time Periods

Period/Day	Time	
	Southbound	Northbound
Peak		
Mon-Fri	6:00 am-9:00 am	3:00 pm-7:00 pm
Sat	12:00 pm-2:00 pm	12:00 pm-2:00 pm
Sun	2:00 pm-5:00 pm	2:00 pm-5:00 pm
Off-Peak		
Mon-Fri	5:00 am-6:00 am	6:00 am-3:00 pm
Mon-Fri	9:00 am-9:00 pm	7:00 pm-9:00 pm
Sat	5:00 am-12:00 pm	6:00 am-12:00 pm
Sat	2:00 pm-9:00 pm	2:00 pm-9:00 pm
Sun	5:00 am-2:00 pm	6:00 am-2:00 pm
Sun	5:00 pm-9:00 pm	5:00 pm-9:00 pm
Overnight		
Mon-Sun	9:00 pm-5:00 am	9:00 pm-5:00 am

In this section, toll sensitivity for opening year (2015) is presented by each time period for weekdays and weekends. Full documentation of toll sensitivity runs is provided in the appendix of this report showing toll sensitivity by direction and for years 2020 and 2015 as well.

The figures that follow illustrate the relationship between ETL traffic and toll revenue for E-ZPass passenger car toll rates ranging from $0.40 to $8.00. For time periods in which revenue levels peak at tolls below $8.00, only the relevant toll rates are shown. This occurs in all but the weekday peak periods. During weekday peak periods, traffic levels drop considerably as toll increases with a leveling of toll revenue toward the upper limit of toll rates. For off-peak periods, since traffic in the general purpose lanes travel consistently at free-flow speeds, the toll revenue hits maximum revenue consistently at $1.20. For weekend peak periods the revenue maximizing toll rate is approximately $2.00 to $2.40.

Figure 66: I-95 ETL Toll Sensitivity, Weekday Peak, 2015

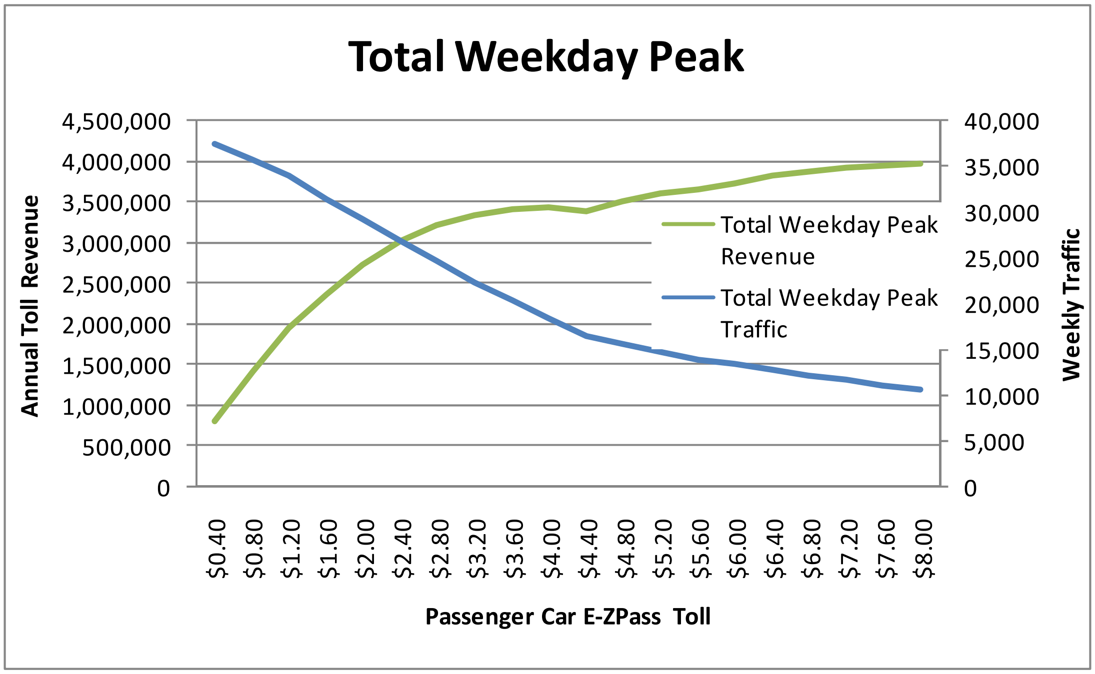


Figure 67: I-95 ETL Toll Sensitivity, Weekday Off-Peak, 2015

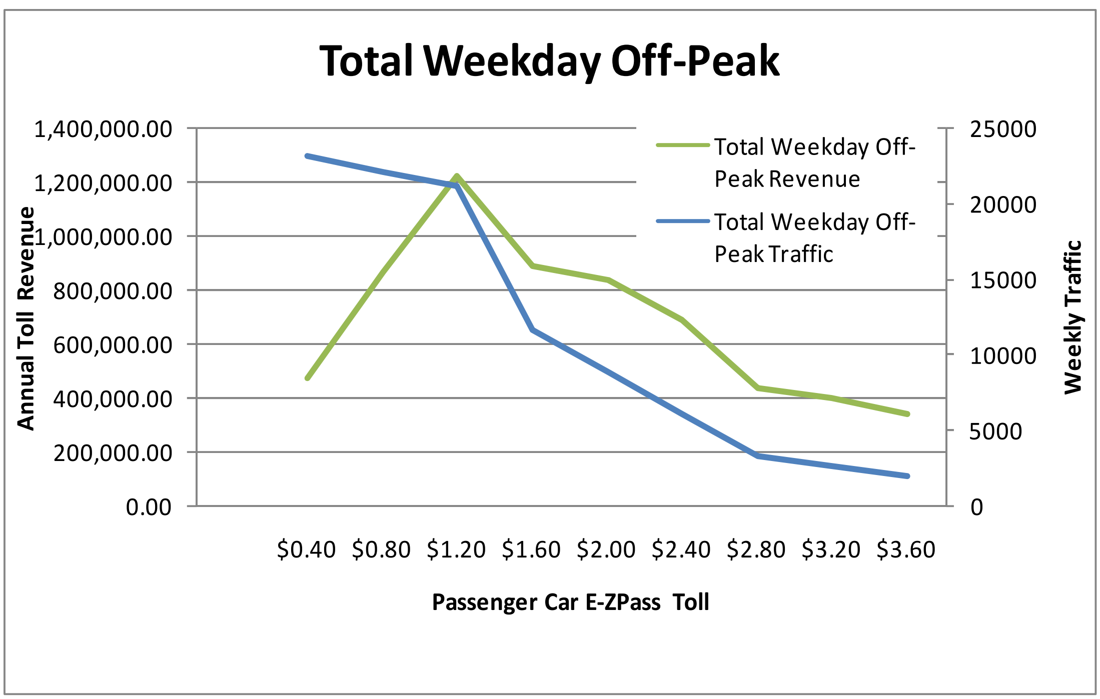


Figure 68: I-95 ETL Toll Sensitivity, Weekend Peak, 2015

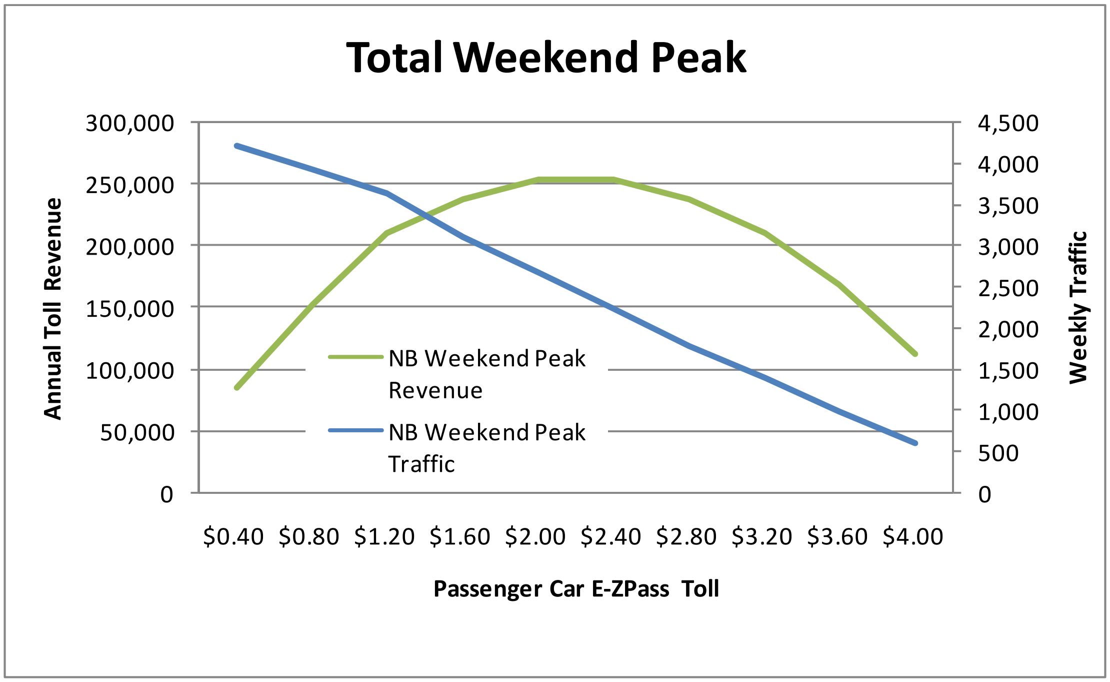


Figure 69: I-95 ETL Toll Sensitivity, Weekend Off-Peak, 2015

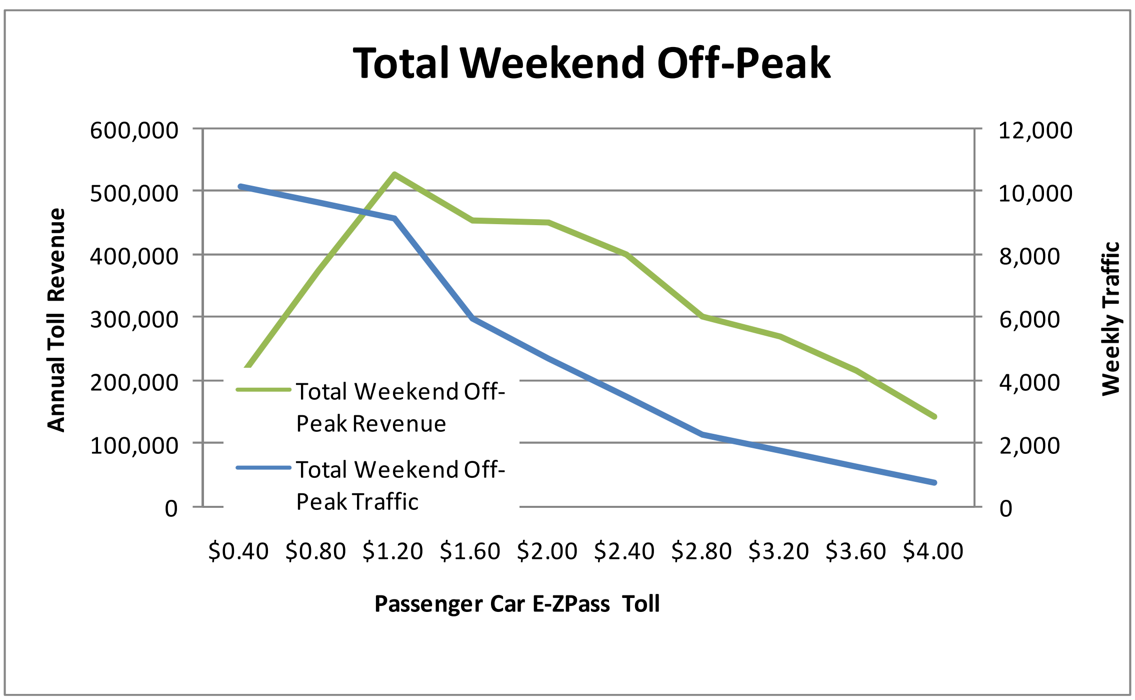
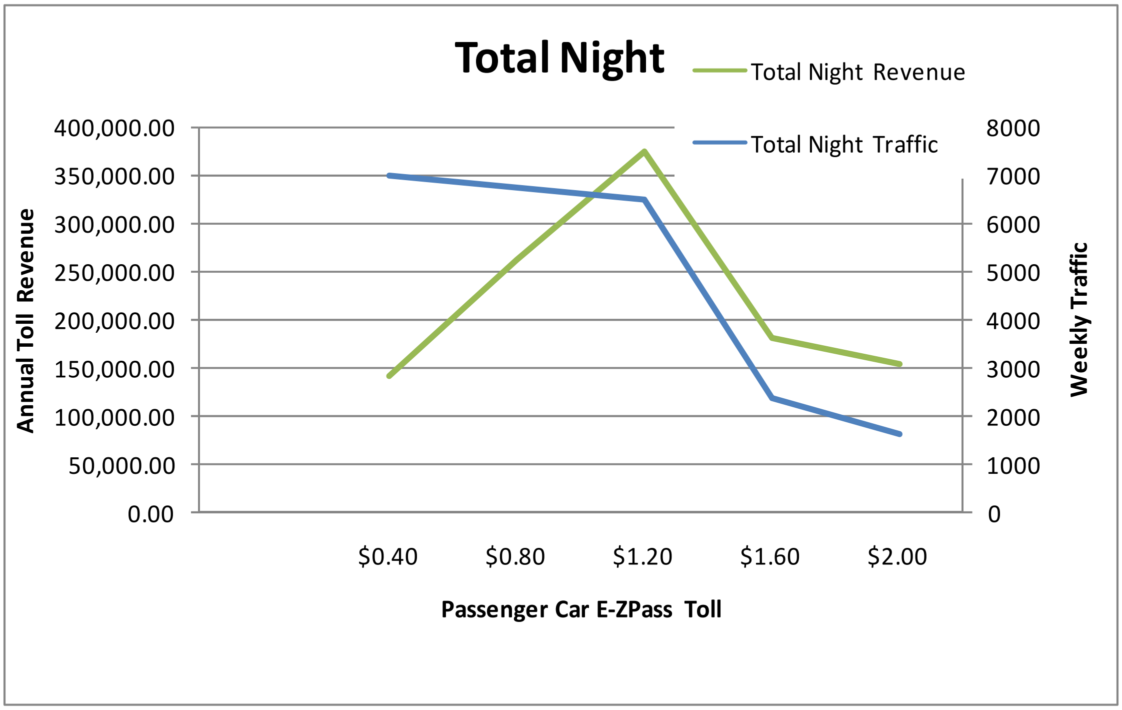


Figure 70: I-95 ETL Toll Sensitivity, Overnight, 2015



6.4 Traffic and Toll Revenue Estimates

Three different estimates of traffic and toll revenue are provided based upon three different tolling policies. First, the base case is provided which assumes the base toll plan presented in the assumptions portion of this section. Then the estimates that assume a revenue-maximizing toll policy are presented, which would provide the estimated maximum revenue available from the ETL with all other assumptions of corridor demand, hourly profile, and the like remaining constant. The final estimates provided are those assuming a throughput maximizing toll rate subject to minimum toll requirements. These final two alternatives bookend the revenue estimates with high and low potential revenues if toll policy were to be adjusted to these two most extreme levels.

6.4.1 Base Case

These base case estimates assume a toll plan as presented previously. This basically assumes a toll rate will be implemented that manages travel speeds in the I-95 ETL to 55 miles per hour. This policy is subject to six pricing periods as is described in the foregoing sections.

There are two infrastructure assumptions for the I-95 ETL allowing for a phased implementation of the lanes. The estimates for both are provided in the following sections, the interim facility and the ultimate facility.

6.4.1.1Full Facility

The full facility, as described in this document, is assumed to open December 1, 2014. The proposed toll schedule for 2015 and 2025 is presented in Table 16. The time period ranges are consistent with what was presented previously in the toll sensitivity analyses section of this report. Similarly, the toll rate ranges are identical to the ICC rate ranges to provide consistency across MDTA facilities. Through the course of the analysis, it was evident that these ranges were appropriate for management of traffic in this corridor. For the duration of the forecast, it is estimated that only peak period toll rates will need to be increased to manage traffic levels. It is estimated that the maximum toll rates will be needed by 2023. The estimated change in peak period tolls to manage traffic is shown in Table 18. It should be noted that these are the rates that were developed in this analysis and used for the purposes of estimating traffic and toll revenue. The operational rates could be different as actual traffic experience will dictate the needed toll rates to manage traffic.

Table 16: Estimated E-ZPass Passenger Car Toll Schedule for Southbound I-95 ETL for 2015 and 2025

Period/Day	Time	Rate Range	2015		2025	
			Rate per Mile	Toll	Rate per Mile	Toll
Peak						
Mon-Fri	6:00 am-9:00 am	$0.25-$0.35	$0.25	$1.75	$0.35	$2.45
Sat	12:00 pm-2:00 pm	$0.25-$0.35	$0.25	$1.75	$0.35	$2.45
Sun	2:00 pm-5:00 pm	$0.25-$0.35	$0.25	$1.75	$0.35	$2.45
Off-Peak						
Mon-Fri	5:00 am-6:00 am	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Mon-Fri	9:00 am-9:00 pm	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Sat	5:00 am-12:00 pm	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Sat	2:00 pm-9:00 pm	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Sun	5:00 am-2:00 pm	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Sun	5:00 pm-9:00 pm	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Overnight						
Mon-Sun	9:00 pm-5:00 am	$0.10-$0.30	$0.10	$0.70	$0.10	$0.70

Table 17: Estimated E-ZPass Passenger Car Toll Schedule for Northbound I-95 ETL for 2015 and 2025

Period/Day	Time	Rate Range	2015		2025	
			Rate per Mile	Toll	Rate per Mile	Toll
Peak						
Mon-Fri	6:00 am-9:00 am	$0.25-$0.35	$0.25	$1.75	$0.35	$2.45
Sat	12:00 pm-2:00 pm	$0.25-$0.35	$0.25	$1.75	$0.35	$2.45
Sun	2:00 pm-5:00 pm	$0.25-$0.35	$0.25	$1.75	$0.35	$2.45
Off-Peak						
Mon-Fri	5:00 am-6:00 am	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Mon-Fri	9:00 am-9:00 pm	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Sat	5:00 am-12:00 pm	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Sat	2:00 pm-9:00 pm	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Sun	5:00 am-2:00 pm	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Sun	5:00 pm-9:00 pm	$0.20-$0.30	$0.20	$1.40	$0.20	$1.40
Overnight						
Mon-Sun	9:00 pm-5:00 am	$0.10-$0.30	$0.10	$0.70	$0.10	$0.70

Table 18: Estimated Peak Period E-ZPass Passenger Car Tolls for I-95 ETL, 2015 to 2025

Year	Peak Period Toll
2015	$1.75
2016	$1.75
2017	$1.75
2018	$1.75
2019	$1.75
2020	$1.90
2021	$2.05
2022	$2.15
2023	$2.45
2024	$2.45
2025	$2.45

With this toll schedule in place and the assumptions presented in this document, the estimates of annual traffic and toll revenue are presented in Table 19. It is estimated that traffic on the ETL will grow at an average annual rate of 5.7 percent and toll revenue will grow at 8.3 percent. The cause for this discrepancy is the estimated needed increase in tolls to manage traffic during peak travel periods as shown in Table 16. This same information is illustrated in Figure 71 to more clearly identify the differences in growth rates.

Table 19: I-95 ETL Annual T&R Estimates (Millions)

Fiscal Year	I-95 ETL Estimated Annual T&R Transactions	I-95 ETL Estimated Annual T&R Gross Toll Revenue
2015	1.8	$3.1
2016	3.6	$6.1
2017	4	$6.8
2018	4.2	$7.1
2019	4.4	$7.5
2020	4.6	$8.2
2021	4.7	$8.7
2022	4.9	$9.6
2023	5	$10.6
2024	5.2	$11.0
2025	5.4	$11.5

Figure 71: I-95 ETL Annual T&R Estimates (Millions)

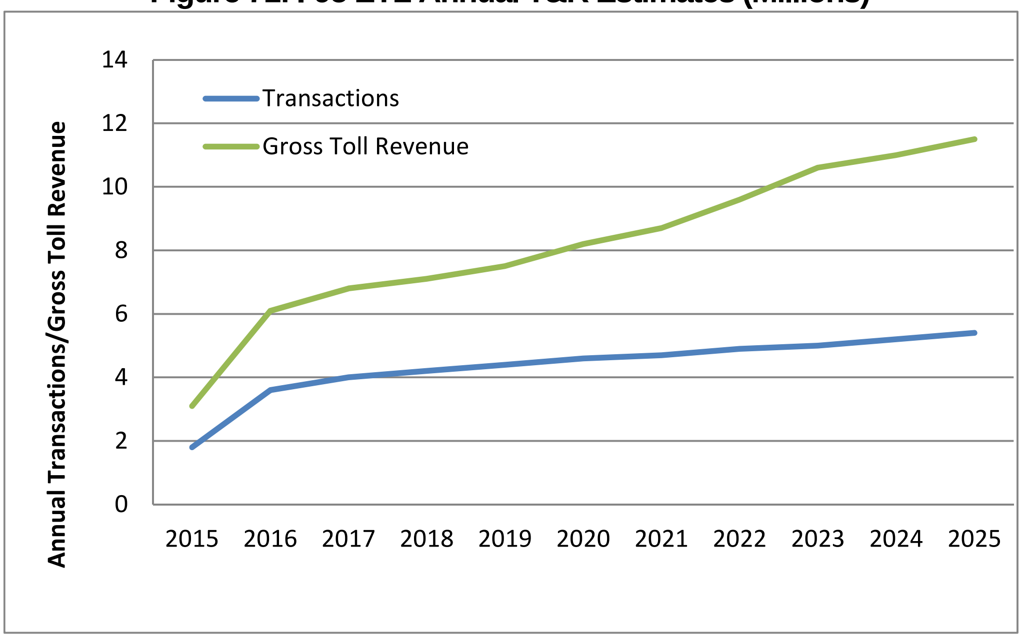


Table 20 presents the estimated average daily traffic and I-95 ETL capture rates by fiscal year. Note the increases in capture rates over time indicating increased congestion as traffic in the corridor is estimated to steadily grow as presented previously.

Table 20: Estimated I-95 Average Daily Traffic and ETL Capture Rates

Fiscal Year	Estimated I-95 Traffic			
	Toll-Free General Purpose	Express Toll Lanes	Total	Capture Rate
2015	167,322	10,038	177,360	5.7%
2016	168,666	10,468	179,134	5.8%
2017	169,916	11,009	180,925	6.1%
2018	171,163	11,571	182,734	6.3%
2019	172,468	12,093	184,562	6.6%
2020	173,824	12,583	186,407	6.8%
2021	175,519	12,752	188,271	6.8%
2022	176,672	13,482	190,154	7.1%
2023	178,395	13,660	192,055	7.1%
2024	179,824	14,152	193,976	7.3%
2025	181,074	14,842	195,916	7.6%

As stated previously, the estimates presented in this section do not take into account the benefit of alternative toll schedules during holiday events that will likely provide slight marginal benefit to presented traffic and toll revenue. This slight benefit was deemed not significant enough to incorporate into these estimates of annual revenue.

6.4.2 Revenue Maximizing

In addition to the base case which employs the tolling policy identified in the assumptions of the analysis, a sensitivity test was run assuming toll revenue maximizing toll rates were implemented. This revenue sensitivity analysis used the results of the toll sensitivity analyses which determined the toll revenue maximizing toll rates by time period. Those toll revenue maximizing rates were then applied in the forecasting model and the appropriate levels of estimated traffic and toll revenue from the I-95 ETL were estimated. All other assumptions of value of time, corridor growth, violations and the like were held constant from the base case to this sensitivity test to reflect only the change in toll policy.

Table 21 presents the estimates of traffic and toll revenue for this revenue maximizing case. The traffic is considerably lower as compared to the base case with revenue much higher. By year the traffic is between 14 and 27 percent lower than the base case with toll revenue between 36 and 62 percent higher.

Table 21: I-95 ETL Annual T&R Estimates, Revenue Maximizing Case

Fiscal Year	I-95 ETL Estimated Annual T&R	
	Transactions	Gross Toll Revenue
2015	1.8	$4.1
2016	3.2	$9.0
2017	3.2	$10.3
2018	3.3	$11.0
2019	3.4	$12.0
2020	3.5	$13.2
2021	3.6	$14.2
2022	3.7	$15.4
2023	3.7	$16.4
2024	3.9	$17.6
2025	4.0	$18.7

6.4.3 Throughput Maximizing

An additional sensitivity test was run with the goal of maximizing throughput in the I-95 corridor. This sensitivity test assumed a minimum toll of $0.40 at all times to maintain a positive net revenue flow from the project when accounting for toll collection costs. Table 22 presents the estimates of traffic and toll revenue for this sensitivity case. There is an estimated increase in traffic between 18 and 25 percent and decrease in toll revenue between 65 and 75 percent for this case. The lowering of tolls in the ETL provides access to more motorists and therefore more through-put, with the result of deteriorating toll revenue.

Table 22: I-95 ETL Annual T&R Estimates, Throughput Maximizing Case

Fiscal Year	I-95 ETL Estimated Annual T&R	
	Transactions	Gross Toll Revenue
2015	2.6	$1.0
2016	4.6	$2.1
2017	4.8	$2.3
2018	5	$2.4
2019	5.2	$2.5
2020	5.5	$2.6
2021	5.7	$2.7
2022	5.9	$2.8
2023	6.2	$2.9
2024	6.4	$3.1
2025	6.7	$3.2

The base case and sensitivity tests have an impact on travel speeds in the corridor. The base case is held to maintaining a speed of 55 miles per hour in the ETL subject to ICC toll rate ranges, while the two sensitivity cases disregard this constraint and are held to either maximizing revenue or throughput (with the exception of a minimum toll held for this case). The impact on minimum travel speeds is presented in Table 23. In the base case, the minimum travel speeds for the ETL is held near 55 miles per hour per toll policy with the toll-free general purpose lanes being 42 miles per hour in 2015 retreating to 38 miles per hour in the latter years of the forecast. The same trend is seen for the revenue maximizing case except with the ETL having the maximum speed allowed of 65 miles per hour due to the limited number of vehicles in the lanes because of the higher toll rates. In this case, the speeds in the adjacent toll-free general purpose lanes are estimated to decrease from 27 miles per hour to 20 miles per hour during the forecast period. For the final sensitivity test, the throughput maximizing case, the travel speeds in the ETL and the general purpose lanes are much closer with travel speeds on the ETL of between 47 and 44 miles per hour and on the general purpose lanes of between 45 and 40 miles per hour as a function of year. These speed differentials depict the consequence of toll policy adjustment to the traffic operations in both the ETL and the general purpose lanes for this portion of the I-95 corridor.

Table 23: Estimated I-95 Corridor Minimum Speeds By Case

	Minimum Estimated Speed in the Corridor (mph)					
	Base Case		Revenue Maximizing		Throughput Maximizing	
Year	Express Toll Lane	General Purpose Lane	Express Toll Lane	General Purpose Lane	Express Toll Lane	General Purpose Lane
2015	58	42	65	27	47	45
2016	58	42	65	26	47	45
2017	57	42	65	25	46	45
2018	56	41	65	25	46	44
2019	55	43	65	24	46	42
2020	55	42	65	24	45	42
2021	55	42	65	23	45	41
2022	55	42	65	23	45	41
2023	54	39	65	21	44	40
2024	54	39	65	20	44	40
2025	53	38	65	20	44	40

6.5 Risk Analysis

In the preceding section the base case and sensitivity cases were presented to provide an understanding of the range of potential traffic and toll revenues with varying toll policies. In this section, a risk analysis of the potential traffic and toll revenue is presented to provide a range of potential revenues assuming different levels of corridor growth, values of time, traffic operations and the like. In contrast to the sensitivity test regarding toll policy, all of these variables are outside of the control of the MDTA. For this risk analysis, toll policy and the other assumptions within the control of the MDTA were held constant to the base case assumptions.

A Monte Carlo analysis was conducted to obtain this more robust understanding of the potential amount of revenues that could be reasonably generated for the proposed I-95 ETL. Monte Carlo analyses use repeated random sampling over multiple iterations to estimate a range of possible outcomes. A Monte Carlo analysis involves the following elements:

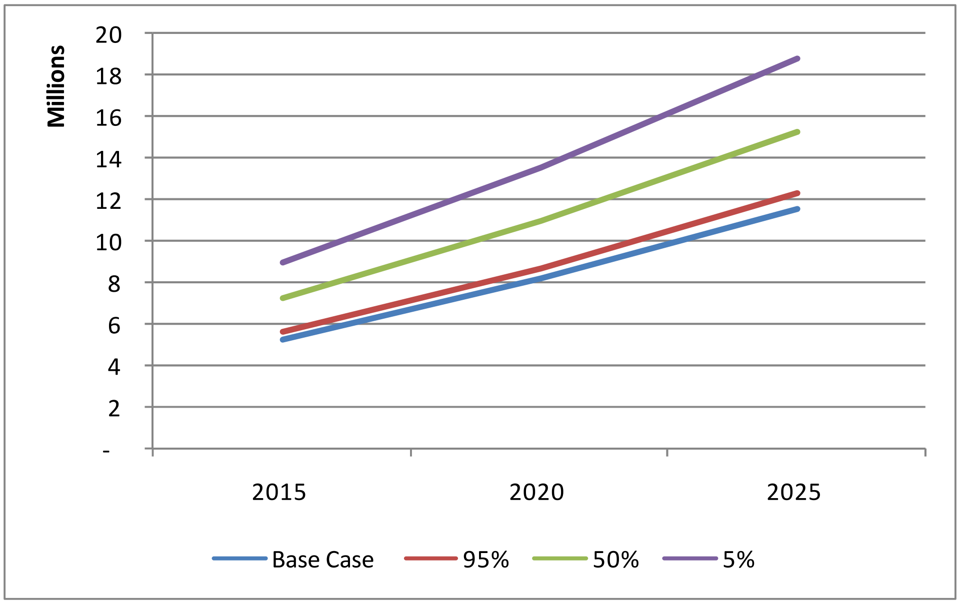
- Defined range of possible inputs;
- Randomly generated inputs within a specified probability distribution;
- Deterministic (or predictable) computation of the inputs; and
- Aggregate results of the individual computations.

The @Risk software was used to conduct this analysis, which carried out ten thousand iterations for the input parameters under analysis. Specifically, the risk analysis tested the impact on revenues based on a range of plausible values for each of the following parameters:

- Capacity on the general purpose lanes during weekdays and weekends;
- Capacity on the managed lanes during weekday and weekends;
- Value of Time Savings by using the Managed Lanes;
- Electronic toll collection (ETC) violation rates;
- Video tolling collection violation rates;
- Truck participation rate; and
- Traffic demand premium.

The results of the risk analysis indicated that the base case forecast is slightly above the 90% confidence forecast, which is defined as the forecast that has a probability of attainment of 90 percent. The 95 percent, 50 percent and 5 percent confidence level forecasts are depicted in Figure 72.

Figure 72: I-95 ETL Toll Revenue Forecast Risk Analysis



7.0 Limits and Disclaimers

It is Jacobs' opinion that the traffic and toll revenue estimates provided herein are reasonable and that they have been prepared in accordance with accepted industry-wide practice. However, given the uncertainties within the current economic climate, it is important to note the following assumptions which, in our opinion, are reasonable:

- This report presents the results of Jacobs' consideration of the information available as of the date hereof and the application of our experience and professional judgment to that information. It is not a guarantee of any future events or trends.
- The traffic and toll revenue estimates will be subject to future economic and social conditions, demographic developments and regional transportation construction activities that cannot be predicted with certainty.
- The estimates contained in this report, while presented with numeric specificity, are based on a number of estimates and assumptions which, though considered reasonable to us, are inherently subject to economic and competitive uncertainties and contingencies, most of which are beyond the control of the MDTA and cannot be predicted with certainty. In many instances, a broad range of alternative assumptions could be considered reasonable. Changes in the assumptions used could result in material differences in estimated outcomes.
- Jacobs' traffic and toll revenue estimations only represent our best judgment and we do not warrant or represent that the actual toll revenues will not vary from our estimates.
- We do not express any opinion on the following items: socioeconomic and demographic forecasts, proposed land use development projects and potential improvements to the regional transportation network.
- The standards of operation and maintenance on all of the system will be maintained as planned within the business rules and practices.
- The general configuration and location of the system and its interchanges will remain as discussed in this report.
- Access to and from the system will remain as discussed in this report.
- No other competing highway projects, tolled or non-tolled, are assumed to be constructed or significantly improved in the project corridor during the project period, except those identified within this report.
- Major highway improvements that are currently underway or fully funded will be completed as planned.
- The system will be well maintained, efficiently operated, and effectively signed to encourage maximum usage.

- No reduced growth initiatives or related controls that would significantly inhibit normal development patterns will be introduced during the estimate period.
- There will be no future serious protracted recession during the estimate period.
- There will be no protracted fuel shortage during the estimate period.
- No local, regional, or national emergency will arise that will abnormally restrict the use of motor vehicles.

In Jacobs' opinion, the assumptions underlying the projections provide a reasonable basis for the revenue projections and operating expenses. However, any financial projection is subject to uncertainties. Inevitably, some assumptions used to develop the projections will not be realized, and unanticipated events and circumstances may occur. There are likely to be differences between the projections and actual results, and those differences may be material. Because of these uncertainties, Jacobs makes no guaranty or warranty with respect to the projections disclosed in this Study.

* * * * *

We greatly appreciate the invaluable assistance provided by the staff of the Maryland Transportation Authority.

Very truly yours,

Richard J. Gobeille, P.E.
National Toll/Finance Unit Manager

Phil Eshelman
Project Manager

APPENDIX A

Stated Preference Survey Technical Memorandum

Jacobs Engineering

Value of Time of Motorists on I-95 ETLs
Final Technical Memorandum

February 5, 2013

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Table of Contents

EXECUTIVE SUMMARY

Jacobs Engineering Group and EurekaFacts as a subcontractor conducted a multimode traffic and toll revenue survey of users and non-users of E-ZPass for the I-95 Express Toll Lanes (ETL) in MD between the I-95/I-895 merge and MD43/White Marsh Boulevard.

The Multinomial Logit Model was used to estimate willingness to pay certain toll fees. The probabilities of choice in the model isolate the effects of other variables. The model measures motorists' willingness to spend certain amounts in order to save time.

Calculation of the Value of Time (VOT)

Description of Models Coefficients -- Each of the coefficients for travel time is greater than one and each of the coefficients for toll costs is less than one. The estimated coefficients say that the more time they save, the more likely the motorists are willing to choose ETL over existing highway lanes, and conversely, as the toll cost goes up, the less likely they are to choose ETL.

Value of Time Calculation -- The value of time is considered as the ratio of the impact (on choosing ETL over existing highway lanes) of a variation of $1.00 in toll cost ($\beta_Cost$) to the impact (on choosing ETL over existing highway lanes) of a variation 1 min in travel time saving (β_Time - factor 60 for hour), normalized by the percentage of respondents likely to choose ETL in the given sub-population (PCT). In other words, we average VOT to include the average value of time of motorists for those who choose ETL as well as the average value of time for those who reject ETL ($0.00/hr).

The percentage of motorists choosing ETL decreases as fees rise. Furthermore, the toll fees that individuals are willing to pay are fairly consistent when comparing time savings of 5, 10 and 15 minutes.

There is wide ranging sensitivity to toll cost as a function of time of day, purpose of trip, and E-ZPass ownership. VOT estimates are for full universe of corridor motorists across all income levels.

Scenario		PCT	Parameter Estimates		VOT ($/hr.)
			Travel Time	Toll Cost	
E-ZPass	Peak Hours	37%	1.123	0.856	$16.90
	Off-Peak Hours	27%	1.149	0.733	$10.46
	Overall	32%	1.123	0.821	$13.99
Non E-ZPass	Overall	25%	1.148	0.594	$7.79

Scenario		PCT	Parameter Estimates		VOT ($/hr.)
			Travel Time	Toll Cost	
E-ZPass Commuting to / from work or work-related travel	Peak Hours	37%	1.117	0.870	$17.51
	Off-Peak Hours	29%	1.171	0.781	$11.57
E-ZPass Not work-related travel	Peak Hours	26%	1.149	0.796	$10.93
	Off-Peak Hours	36%	1.155	0.631	$11.77

Travel Time Savings

- Very similar sensitivity to travel times
- 12.3% to 14.9% **gain** in traffic for a minute time savings

Toll Cost

- Wide Ranging sensitivity to toll cost as a function of time of day and E-ZPass ownership
- 14.4% to 40.6% **loss** in traffic for toll increase of $1.00

INTRODUCTION

Jacobs Engineering Group Inc., one of the world's largest and most diverse providers of professional technical services, was awarded the Maryland Transportation Authority (MDTA) T&R contract in 2009 with EurekaFacts serving as a subcontractor. Jacobs was directed to conduct a traffic and toll revenue study for the I-95 Express Toll Lanes (ETLs). EurekaFacts was tasked with gauging the perceptions of motorists' value of time perceptions regarding ELTs under various conditions. The methods used included a mixed mode data collection approach including email, notification postcards, an online survey, and computer-assisted telephone interviewing (CATI) data collection.

EurekaFacts developed the survey instrument with assistance from Jacobs Engineering. An online quantitative survey was conducted among E-ZPass user and non E-ZPass user vehicle owners residing in the area of I-95 of interest (the area between the I-95/I-895 merge and MD43/White Marsh Boulevard). In addition to vehicle and respondent demographic data, the survey yielded measurements of the incidence drivers are likely to consider ETL under various circumstances (scenarios) and the relationship between perceived time savings and the cost they would be willing to pay. Lastly, a nonlinear regression analysis was conducted to measure the probability of individuals choosing ETLs over other options. A linear model was not selected in order to account for the natural discrete choices presented to individuals. The data resulting from this study will be used as input into the Jacobs revenue forecasting model.

Note: Results presented in this report are based on *stated intentions* and are not based on actual behaviors.

METHODOLOGY

Based upon a literature review and an investigation of previous related surveys, EurekaFacts developed an online survey instrument to record driver data including quantitatively measuring the value of time of motorists who use the section of I-95 of interest. The questionnaire was reviewed by Jacobs and approved after incorporating desired changes. To permit segmentation respondents were asked such questions about their most recent trip as trip origin, destination, purpose, day of week, time of the day, total travel time, travel frequency, as well as socio-economic demographic questions. The survey also contained preference scenario (trade-off) questions requiring respondents to choose between ELTs and other lanes under various conditions (peak/nonpeak, travel time savings, etc.) and the relationship between perceived time savings and the cost they would be willing to pay.

The survey was administered to a sample of both E-ZPass users and non E-ZPass users. Using the data collected from the survey, EurekaFacts performed descriptive statistics, crosstabs, willingness to pay modeling, and regression analyses.

Developing the Survey Instrument

The survey instrument was developed by EurekaFacts with assistance from Jacobs Engineering and MDTA. The instrument contained roughly 35 questions with a respondent burden of approximately 15 minutes to complete, depending on which scenario was presented to the respondent. The survey instrument included screener questions to ensure respondents are vehicle drivers familiar with the study area. The survey was pretested to 100 E-ZPass users. The instrument was inspected by a survey methods expert and then tested prior to deployment.

Sampling

To identify survey participants and obtain a balanced distribution of E-ZPass and non E-ZPass users along the I-95 Corridor, MDTA provided a list of 115,331 private vehicle E-ZPass users and 1,631 commercial vehicles whose owners reside in the geographic area covered by the study. The list contained email and mailing addresses. From this list a stratified sample was drawn containing 6,081 randomly selected private vehicle E-ZPass users and 1,169 commercial vehicle E-ZPass users. To identify candidate non-E-ZPass users, EurekaFacts purchased a list of vehicle owners residing in zip codes of the study as defined by Jacobs/MDTA and removing addresses of known E-ZPass users. This produced a list of 10,727 non E-ZPass users.

Postcards containing a web link to an online survey were sent to the addresses in the sample, and email messages containing the invitation link were sent to those for whom an email address was known. A unique code was provided to each respondent in order to avoid multiple entries and manage sampling. Recipients of the email or postcard were encouraged to complete the online survey which was available 24/7. EurekaFacts programmed the survey instrument and contacted non-respondents by telephone. The average time to administer the survey by CATI was also 15 minutes.

EurekaFacts mailed postcards containing a link to an online survey to the vehicle owners without an E-ZPass account. Both E-ZPass users and non E-ZPass users who did not complete the survey online were then contacted and surveyed by telephone. EurekaFacts assigned each survey participant a unique ID to ensure only one response per person. The survey was fielded between November 1 and November 16, 2012. There were no disruptive incidents or notable events during the data collection period that could suggest biases or other limitations to the data collection effort.

Data Collection

From this combined sample of 17,977 addresses, EurekaFacts obtained responses from 3,390 respondents. The survey yielded an overall response rate of 19% which is within the expected target. Response rates by group were: 22% among commercial vehicles, 42% among E-ZPass users and 5% among non E-ZPass users (the low response rate of the latter was not unexpected).

The number of complete responses collected yielded a margin of error of ± 4.0% for non-users, which is common in survey data. Percentages based on all 3,390 responses are subject to a ±1.5% margin of error at the 95% confidence level. In other words, for each sample size, one is 95% confident that the "true" percentage is in the region indicated by the corresponding segment with a ±1.5% margin of error.

Table 1: Response Rate Breakdown

Respondent	Vehicle Type	Sample	Raw Responses	Raw Response Rate
E-ZPass users	Commercial	1,169	259	22%
	Private	6,081	2,560	42%
Non E-ZPass users		10,727	571	5%
TOTAL		17,977	3,390	19%

For the purposes of analysis, we considered only complete and valid responses so individuals who did not answer at least one ETL question were removed from the sample. As a result, the number in the sample was reduced by about 1,000 cases. The reason for exclusion of cases was based on the screening due to non-use of the section of I-95 under study. The following table shows the total number of complete usable cases by survey mode.

Table 2: Number Responding by Survey Mode

Data Collection Mode	No. Responding	Percent
Email/Online	2,006	84%
Postcard/Online	148	6%
Telephone	242	10%
Total	2,396	100%

Statistical Analysis Techniques

After examining response/non-response, EurekaFacts chose not to weight the data and instead conducted separate analyses of users and non-users. The differences introduced by survey mode included income and gender differences but were considered small enough not to warrant weighting. The large difference in sample sizes would have introduced large estimation errors in the more precise data set of E-ZPass users (who happen to be the main population of interest).

EurekaFacts conducted descriptive analyses and cross-tabulations to obtain a picture of survey responses and respondents' demographics. Various statistical analyses were conducted to provide additional insight into the parameters collected, including descriptive analysis, frequencies, crosstabs and chi-square tests. As a result, some variables' categories were grouped to provide a more robust incidence of the variables associated with willingness to use ETL.

Willingness to Pay Analyses

Willingness to pay is a choice modeling technique used to determine the maximum amount a person would be willing to pay or sacrifice to receive a good - in this case - a toll fee in exchange for faster ETL lanes. EurekaFacts estimated consumer willingness to pay using a multi-step modeling analysis to ascertain the likelihood to use ETL lanes. The analysis queried people to ascertain how they balance the cost of ETL lanes versus other factors, such as perceived time savings. Using this data, EurekaFacts generated an alternative pricing schedule for ETLs. In order to reduce fatigue and optimize data collection, respondents were asked only two or three different willingness to pay questions regarding time savings and toll fee levels. EurekaFacts used this data to extrapolate willingness to pay.

Value of time is very heterogeneous among motorists (e.g., males have a different willingness to pay for ETL than females) and often depends on such socio-demographic factors as age, gender and income. Even though pricing will not be based on demographics, understanding motorists' differential willingness to pay for ETL is important in designing a price structure and finding the optimum price that could generate maximum revenue. For that reason, EurekaFacts analyzed responses to identify segments of customers based on their appreciation of usage of ETL. EurekaFacts studied the distribution of commuters' preferences for the ETL, key factors influencing choice in usage of the ETL, and the impact of value of time to motorists. To accomplish this EurekaFacts utilized the scenario variables (toll pricing and travel saving time), trip characteristics variables (such as origin of the trip, destination of the trip, purpose of the trip, day of week of the trip, time of the day, total travel time, travel length, frequency of travel) and demographic variables as predictors to model the value of time to motorists.

The analysis included calculations to ascertain the relationship between perceived time savings and the toll motorists are willing to pay. EurekaFacts used a Multinomial Logit Model because it is most appropriate for the type of discrete choice data. Using a Multinomial Logit Model we ascertained the likelihood a respondent would choose an ETL at a given toll fee to save a given amount of time over existing highway lanes. Specifically, the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) were used to select the best model to measure relative goodness of fit. ETL questions were transposed (one line represents one ETL question) for the purpose of the statistical modeling.

RESULTS OF STATISTICAL ANALYSES

The following descriptive statistics includes the results of tabulations and crosstabs performed on the data associated with each question. The data has been grouped into results for non E-ZPass users only and E-ZPass users. By design, the bulk of the reported data falls into the last category. It should be noted that totals in the tables that follow differ slightly because not all respondents answered all survey questions. The total refers to the total number of responses to the specific survey question.

Likelihood to use ETL was examined among both users and non-users. However, the questions regarding choice of lanes at certain toll fees offer greater precision and methodological reliability among users. For this reason the document examines ETL choice among E-ZPass users only.

Results for Non-E-ZPass Users

While the objective of the study was to estimate the value of time to motorists among E-ZPass users, the incidence of users and intent to acquire E-ZPass is of interest as well. Among non-users, the most common reasons cited for not using E-ZPass were not using toll roads (66%), the cost of E-ZPass (26%), and concern for privacy (10%). For this table, the percent column does not total 100% because respondents could choose more than one reason.

Table 3: Reasons for Not Having/Wanting an E-ZPass

Reasons for not having or not wanting an E-ZPass	No. Responding	Percent
I do not use toll roads often	145	66%
Too costly	57	26%
Concerned about privacy	23	10%
No credit card	9	4%
What's an E-Z Pass?	3	1%
Other, please specify	42	19%
Total	279	

Among non-users, 37% indicated they are willing to use E-ZPass.

Table 4: Non-User Willingness to Purchase E-ZPass

Non-User Willingness to Purchase E-ZPass	No. Responding	Percent
I do not have an E-ZPass, but I would obtain one if it made travel easier	121	37%
I do not have an E-ZPass and I will not get one	208	63%
Total	329	100%

Results for E-ZPass Users

E-ZPass Users Crosstab Results

User Vehicle Types

The vast majority of respondents (94%) drive either a 2-axle passenger car, SUV or pick-up truck as their primary vehicle. The remainder drove commercial trucks or motorcycles.

Table 5: Types of Vehicles Driven

Type of Vehicle Driven	No. Responding	Percent
Passenger car, SUV, or pick-up truck (2-axle private vehicle)	1,908	94%
2-axle truck	76	4%
3-axle vehicle (including cars pulling a one axle trailer)	4	0%
4-axle vehicle (including cars pulling a two axle trailer)	11	1%
5-axle vehicle (including cars pulling a three axle trailer)	8	0%
6-axle truck or larger	5	0%
Motorcycle	4	0%
Other	11	1%
Base:	2,027	100%

Most respondents (85%) drive their vehicle for private use as opposed to commercial or mixed use.

Table 6: Usage of Vehicle

Usage of Vehicle	No. Responding	Percent
Private	1,729	85%
Commercial	97	5%
Mixed (private and commercial)	203	10%
Base:	2,029	100%

User Demographics

All respondents reported having a valid driver’s license.

Table 7: Breakdown of Respondents with Valid Driver’s License

Have valid driver's license	No. Responding	Percent
Yes	2,033	100%
No	0	0%
Total	2,033	100%

Respondents were 58% male.

Table 8: Gender of Respondents

Gender	No. Responding	Percent
Male	1,180	58%
Female	774	38%
Prefer not to answer	66	3%
Total	2,020	100%

Household income was well distributed but with slightly fewer respondents in the lowest and highest income brackets. Those earning less than $50,000 per year comprised 15% of respondents. Those earning more than $150,000 comprised 11%. This measure is consistent with the household income for residents of Maryland when compared with estimates reported by the U.S. Census Bureau American Community Survey.

Table 9: Household Income of Respondents

Household income	No. Responding	Percent
Less than $25,000	59	3%
$25,001 to $50,000	232	12%
$50,001 to $75,000	348	17%
$75,001 to $100,000	389	19%
$100,001 to $150,000	391	19%
More than $150,000	224	11%
Prefer not to answer	365	18%
Total	2,008	100%

Respondents were mostly likely to between 46 to 65 years of age (51%) and least likely to be 18 to 25 years old (3%).

Table 10: Age of Respondents

Age	No. Responding	Percent
18 - 25	51	3%
26 - 35	317	16%
36 - 45	361	18%
46 – 55	541	27%
56 – 65	479	24%
66 or older	177	9%
Prefer not to answer	96	5%
Total	2,022	100%

Respondents typically work full time (77%) or are retired (11%). About 8% work part time or are unemployed.

Table 11: Employment Status of Respondents

Employment status	No. Responding	Percent
Work full-time	1,547	77%
Work part-time	104	5%
Temporarily unemployed	38	2%
Do not work, but not retired	26	1%
Retired	227	11%
Prefer not to answer	77	4%
Total	2,019	100%

User Travel Habits

Most respondents traveled the section of I-95 of interest varied often. About 37% travel the section 4 or more times per week and another 24% travel it 1 to 3 times per week.

Table 12: Frequency of Travel on I-95 Section of Interest

Frequency I-95 section of interest is traveled	No. Responding	Percent
4 or more times per week	754	37%
2 to 3 times per week	289	14%
Once a week	206	10%
1 to 3 times per month	446	22%
Less than once a month, but more than twice a	266	13%
2 times per year or less	67	3%
Never	5	0%
Total	2,033	100%

Of those who traveled it rarely, the reasons cited for not using the I-95 section included "not on my way" (72%) and traffic congestion (13%).

Table 13: Reasons for Not/Rarely Using the I-95 Section of Interest

Reason not/rarely using the I-95 section of interest	No. Responding	Percent
Not on my way to where I need to go	52	72%
Traffic congestion	9	13%
Other (Please specify)	11	15%
Total	72	100%

Exits 62, 64, and 67 on I-95 are heavily used. About 42% of respondents reported entering I-95 at either exists 62, 64, or 67 while 38% entered at a point north of Exit 67.

Table 14: Where Respondents Entered the I-95 Highway

Where entered the I-95 Highway	No. Responding	Percent
North of Entrance ramp 67 (already on I-95)	776	38%
Entrance ramp 67 MD 43 (White Marsh)	227	11%
Entrance ramp 64 I-695 (Baltimore Beltway)	494	24%
Entrance ramp 62, I-895 South (Harbor	137	7%
South of Entrance ramp 62 (already on I-95)	392	19%
Total	2,026	100%

Half of respondents (50%) reported exiting at 62, 64, or 67 while 31% exited south of exit 62.

Table 15: Where Respondents Exited the I-95 Highway

Where exited the I-95 Highway	No. Responding	Percent
North of Entrance ramp 67 (already on I-95)	366	18%
Entrance ramp 67 MD 43 (White Marsh)	371	18%
Entrance ramp 64 I-695 (Baltimore Beltway)	305	15%
Entrance ramp 62, I-895 South (Harbor	348	17%
South of Entrance ramp 62 (already on I-95)	636	31%
Total	2,026	100%

Sunday was the least traveled day of the week but Tuesday was fairly light as well. Traffic frequency was nearly equal among all other days, even Saturday. Respondents were most likely to travel in the morning (54%), followed by afternoon (26%), evening (18%), and night (2%). The most traveled hours of the day were 7am-8am, followed by 6am-7am and 8am-9am.

Table16: Day of the Week Trip Taken

Day of the week trip taken	No. Responding	Percent
Monday	369	18%
Tuesday	209	10%
Wednesday	330	16%
Thursday	356	18%
Friday	323	16%
Saturday	306	15%
Sunday	133	7%
Total	2,026	100%

Table 17: Time of Day Trip Taken

Time of the day trip taken	No. Responding	Percent
Morning (4am - 12pm)	**1,089**	**54%**
Between 4 AM and 5 AM	45	4%
Between 5 AM and 6 AM	95	9%
Between 6 AM and 7 AM	211	19%
Between 7 AM and 8 AM	250	23%
Between 8 AM and 9 AM	173	16%
Between 9 AM and 10 AM	140	13%
Between 10 AM and 11 AM	125	11%
Between 11 AM and 12 PM	52	5%
Total	1,091	100%

Time of the day trip taken	No. Responding	Percent
Afternoon (12pm - 5pm)	**534**	**26%**
Between 12 PM and 1 PM	92	17%
Between 1 PM and 2 PM	141	26%
Between 2 PM and 3 PM	114	21%
Between 3 PM and 4 PM	98	18%
Between 4 PM and 5 PM	89	17%
Total	534	100%
Evening (5pm - 9pm)	**361**	**18%**
Between 5 PM and 6 PM	164	45%
Between 6 PM and 7 PM	110	30%
Between 7 PM and 8 PM	60	17%
Between 8 PM and 9 PM	27	7%
Total	361	100%
Night (9pm - 4am)	**42**	**2%**
Between 9 PM and 10 PM	15	36%
Between 10 PM and 11 PM	8	19%
Between 11 PM and 12 AM	6	14%
Between 12 AM and 1 AM	4	10%
Between 1 AM and 2 AM	3	7%
Between 2 AM and 3 AM	2	5%
Between 3 AM and 4 AM	4	10%
Total	42	100%
TOTAL	**2,026**	**100%**

The primary purpose of the trip was commuting or work-related (49%). Shopping, errands, and entertainment were 34% of reported trips. Only 2% of respondents reported the trips were school related.

Table 18: Primary Purpose for Trip

Primary purpose for trip	No. Responding	Percent
Commuting to / from work	615	30%
Shopping / Errands / Personal Appointment	438	22%
Work-related travel	392	19%
Social / Dining / Entertainment	246	12%
Recreation / Sports	117	6%
To / from school	35	2%
Other (please specify)	183	9%
Total	2,026	100%

Trip lengths varied considerably. Many trips were 16 to 45 minutes in length (43%), but 39% were longer. Only 5% were shorter in length.

Table 19: Total Travel Time in One Direction for Trip

Total travel time in one direction for trip	No. Responding	Percent
0 min - 15 min	105	5%
16 min - 30 min	441	22%
31 min - 45 min	431	21%
46 min - 60 min	171	8%
1h 1 min - 1h 15 min	317	16%
1h 16 min - 1h 30 min	129	6%
1h 31 min - 1h 45 min	36	2%
1h 46 min - 1h 59 min	16	1%
2h 0 min - 2h 59 min	56	3%
3h 0 min - 4h 59 min	42	2%
5h 0 min - 6h 59 min	5	0%
More than 7h 0 min	14	1%
Not Answered	270	13%
Total	2,033	100%

With regard to variability in trip time, most respondents reported time varied (64%) while 19% said it did not vary and 17% were less sure whether it varied.

Table 20: Variation in Travel Time

Does the total travel time vary for trip?	No. Responding	Percent
Yes	1,179	64%
No	351	19%
I'm not sure / It depends	306	17%
Total	1,836	100%

There were several questions that asked drivers what factors were important to them in choosing a route for commuting or job-related purposes. Of the drivers that indicated a factor was Extremely Important or Very Important, drivers cited “trip safety” (77%), “avoiding traffic congestion” (76%), and “low cost” (74%). “Time savings” was cited by 53% of drivers as Extremely Important or Very Important.

Table 21: Importance of Factors in Choosing Driving Route for Commuting or Job-Related Purposes

	Extremely Important		Very Important		Somewhat Important		Not Very Important		Not Important		Total	
	No. Resp.	%	**No. Resp.**	%	**No. Resp.**	%	**No. Resp.**	%	**No. Resp.**	%	**No. Resp.**	%
Low Cost	888	45	574	29	375	19	92	5	52	3	1981	100
Trip Safety	886	45	629	32	308	16	76	4	69	4	1968	100
Avoiding Traffic Congestion	770	39	734	37	398	20	50	3	37	2	1989	100
Time Savings	429	22	618	31	713	36	140	7	83	4	1983	100

Overall, 31% of users are likely to consider ETL lanes. However, users were more likely to consider using an ETL during Peak-hour (37%) than during non-Peak hour time (27%). Section A in the table below presents the percentage of users who would choose ETLs, Section B represents the set of individuals who would be unsure of their choice, and Section C represents the individuals who would prefer the current highway lane. The analysis of choices concentrates on the definitive choice (Section A).

Table 22: Breakdown of Likelihood to Consider Toll Fee by Peak/Non-Peak Hour

	A Likely to consider ETL for a given toll fee level		**B Equally likely to choose Existing Highway lane or ETL**		**C Preference for Existing Highway lane for the current travel time**		**Total**	
	No. Responding	**%**	**No. Responding**	**%**	**No. Responding**	**%**	**No. Responding**	**%**
Off-Peak Hours	346	27%	0	0%	919	73%	1265	100%
Peak Hours	284	37%	28	4%	456	59%	768	100%
Total	630	31%	28	1%	1375	68%	2033	100%

E-ZPass Users Willingness to Pay Results

In order to calculate preference for ETLs, respondents were asked to state their preference with given choices between saving time for a certain toll and staying on a free highway for the current travel time. Each respondent was presented with a set of 2 to 3 randomly rotated scenarios to obtain quality data and avoid respondent fatigue. A scenario presented one toll fee, one level time saving and offered the respondent the possibility to pay the toll fee to save time or to use the existing lanes for the current travel time. A fixed toll fee was faced in each scenario and their choice was captured.

EurekaFacts avoided asking respondents to select a price level they would consider fair (in a range of toll fee from $0.50 to $5.00) to save a given amount of minutes in travel time to circumvent the natural preference to select the lowest fee.

Results are presented for both E-ZPass users and non E-ZPass users.

E-ZPass Users

The results are as follows:

- 5% to 18% of E-ZPass users stated a clear preference for ETL to save 5 min for any of the toll level proposed between $0.50 and $4.00;
- 10% to 30% of E-ZPass users stated a clear preference for ETL to save 10 min for any of the toll level proposed between $1.00 and $4.50;
- 19% to 30% of E-ZPass users stated a clear preference for ETL to save 15 min for any of the toll level proposed between $1.50 and $5.00.

The detailed results are presented in the table below:

Table 23: ETL Preference for E-ZPass users

Time of Day	Toll Fee	5 min time saving			10 min time saving			15 min time saving		
		Choose ETL		Total	Choose ETL		Total	Choose ETL		Total
		#	Row N %	#	#	Row N %	#	#	Row N %	#
non-Peak Hours	**$0.50**	82	**19%**	436						
	$1.00	50	12%	423	90	21%	436			
	$1.50	45	11%	406	102	**24%**	423			
	$2.00				86	21%	406			
	$2.50									
	$3.00									
	$3.50									
	$4.00									
	$4.50									
	$5.00									
Peak Hours	$0.50	12	12%	99						
	$1.00	13	14%	94	22	22%	99			
	$1.50	4	4%	93	23	24%	94	24	24%	98
	$2.00	16	**15%**	106	19	20%	93	25	27%	94

Time of Day	Toll Fee	5 min time saving			10 min time saving			15 min time saving		
		Choose ETL		Total	Choose ETL		Total	Choose ETL		Total
		#	Row N %	#	#	Row N %	#	#	Row N %	#
	$2.50	6	7%	86	32	30%	106	21	23%	93
	$3.00	14	13%	104	9	10%	86	32	30%	106
	$3.50	11	12%	91	26	25%	104	18	21%	86
	$4.00	5	5%	95	11	12%	91	28	27%	104
	$4.50				16	17%	95	23	25%	91
	$5.00							18	19%	95
Overall	$0.50	94	18%	535						
	$1.00	63	12%	517	112	21%	535			
	$1.50	49	10%	499	125	24%	517	24	24%	98
	$2.00	16	15%	106	105	21%	499	25	26%	95
	$2.50	6	7%	86	32	30%	106	21	23%	93
	$3.00	14	13%	104	9	10%	86	32	30%	106
	$3.50	11	12%	91	26	25%	104	18	21%	86
	$4.00	5	5%	95	11	12%	91	28	27%	104
	$4.50				16	17%	95	23	25%	91
	$5.00							18	19%	95

Among the different time saving scenarios for different toll fees, the preference for ETL is the highest in the following situations:

- 18% E-ZPass users stated a clear preference for a toll fee of $0.50 to save 5 min in travel time, with a margin of error of ± 4%.
- 30% E-ZPass users stated a clear preference for a toll fee of $2.50 to save 10 min in travel time, with a margin of error of ± 9%;
- 30% E-ZPass users stated a clear preference for a toll fee of $3.00 to save 15 min in travel time, with a margin of error of ± 9%.

To counter the effect of a high margin of error on ETL preference estimates, we considered a “moving average” of order 2. We aggregated two consecutive toll fee levels for a given time saving and considered a respondent’s preference for ETL as a preference for this fee bracket. In other words, a respondent’s choice of a toll fee of $0.50 to save 5 min in travel time or $1.00 to save 5 min in travel time will considered as a choice about $0.50 - $1.00 to save 5 min. The highest likelihood to choose ETL to save time is the highlighted in the next table:

- 15% E-ZPass users stated a clear preference for a toll fee of $0.50 - $1.00 to save 5 min in travel time, with a margin of error of ± 3%.
- 23% E-ZPass users stated a clear preference for a toll fee of $2.00 - $2.50 to save 10 min in travel time, with a margin of error of ± 4%;
- 27% E-ZPass users stated a clear preference for a toll fee of $3.00 - $3.50 to save 15 min in travel time, with a margin of error of ± 7%.
- Differences between Peak and non-Peak hours in willingness to save 5, 10, or 15 min for E-ZPass users were minor.

Table 24: ETL Preference with "Moving Average" of Order 2

Time of Day	Toll Fee	5 min time saving			10 min time saving			15 min time saving		
		Choose ETL		Total	Choose ETL		Total	Choose ETL		Total
		#	Row N %	#	#	Row N %	#	#	Row N %	#
non-Peak Hours	**$0.50 - $1.00**	132	**15%**	859						
	$1.00 - $1.50	95	11%	829	192	22%	859			
	$1.50 - $2.00	45	11%	406	188	**23%**	829			
	$2.00 - $2.50				86	21%	406			
	$2.50 - $3.00									
	$3.00 - $3.50									
	$3.50 - $4.00									
	$4.00 - $4.50									
	$4.50 - $5.00									
Peak Hours	**$0.50 - $1.00**	25	**13%**	193						
	$1.00 - $1.50	17	9%	187	45	23%	193			
	$1.50 - $2.00	20	10%	199	42	22%	187	49	26%	192
	$2.00 - $2.50	22	11%	192	51	**26%**	199	46	25%	187
	$2.50 - $3.00	20	11%	190	41	21%	192	53	**27%**	199
	$3.00 - $3.50	25	**13%**	195	35	18%	190	50	26%	192
	$3.50 - $4.00	16	9%	186	37	19%	195	46	24%	190
	$4.00 - $4.50	5	5%	95	27	15%	186	51	26%	195
	$4.50 - $5.00				16	17%	95	41	22%	186
Overall	**$0.50 - $1.00**	157	**15%**	1052						
	$1.00 - $1.50	112	11%	1016	237	23%	1052			
	$1.50 - $2.00	65	11%	605	230	23%	1016	49	25%	193
	$2.00 - $2.50	22	11%	192	137	**23%**	605	46	24%	188
	$2.50 - $3.00	20	11%	190	41	21%	192	53	**27%**	199
	$3.00 - $3.50	25	13%	195	35	18%	190	50	26%	192
	$3.50 - $4.00	16	9%	186	37	19%	195	46	24%	190
	$4.00 - $4.50	5	5%	95	27	15%	186	51	26%	195
	$4.50 - $5.00				16	17%	95	41	22%	186

Overall, the empirical likelihood of E-ZPass users are likely to consider ETL for any given toll fee level at any time saving was 31%. A number of factors influence the likelihood that a respondent will chose ETL:

- This percentage increases up to 33% for those who travel on the I-95 Highway section between the I-95/I-895 merge and MD 43/White Marsh Boulevard in either direction 4 times per week or more, and falls to 28% for those who travel less than once a week in this I-95 section.
- The primary purpose of the commute seems to influence ETL preference as well. Respondents commuting to/from work, on a work-related travel or for social/dining/entertainment have an overall preference above 33% while those commuting for other purposes have a preference below 31%.
- Concern for time saving, traffic congestion, low cost and trip safety also influence the likelihood to use ETL.
    - 47% of those who consider time saving extremely important are likely to consider ETL.
    - 37% of those who consider traffic congestion extremely important are likely to consider ETL.
    - 31% of those who consider the trip safety extremely important are likely to consider ETL.
    - 24% of those who consider the cost extremely important are likely to consider ETL.
- With regard for household income, 37% of respondents with a household above $150,000 are likely to consider ETL compared to 32% of respondents with a household income below $50,000.
- When age is considered, 42% of those 18 to 35 years old are likely to consider ETL compared to 26% of respondents 56 years and older.
- Regarding gender, 32% of males would consider ETL versus 30% of females.

In some cases, respondents overwhelmingly belong to one group casting doubt on the robustness of any comparison with other categories of the group: about 94% of respondents drive a passenger car, SUV or pick-up truck, 85% drive private vehicles and 75% work full-time.

Non E-ZPass Users

Tables 25 and 26 present the results for non E-ZPass users; however, there is insufficient data to make conclusive inferences. Because the counts per cell are small, the margins of error are quite high. Readers are cautioned not to draw erroneous conclusions.

Table 25: ETL Preference for non E-ZPass users

Time of Day	Toll Fee	5 min time saving			10 min time saving			15 min time saving		
		Choose ETL		Total	Choose ETL		Total	Choose ETL		Total
		#	Row N %	#	#	Row N %	#	#	Row N %	#
non-Peak Hours	$0.50	11	15%	75						
	$1.00	14	16%	86		21%	75			
	$1.50	6	8%	76		17%	86			
	$2.00	-		-		16%	76			
	$2.50	-		-	-		-			
	$3.00	-		-	-		-			
	$3.50	-		-	-		-			
	$4.00	-		-	-		-			
	$4.50				-		-			
	$5.00									
Peak Hours	$0.50	2	18%	11						
	$1.00	2	14%	14		18%	11			
	$1.50	3	17%	18		7%	14	1	9%	11
	$2.00	-	0%	9		22%	18	3	21%	14
	$2.50	-	0%	9	1	11%	9	3	17%	18
	$3.00	-	0%	11	1	11%	9	2	22%	9
	$3.50	-	0%	10	1	9%	11	2	22%	9
	$4.00	1	10%	10	-	0%	10	1	9%	11
	$4.50				2	20%	10		0%	10
	$5.00							3	30%	10
Overall	$0.50	13	15%	86						
	$1.00	16	16%	100	18	21%	86			
	$1.50	9	10%	94	16	16%	100		9%	11
	$2.00	-	0%	9	16	17%	94	3	21%	14
	$2.50	-	0%	9	1	11%	9	3	17%	18
	$3.00	-	0%	11		11%	9		22%	9
	$3.50	-	0%	10		9%	11	2	22%	9
	$4.00	1	10%	10	-	0%	10		9%	11
	$4.50				2	20%	10		0%	10
	$5.00							3	30%	10

Table 26: ETL Preference with "Moving Average" of Order 2

Time of Day	Toll Fee	5 min time saving			10 min time saving			15 min time saving		
		Choose ETL		Total	Choose ETL		Total	Choose ETL		Total
		#	Row N %	#	#	Row N %	#	#	Row N %	#
non-Peak Hours	$0.50 - $1.00	25	16%	161						
	$1.00 - $1.50	20	12%	162	31	19%	161			
	$1.50 - $2.00	6	8%	76	27	17%	162			
	$2.00 - $2.50	-		-	12	16%	76			
	$2.50 - $3.00	-		-	-		-			
	$3.00 - $3.50	-		-	-		-			
	$3.50 - $4.00	-		-	-		-			
	$4.00 - $4.50	-		-	-		-			
	$4.50 - $5.00				-		-			
Peak Hours	$0.50 - $1.00	4	16%	25						
	$1.00 - $1.50	5	16%	32	3	12%	25			
	$1.50 - $2.00	3	11%	27	5	16%	32	4	16%	25
	$2.00 - $2.50	-	0%	18	5	19%	27	6	19%	32
	$2.50 - $3.00	-	0%	20	2	11%	18	5	19%	27
	$3.00 - $3.50	-	0%	21	2	10%	20	4	22%	18
	$3.50 - $4.00	1	5%	20	1	5%	21	3	15%	20
	$4.00 - $4.50	1	10%	10	2	10%	20	1	5%	21
	$4.50 - $5.00				2	20%	10	3	15%	20
Overall	$0.50 - $1.00	29	16%	186						
	$1.00 - $1.50	25	13%	194	34	18%	186			
	$1.50 - $2.00	9	9%	103	32	16%	194	4	16%	25
	$2.00 - $2.50	-	0%	18	17	17%	103	6	19%	32
	$2.50 - $3.00	-	0%	20	2	11%	18	5	19%	27
	$3.00 - $3.50	-	0%	21	2	10%	20	4	22%	18
	$3.50 - $4.00	1	5%	20	1	5%	21	3	15%	20
	$4.00 - $4.50	1	10%	10	2	10%	20	1	5%	21
	$4.50 - $5.00				2	20%	10	3	15%	20

Value of Time (VOT) Modeling Results

The Multinomial Logit Model was conducted to estimate the probability of choosing ETL over existing lanes during peak and off-peak hours.[1] The results, presented in the following tables, were found to be statistically significant and a final model was developed with better performance than an intercept model only. This means that the model developed uses the effects of trip-related variables to better explain the value of time to motorists can be estimated.

Calculation of the Value of Time (VOT)

Travel Time Saving – Exp(B)=1.123: If the travel time saved using ETL increases by one minute, the relative likelihood to choose ETL over existing highway lanes is expected to change by a factor of 1.123 (it increases), everything else being held constant.

Toll Cost – Exp(B)=0.821: If the toll cost for using ETL increases by $1.00, the relative likelihood to choose ETL over existing highway lanes is expected to change by a factor of 0.821 (it decreases), everything else being held constant.

The estimated coefficients say that the more time they save, the more likely the motorists are willing to choose ETL over existing highway lanes, and conversely, as the toll cost goes up, the less likely they are to choose ETL.

Therefore, the value of time of motorist is considered as the ratio of the impact (on choosing ETL over existing highway lanes) of a variation of $1.00 in toll cost ($\beta_Cost$) to the impact (on choosing ETL over existing highway lanes) of a variation 1 min in travel time saving (β_Time - factor 60 for hour), normalized by the percentage of respondents likely to choose ETL in the given sub-population (PCT). In other words, we average VOT to include the average value of time of motorists for those who choose ETL as well as the average value of time for those who reject ETL ($0.00/hour).

$$VOT = 60 \times \frac{\beta\_Cost}{\beta\_Time} \times PCT$$

[1] A linear regression is used to model the relationship between a scalar outcome and a set of explanatory variables. The outcome in this case (the stated preference between ETL or existing highway lanes to save on travel time) is, however, not scalar but categorical (Yes, Maybe, or No). Because the outcome is categorical, a Multinomial Logit Model was the appropriate to model to use.

Tables 29 and 30 present the Value of Time calculations for off-peak and peak hours for E-ZPass users. Due to the small count of non E-ZPass users, only an overall value of time is presented. There is wide ranging sensitivity to toll cost as a function of time of day, purpose of trip, and E-ZPass ownership.

- The value of time of E-ZPass users during peak hours $16.90. Thirty-seven percent (37%) state a clear preference for ETL;
- The value of time of E-ZPass users during off-peak hours is $10.46. Twenty-seven percent (27%) state a clear preference for ETL;
- The value of time of non E-ZPass 25% is $7.79. Twenty-five percent (25%) state a clear preference for ETL;
- The value of time of E-ZPass users during peak hours for commuting to / from work or work-related travel is $17.51. Thirty-seven percent (37%) state a clear preference for ETL;
- The value of time of E-ZPass users during off-peak hours for commuting to / from work or work-related travel is $11.57. Twenty-nine percent (29%) state a clear preference for ETL.
- The value of time of E-ZPass users during peak hours for non-work-related travel is $10.93. Twenty-six percent (26%) state a clear preference for ETL;
- The value of time of E-ZPass users during off-peak hours for non-work-related travel is $10.46. Twenty-seven percent (27%) state a clear preference for ETL.

Table 29: Value of Time Estimates: Off-Peak Hours versus Peak Hours (E-ZPass and Non E-ZPass users)

Scenario		PCT	Parameter Estimates		VOT ($/hr.)
			Travel Time	Toll Cost	
E-ZPass	Peak Hours	37%	1.123	0.856	$16.90
	Off-Peak Hours	27%	1.149	0.733	$10.46
	Overall	32%	1.123	0.821	$13.99
Non E-ZPass	Overall	25%	1.148	0.594	$7.79

Table 30: Value of Time Estimates: Work-Related Travel Off-Peak Hours and Peak Hours (E-ZPass users)

Scenario		PCT	Parameter Estimates		VOT ($/hr.)
			Travel Time	Toll Cost	
E-ZPass Commuting to / from work or work-related travel	Peak Hours	37%	1.117	0.870	$17.51
	Off-Peak Hours	29%	1.171	0.781	$11.57
E-ZPass Not work-related travel	Peak Hours	26%	1.149	0.796	$10.93
	Off-Peak Hours	36%	1.155	0.631	$11.77

Table 31 to Table 36 present the parameter estimates for ETL preference.

- Tables 31 to 34 present a different travel scenario for E-ZPass users (e.g., peak hours versus off-peak hours, work or work-related travel versus non work related travel).
- Table 35 presents E-ZPass users overall.
- Table 36 presents non E-ZPass users overall.

Notes: Everything else held constant

1. The positive coefficient (column B) of the travel time savings indicates that the likelihood to choose ETL over existing highway lanes increases when travel time savings increases.
2. The negative coefficient (column B) of the toll cost indicates that the likelihood to choose ETL over existing highway lanes decreases when the toll cost increases.
3. Sig. (column F) indicates the level of significance of the coefficient (in column B) compared to 0.
4. Exp(B) (column G) indicates an increased likelihood when greater than 1 and a decreased likelihood when less than 1.
5. Travel time saving and toll cost are considered continuous.

Table 31: Parameter Estimates**: Commuting To / From Work or Work-Related Travel - Peak Hours (E-ZPass users)**

Choice[a] I would choose the ETL	B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B) Lower Bound	95% Confidence Interval for Exp(B) Upper Bound
Intercept	-4.131	1.270	10.578	1	.001			
Travel Time Saving	**.111**	**.020**	**30.648**	**1**	**.000**	**1.117**	**1.074**	**1.162**
Toll Cost	**-.139**	**.068**	**4.184**	**1**	**.041**	**.870**	**.761**	**.994**
Gender: Male	.369	.163	5.088	1	.024	1.446	1.049	1.991
Gender: Female	0[b]			0				
HH Income: Less than $50,000	-.322	.289	1.246	1	.264	.725	.412	1.276
HH Income: $50,001 to $75,000	-.961	.268	12.915	1	.000	.382	.226	.646
HH Income: $75,001 to $100,000	-.210	.224	.883	1	.347	.810	.522	1.257
HH Income: $100,001 to $150,000	-.153	.226	.455	1	.500	.858	.551	1.338
HH Income: More than $150,000	0[b]			0				
Age: 18 - 35	2.114	1.078	3.844	1	.050	8.280	1.001	68.504
Age: 36 - 45	2.161	1.075	4.040	1	.044	8.680	1.055	71.406
Age: 46 - 55	1.935	1.073	3.256	1	.071	6.926	.846	56.689
Age: 56 - 65	1.936	1.071	3.269	1	.071	6.934	.850	56.581
Age: 66 or older	0[b]			0				
Employment Status: Work full-time	-.260	.837	.096	1	.756	.771	.150	3.977
Employment Status: Work part-time or Unemployed, but not retired	-.136	.909	.022	1	.881	.873	.147	5.188
Employment Status: Retired	0[b]			0				
Vehicle Usage: Commercial or Mixed Commercial/Private	.277	.181	2.348	1	.125	1.319	.926	1.880
Vehicle Usage: Private	0[b]			0				
Travel frequency: 4 or more times per week	.306	.393	.607	1	.436	1.358	.629	2.931
Travel frequency: 1 to 3 times per week	.439	.418	1.102	1	.294	1.551	.684	3.517
Travel frequency: 1 to 3 times per month	-.021	.478	.002	1	.965	.979	.383	2.500
Travel frequency: Less than once a month	0[b]			0				

a. The reference category is: I would choose Existing Highway lane for the current travel time.
b. This parameter is set to zero because it is redundant.

Table 32: Parameter Estimates: **Commuting To / From Work or Work-Related Travel - Off-Peak Hours (E-ZPass users)**

Choice[a] I would choose the ETL	B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
							Lower Bound	Upper Bound
Intercept	-3.196	1.105	8.364	1	.004			
Travel Time Saving	**.157**	**.044**	**13.084**	**1**	**.000**	**1.171**	**1.075**	**1.275**
Toll Cost	**-.247**	**.225**	**1.202**	**1**	**.273**	**.781**	**.502**	**1.215**
Gender: Male	.055	.224	.061	1	.805	1.057	.681	1.641
Gender: Female	0[b]			0				
HH Income: Less than $50,000	-.087	.360	.059	1	.808	.916	.453	1.855
HH Income: $50,001 to $75,000	.036	.311	.013	1	.908	1.037	.564	1.906
HH Income: $75,001 to $100,000	-.021	.296	.005	1	.943	.979	.548	1.749
HH Income: $100,001 to $150,000	.059	.300	.039	1	.843	1.061	.590	1.908
HH Income: More than $150,000	0[b]			0				
Age: 18 - 35	.543	.586	.857	1	.354	1.721	.545	5.432
Age: 36 - 45	.036	.599	.004	1	.951	1.037	.321	3.353
Age: 46 - 55	.710	.567	1.567	1	.211	2.034	.669	6.185
Age: 56 - 65	.244	.572	.183	1	.669	1.277	.416	3.917
Age: 66 or older	0[b]			0				
Employment Status: Work full-time	-.585	.796	.540	1	.462	.557	.117	2.650
Employment Status: Work part-time or Unemployed, but not retired	.239	.835	.082	1	.775	1.270	.247	6.532
Employment Status: Retired	0[b]			0				
Vehicle Usage: Commercial or Mixed Commercial/Private	.272	.223	1.490	1	.222	1.313	.848	2.032
Vehicle Usage: Private	0[b]			0				
Travel frequency: 4 or more times per week	1.091	.636	2.942	1	.086	2.977	.856	10.355
Travel frequency: 1 to 3 times per week	1.426	.647	4.856	1	.028	4.162	1.171	14.795
Travel frequency: 1 to 3 times per month	1.426	.673	4.485	1	.034	4.163	1.112	15.583
Travel frequency: Less than once a month	0[b]			0				

a. The reference category is: I would choose Existing Highway lane for the current travel time.
b. This parameter is set to zero because it is redundant.

Table 33: Parameter Estimates**: Not Work Related Travel - Peak Hours (E-ZPass users)**

Choice[a] I would choose the ETL	B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B) Lower Bound	95% Confidence Interval for Exp(B) Upper Bound
Intercept	-2.700	.709	14.521	1	.000			
Travel Time Saving	**.139**	**.030**	**21.164**	**1**	**.000**	1.149	**1.083**	**1.220**
Toll Cost	**-.228**	**.099**	**5.282**	**1**	**.022**	.796	**.656**	**.967**
Gender: Male	-.030	.241	.016	1	.901	.970	.605	1.556
Gender: Female	0[b]			0				
HH Income: Less than $50,000	.184	.391	.221	1	.639	1.202	.558	2.588
HH Income: $50,001 to $75,000	-.348	.389	.800	1	.371	.706	.329	1.513
HH Income: $75,001 to $100,000	-.950	.418	5.165	1	.023	.387	.170	.877
HH Income: $100,001 to $150,000	-.658	.397	2.746	1	.098	.518	.238	1.128
HH Income: More than $150,000	0[b]			0				
Age: 18 - 35	1.664	.564	8.693	1	.003	5.279	1.747	15.952
Age: 36 - 45	.604	.573	1.110	1	.292	1.829	.595	5.626
Age: 46 - 55	1.492	.574	6.767	1	.009	4.448	1.445	13.695
Age: 56 - 65	.892	.484	3.398	1	.065	2.439	.945	6.294
Age: 66 or older	0[b]			0				
Employment Status: Work full-time	.098	.441	.050	1	.823	1.103	.465	2.618
Employment Status: Work part-time or Unemployed, but not retired	.286	.485	.348	1	.555	1.331	.514	3.447
Employment Status: Retired	0[b]			0				
Vehicle Usage: Commercial or Mixed Commercial/Private	-.433	.597	.528	1	.467	.648	.201	2.087
Vehicle Usage: Private	0[b]			0				
Travel frequency: 4 or more times per week	.051	.465	.012	1	.912	1.053	.423	2.618
Travel frequency: 1 to 3 times per week	-.344	.327	1.107	1	.293	.709	.374	1.345
Travel frequency: 1 to 3 times per month	-.032	.325	.010	1	.921	.968	.512	1.830
Travel frequency: Less than once a month	0[b]			0				

a. The reference category is: I would choose Existing Highway lane for the current travel time.

b. This parameter is set to zero because it is redundant.

Table 34: Parameter Estimates: **Not Work Related Travel - Off-Peak Hours (E-ZPass users)**

Choice[a] I would choose the ETL	B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B) Lower Bound	95% Confidence Interval for Exp(B) Upper Bound
Intercept	-1.830	.485	14.268	1	.000			
Travel Time Saving	**.144**	**.038**	**14.173**	**1**	**.000**	**1.155**	**1.071**	**1.245**
Toll Cost	**-.461**	**.202**	**5.198**	**1**	**.023**	**.631**	**.424**	**.937**
Gender: Male	.124	.169	.539	1	.463	1.132	.813	1.575
Gender: Female	0[b]			0				
HH Income: Less than $50,000	-.677	.290	5.446	1	.020	.508	.288	.897
HH Income: $50,001 to $75,000	-.830	.290	8.165	1	.004	.436	.247	.771
HH Income: $75,001 to $100,000	-.599	.280	4.570	1	.033	.549	.317	.951
HH Income: $100,001 to $150,000	-.415	.272	2.334	1	.127	.660	.388	1.125
HH Income: More than $150,000	0[b]			0				
Age: 18 - 35	.499	.340	2.151	1	.142	1.647	.846	3.207
Age: 36 - 45	-.077	.365	.044	1	.833	.926	.453	1.893
Age: 46 - 55	-.448	.350	1.633	1	.201	.639	.322	1.270
Age: 56 - 65	.055	.307	.032	1	.858	1.056	.579	1.928
Age: 66 or older	0[b]			0				
Employment Status: Work full-time	.479	.296	2.621	1	.105	1.614	.904	2.883
Employment Status: Work part-time or Unemployed, but not retired	.884	.325	7.397	1	.007	2.420	1.280	4.574
Employment Status: Retired	0[b]			0				
Vehicle Usage: Commercial or Mixed Commercial/Private	.966	.299	10.429	1	.001	2.627	1.462	4.722
Vehicle Usage: Private	0[b]			0				
Travel frequency: 4 or more times per week	-.499	.341	2.139	1	.144	.607	.311	1.185
Travel frequency: 1 to 3 times per week	-.223	.214	1.084	1	.298	.800	.526	1.218
Travel frequency: 1 to 3 times per month	-.178	.202	.776	1	.378	.837	.563	1.244
Travel frequency: Less than once a month	0[b]			0				

a. The reference category is: I would choose Existing Highway lane for the current travel time.

b. This parameter is set to zero because it is redundant.

Table 35: Parameter Estimates: **E-ZPass users**

Choice[a] I would choose the ETL	B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B) Lower Bound	Upper Bound
	-2.536	.281	81.384	1	.000			
Travel Time Saving	**.116**	**.014**	**70.624**	**1**	**.000**	1.123	**1.093**	**1.154**
Toll Cost	**-.198**	**.043**	**21.584**	**1**	**.000**	.821	**.755**	**.892**
Gender: Male	.217	.092	5.604	1	.018	1.243	1.038	1.488
Gender: Female	0[b]			0				
HH Income: Less than $50,000	-.286	.154	3.423	1	.064	.752	.555	1.017
HH Income: $50,001 to $75,000	-.530	.147	12.983	1	.000	.589	.441	.785
HH Income: $75,001 to $100,000	-.331	.138	5.732	1	.017	.718	.547	.942
HH Income: $100,001 to $150,000	-.265	.138	3.687	1	.055	.768	.586	1.006
HH Income: More than $150,000	0[b]			0				
Age: 18 - 35	.789	.231	11.674	1	.001	2.201	1.400	3.460
Age: 36 - 45	.401	.234	2.924	1	.087	1.493	.943	2.364
Age: 46 - 55	.487	.227	4.605	1	.032	1.627	1.043	2.538
Age: 56 - 65	.411	.216	3.633	1	.057	1.509	.988	2.304
Age: 66 or older	0[b]			0				
Employment Status: Work full-time	.228	.202	1.277	1	.258	1.257	.846	1.867
Employment Status: Work part-time or Unemployed, but not retired	.601	.228	6.982	1	.008	1.825	1.168	2.850
Employment Status: Retired	0[b]			0				
Vehicle Usage: Commercial or Mixed Commercial/Private	.316	.117	7.338	1	.007	1.372	1.091	1.724
Vehicle Usage: Private	0[b]			0				
Travel frequency: 4 or more times per week	-.082	.138	.351	1	.553	.922	.704	1.207
Travel frequency: 1 to 3 times per week	.014	.144	.009	1	.924	1.014	.764	1.345
Travel frequency: 1 to 3 times per month	.025	.148	.029	1	.865	1.026	.767	1.371
Travel frequency: Less than once a month	0[b]			0				

a. The reference category is: I would choose Existing Highway lane for the current travel time.

b. This parameter is set to zero because it is redundant.

Table 36: Parameter Estimates: **Non E-ZPass users**

Choice[a] I would choose the ETL	B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B) Lower Bound	95% Confidence Interval for Exp(B) Upper Bound
Intercept	-3.704	1.234	9.014	1	.003			
Travel Time Saving	**.138**	**.043**	**10.307**	**1**	**.001**	**1.148**	**1.055**	**1.249**
Toll Cost	**-.520**	**.165**	**9.899**	**1**	**.002**	**.594**	**.430**	**.822**
Gender: Male	.742	.258	8.284	1	.004	2.101	1.267	3.482
Gender: Female	0[b]			0				
HH Income: Less than $50,000	1.138	1.132	1.011	1	.315	3.122	.340	28.698
HH Income: $50,001 to $75,000	1.135	1.126	1.017	1	.313	3.112	.343	28.266
HH Income: $75,001 to $100,000	.875	1.167	.562	1	.454	2.398	.244	23.612
HH Income: $100,001 to $150,000	.605	1.171	.267	1	.605	1.832	.185	18.174
HH Income: More than $150,000	0[b]			0				
Age: 18 - 35	.027	.546	.002	1	.961	1.027	.353	2.993
Age: 36 - 45	-.705	.563	1.567	1	.211	.494	.164	1.490
Age: 46 - 55	.214	.480	.198	1	.656	1.238	.484	3.171
Age: 56 - 65	-.498	.462	1.163	1	.281	.608	.246	1.502
Age: 66 or older	0[b]			0				
Employment Status: Work full-time	.801	.446	3.229	1	.072	2.227	.930	5.333
Employment Status: Work part-time or Unemployed, but not retired	.673	.478	1.984	1	.159	1.960	.769	4.996
Employment Status: Retired	0[b]			0				
Vehicle Usage: Commercial or Mixed Commercial/Private	-.876	.351	6.225	1	.013	.417	.209	.829
Vehicle Usage: Private	0[b]			0				
Travel frequency: 4 or more times per week	.589	.354	2.773	1	.096	1.803	.901	3.607
Travel frequency: 1 to 3 times per week	.039	.339	.014	1	.907	1.040	.536	2.020
Travel frequency: 1 to 3 times per month	-.554	.366	2.289	1	.130	.575	.280	1.178
Travel frequency: Less than once a month	0[b]			0				

a. The reference category is: I would choose Existing Highway lane for the current travel time.

b. This parameter is set to zero because it is redundant.

QUESTIONNAIRE

Maryland Transportation Authority Survey

Welcome to the Maryland Transportation Authority Survey!

EurekaFacts is conducting this survey on behalf of MDTA, to assess motorists' needs and travel preferences.

Part A- About your recent travel

1. Do you currently have a valid driver's license?
    - Yes
    - No (Terminate)

We would first like to ask you some questions about your recent vehicle trips.

2. How often, if at all, do you travel on the I-95 Highway section between the I-95/I-895 merge and MD 43/White Marsh Boulevard in either direction? Please see the map below. The I-95 Highway section in question is marked on the map between the two red locations.
    - ❍ 4 or more times per week (Skip to Q. 4)
    - ❍ 2 to 3 times per week (Skip to Q. 4)
    - ❍ Once a week (Skip to Q. 4)
    - ❍ 1 to 3 times per month (Skip to Q. 4)
    - ❍ Less than once a month, but more than twice a year (Skip to Q. 4)
    - ❍ 2 times per year or less (Go to Q.3 and then Q. 4, do not skip to Part D)
    - ❍ Never (Go to Q.3)

[INSERT MAP]

3. What is the reason that you are not using, or rarely using, the I-95 Highway section between the I- 95/I-895 merge and MD 43/White Marsh Boulevard?
    - ❍ Not on my way to where I need to go (If answered "Never" in Q2, Terminate)
    - ❍ Traffic congestion (If answered "Never" in Q2, skip to Part D)
    - ❍ Other (Please specify) (If answered "Never" in Q2, skip to Part D)

    ____

____

Please think of the most recent trip in which you passed through the I-95 Highway section between the I-95/I-895 merge and MD/43 White Marsh Boulevard. For all of the following questions, please answer based on this specific trip.

____

4. Where did you start the most recent trip that took you through the I-95 Highway between the I-95/I-895 merge and MD/43 White Marsh Boulevard? Please enter the address, nearest intersection or landmark. For instance, if you took a trip from home to work, then put either your home address or closest major intersection.

   Address / Intersection / Landmark ____________________
   City ____________________
   State ____________________
   Zip Code ____________________

5. Where did you end this trip that took you through the I-95 Highway between the I-95/I-895 merge and MD 43/White Marsh Boulevard? Please enter the address, nearest intersection or landmark. The address should be different than the starting point of the trip.

   Address / Intersection / Landmark ____________________
   City ____________________
   State ____________________
   Zip Code ____________________

For the following questions, please answer based only on the specified trip in one direction from starting location to ending location that you indicated earlier.

6. During this specific trip, where did you enter the I-95 Highway? Please select the appropriate entrance ramp number from the list below.

   South of Entrance ramp 62 (I was already on I-95 when I arrived at this section of the highway)
   Entrance ramp 62 I-895 South (Harbor Tunnel Thruway) – Annapolis
   Entrance ramp 64 I-695 (Baltimore Beltway) – Essex, Towson
   Entrance ramp 67 MD 43 (White Marsh Boulevard)
   North of Entrance ramp 67 (I was already on I-95 when I arrived at this section of the highway)

7. During this specific trip, where did you exit the I-95 Highway? Please select the appropriate exit number from the list below.

   South of Exit 62 (I stayed on I-95 after leaving this section of the highway)
   Exit 62 I-895 South (Harbor Tunnel Thruway) – Annapolis
   Exit 64 I-695 (Baltimore Beltway) – Essex, Towson
   Exit 67 MD 43 (White Marsh Boulevard)
   North of Exit 67 (I stayed on I-95 after leaving this section of the highway)

8. On which day of the week did you make this specific trip?

- ❍ Monday
- ❍ Tuesday
- ❍ Wednesday
- ❍ Thursday
- ❍ Friday
- ❍ Saturday
- ❍ Sunday

9. At what time of the day did you make this specific trip that took you through the I-95 Highway between the I-95/I-895 merge and MD 43/White Marsh Boulevard?

- ❍ Morning: 4am – 12pm (Go to Q.10)
- ❍ Afternoon: 12pm – 5pm (Go to Q.11)
- ❍ Evening: 5pm – 9pm (Go to Q.12)
- ❍ At night: 9pm – 4am (Go to Q.13)

10. At what time did you make this specific trip that took you through the I-95 Highway between the I-95/I-895 merge and MD 43/White Marsh Boulevard?
Morning:

- ❍ Between 4 AM and 5 AM
- ❍ Between 5 AM and 6 AM
- ❍ Between 6 AM and 7 AM
- ❍ Between 7 AM and 8 AM
- ❍ Between 8 AM and 9 AM
- ❍ Between 9 AM and 10 AM
- ❍ Between 10 AM and 11 AM
- ❍ Between 11 AM and 12 PM

11. At what time did you make this specific trip that took you through the I-95 Highway between the I-95/I-895 merge and MD 43/White Marsh Boulevard?
Afternoon:

- ❍ Between 12 PM and 1 PM
- ❍ Between 1 PM and 2 PM
- ❍ Between 2 PM and 3 PM
- ❍ Between 3 PM and 4 PM
- ❍ Between 4 PM and 5 PM

12. At what time did you make this specific trip that took you through the I-95 Highway between the I-95/I-895 merge and MD 43/White Marsh Boulevard?
Evening:

- ❍ Between 5 PM and 6 PM
- ❍ Between 6 PM and 7 PM
- ❍ Between 7 PM and 8 PM
- ❍ Between 8 PM and 9 PM

13. At what time did you make this specific trip that took you through the I-95 Highway between the I-95/I-895 merge and MD 43/White Marsh Boulevard?
At night:

- ❍ Between 9 PM and 10 PM
- ❍ Between 10 PM and 11 PM
- ❍ Between 11 PM and 12 AM
- ❍ Between 12 AM and 1 AM
- ❍ Between 1 AM and 2 AM
- ❍ Between 2 AM and 3 AM
- ❍ Between 3 AM and 4 AM

14. What was your primary purpose for this specific trip that took you through the I-95 Highway between the I-95/I-895 merge and White Marsh Boulevard?

- ❍ Commuting to / from work
- ❍ Work-related travel
- ❍ To / from school
- ❍ Shopping / Errands / Personal Appointment
- ❍ Social / Dining / Entertainment
- ❍ Recreation / Sports
- ❍ Other (Please specify)

____

15. How often do you make this particular trip for the specified trip purpose, in this one direction (from starting location that you noted to ending location that you noted) via the same route?

- ❍ 4 or more times per week
- ❍ 2 to 3 times per week
- ❍ 1 time per week
- ❍ 1 to 3 times per month
- ❍ Less than 1 time per month but more than 2 times per year
- ❍ 2 times per year or less (Skip to Q. 17)

16. Does the total travel time vary when you make this particular trip?

- ❍ Yes
- ❍ No

17. What was your total travel time (in one direction) for this specific trip?

_____:_____ Hours and minutes

Part B – Stated preferred choices - for non-commuters and anyone traveling during off-peak and night hours and portion of section length

*****PROGRAMMING NOTE: These scenario sets will only be shown to people who did NOT make their last trip during rush hour. Rush hours are 7AM to 10 AM and 4PM to 7PM, Monday through Friday. After answering one set of scenarios, respondents will skip to Q55***

New, faster travel lanes (the Express Toll Lanes or "ETL") are being built parallel to the existing lanes on the I-95 Highway between the I-95/I-895 merge and MD 43/White Marsh Boulevard. For the following questions, please assume that you are making a trip in the future just like your last off-peak hours trip that you described earlier in the survey. This future trip is on the same day of the week, at the same time of day, and for the same purpose as your last off-peak hours trip, and you are under the same level of time constraints.

For the following 3 (three) questions, we would like you to consider how much you might pay for using new travel lanes in order to reduce the amount of time it takes to reach your destination while using the I-95 Highway between the I-95/I-895 merge and MD 43/White Marsh Boulevard .

In the following two scenarios, please look at the options given and indicate which you would most likely choose for your most recent non-commuting trip.

[First set of rotating scenarios]

Scenario 1	Option A	Option B
Lane Type	Express Toll Lane	Existing Highway lane
Time saving	5 min shorter travel	Same time as now
Toll	$0.40	$0.00

18. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 2	Option A	Option B
Lane Type	Existing Highway lane	Express Toll Lane
Time saving	Same time as now	10 min shorter travel
Toll	$0.00	$ 1.00

19. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

[Second set of rotating scenarios]

Scenario 1	Option A	Option B
Lane Type	Existing Highway lane	Express Toll Lane
Time saving	Same time as now	5 min shorter travel
Toll	$0.00	$1.00

20. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 2	Option A	Option B
Lane Type	Express Toll Lane	Existing Highway lane
Time saving	10 min shorter travel	Same time as now
Toll	$ 1.50	$0.00

21. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

[Third set of rotating scenarios]

Scenario 1	Option A	Option B
Lane Type	Express Toll Lane	Existing Highway lane
Time saving	5 min shorter travel	Same time as now
Toll	$1.50	$0.00

22. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 2	Option A	Option B
Lane Type	Existing Highway lane	Express Toll Lane
Time saving	Same time as now	10 min shorter travel
Toll	$0.00	$ 2.00

23. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Part C – Stated preferred choices - for work commuters and anyone traveling during the peak hours and full section length

*****PROGRAMMING NOTE: These scenario sets will only be shown to people who DID make their last trip during rush hour. Rush hours are 7AM to 10 AM and 4PM to 7PM, Monday through Friday. After answering one set of scenarios, respondents will skip to Q55***

New, faster travel lanes (the Express Toll Lanes or "ETL") are being built parallel to the existing lanes on the I-95 Highway between the I-95/I-895 merge and MD 43/White Marsh Boulevard. For the following questions, please assume that you are making a trip in the future just like your last peak period trip that you described earlier in the survey. This future trip is on the same day of the week, at the same time of day, and for the same purpose as your last peak period trip, and you are under the same level of time constraints.

For the following 3 (three) questions, we would like to consider how much you might pay for those new travel lanes in order to reduce the amount of time it takes to reach your destination while using the I-95 Highway between the I-95/I-895 merge and White Marsh Boulevard.

In the following three scenarios, please look at the options given and indicate which you would be most likely to choose for your most recent commuting trip.

[First set of rotating scenarios]

Scenario 1	**Option A**	**Option B**
Lane Type	Express Toll Lanes	Existing Highway lane
Time saving	5 min shorter travel	Same time as now
Toll	$ 1.00	$0.00

24. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 2	**Option A**	**Option B**
Lane Type	Existing Highway lane	Express Toll Lane
Time saving	Same time as now	10 min shorter travel
Toll	$0.00	$ 1.50

25. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 3	**Option A**	**Option B**
Lane Type	Express Toll Lane	Existing Highway lane
Time saving	15 min shorter travel	Same time as now
Toll	$ 2.00	$0.00

26. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

[Second set of rotating scenarios]

Scenario 1	Option A	Option B
Lane Type	Existing Highway lane	Express Toll Lane
Time saving	Same time as now	5 min shorter travel
Toll	$0.00	$ 1.50

27. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 2	Option A	Option B
Lane Type	Express Toll Lane	Existing Highway lane
Time saving	10 min shorter travel	Same time as now
Toll	$ 2.00	$0.00

28. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 3	Option A	Option B
Lane Type	Existing Highway lane	Express Toll Lane
Time saving	Same time as now	15 min shorter travel
Toll	$0.00	$ 2.50

29. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

[Third set of rotating scenarios]

Scenario 1	Option A	Option B
Lane Type	Express Toll Lane	Existing Highway lane
Time saving	5 min shorter travel	Same time as now
Toll	$ 2.00	$0.00

30. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 2	Option A	Option B
Lane Type	Existing Highway lane	Express Toll Lane
Time saving	Same time as now	10 min shorter travel
Toll	$0.00	$ 2.50

31. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 3	Option A	Option B
Lane Type	Express Toll Lane	Existing Highway lane
Time saving	15 min shorter travel	Same time as now
Toll	$ 3.00	$0.00

32. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

[Fourth set of rotating scenarios]

Scenario 1	Option A	Option B
Lane Type	Existing Highway lane	Express Toll Lane
Time saving	Same time as now	5 min shorter travel
Toll	$0.00	$ 2.50

33. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 2	Option A	Option B
Lane Type	Express Toll Lane	Existing Highway lane
Time saving	10 min shorter travel	Same time as now
Toll	$ 3.00	$0.00

34. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 3	Option A	Option B
Lane Type	Existing Highway lane	Express Toll Lane
Time saving	Same time as now	15 min shorter travel
Toll	$0.00	$ 3.50

35. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

[Fifth set of rotating scenarios]

Scenario 1	**Option A**	**Option B**
Lane Type	Express Toll Lane	Existing Highway lane
Time saving	5 min shorter travel	Same time as now
Toll	$ 3.00	$0.00

36. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 2	**Option A**	**Option B**
Lane Type	Existing Highway lane	Express Toll Lane
Time saving	Same time as now	10 min shorter travel
Toll	$0.00	$ 3.50

37. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 3	**Option A**	**Option B**
Lane Type	Express Toll Lane	Existing Highway lane
Time saving	15 min shorter travel	Same time as now
Toll	$ 4.00	$0.00

38. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

[Sixth set of rotating scenarios]

Scenario 1	Option A	Option B
Lane Type	Express Toll Lane	Existing Highway lane
Time saving	5 min shorter travel	Same time as now
Toll	$ 3.50	$0.00

39. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 2	Option A	Option B
Lane Type	Existing Highway lane	Express Toll Lane
Time saving	Same time as now	10 min shorter travel
Toll	$0.00	$ 4.00

40. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 3	Option A	Option B
Lane Type	Express Toll Lane	Existing Highway lane
Time saving	15 min shorter travel	Same time as now
Toll	$ 4.50	$0.00

41. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

[Seventh set of rotating scenarios]

Scenario 1	Option A	Option B
Lane Type	Existing Highway lane	Express Toll Lane
Time saving	Same time as now	5 min shorter travel
Toll	$0.00	$ 4.00

42. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 2	Option A	Option B
Lane Type	Express Toll Lane	Existing Highway lane
Time saving	10 min shorter travel	Same time as now
Toll	$ 4.50	$0.00

43. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 3	Option A	Option B
Lane Type	Existing Highway lane	Express Toll Lane
Time saving	Same time as now	15 min shorter travel
Toll	$0.00	$ 5.00

44. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

[Eighth set of rotating scenarios]

Scenario 1	Option A	Option B
Lane Type	Express Toll Lane	Existing Highway lane
Time saving	5 min shorter travel	Same time as now
Toll	$ 0.50	$0.00

45. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 2	Option A	Option B
Lane Type	Existing Highway lane	Express Toll Lane
Time saving	Same time as now	10 min shorter travel
Toll	$0.00	$ 1.00

46. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 3	Option A	Option B
Lane Type	Express Toll Lane	Existing Highway lane
Time saving	15 min shorter travel	Same time as now
Toll	$ 1.50	$0.00

47. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Part D – Stated preferred choices - for those who do not use I-95 section under study because of traffic congestion

Only participants who answered "Never" in Q2 AND "Traffic congestion" or "Other" in Q3 will answer Part D. After answering one set of scenarios, respondents will skip to Q55

New, faster travel lanes (the Express Toll Lanes or "ETL") are being built parallel to the existing lanes on the I-95 highway between the I-95/I-895 merge and MD 43/White Marsh Boulevard.

48. After the new, faster lanes are built, would you consider using the I-95 highway between the I-95/I-895 merge and MD 43/White Marsh Boulevard?

- ❍ Yes (Go To Q. 49)
- ❍ No [Terminate]
- ❍ I'm not sure / It depends (Go To Q. 49)

Although in the previous questions you noted that you never used the I-95 highway between the I-95/I-895 merge and MD 43/White Marsh Boulevard, for the next questions, please consider a hypothetical trip you might take through this section of the highway.

In the following two scenarios, please look at the options given and indicate which you would most likely choose for your trip.

[First set of rotating scenarios]

Scenario 1	Option A	Option B
Lane Type	Express Toll Lane	Existing Highway lane
Time saving	5 min shorter travel	Same time as now
Toll	$0.50	$0.00

49. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 2	Option A	Option B
Lane Type	Existing Highway lane	Express Toll Lane
Time saving	Same time as now	10 min shorter travel
Toll	$0.00	$ 1.00

50. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

[Second set of rotating scenarios]

Scenario 1	Option A	Option B
Lane Type	Existing Highway lane	Express Toll Lane
Time saving	Same time as now	5 min shorter travel
Toll	$0.00	$1.00

51. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 2	Option A	Option B
Lane Type	Express Toll Lane	Existing Highway lane
Time saving	10 min shorter travel	Same time as now
Toll	$ 1.50	$0.00

52. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

[Third set of rotating scenarios]

Scenario 1	Option A	Option B
Lane Type	Express Toll Lane	Existing Highway lane
Time saving	5 min shorter travel	Same time as now
Toll	$1.50	$0.00

53. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

Scenario 2	Option A	Option B
Lane Type	Existing Highway lane	Express Toll Lane
Time saving	Same time as now	10 min shorter travel
Toll	$0.00	$ 2.00

54. Which option would you choose?

- ❍ I would choose option B over option A
- ❍ I would choose option A over option B
- ❍ I am equally likely to choose either option

55. Rate the following factors in terms of importance when choosing your driving route for any commuting or other job-related purpose:

	Extremely Important	Very Important	Somewhat Important	Not Very Important	Not Important
Time savings					
Avoiding traffic congestion					
Low cost					
Trip safety					

56. What type of vehicle do you drive most often? (Select one)

- ❍ Passenger car, SUV, or pick-up truck (2-axle private vehicle)
- ❍ Motorcycle
- ❍ 2-axle truck
- ❍ 3-axle vehicle (including cars pulling a one axle trailer)
- ❍ 4-axle vehicle (including cars pulling a two axle trailer)
- ❍ 5-axle vehicle (including cars pulling a three axle trailer)
- ❍ 6-axle truck or larger
- ❍ Other (please specify)

____

57. The usage of this vehicle is:

- ❍ Commercial
- ❍ Private
- ❍ Mixed (private and commercial)

58. Please mark the appropriate selection(s):

- ❍ I have an E-ZPass (Skip to Q. 60)
- ❍ I do not have an E-ZPass, but I would obtain one if it made travel easier (Skip to Q. 60)
- ❍ I do not have an E-ZPass and I will not get one (Go to Q. 59)

59. What is the reason that you do not have or do not want to use the E-ZPass? (Select all that apply)

- ❍ I am concerned about privacy
- ❍ I think it is too costly to use
- ❍ I have no credit card
- ❍ I do not use toll roads often enough
- ❍ I do not know what E-ZPass is
- ❍ Other, please specify

____

The following set of questions are asked only to ensure that this study represents the feedback and opinions from all relevant groups of drivers residing in the area and who may be interested in the I-95 ETLs under development.

60. What is your gender?

- ❍ Male
- ❍ Female
- ❍ Prefer not to answer

61. Please indicate your household income range.

- ❍ Less than $25,000
- ❍ $25,001 to $50,000
- ❍ $50,001 to $75,000
- ❍ $75,001 to $100,000
- ❍ $100,001 to $150,000
- ❍ More than $150,000
- ❍ Prefer not to answer

62. Please indicate your age

- ❍ 18 - 25
- ❍ 26 - 35
- ❍ 36 - 45
- ❍ 46 - 55
- ❍ 56 - 65
- ❍ 66 +
- ❍ Prefer not to answer

63. What is your employment status?

- ❍ Work full-time
- ❍ Work part-time
- ❍ Temporary unemployed
- ❍ Do not work, but not retired
- ❍ Retired
- ❍ Prefer not to answer

Thank you for taking our survey!

APPENDIX B

Travel Demand Modeling and Microsimulation Modeling Technical Memorandum

MEMORANDUM

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Date: December 14, 2013

To: Joe Sobleski, Jacobs

From: James A. Burnett, P.E., PTOE, RK&K
Zichuan Li, Ph.D., RK&K
Robert R. Josef, RK&K

CC: Phil Eshelman, Jacobs
Rick Gobeille, Jacobs
Karen B. Kahl, P.E., PTOE, RK&K

Subject: **I-95 Section 100 Express Toll Lanes (ETL) Study**
Summary of Forecasting and Analysis Methodology and Results

The purpose of this memorandum is to document the methodology and results of RK&K's efforts assisting Jacobs in the development of traffic volume estimates and subsequently analyzing traffic operations along I-95 and surrounding roadways after the I-95 Section 100 Express Toll Lanes (ETLs) open in Baltimore, Maryland. This work was performed for the Maryland Transportation Authority (MdTA) to help the Authority determine the appropriate toll rates to implement when the lanes open (anticipated opening in 2014), as well as in planning year 2025. In general terms, using the regional travel forecasting model, RK&K extracted volume data that was then provided to Jacobs who post-processed the raw volumes using a proprietary toll revenue model. Jacobs subsequently provided those refined volume estimates back to RK&K who used them in a VISSIM model to study the traffic operations in the ETLs and GP lanes.

Background

The I-95 Section 100 ETL study covers the roadway section from the I-95/MD 43 interchange in Baltimore County to the split of I-895 and I-95 just inside the Baltimore City limits. The northern end of the ETLs on I-95 southbound starts approximately one (1) mile north of the MD 43 interchange, and can also be accessed via a signalized ramp from both eastbound and westbound MD 43. Further south along I-95 (beyond the I-695 interchange), the southbound ETLs split into an I-895 branch and an I-95 branch. Traffic on the I-895 branch southbound ETLs can merge back onto the I-895 general purpose (GP) lanes about 2,300 feet prior to Moravia Road, or continue onto Moravia Road via a ramp in the median that terminates at a signalized intersection. The I-95 branch simply merges back onto the I-95 southbound GP lanes about 2,300 feet prior to the US 40 (Pulaski Highway) interchange.

Similarly, in the northbound direction, the ETLs start at the southern project limits from an I-95 branch and an I-895 branch. The northbound I-95 branch starts just north of the US 40 (Pulaski Highway) interchange. The northbound I-895 branch starts at the Moravia Road interchange, where traffic from the Moravia Road overpass can enter the ETLs via a signalized ramp in the median of I-895. Traffic from the northbound I-895 GP lanes can also enter the ETLs approximately 1,700 feet north of the Moravia Road interchange. The northbound I-895 ETLs branch merges with the northbound I-95 ETLs branch and continues beyond I-695 to the MD 43 interchange. Northbound ETL traffic can exit the ETLs to both eastbound and westbound MD 43 via a signalized ramp in the I-95 median, or they can merge back into northbound I-95 GP lanes approximately one (1) mile north of the MD 43 interchange.

The following intersections and interchanges were included in this study (from north to south):

1. MD 43 (White Marsh Boulevard) at Honeygo Boulevard intersection
2. I-95 at MD 43 interchange including ETLs to/from I-95
3. MD 43 at MD 7 (Philadelphia Road) interchangeI-695 at US 1 (Belair Road) interchange
4. I-95 at I-695 interchange without ETL access ramps
5. I-695 at MD 7 (Philadelphia Road) interchange
6. I-95 at I-895 split, including ETL split to I-95 and I-895
7. I-895 at Moravia Road interchange, including ETL ramps to/from I-95)
8. I-95 at US 40 (Pulaski Highway) interchange with ETL access ramp

The two major components of RK&K's study were traffic volume estimates and VISSIM simulation analysis, and the details of those efforts are summarized in the following sections.

Traffic Volume Estimates

RK&K prepared traffic volume estimates within the study limits for the following scenarios:

- Existing 2012
- ETLs opening year 2015 (approximately corresponding to the actual anticipated ETL opening year of 2014, but using 2015 for simplicity to correspond with the regional transportation model);
- Long-range planning year 2025

Existing Traffic Counts and Origin-Destination Matrix

RK&K received VISSIM simulation models from MdTA which were developed by Parsons Brinckerhoff & URS Corporation, with documentation dated March 20, 2012. Those VISSIM models represented a 2014 opening year scenario for the I-95 ETLs. To validate the volumes that were included in those models, RK&K performed a comparison of the traffic volumes from the VISSIM models and actual traffic counts along I-895 and I-95 to south of the I-95/I-895 split (see **Figure 1** for details). These counts were collected by RK&K in 2009 and 2012 under a separate contract with MdTA. The comparison results are listed in **Table 1.**

Figure 1:
Traffic Counts Locations Used to Validate Original 2014 VISSIM Model

The comparison results in **Table 1** indicated that the traffic volumes from the original 2014 VISSIM models were significantly higher than the 2009 and 2012 ground counts. For instance, the northbound PM peak VISSIM traffic was 52% higher on I-895 northbound and 47% higher on I-95 northbound than the actual counts. Upon further investigation, RK&K determined that the source of the 2014 VISSIM model volumes were 2007-2010 counts projected forward to 2014. This finding, along with the aforementioned discrepancy between recent count data and the VISSIM model volumes, indicated that the volumes in the original 2014 VISSIM models would need to be revised to better match existing conditions. Further review of the traffic counts from 2009 and 2012 collected by RK&K for several locations within the study limits revealed that the 2009 and 2012 volumes were nearly identical, indicating that there was little or no growth in the study limits from 2009 to 2012.

Table 1:
The Comparison Results between Original 2014 VISSIM Volume Network and Recent Traffic Counts

Peak	Location	2009 Counts	2012 Counts	Average Counts	VISSIM (2014)	Difference[1]
AM	From Q (895 NB Mainline)	1,190	1,200	1,195	1,565	31%
	To Q (895 SB Mainline)	2,660	2,600	2,630	3,702	41%
	From T (I-95 NB Mainline)	2,660	2,560	2,610	2,395	-8%
	To T (I-95 SB Mainline)	5,440	5,570	5,505	6,702	22%
PM	From Q (895 NB Mainline)	2,135	1,950	2,043	3,110	52%
	To Q (895 SB Mainline)	1,580	1,650	1,615	1,876	16%
	From T (I-95 NB Mainline)	4,610	4,350	4,480	6,600	47%
	To T (I-95 SB Mainline)	3,420	3,270	3,345	3,455	3%

[1] Since the volumes from Year 2009 and Year 2012 are consistent with each other, the difference is calculated as follows: Difference = (VISSIM 2014 – Average) / (Average of Year 2009 and Year 2012) X 100%

As a result, RK&K developed a new existing (Year 2012) traffic volume network (see **Appendix 1**) based on actual ground counts. This traffic counts network was developed based on the ramp and intersection turning movement counts obtained from the SHA's Internet Traffic Monitoring System (I-TMS) and the MdTA traffic count project conducted by RK&K. Those traffic counts were mostly collected between 2010 and 2012 (see **Appendix 1** for details). Based on this traffic count network, an Origin-Destination (O-D) Matrix was developed using the fraction method. The resulting O-D matrix and its O-D labeling convention can be found in **Appendix 2** and **Figure 3**, respectively. To ensure the VISSIM volumes were as accurate as possible, which is critical to the study's goal to estimate congestion on the general purpose lanes, RK&K revised all the volumes in the existing VISSIM models to reflect the new OD matrices developed by RK&K, and calibrated those VISSIM models with recent INRIX speed data from I-95 section 100, provided by Jacobs.

Model Development and Calibration

The primary tool used to develop traffic volume estimates for the I-95 Section 100 ETL project was the regional travel demand model, which was obtained from the Baltimore Metropolitan Council (BMC). A section of the travel network which includes Section 100 is shown in **Figure 2**. The most recent version of the model available for this study was Version 4.2. The BMC model, at this point, still utilizes the four step transportation process of trip generation, trip distribution, mode split and traffic assignment. BMC supplied all scripts and inputs necessary to perform a complete model run using Cube Voyager software.

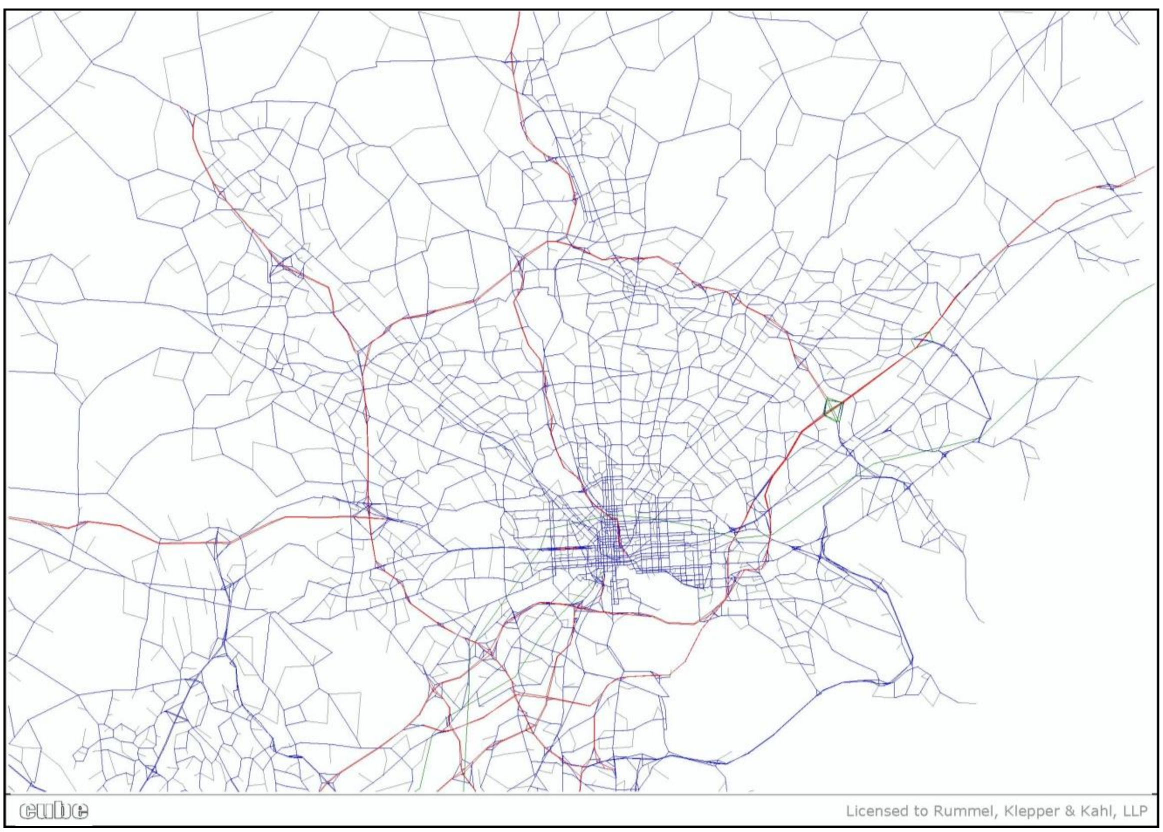


Figure 2:
Baltimore Metropolitan Council (BMC) 2015 Regional Model Network

Three model years were provided by the BMC – a year 2008 base year; a year 2015 intermediate year (approximately corresponding to the anticipated ETL opening year of 2014); and a long-range planning year of 2025. As a first step, the models were run for all three years to create regional highway networks and trip tables. At this point, none of the BMC input data were changed. All three model runs were successful in creating overall regional traffic volumes and trip tables which were, within insignificant rounding errors, the same as the output from the runs performed by BMC. Although the model base is year 2008, it was necessary to obtain the best fit between the model results and the most current counts available. The historical counts on I-95 and parallel routes in the vicinity of Section 100 indicate that traffic growth on these facilities has been essentially static over the past few years.

As part of the due diligence efforts for the study, all three travel networks were reviewed to ensure that the base year matched current conditions, and that future year networks reflect the most current Transportation Improvement Plans and the Long Range Plan. Next, it was determined that no major changes in the highway network have been made in the Section 100 corridor since 2008, nor were any assumed for 2015 or 2025, other than the Section 100 ETL project. Therefore, for the purposes of this study, it was reasonably assumed that the 2008 model could be used to represent current traffic conditions in the corridor.

Travel demand models are generally validated against daily traffic. Since Section 100 is a relatively short segment of I-95, assigned daily volumes output from the model were compared with 2011 daily counts across two short cordon lines. These include only I-95 and nearby parallel arterials which would represent potential competition for trips. These cordon lines are shown in **Table 2**. Along Section 100, where the ETLs would be implemented, the counts on I-95 compared quite favorably with the model output, within 4.5 percent. However, the parallel routes US 1, US 40 and MD 7 were all significantly under-assigned. This indicates that the model is understating congestion in the immediate area. This finding was considered in evaluating whether diversion to the managed lanes as shown in the model would be reasonable.

Table 2:
Regional Model Cordon Line Comparison

Route	Daily assigned volume	2011 Daily Volume	Difference (count versus model output)
Cordon Line #1: Just South of MD 43			
US 1	34,764	47,141	35.6%
I-95	162,473	169,715	**4.5%**
MD 7	4,869	22,842	369.1%
US 40	23,405	31,752	35.7%
MD 150	29,202	38,982	33.5%
	254,713	**310,432**	**21.9%**
Cordon Line #2: Further South of MD 43			
US 1	22,292	29,891	35.6%
I-95	162,114	171,382	4.5%
MD 7	9,358	17,952	369.1%
US 40	32,412	35,462	35.7%
MD 150	4,920	11,980	33.5%
	231,096	**266,667**	**15.4%**

Future Year Analysis

Once the base year results were assessed, the model was used to generate the output necessary for the evaluation of the ETLs. MdTA requested estimates of volumes for nine (9) scenarios:

- 2015 opening year (no 695 connections, no toll, no ETLs)
- 2015 opening year (no 695 connections, no toll, with ETLs)
- 2015 opening year (no 695 connections, with toll, with ETLs)
- 2015 opening year (with 695 connections, no toll, with ETLs)
- 2015 opening year (with 695 connections, with toll, with ETLs)
- 2025 (no 695 connections, no toll, with ETLs)
- 2025 (no 695 connections, with toll, with ETLs)
- 2025 (with 695 connections, no toll, with ETLs)
- 2025 (with 695 connections, with toll, with ETLs)

Although links representing the Section 100 ETLs were included in the BMC model, they were not coded with sufficient detail in order to properly model the lanes. Therefore, additional link detail was added in order to reflect the current lanes and interchanges, and also the ETLs and their connections. The links were coded to ensure that movements using the ETLs could be distinguished from those that do not. Special attention was paid to the interchange at I-695, since scenarios with and without direct connections from the ETLs to I-695 were requested by MdTA. It should be noted that for the majority of scenarios, direct access ramps between the ETLs and I-695 were not included. These ramps were originally included in the design of the Section 100 ETL project, but due to funding constraints, are unlikely to be constructed at this time.

At this point, the coding of the future year "build" networks matched the networks used for the VISSIM analysis, which is shown in **Figure 3.** Once the networks were coded, a method for extracting volumes from the model runs for the VISSIM analysis of the ETLs was developed. This was a critical step because the VISSIM model required volumes to be entered as origin-destination (O-D) pairs rather than simple link volumes. The goal was to create ramp-to-ramp movements on I-95 for both the GP lanes and, in the "build" scenarios, the ETLs. This was done by running a select link analysis run for every entrance ramp to I-95 in Section 100 for the AM and PM peak periods for all scenarios. Then, the volumes heading from each entrance ramp to each exit ramp were extracted and placed in matrix format for both the "no-build" and "build" scenarios. An example of the "raw" output volumes in a matrix is shown in **Figure 4** for 2015 (2015 is the year of the BMC model run – there is no 2014 BMC model run, the year that the ETLs are anticipated to open). This example shows the "build" condition during the AM peak for the scenario in which there are no direct connectors to I-695 for the managed lanes.

Once the matrices were all obtained, the relationships between the matrices from the model for the different scenarios were used to adjust the "no-build" 2015 seed matrix (developed from extrapolating actual counts to the anticipated opening year of 2015).This resulted in the final matrices for each scenario. Some adjustments had to be made manually if a ramp-to-ramp movement from the model was not shown in the "seed" matrix, or vice versa; or if a movement looked unreasonable due to over congestion in the regional model.

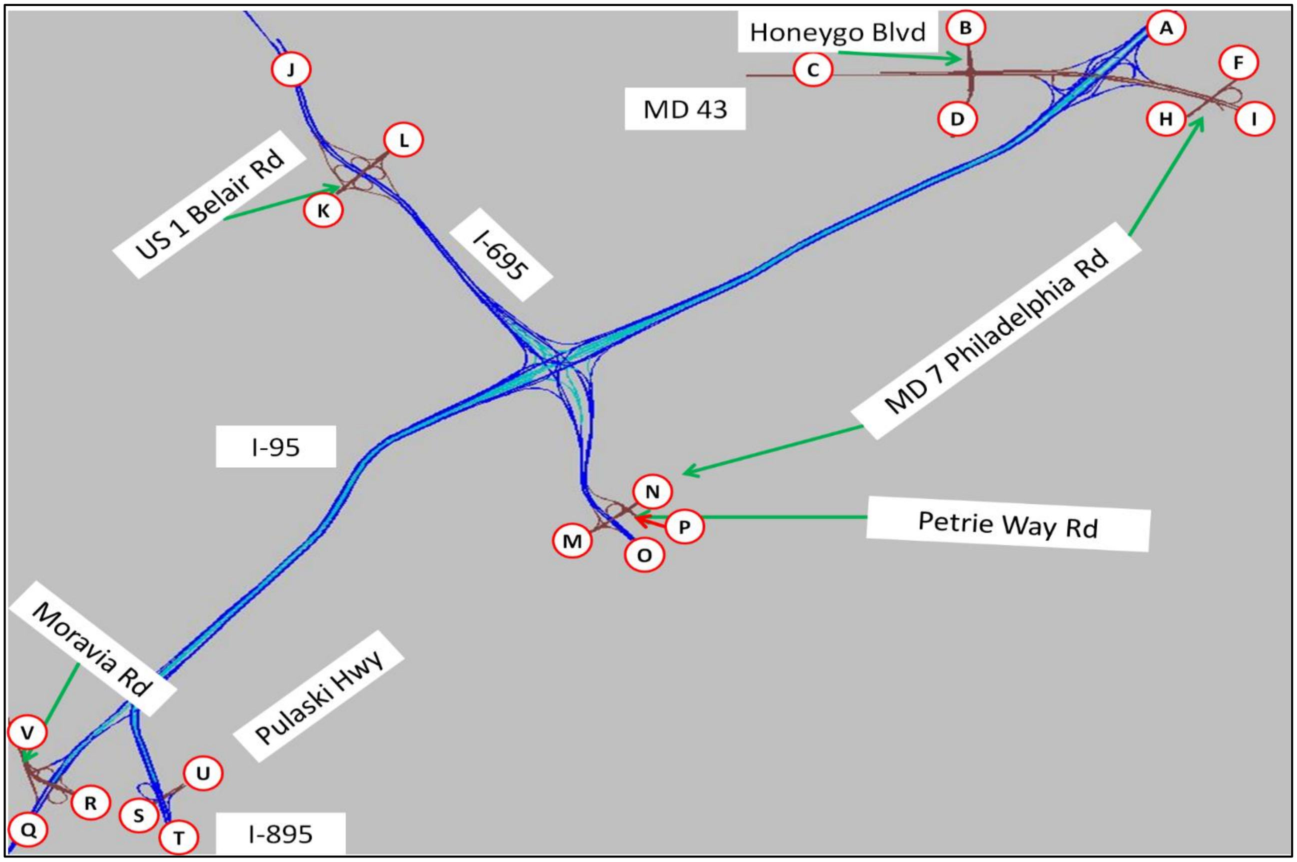


Figure 3:
VISSIM Network for I-95 Section 100 Study

	A	B	C	D	F	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	TOTALS
A		93	664	712	0	0	148	1908	314	13	57	18	1718	32	1533	2463	0	6303	0	1138	17114
B	111		236	748	0	0	124	0	2	2	16	1	281	6	363	516	2	1098	1	197	3704
C	472	119		455	75	0	942	0	0	0	2	0	109	0	104	138	0	335	0	37	2788
D	145	376	349		1	0	50	0	0	0	1	0	27	0	75	36	1	116	0	22	1199
F	5	16	184	65		955	0	5	0	0	0	23	1	0	89	71	0	259	80	0	1753
H	18	0	0	0	178		0	0	0	0	0	0	0	0	0	0	0	0	0	0	196
I	340	145	1580	379	0	0		10	24	0	0	0	0	0	238	87	0	1521	0	299	4623
J	1935	0	0	0	1	0	27		581	36	116	243	3424	116	875	179	0	2411	0	168	10112
K	0	0	0	0	0	0	0	1011		0	0	0	0	0	0	0	0	0	0	0	1011
L	0	0	0	0	0	0	0	658	3844		0	0	0	0	3	0	13	0	0	3	4521
M	117	3	0	0	0	0	0	67	0	4		320	0	242	0	0	0	0	0	0	753
N	28	0	0	0	0	0	0	200	3	2	910		543	283	65	0	0	9	0	0	2043
O	1329	53	1	65	1	0	0	4005	360	758	0	0		97	254	0	0	0	0	77	7000
P	8	0	0	0	0	0	0	35	2	7	83	78	31		2	0	0	4	0	0	250
Q	1491	45	0	83	37	0	94	416	20	265	0	72	0	18		0	0	0	0	0	2541
R	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	*0*	11
S	168	15	0	18					9	32	0	0	0	0	0	0		0	0	0	242
T	4704	112	4	95	41	0	529	709	34	362	0	6	0	29	0	0	0		879	0	7504
U	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***296***		0	296
V	590	13	0	16	20	0	56	45	2	2	0	0	0	0	629	*0*	0	0	0		1373
TOTALS	11472	990	3018	2636	354	955	1970	9069	5195	1483	1185	761	6134	823	4230	3490	16	12352	960	1941	**69034**

Figure 4:
2015 "Build" AM Peak Ramp to Ramp Movements
No Direct Connections to I-695, Including Toll Free ETLs

Next, the ratios between the 2015 tolled and toll-free model matrices were applied to the new 2015 toll-free matrices calculated in the step above to get adjusted 2015 tolled matrices for the tolled scenario. Similarly, the ratios between the toll-free scenarios with and without the connectors were used to get adjusted matrices for the scenarios with the connectors. Finally, the ratios between the toll and toll-free model matrices for the option with the connectors were applied to the adjusted toll free scenario to get the adjusted matrices for the toll condition.

To calculate 2025 forecasts, the first "build" scenario (toll-free with no connectors) was developed by calculating the ratios between the 2025 and 2015 model matrices. These were then applied to the adjusted 2015 matrix to grow it to 2025 levels. Then, the same methodology used for the 2015 runs was followed for the three additional "build" scenarios in 2025, resulting in the adjusted matrices for those scenarios. After the matrices were checked for reasonableness, they were sent to Jacobs to be post-processed with their proprietary toll revenue model. Subsequently, Jacobs provided RK&K with refined volume forecasts for each scenario, still in O-D pair format, ready to be input into VISSIM.

VISSIM Simulation Analysis

Existing VISSIM Simulation (2012) Development and Calibration

The following tasks were performed to develop the existing conditions VISSIM simulation:

1. Extended I-95 in the VISSIM model to cover the north end of the study area. ETLs were also extended to accurately model their merging/diverging ramps to/from the general purpose lanes on I-95 based on the latest design plans from MdTA.
2. Revised the origin-destination matrices for the existing VISSIM models (AM and PM peaks) using the O-D matrices developed from the BMC travel demand model.
3. Restricted all trucks from using the left-most lane of the I-95 mainline.
4. Changed the desired speed distributions of I-95 mainline so that the left-most lanes had slightly higher desired speeds than the right-most lanes.
5. Changed the driver behavior assumptions at several merge and diverge location to eliminate unreasonable driver behavior observed in the simulation.
6. Adjusted the lane changing decision points to more accurately reflect the behavior of motorists travelling through I-95 Section 100, namely that many motorists "get in line" in their desired travel/exit lane one mile (sometimes more) before their desired exit rather than making several lane changes within the last thousand feet approaching the exit.
7. Calibrated the existing conditions VISSIM models (AM and PM) with INRIX travel speeds provided by Jacobs Engineering Group Inc. The calibration results are listed in **Table 3**, which indicate that the revised existing conditions VISSIM models represent the actual traffic conditions reasonably well.

Table 3:
Existing Conditions VISSIM Model Travel Speed Calibration Results (2012)

	INRIX	VISSIM
SB (AM PEAK)*	23	27
NB (PM PEAK)*	35	35

*Average Peak Hour Vehicle Speeds on I-95 South of the I-695 Interchange (mph)

2012 VISSIM Simulation Analysis

The existing (2012) conditions and two (2) "build" scenarios were developed for the current year (2012): One model for Toll-free ETLs and one model for Tolled ETLs at the base toll rate. These 2012 "build" scenarios are hypothetical test cases; the ETLs are not anticipated to be open to traffic until 2014. RK&K input the refined traffic forecasts provided by Jacobs Engineering Group Inc. and conducted the VISSIM simulation. The average travel speeds (see **Table 4**) at two (2) congested locations and the travel times (see **Table 5**) on the I-95 GP lanes and ETLs have been chosen as the Measures of Effectiveness (MOEs). Those MOEs were taken from the averages of five (5) VISSIM simulation runs, and more details about these MOEs can be found in **Appendix 3.**

Table 4:
2012 VISSIM Travel Speed Comparison (mph)

	2012 INRIX Data	2012 VISSIM Simulation Results		
		No-Build with No ETLs	Build with Untolled ETLs	Build with ETLs at Base Toll Rate
GP SB (AM PEAK)	25	28	54	53
ETL SB (AM PEAK)	N/A	N/A	58	58
GP NB (PM PEAK)	26	23	54	51
ETL NB (PM PEAK)	N/A	N/A	58	61

The average travel speeds in **Table** 4 indicated that under the Build with Toll-Free ETLs scenario, the speeds in the GP lanes would be much higher than the No-Build scenario. Introducing a toll at the base rate will result in a shift in traffic out of the ETLs and into the GP lanes and would result in somewhat slightly slower speeds in the GP lanes than the Build with Toll-Free ETLs scenario. The ETLs would maintain near free flow speeds under both scenarios, which are higher compared to those of GP lanes.

Table 5:
Average Travel Time from 2012 VISSIM Simulation (minutes)

		No-Build with No ETLs	Build with Toll-Free ETLs	Build with ETLs at Base Toll Rate
To I-95	GP SB (AM PEAK)	9.5	8.1	8.2
	ETL SB (AM PEAK)	N/A	7.6	7.6
To I-895	GP SB (AM PEAK)	12.0	10.3	9.3
	ETL SB (AM PEAK)	N/A	7.6	7.5
From I-95	GP NB (PM PEAK)	9.5	8.6	8.7
	ETL NB (PM PEAK)	N/A	8.3	7.6
From I-895	GP NB (PM PEAK)	11.5	8.4	8.7
	ETL NB (PM PEAK)	N/A	8.0	7.9

The average travel times in **Table 5** show that travel times in the ETLs remained approximately constant, which is about 8 minutes in both the southbound and northbound directions under all scenarios. The travel times in the GP lanes varied from 8.1 minutes to 9.5 minutes for the southbound I-95 branch, and from 9.3 to 12.0 minutes for the southbound I-895 branch. In the northbound direction, the travel time variation similar to that of the southbound direction. In conclusion, the ETLs would have shorter travel times than the GP lanes.

The results presented in **Table 4** and **5** indicate that the opening of ETLs can significantly improve the traffic conditions in the GP lanes. They will reduce travel times and increase travel speeds closer to free flowing conditions. The results also indicate that implementing the base toll rate on the ETLs will have no significant impact on the traffic conditions in the ETL lanes, and only a minor impact on traffic conditions in the GP lanes.

2015 and 2025 VISSIM Simulation Analysis

RK&K developed an additional VISSIM model for the build scenario of 2025 with refined O-D matrices provided by Jacobs. Only one 2025 scenario was analyzed: 2025 Build with ETLs at the Base Toll Rate. The average travel speeds and travel times for the GP lanes and ETLs are represented in **Table 6** and **7**, which also compares the 2025 results with 2012 and 2015[1] model results. These results were based on the average of five (5) VISSIM simulation runs. More details of those MOEs can be found in **Appendix 4.**

Table 6:
Average Travel Speeds (mph) from VISSIM Simulations

	2012 Build with Toll-Free ETLs	2012 Build with ETLs at Base Toll Rate	2015 Build with ETLs at Base Toll Rate	2025 Build with ETLs at Base Toll Rate
GP SB (AM PEAK)	54	53	48	31
ETL SB (AM PEAK)	58	58	58	58
GP NB (PM PEAK)	54	51	45	27
ETL NB (PM PEAK)	58	61	61	60

The average travel speeds in **Table 6** indicate the ETLs would maintain higher speeds under all scenarios than the GP lanes. The average speeds in the ETLs also demonstrate less variation than the GP lanes.

[1] An earlier version of this report presented results from a 2015 VISSIM model. When the report was updated in December 2013, the 2015 model was not re-run. Instead, the results for the 2015 Build scenario were estimated by means of linear interpolation between the 2012 and 2025 Build Scenario results.

Table 7:
Average Travel Time (minutes) from VISSIM Simulations

		2012 Build with Toll-Free ETLs	2012 Build with ETLs at Base Toll Rate	2015 Build with ETLs at Base Toll Rate	2025 Build with ETLs at Base Toll Rate
To I-95	GP SB (AM PEAK)	8.1	8.2	9.3	12.9
	ETL SB (AM PEAK)	7.6	7.6	7.6	7.7
To I-895	GP SB (AM PEAK)	10.3	9.3	10.8	15.6
	ETL SB (AM PEAK)	7.6	7.5	7.6	7.7
From I-95	GP NB (PM PEAK)	8.6	8.7	8.8	9.3
	ETL NB (PM PEAK)	8.3	7.6	7.6	7.8
From I-895	GP NB (PM PEAK)	8.4	8.7	9.2	10.9
	ETL NB (PM PEAK)	8.0	7.9	7.9	8.0

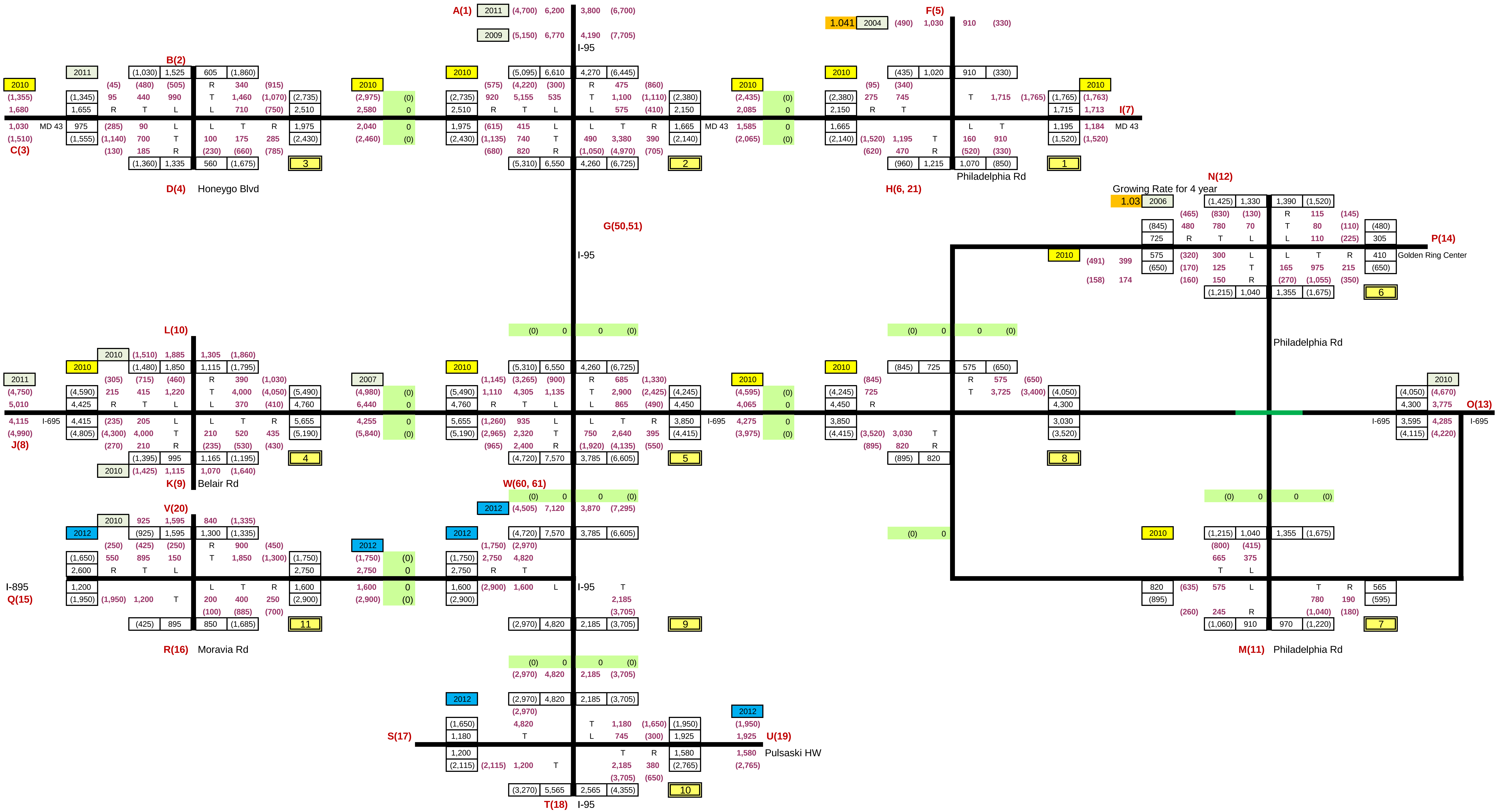
The average travel times listed in **Table 7** indicate the travel times in the ETLs would be lower than in the parallel GP lanes for all scenarios, especially for the southbound I-95 to I-895 ETL branch. In that direction, travel times are expected to deteriorate (increase) by approximately 6 minutes between 2012 and 2025 in the GP lanes, while travel times in the ETLs would remain free flowing through 2025. In both directions and both peak periods, the GP lanes will be more congested (higher travel times) in 2025 than in 2012, which the ETLs are expected to remain free flowing through 2025.

Conclusions

The VISSIM analysis results indicate that Express Toll Lanes (ETLs) generally would maintain higher speeds and thus would have shorter travel times than their parallel general purpose (GP) lanes. In summary, when the ETLs open (2012 analysis), the ETL's are expected to have free flowing traffic and will save motorists 1-2 minutes of travel time compared to traffic using the GP lanes. By 2025, the ETLs are still expected to have free flowing traffic and the time savings for using the ETLs will grow to approximately 2-8 minutes compared to traveling in the GP lanes.

Appendices:

1. Existing Traffic Counts Network (2012)
2. Existing Origin-Destination matrix (2012)
3. Travel speeds and travel time comparison (2012)
4. Travel speeds and travel time comparison (2015 and 2025)


A(1)
I-95
F(5)
B(2)
MD 43
I(7)
C(3)
D(4) Honeygo Blvd
Philadelphia Rd
H(6, 21)
N(12)
Growing Rate for 4 year
G(50,51)
P(14)
Golden Ring Center
L(10)
Philadelphia Rd
I-695
O(13)
J(8)
K(9) Belair Rd
W(60, 61)
V(20)
I-895
Q(15)
R(16) Moravia Rd
M(11) Philadelphia Rd
S(17)
U(19)
Pulsaski HW
T(18)
1
2
3
4
5
6
7
8
9
10
11

AM PC+CV		Destination																							
		A	B	C	D	F	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	Total	Counts	Vissim	% Diff
Origin	A		123	540	257		170	365	745	63	65	54	105	711	23	828			2157		403	6610	6610	8325	26%
	B	202		96	443		125	270	57	5	5	4		55		64			167		31	1525	1525	1965	29%
	C	157	91		186		98	209	45	4	4	3		43		50			130		24	1045	1045	1710	64%
	D	58	176	101			36	77	17	1	1	1		16		18			48		9	560	560	750	34%
	F	62	20	87	41		746		11	1	1	1		10		12			31		6	1030	1030	1065	3%
	H	39	12	55	26	910			7	1	1			7		8			20		4	1090	1090	475	-56%
	I	378	120	527	251				66		6	5		63		74			191		35	1715	1715	1950	14%
	J	526	10	45	21		19	41		230	260	100	197	1330	43	416			1084		202	4525	4525	5345	18%
	K	58	1	5	2		2	4	322		531	11		146		46			119		22	1270	1270	1070	-16%
	L	159	3	14	6		6	13	250	415		30	60	402	13	126			328		61	1885	1885	1930	2%
	M	17		1	1		1	1	99	8	9		481	190	105	7			17		3	940	940	875	-7%
	N	52	1	4	2		2	4	304	26	27	499		281	70	20			53		10	1355	1355	1415	4%
	O	471	9	40	19		17	37	2739	231	241	97	303		126	183			477		89	5080	5080	4500	-11%
	P	8		1				1	48	4	4	70	115	40		3			8		2	305	305	130	-57%
	Q	685	13	58	28		25	54	110	9	9	14		195								1200	1200	1565	30%
	R	138	3	12	6		5	11	22	2	2	3	6	39	1	200					400	850	850	1030	21%
	S																			1200		1200	1200	1060	-12%
	T	1209	23	103	49		44	95	195	16	17	26	51	345	11					380		2565	2565	2395	-7%
	U																	1180	745			1925	1925	1880	-2%
	V	83	2	7	3		3	7	13	1	1	2	4	24	1	550	894					1595	1595	1797	13%
	Total	4303	607	1695	1341	910	1299	1190	5050	1018	1184	921	1322	3897	393	2605	894	1180	5576	1580	1302	38270	38270	41232	8%
	Counts	4270	605	1680	1335	910	1295	1185	5010	1020	1170	920	1390	3940	410	2600	895	1180	5565	1580	1300				
	Vissim	4261	786	1818	1796	806	840	1760	5394	961	1090	805	937	4766	161	3702	1329	1145	6702	1060	1112				
	% Diff	0%	30%	8%	35%	-11%	-35%	49%	8%	-6%	-7%	-12%	-33%	21%	-61%	42%	48%	-3%	20%	-33%	-14%				

PM PC+CV	Destination																						
Origin	A	B	C	D	F	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	Total	Counts	Vissim	% Diff
A		189	232	155		87	213	674	67	169	42	68	583	23	715			1632		247	5095	5095	5325	5%
B	128		45	481		69	168	23	2	6	1		19		24			55		8	1030	1030	1315	28%
C	290	286		131		157	382	51	5	13	3		44		54			125		19	1560	1560	1965	26%
D	199	662	231			107	261	35	3	9	2		30		37			85		13	1675	1675	2275	36%
F	53	24	29	19		341		4		1			3		4			10		1	490	490	500	2%
H	184	82	100	67	330			14	1	4	1		12		15			34		5	850	850	1505	77%
I	627	279	343	229				47		12	3		41		50			116		17	1765	1765	1815	3%
J	742	51	63	42		31	75		295	295	100	165	1406	55	212			484		73	4090	4090	5655	38%
K	93	6	8	5		4	9	286		542	12		177		27			60		9	1240	1240	1640	32%
L	98	7	8	6		4	10	335	714		13	22	185	7	28			64		10	1510	1510	1450	-4%
M	47	3	4	3		2	5	136	14	34		578	205	192	6			15		2	1245	1245	1250	0%
N	80	6	7	5		3	8	235	23	59	557		328	130	11			25		4	1480	1480	1575	6%
O	846	59	72	49		35	85	2479	246	621	102	323		172	116			266		40	5510	5510	4300	-22%
P	19	1	2	1		1	2	56	6	14	141	144	83		3			6		1	480	480	475	-1%
Q	937	65	80	53		38	94	125	12	31	34		480								1950	1950	3110	59%
R	324	22	28	18		13	33	43	4	11	12	19	166	6	100					886	1685	1685	1825	8%
S																			2115		2115	2115	1800	-15%
T	1714	119	146	97		71	172	229	23	57	63	103	877	34					650		4355	4355	6600	52%
U																	1650	300			1950	1950	1130	-42%
V	116	8	10	7		5	12	15	2	4	4	7	59	2	250	425					925	925	1150	24%
Total	6497	1870	1408	1367	330	969	1529	4787	1417	1882	1091	1429	4698	621	1652	425	1650	3277	2765	1335	41000	41000	46660	0.138
Counts	6445	1860	1400	1360	330	965	1520	4750	1425	1860	1090	1520	4735	650	1650	425	1650	3270	2765	1335				
Vissim	8493	2461	1806	1478	1030	869	2483	5450	1400	2550	982	1203	5193	366	1876	856	800	3455	2460	1449				
% Diff	32%	32%	29%	9%	212%	-10%	63%	15%	-2%	37%	-10%	-21%	10%	-44%	14%	101%	-52%	6%	-11%	9%				

AM PC+CV		Destination																				
		A	B	C	D	F	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	Total
Origin	A		194	570	311		189	486	267	46	83	53	46	456	11	1609	167		3511		327	8325
	B	181		140	775		96	247	247	4	7	5	27	147	1	20	13		51		3	1965
	C	225	125		285		119	306	306	5	9	6	33	182	1	25	16		63		4	1710
	D	69	200	150			37	94	94	1	3	2	10	56	0	8	5		19		1	750
	F	34	19	57	31		840		37	1	1	1	4	22	0	4	2		11		1	1065
	H	26	15	44	24	300			29	0	1	1	3	17	0	3	2		9		1	475
	I	291	169	495	270				320	5	9	6	35	191	1	38	18		97		6	1950
	J	590						243		265	230			2116		676			1225			5345
	K	46	1	4	2		1	4	290		440	8	18	121	2	39	5		81		8	1070
	L	148						61	250	465				530		169			307			1930
	M	32	1	3	1		1	2	140	7	12		350	250	25	15	2		31		3	875
	N	69	2	6	3		2	5	302	14	26	530		280	65	32	4		67		7	1415
	O	337		174				139	2238	106	193	150	300		50	237	33		492		50	4500
	P	4	0	0	0		0	0	20	1	2	20	55	20		2	0		4		0	130
	Q	815	22	65	36		23	63	323	15	28	10	21	143	2							1565
	R	67	2	5	3		2	5	25	1	2	1	2	11	0	205					700	1030
	S																			1060		1060
	T	1263	34	100	54		34	97	484	23	42	14	32	214	3							2395
	U																	1145	735			1880
	V	64	2	5	0		2	5	24	1	2	1	2	10	0	620	1060					1798
	Total	4261	786	1818	1796	300	1346	1760	5394	961	1090	805	937	4766	161	3702	1329	1145	6702	1060	1112	41233

PM PC+CV		Destination																				
		A	B	C	D	F	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	Total
Origin	A		279	279	142		87	288	780	56	189	54	77	600	15	718	69		1546		147	5325
	B	139		115	650		59	196	30	2	7	2	3	23	1	26	3		55		5	1315
	C	333	425		225		141	469	71	5	17	5	7	55	1	62	6		131		13	1965
	D	278	850	325			118	392	59	4	14	4	6	46	1	52	5		110		10	2275
	F	48	27	27	14		350		7	0	2	0	1	5	0	6	1		12		1	500
	H	151	85	85	43	1030			21	1	5	1	2	16	0	18	2		39		4	1505
	I	577	326	326	166				79	6	19	5	8	61	2	70	7		149		14	1815
	J	1087						318		340	330			2640		331			609			5655
	K	77	8	8	4		2	8	240		1020	14	21	162	4	21	2		45		4	1640
	L	103						30	275	705				248		31			58			1450
	M	59	6	6	3		2	6	120	9	29		550	325	100	10	1		22		2	1250
	N	124	12	12	6		4	13	251	18	61	565		310	125	21	2		45		4	1575
	O	727		180				212	1638	118	398	175	275		100	140	14		294		28	4300
	P	27	3	3	1		1	3	55	4	13	100	175	75		5	0		10		1	475
	Q	399	140	140	71		34	171	1501	43	353	18	26	207	5							3110
	R	56	22	22	11		6	26	97	7	24	3	4	212	1	120					1215	1825
	S																			1800		1800
	T	4289	271	271	137		63	341	196	79	60	34	48	141	10					660		6600
	U																	800	330			1130
	V	19	7	7	4		2	9	31	2	8	1	1	69	0	245	745					1150
	Total	8493	2461	1806	1478	1030	869	2483	5450	1400	2550	982	1203	5193	366	1876	856	800	3455	2460	1449	46660

AM PC+CV		Destination																				
		A	B	C	D	F	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	Total
Origin	A		71	30	54		19	121	-478	-17	18	-1	-59	-255	-12	781	167		1354		-76	1715
	B	-21		44	332		-29	-22	190	-1	2	1	27	92	1	-45	13		-116		-28	440
	C	67	34		99		21	97	261	1	5	3	33	139	1	-26	16		-67		-20	665
	D	11	24	49			1	17	77	0	2	1	10	40	0	-11	5		-29		-8	190
	F	-29	-1	-30	-10		94		26	0	0	0	4	12	0	-8	2		-20		-5	35
	H	-13	3	-11	-2	-610			22	-1	0	1	3	10	0	-5	2		-11		-3	-615
	I	-87	48	-32	19				254	5	3	1	35	128	1	-36	18		-94		-29	235
	J	63	-10	-45	-21		-19	202		35	-30	-100	-197	786	-43	260			140		-202	820
	K	-12	0	-1	0		-1	-1	-32		-91	-3	18	-25	2	-7	5		-39		-14	-200
	L	-11	-3	-14	-6		-6	48	0	50		-30	-60	128	-13	43			-21		-61	45
	M	15	1	2	0		0	1	41	-1	3		-131	60	-80	8	2		14		0	-65
	N	17	1	2	1			1	-2	-12	-1	31		-1	-5	12	4		14		-3	60
	O	-133	-9	134	-19		-17	102	-501	-125	-47	53	-3		-76	54	33		15		-38	-580
	P	-4	0	-1	0			-1	-29	-3	-2	-50	-60	-20		-1	0		-4		-2	-175
	Q	130	9	8	8		-2	9	212	6	19	-5	21	-52	2							365
	R	-71	-1	-7	-3		-3	-6	3	-1	0	-2	-4	-28	-1	5					300	180
	S																			-140		-140
	T	54	11	-3	5		-10	2	289	7	25	-12	-19	-131	-8					-380		-170
	U																	-35	-10			-45
	V	-19	0	-2	-3		-1	-2	11	0	1	-1	-2	-14	-1	70	166					203
	Total	-42	179	123	455	-610	47	570	344	-57	-94	-116	-385	869	-232	1097	435	-35	1126	-520	-190	2963

AM PC+CV		Destination																				
		A	B	C	D	F	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	Total
Origin	A		156	-261	-115		-83	-77	35	-7	124	0	-28	-111	-8	-110	69		-611		-256	-1285
	B	-63		19	207		-66	-74	-28	-3	2	-2	3	-33	1	-39	3		-112		-26	-210
	C	176	334		39		44	259	26	1	13	2	7	11	1	11	6		1		-12	920
	D	220	674	224			82	315	42	3	13	3	6	30	1	34	5		62		1	1715
	F	-14	7	-60	-27		-396		-4	-1	1	-1	1	-5	0	-6	1		-19		-5	-530
	H	112	73	30	17	120			14	0	4	1	2	9	0	10	2		19		0	415
	I	199	206	-201	-85				14	6	13	0	8	-2	2	-4	7		-42		-21	100
	J	561	-10	-45	-21		-19	277		110	70	-100	-197	1310	-43	-85			-475		-202	1130
	K	19	7	3	2		0	4	-82		489	3	21	16	4	-25	2		-75		-18	370
	L	-56	-3	-14	-6		-6	17	25	290		-30	-60	-153	-13	-95			-270		-61	-435
	M	42	6	5	2		1	5	21	1	20		69	135	-5	3	1		5		-1	310
	N	72	11	8	4		2	9	-53	-8	34	66		29	55	1	2		-8		-6	220
	O	256	-9	139	-19		-17	175	-1100	-113	158	78	-28		-26	-43	14		-183		-61	-780
	P	19	3	2	1		1	2	6	0	9	30	60	35		2	0		2		-1	170
	Q	-285	127	82	43		10	118	1390	34	344	4	26	12	5							1910
	R	-82	19	10	5		1	15	75	5	22	0	-2	173	0	-80					815	975
	S																			600		600
	T	3079	248	168	88		19	246	1	63	43	8	-3	-204	-1					280		4035
	U																	-380	-415			-795
	V	-64	5	0	1		-1	2	18	1	7	-1	-3	45	-1	-305	-149					-445
	Total	4190	1854	111	137	120	-430	1293	400	382	1366	61	-119	1296	-28	-730	-39	-380	-2121	880	147	8390

Section 100 Speeds and Travel Times

Southbound (AM)

Southbound (AM) Travel Speeds (mph)

	2012 INRIX Data	Simulation Results: 2012 No-Build with No ETLs	2012 Build with Untolled ETLs	2012 Build with ETLs at Base Toll Rate
In General Purpose Lanes	25	28	54	53
In Express Toll Lanes (ETLs)			58	58

Southbound (AM) Travel Times (minutes)

		Simulation Results: 2012 No-Build with No ETLs	2012 Build with Untolled ETLs	2012 Build with ETLs at Base Toll Rate
To I-95	In General Purpose Lanes	9.5	8.1	8.2
To I-95	In Express Toll Lanes (ETLs)		7.6	7.6
To I-895	In General Purpose Lanes	12.0	10.3	9.3
To I-895	In Express Toll Lanes (ETLs)		7.6	7.5

* Travel times begin approx. 500 feet north of the ETL entrance and end approx. 500 feet north of the ETL termini.

Northbound (PM)

Northbound (PM) Travel Speeds (mph)

	2012 INRIX Data	Simulation Results: 2012 No-Build with No ETLs	2012 Build with Untolled ETLs	2012 Build with ETLs at Base Toll Rate
In General Purpose Lanes	26	23	54	51
In Express Toll Lanes (ETLs)			58	61

Northbound (PM) Travel Times (minutes)

		Simulation Results: 2012 No-Build with No ETLs	2012 Build with Untolled ETLs	2012 Build with ETLs at Base Toll Rate
From I-95	In General Purpose Lanes	9.5	8.6	8.7
From I-95	In Express Toll Lanes (ETLs)		8.3	7.6
From I-895	In General Purpose Lanes	11.5	8.4	8.7
From I-895	In Express Toll Lanes (ETLs)		8.0	7.9

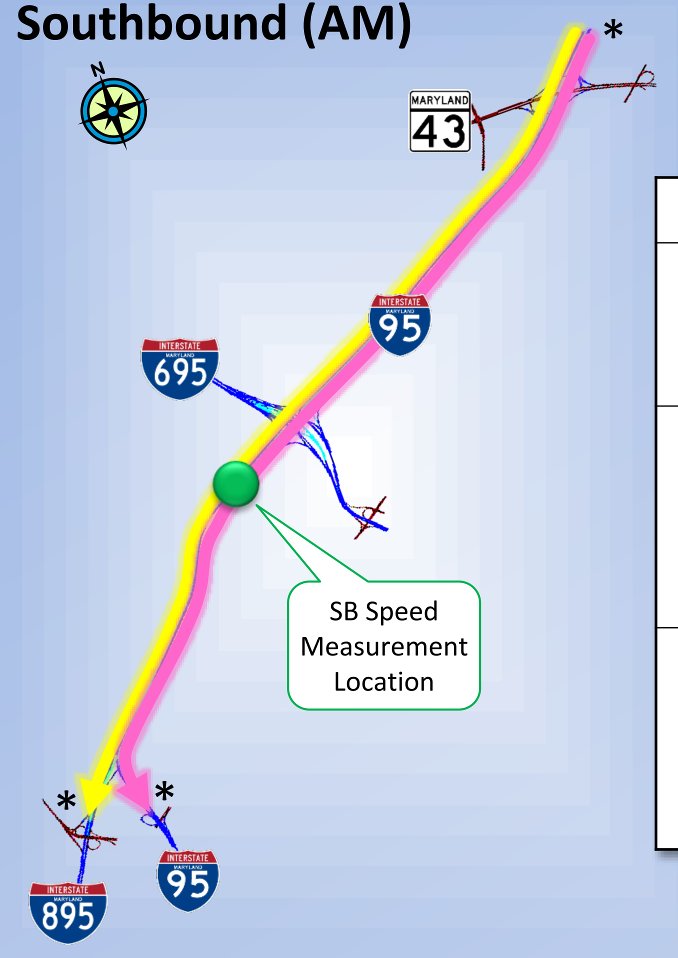
* Travel times begin approx. 500 feet south of the ETL entrances and end approx. 500 feet south of the ETL terminus.

RK&K | Maryland Transportation Authority | Express Toll Lanes 95

Last Updated: November 29, 2012

Section 100 Speeds and Travel Times

Southbound (AM)



Southbound (AM) Travel Speeds from Simulation (mph)				
	2012 Build with Untolled ETLs	With ETLs at Base Toll Rate		
		2012 Build	2015 Build	2025 Build
In General Purpose Lanes	54	53	48	31
In Express Toll Lanes (ETLs)	58	58	58	58

Southbound (AM) Travel Times from Simulation (minutes)					
		2012 Build with Untolled ETLs	With ETLs at Base Toll Rate		
			2012 Build	2015 Build	2025 Build
To I-95	In General Purpose Lanes	8.1	8.2	9.3	12.9
	In Express Toll Lanes (ETLs)	7.6	7.6	7.6	7.7
To I-895	In General Purpose Lanes	10.3	9.3	10.8	15.6
	In Express Toll Lanes (ETLs)	7.6	7.5	7.6	7.7

* Travel times begin approx. 500 feet north of the ETL entrance and end approx. 500 feet north of the ETL termini.

Northbound (PM)

Northbound (PM) Travel Speeds from Simulation (mph)				
	2012 Build with Untolled ETLs	With ETLs at Base Toll Rate		
		2012 Build	2015 Build	2025 Build
In General Purpose Lanes	54	51	45	27
In Express Toll Lanes (ETLs)	58	61	61	60

Northbound (PM) Travel Times (minutes)					
		2012 Build with Untolled ETLs	With ETLs at Base Toll Rate		
			2012 Build	2015 Build	2025 Build
From I-95	In General Purpose Lanes	8.6	8.7	8.8	9.3
	In Express Toll Lanes (ETLs)	8.3	7.6	7.6	7.8
From I-895	In General Purpose Lanes	8.4	8.7	9.2	10.9
	In Express Toll Lanes (ETLs)	8.0	7.9	7.9	8.0

* Travel times begin approx. 500 feet south of the ETL entrances and end approx. 500 feet south of the ETL terminus.

Last Updated: August 8th, 2013

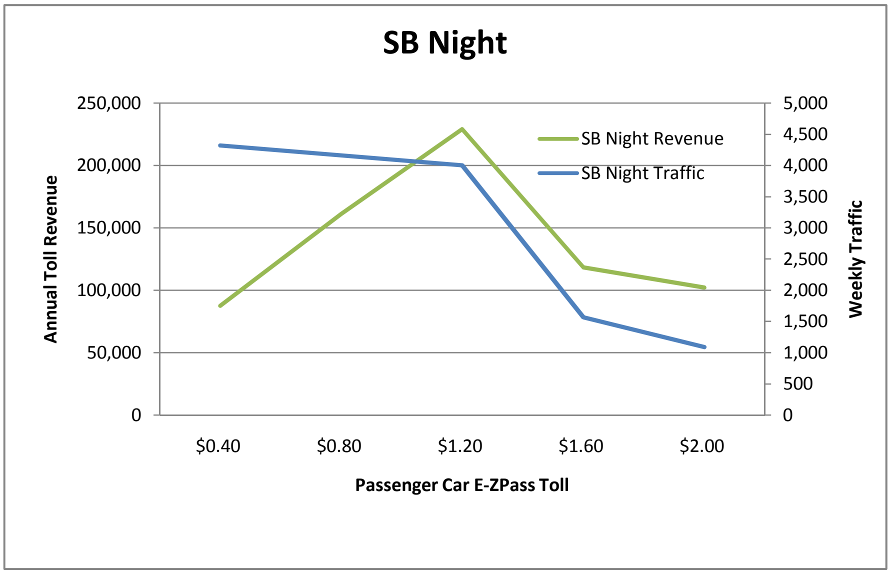
APPENDIX C

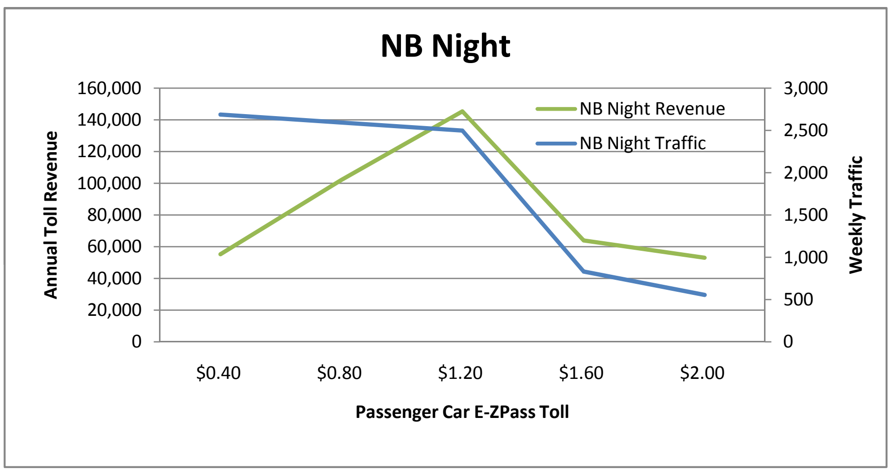
Toll Sensitivity Analyses

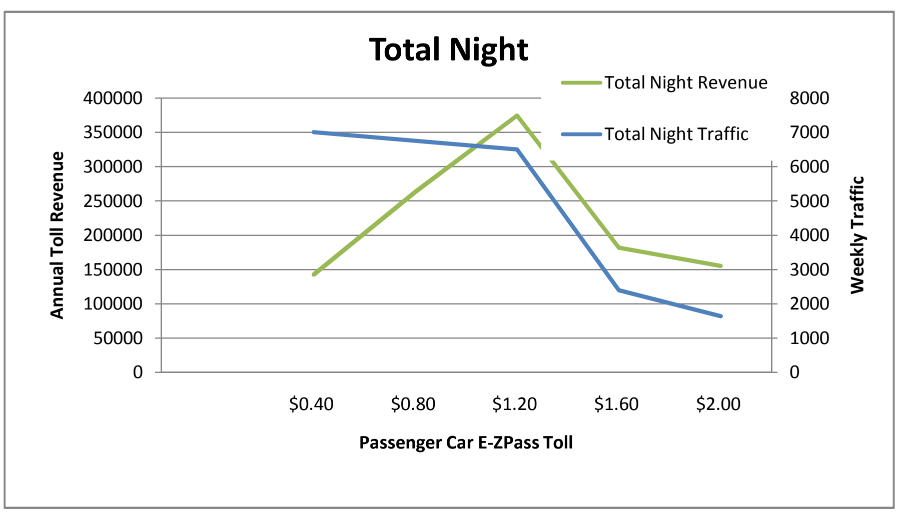
MDTA I-95 ETL T&R Study

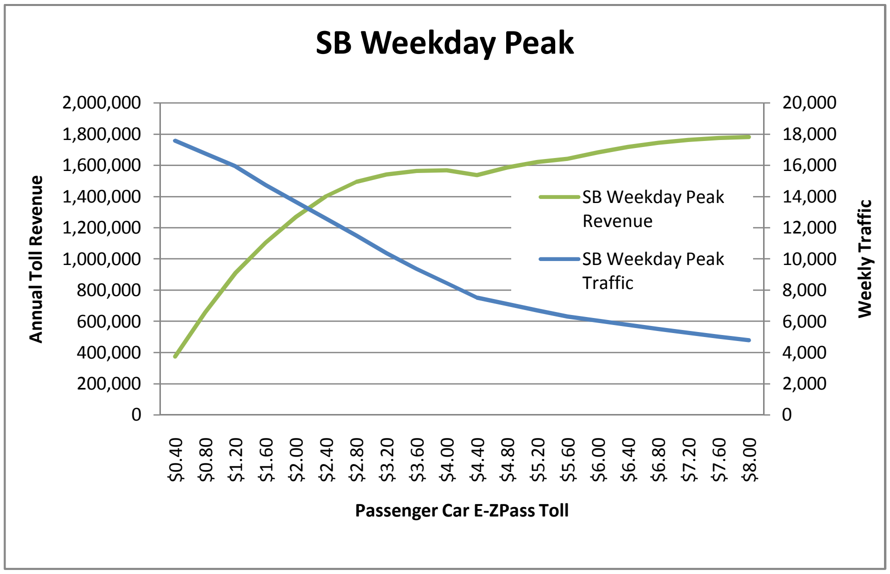
2015 Toll Sensitivity Graphs

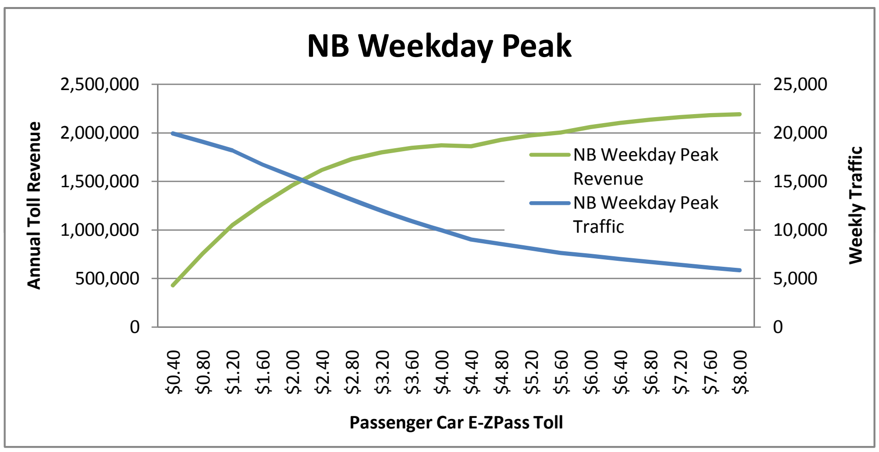
Time Period Definition by Day and Direction		
Time Period	**Southbound**	**Northbound**
Night (Weekday and Weekend)	6 pm to 5 am	8 pm to 6 am
Weekday Peak (Mon-Thurs)	6 am to 8:30 am	3 pm to 7 pm
Weekday Peak (Fri)	6 am to 8:30 am	3 pm to 7 pm
Weekday Off-Peak	5 am to 6 am; 8:30 am to 6 pm	6 am to 3 pm; 7pm to 8 pm
Weekend Peak (Sat)	5 am to 12 pm; 2 pm to 6 pm	5 am to 12 pm; 2 pm to 8 pm
Weekend Off-Peak (Sat)	12 pm to 2 pm	12 pm to 2 pm
Weekend Peak (Sun)	5 am to 2 pm; 5 pm to 6 pm	5 am to 2 pm; 5 pm to 8 pm
Weekend Off-Peak (Sun)	2 pm to 5 pm	2 pm to 5 pm

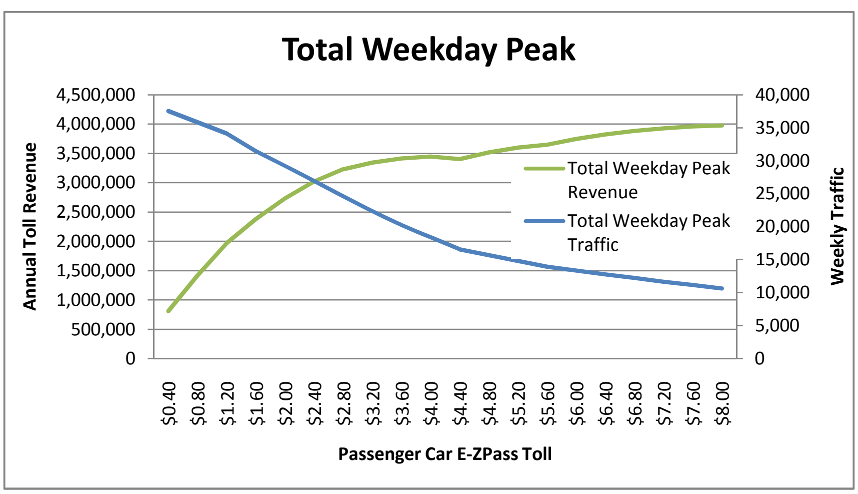

SB Night
250,000
200,000
150,000
100,000
50,000
0
Annual Toll Revenue
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Weekly Traffic
SB Night Revenue
SB Night Traffic
$0.40
$0.80
$1.20
$1.60
$2.00
Passenger Car E-ZPass Toll

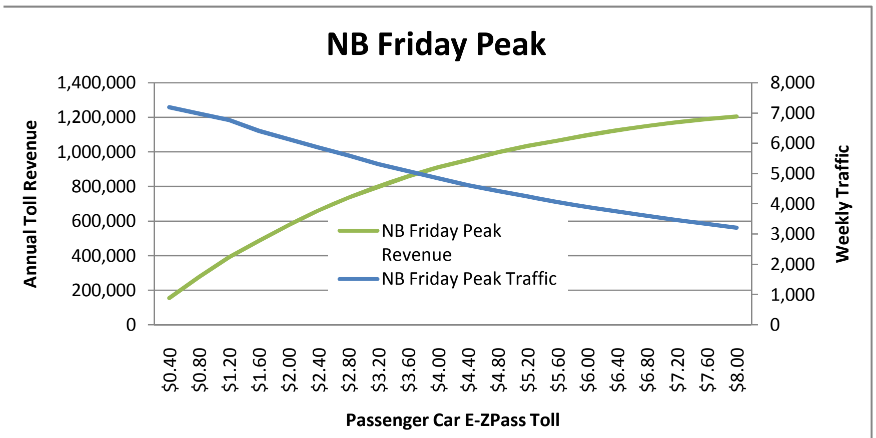

NB Night
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Annual Toll Revenue
3,000
2,500
2,000
1,500
1,000
500
0
Weekly Traffic
NB Night Revenue
NB Night Traffic
$0.40
$0.80
$1.20
$1.60
$2.00
Passenger Car E-ZPass Toll

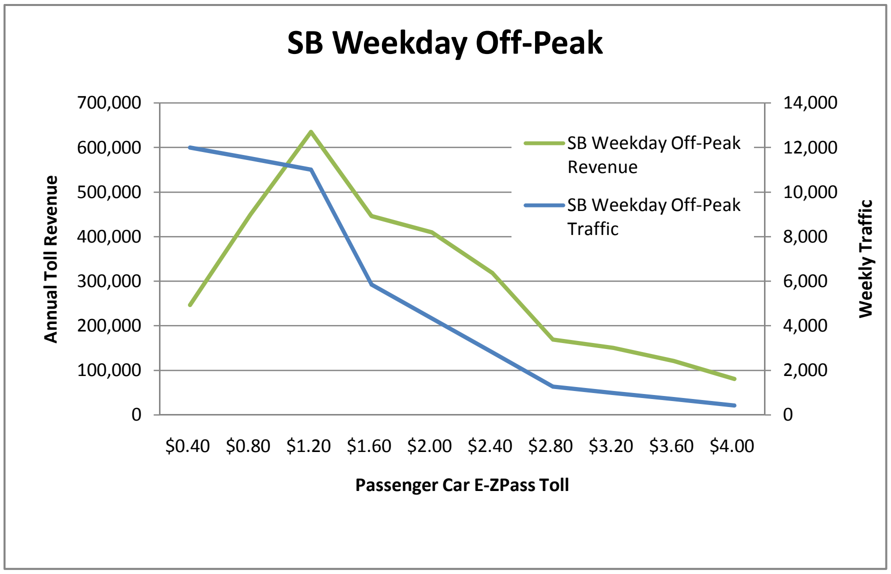

Total Night
400000
350000
300000
250000
200000
150000
100000
50000
0
Annual Toll Revenue
8000
7000
6000
5000
4000
3000
2000
1000
0
Weekly Traffic
Total Night Revenue
Total Night Traffic
$0.40
$0.80
$1.20
$1.60
$2.00
Passenger Car E-ZPass Toll

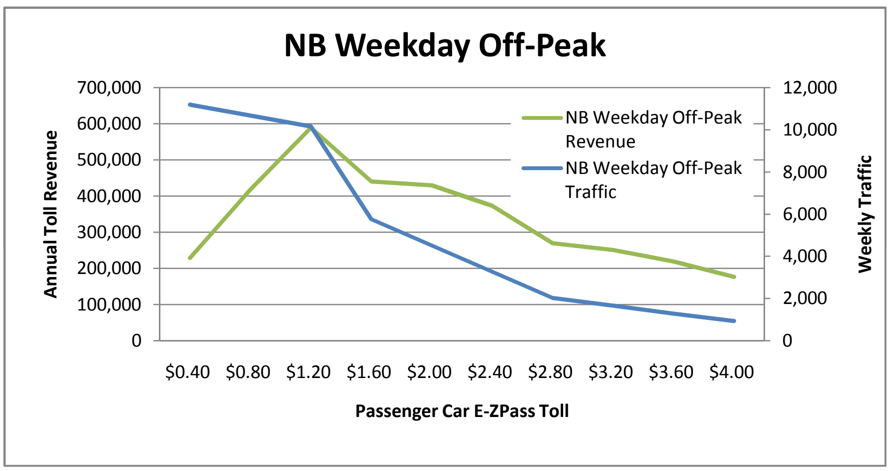

SB Weekday Peak
2,000,000
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Annual Toll Revenue
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Weekly Traffic
SB Weekday Peak Revenue
SB Weekday Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00 $4.40 $4.80 $5.20 $5.60 $6.00 $6.40 $6.80 $7.20 $7.60 $8.00
Passenger Car E-ZPass Toll

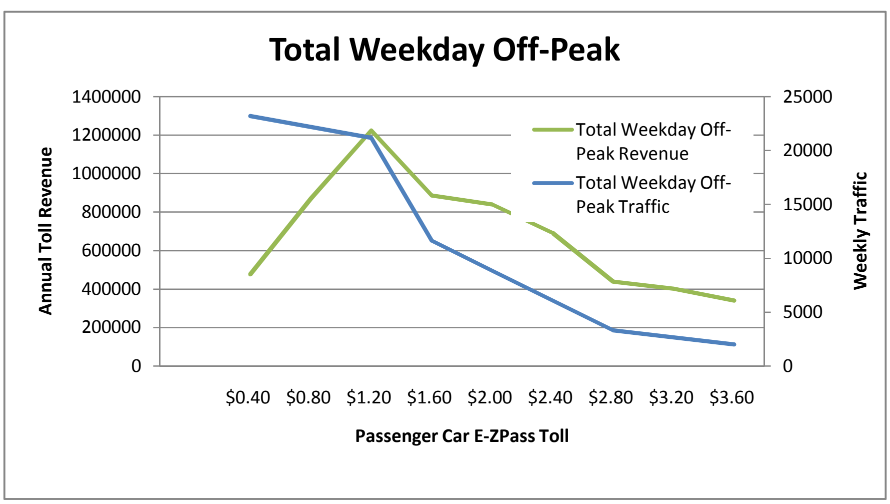

NB Weekday Peak
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Annual Toll Revenue
25,000
20,000
15,000
10,000
5,000
0
Weekly Traffic
NB Weekday Peak Revenue
NB Weekday Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00 $4.40 $4.80 $5.20 $5.60 $6.00 $6.40 $6.80 $7.20 $7.60 $8.00
Passenger Car E-ZPass Toll

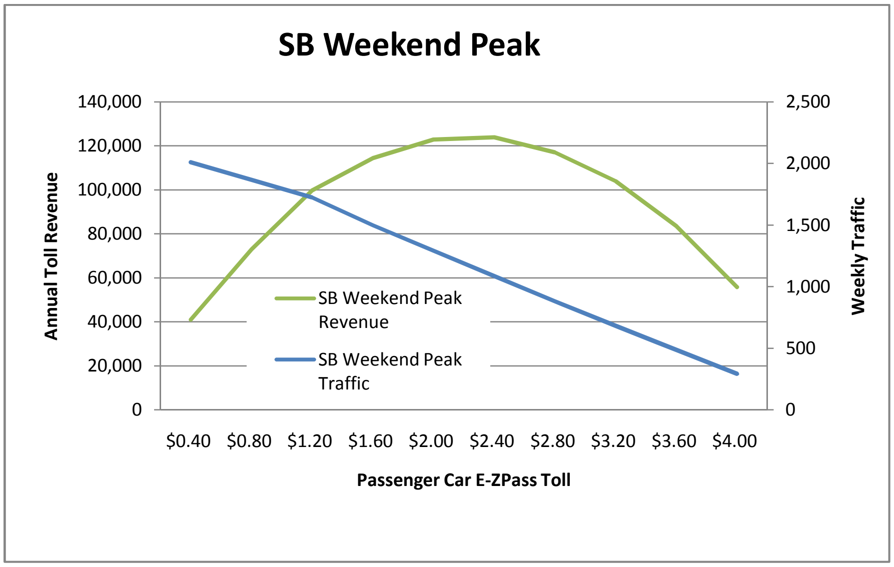

Total Weekday Peak
4,500,000
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Annual Toll Revenue
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Weekly Traffic
Total Weekday Peak Revenue
Total Weekday Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00 $4.40 $4.80 $5.20 $5.60 $6.00 $6.40 $6.80 $7.20 $7.60 $8.00
Passenger Car E-ZPass Toll

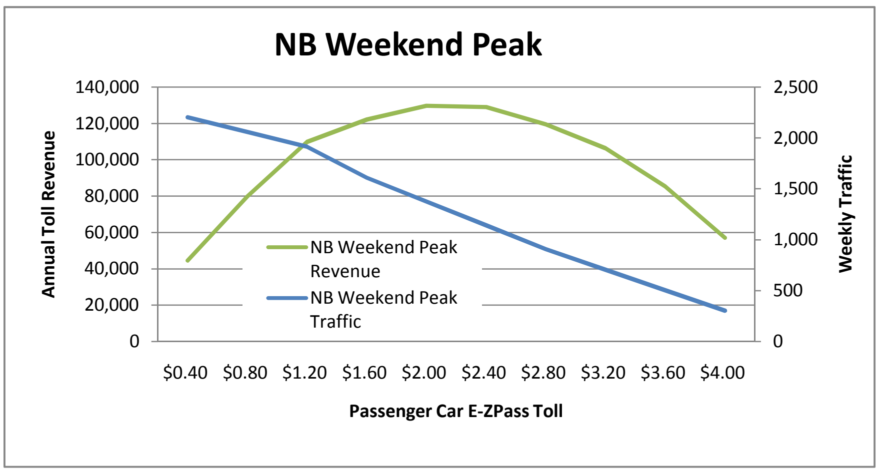

NB Friday Peak
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Annual Toll Revenue
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Weekly Traffic
NB Friday Peak Revenue
NB Friday Peak Traffic
$0.40
$0.80
$1.20
$1.60
$2.00
$2.40
$2.80
$3.20
$3.60
$4.00
$4.40
$4.80
$5.20
$5.60
$6.00
$6.40
$6.80
$7.20
$7.60
$8.00
Passenger Car E-ZPass Toll

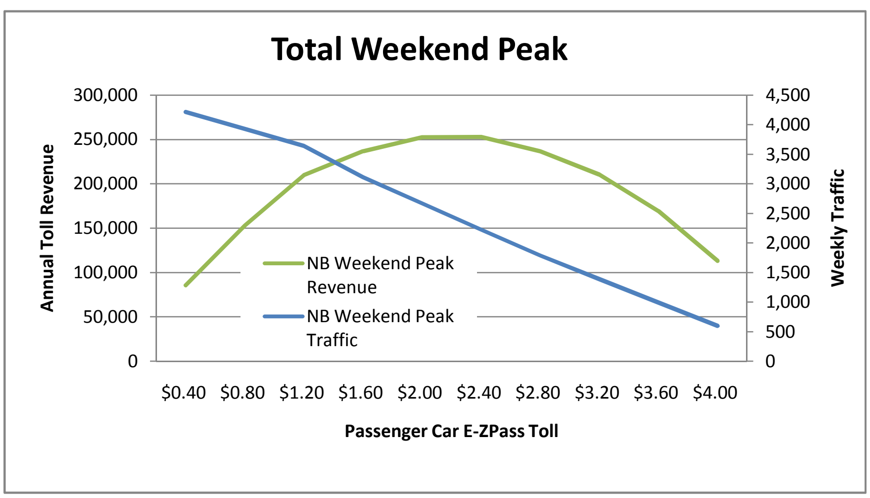

SB Weekday Off-Peak
Annual Toll Revenue
Weekly Traffic
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
SB Weekday Off-Peak Revenue
SB Weekday Off-Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll

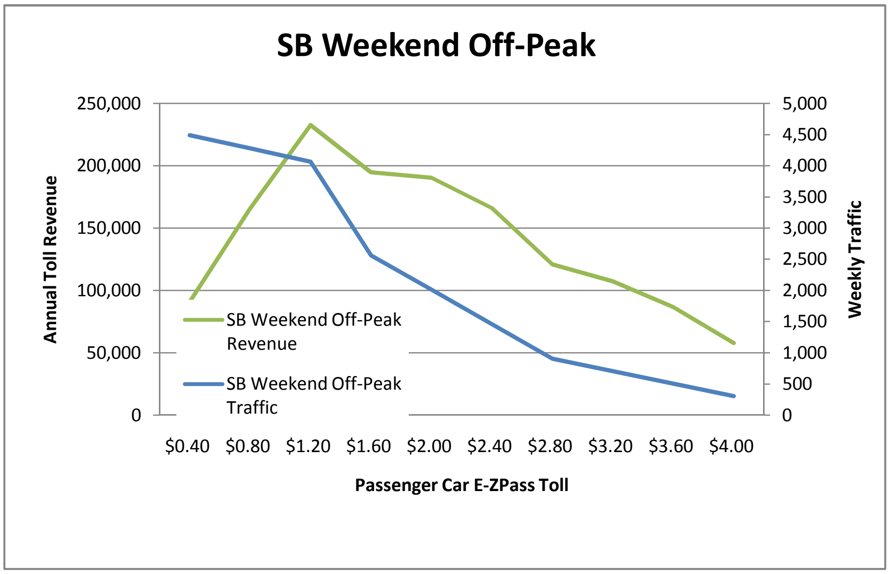

NB Weekday Off-Peak
Annual Toll Revenue
Weekly Traffic
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
12,000
10,000
8,000
6,000
4,000
2,000
0
NB Weekday Off-Peak Revenue
NB Weekday Off-Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll

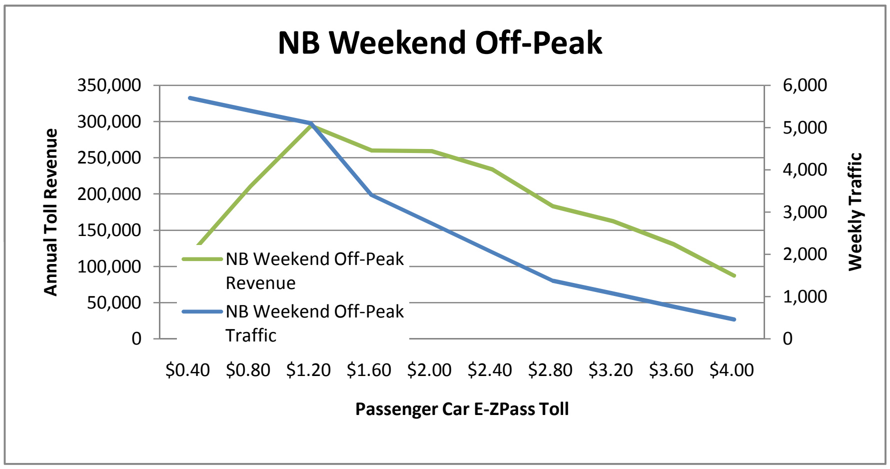

Total Weekday Off-Peak
Annual Toll Revenue
Weekly Traffic
1400000
1200000
1000000
800000
600000
400000
200000
0
25000
20000
15000
10000
5000
0
Total Weekday Off-Peak Revenue
Total Weekday Off-Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60
Passenger Car E-ZPass Toll

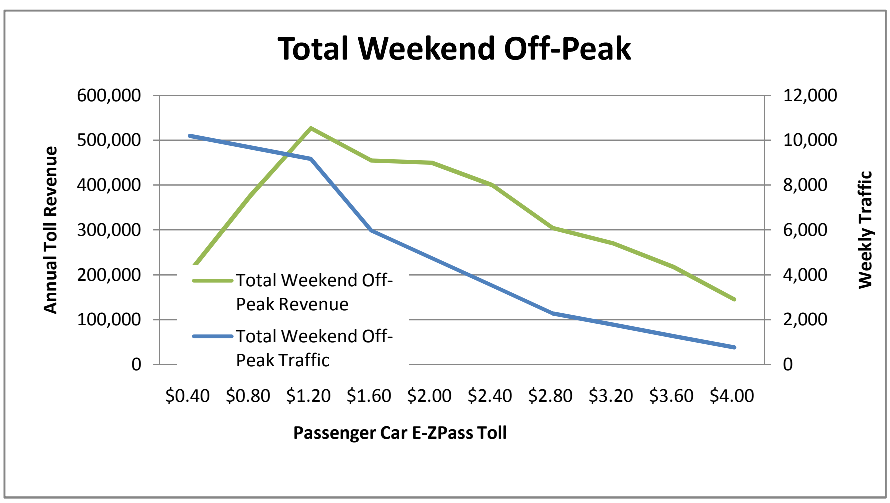

SB Weekend Peak
Annual Toll Revenue
Weekly Traffic
SB Weekend Peak Revenue
SB Weekend Peak Traffic
Passenger Car E-ZPass Toll


NB Weekend Peak
Annual Toll Revenue
Weekly Traffic
NB Weekend Peak Revenue
NB Weekend Peak Traffic
Passenger Car E-ZPass Toll

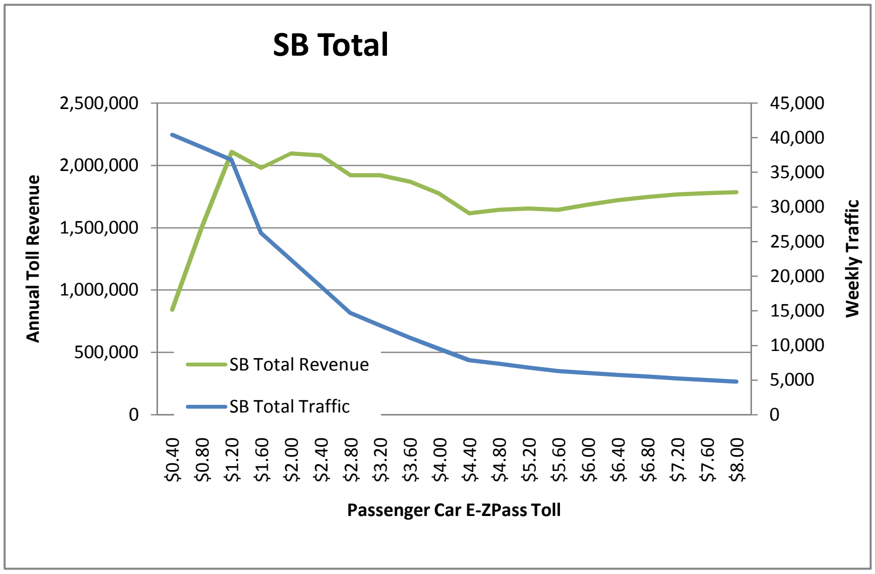

Total Weekend Peak
Annual Toll Revenue
Weekly Traffic
NB Weekend Peak Revenue
NB Weekend Peak Traffic
Passenger Car E-ZPass Toll

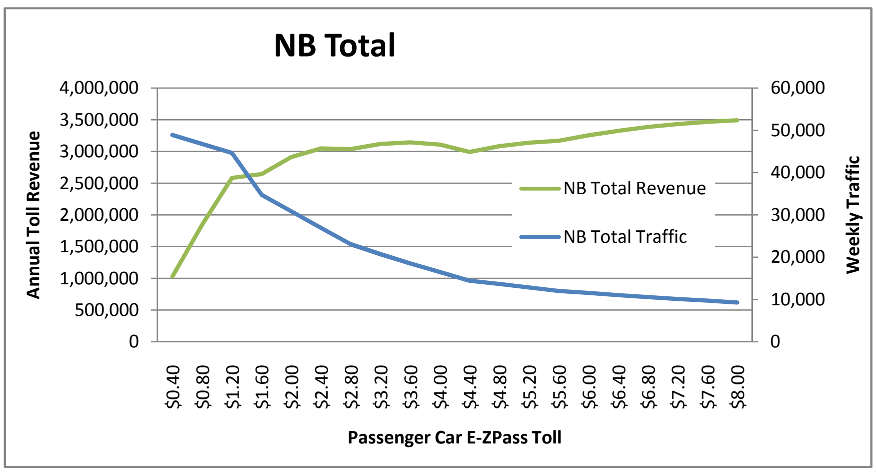

SB Weekend Off-Peak
Annual Toll Revenue
250,000
200,000
150,000
100,000
50,000
0
Weekly Traffic
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
SB Weekend Off-Peak Revenue
SB Weekend Off-Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll

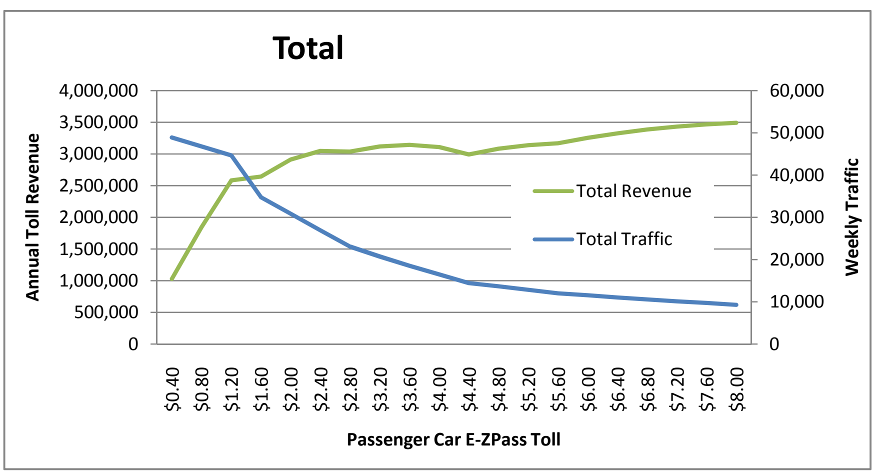

NB Weekend Off-Peak
Annual Toll Revenue
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
Weekly Traffic
6,000
5,000
4,000
3,000
2,000
1,000
0
NB Weekend Off-Peak Revenue
NB Weekend Off-Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll


Total Weekend Off-Peak
Annual Toll Revenue
600,000
500,000
400,000
300,000
200,000
100,000
0
Weekly Traffic
12,000
10,000
8,000
6,000
4,000
2,000
0
Total Weekend Off-Peak Revenue
Total Weekend Off-Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll

JACOBS


SB Total
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Annual Toll Revenue
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Weekly Traffic
SB Total Revenue
SB Total Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00 $4.40 $4.80 $5.20 $5.60 $6.00 $6.40 $6.80 $7.20 $7.60 $8.00
Passenger Car E-ZPass Toll

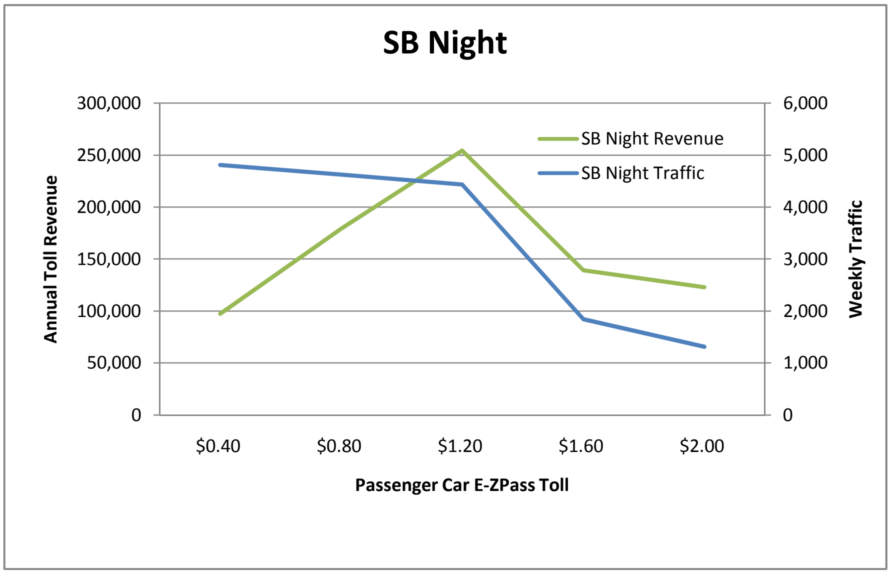

NB Total
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Annual Toll Revenue
60,000
50,000
40,000
30,000
20,000
10,000
0
Weekly Traffic
NB Total Revenue
NB Total Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00 $4.40 $4.80 $5.20 $5.60 $6.00 $6.40 $6.80 $7.20 $7.60 $8.00
Passenger Car E-ZPass Toll

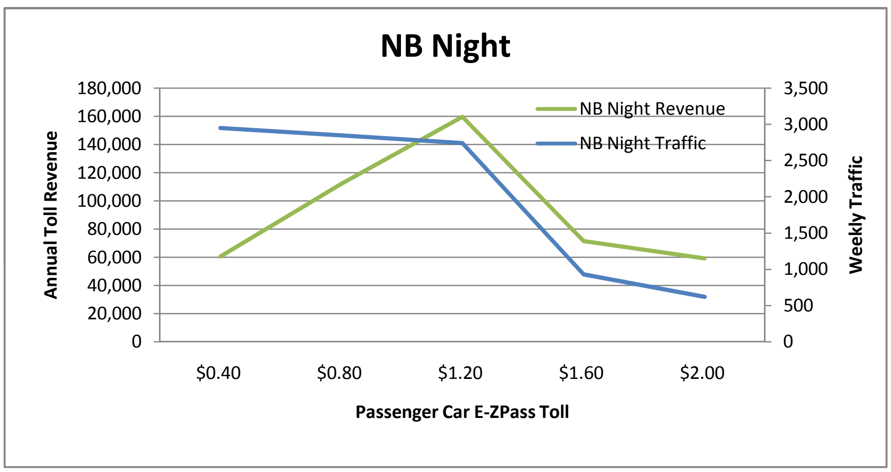

Total
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Annual Toll Revenue
60,000
50,000
40,000
30,000
20,000
10,000
0
Weekly Traffic
Total Revenue
Total Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00 $4.40 $4.80 $5.20 $5.60 $6.00 $6.40 $6.80 $7.20 $7.60 $8.00
Passenger Car E-ZPass Toll

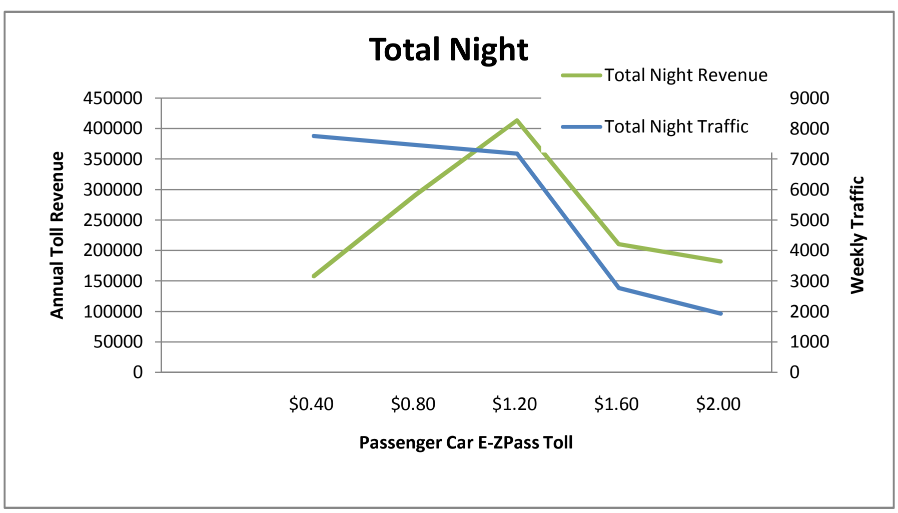
MDTA I-95 ETL T&R Study

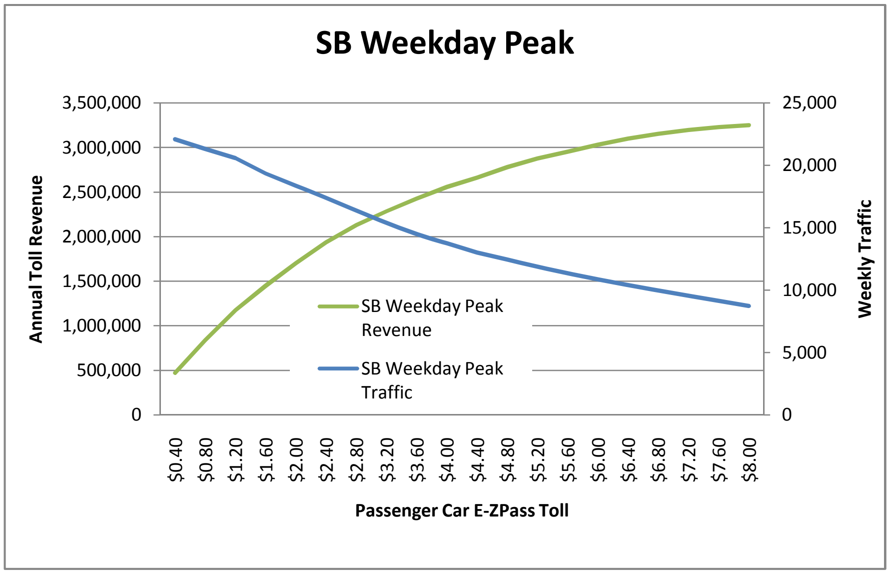
2020 Toll Sensitivity Graphs

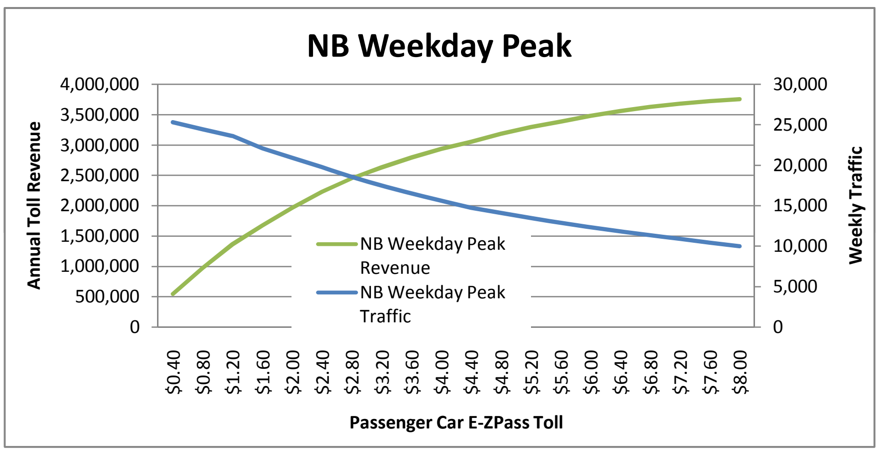
Time Period Definition by Day and Direction		
Time Period	**Southbound**	**Northbound**
Night (Weekday and Weekend)	6 pm to 5 am	8 pm to 6 am
Weekday Peak (Mon-Thurs)	6 am to 8:30 am	3 pm to 7 pm
Weekday Peak (Fri)	6 am to 8:30 am	3 pm to 7 pm
Weekday Off-Peak	5 am to 6 am; 8:30 am to 6 pm	6 am to 3 pm; 7pm to 8 pm
Weekend Peak (Sat)	5 am to 12 pm; 2 pm to 6 pm	5 am to 12 pm; 2 pm to 8 pm
Weekend Off-Peak (Sat)	12 pm to 2 pm	12 pm to 2 pm
Weekend Peak (Sun)	5 am to 2 pm; 5 pm to 6 pm	5 am to 2 pm; 5 pm to 8 pm
Weekend Off-Peak (Sun)	2 pm to 5 pm	2 pm to 5 pm

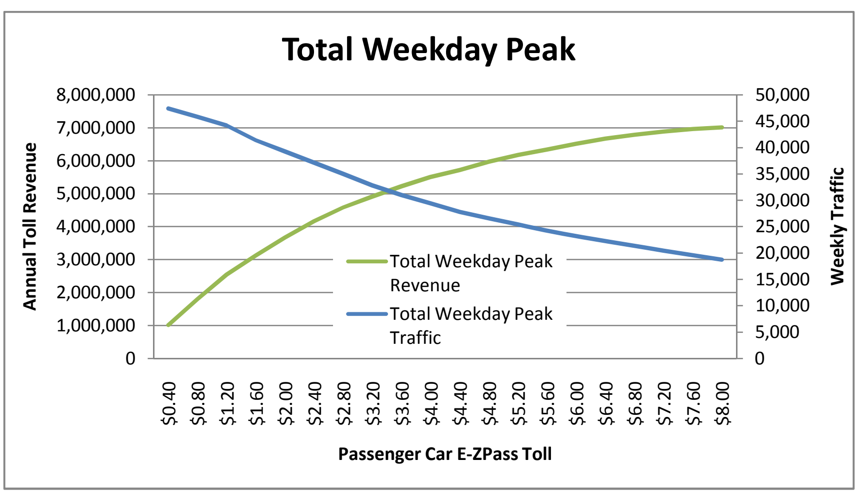

SB Night
300,000
250,000
200,000
150,000
100,000
50,000
0
6,000
5,000
4,000
3,000
2,000
1,000
0
Annual Toll Revenue
Weekly Traffic
SB Night Revenue
SB Night Traffic
$0.40
$0.80
$1.20
$1.60
$2.00
Passenger Car E-ZPass Toll

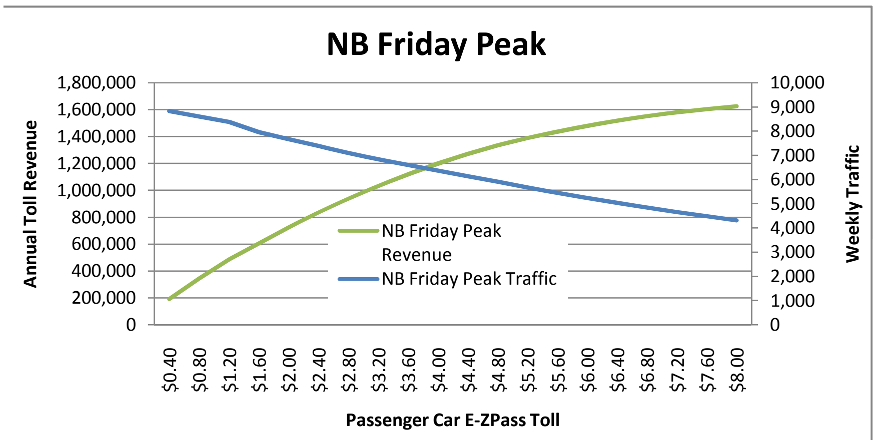

NB Night
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Annual Toll Revenue
Weekly Traffic
NB Night Revenue
NB Night Traffic
$0.40
$0.80
$1.20
$1.60
$2.00
Passenger Car E-ZPass Toll

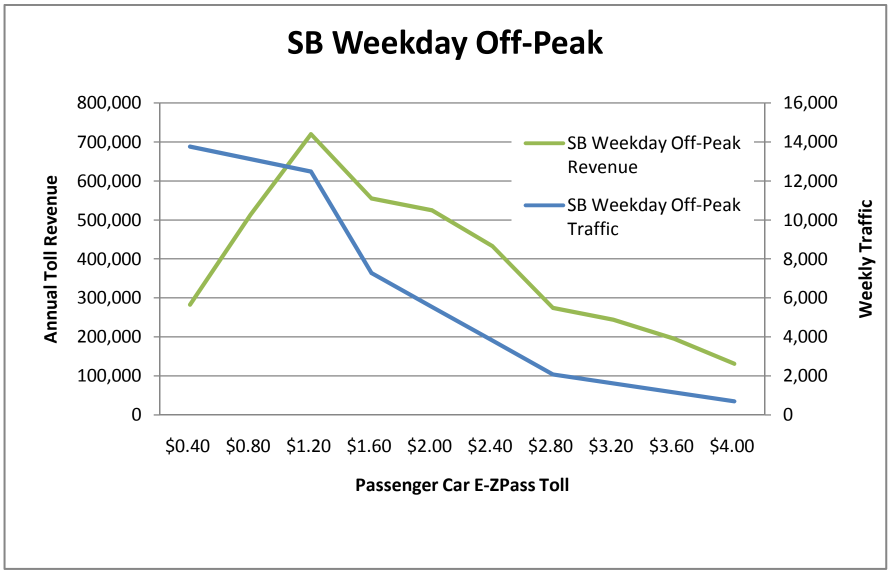

Total Night
Total Night Revenue
Total Night Traffic
450000
400000
350000
300000
250000
200000
150000
100000
50000
0
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Annual Toll Revenue
Weekly Traffic
$0.40
$0.80
$1.20
$1.60
$2.00
Passenger Car E-ZPass Toll

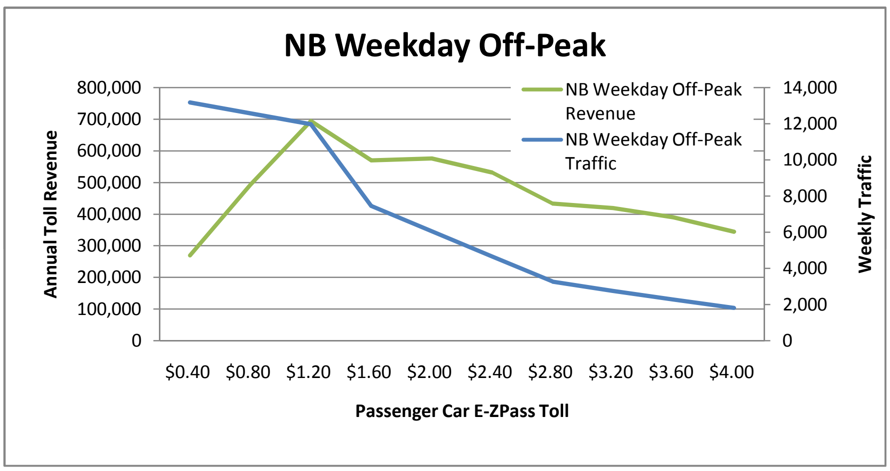

SB Weekday Peak
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Annual Toll Revenue
25,000
20,000
15,000
10,000
5,000
0
Weekly Traffic
SB Weekday Peak Revenue
SB Weekday Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00 $4.40 $4.80 $5.20 $5.60 $6.00 $6.40 $6.80 $7.20 $7.60 $8.00
Passenger Car E-ZPass Toll

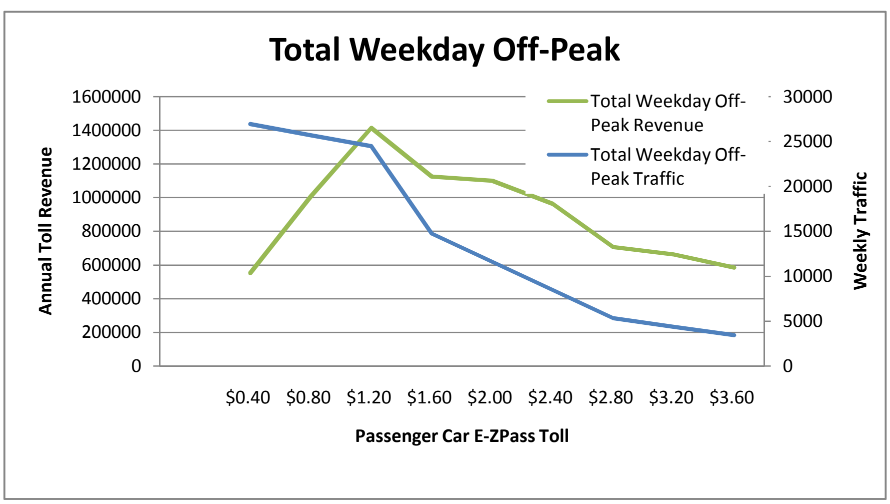

NB Weekday Peak
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Annual Toll Revenue
30,000
25,000
20,000
15,000
10,000
5,000
0
Weekly Traffic
NB Weekday Peak Revenue
NB Weekday Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00 $4.40 $4.80 $5.20 $5.60 $6.00 $6.40 $6.80 $7.20 $7.60 $8.00
Passenger Car E-ZPass Toll


Total Weekday Peak
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Annual Toll Revenue
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Weekly Traffic
Total Weekday Peak Revenue
Total Weekday Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00 $4.40 $4.80 $5.20 $5.60 $6.00 $6.40 $6.80 $7.20 $7.60 $8.00
Passenger Car E-ZPass Toll

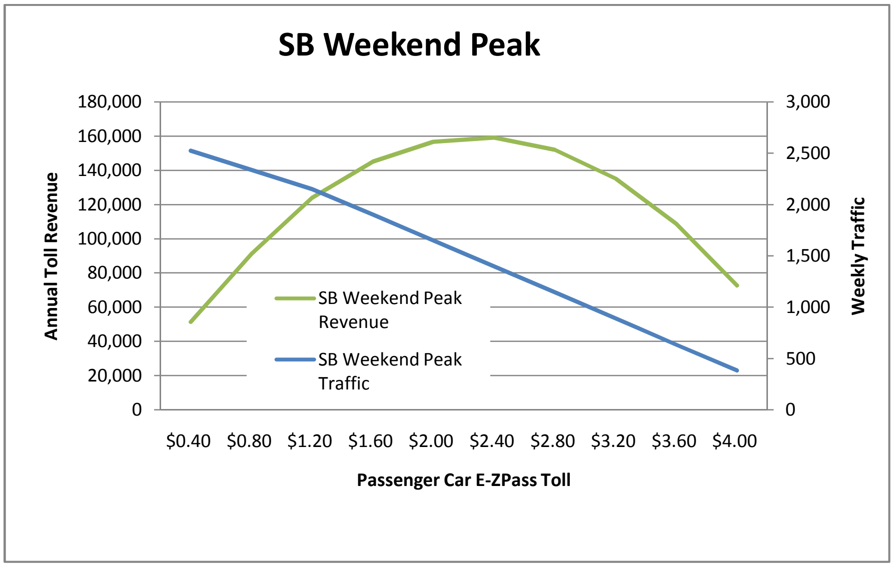

NB Friday Peak
Annual Toll Revenue
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Weekly Traffic
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
NB Friday Peak Revenue
NB Friday Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00 $4.40 $4.80 $5.20 $5.60 $6.00 $6.40 $6.80 $7.20 $7.60 $8.00
Passenger Car E-ZPass Toll


SB Weekday Off-Peak
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
Annual Toll Revenue
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Weekly Traffic
SB Weekday Off-Peak Revenue
SB Weekday Off-Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll

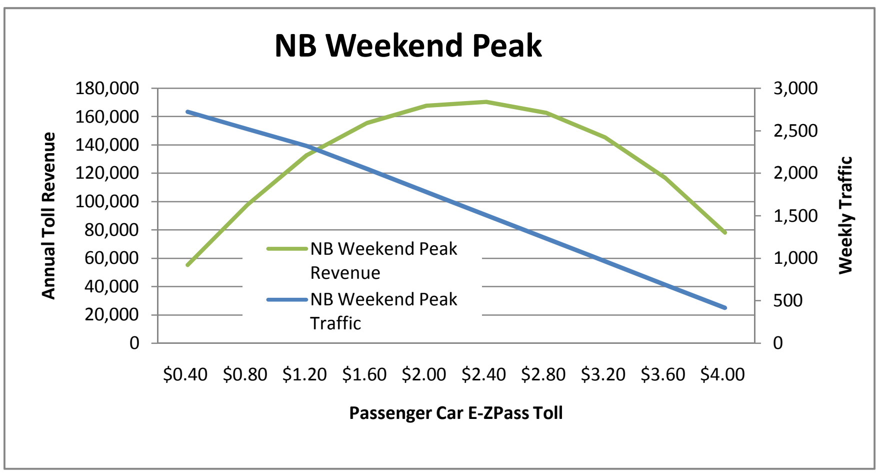

NB Weekday Off-Peak
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
Annual Toll Revenue
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Weekly Traffic
NB Weekday Off-Peak Revenue
NB Weekday Off-Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll


Total Weekday Off-Peak
1600000
1400000
1200000
1000000
800000
600000
400000
200000
0
Annual Toll Revenue
30000
25000
20000
15000
10000
5000
0
Weekly Traffic
Total Weekday Off-Peak Revenue
Total Weekday Off-Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60
Passenger Car E-ZPass Toll

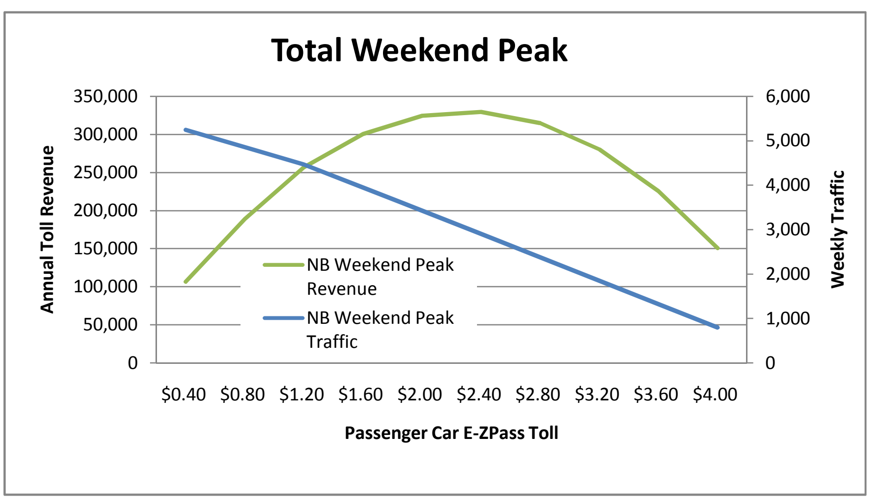
JACOBS



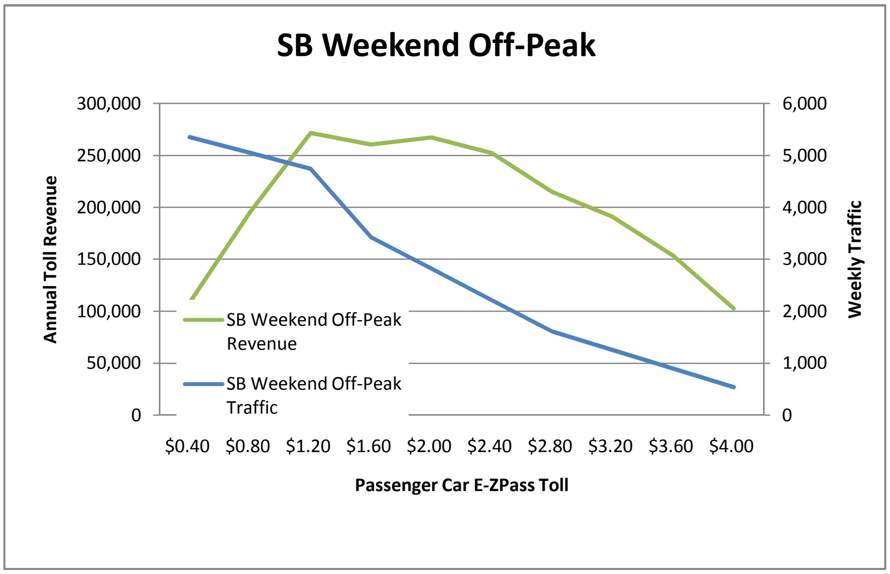
SB Weekend Peak
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Annual Toll Revenue
3,000
2,500
2,000
1,500
1,000
500
0
Weekly Traffic
SB Weekend Peak Revenue
SB Weekend Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll

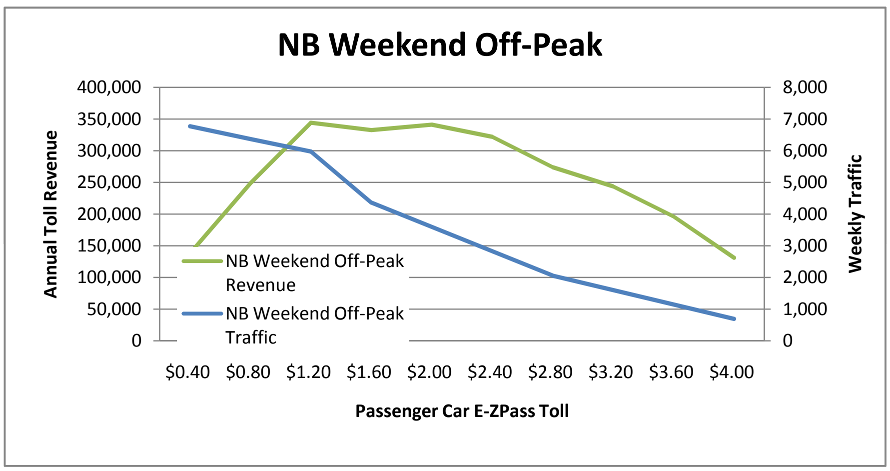


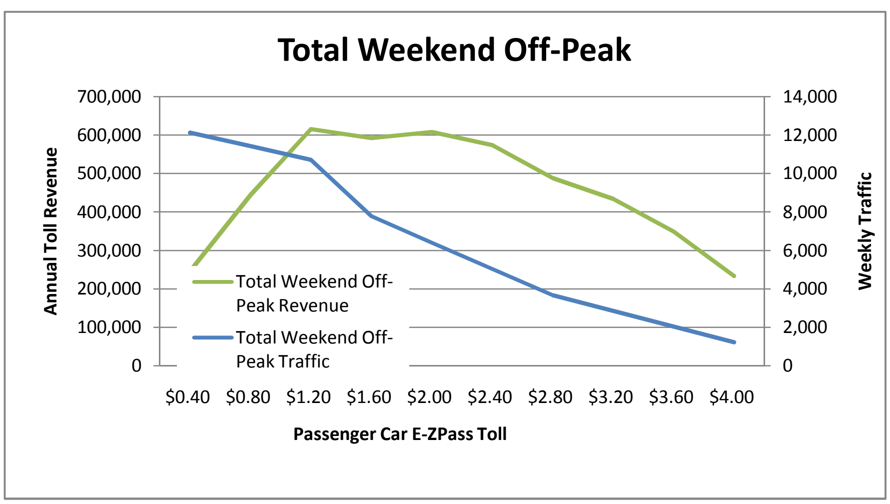
NB Weekend Peak
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Annual Toll Revenue
3,000
2,500
2,000
1,500
1,000
500
0
Weekly Traffic
NB Weekend Peak Revenue
NB Weekend Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll

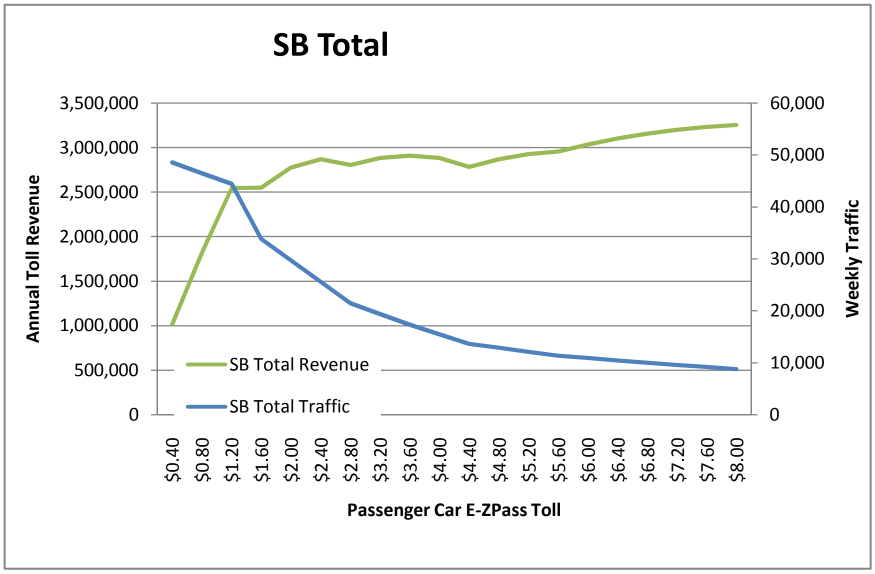


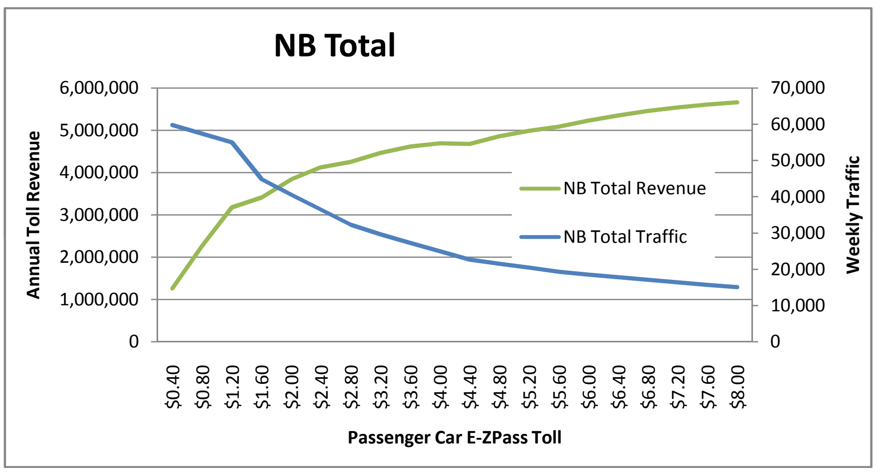
Total Weekend Peak
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
Annual Toll Revenue
6,000
5,000
4,000
3,000
2,000
1,000
0
Weekly Traffic
NB Weekend Peak Revenue
NB Weekend Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll

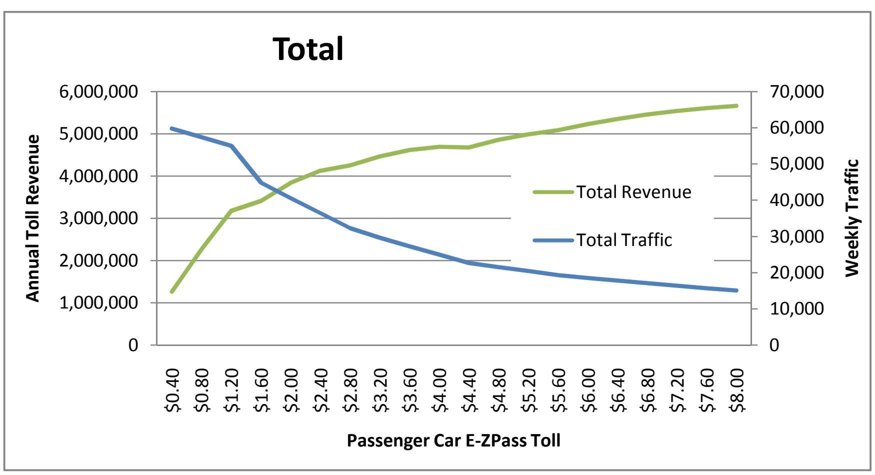

SB Weekend Off-Peak
300,000
250,000
200,000
150,000
100,000
50,000
0
6,000
5,000
4,000
3,000
2,000
1,000
0
Annual Toll Revenue
Weekly Traffic
SB Weekend Off-Peak Revenue
SB Weekend Off-Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll


NB Weekend Off-Peak
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Annual Toll Revenue
Weekly Traffic
NB Weekend Off-Peak Revenue
NB Weekend Off-Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll


Total Weekend Off-Peak
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Annual Toll Revenue
Weekly Traffic
Total Weekend Off-Peak Revenue
Total Weekend Off-Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll


SB Total
Annual Toll Revenue
Weekly Traffic
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
60,000
50,000
40,000
30,000
20,000
10,000
0
SB Total Revenue
SB Total Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00 $4.40 $4.80 $5.20 $5.60 $6.00 $6.40 $6.80 $7.20 $7.60 $8.00
Passenger Car E-ZPass Toll

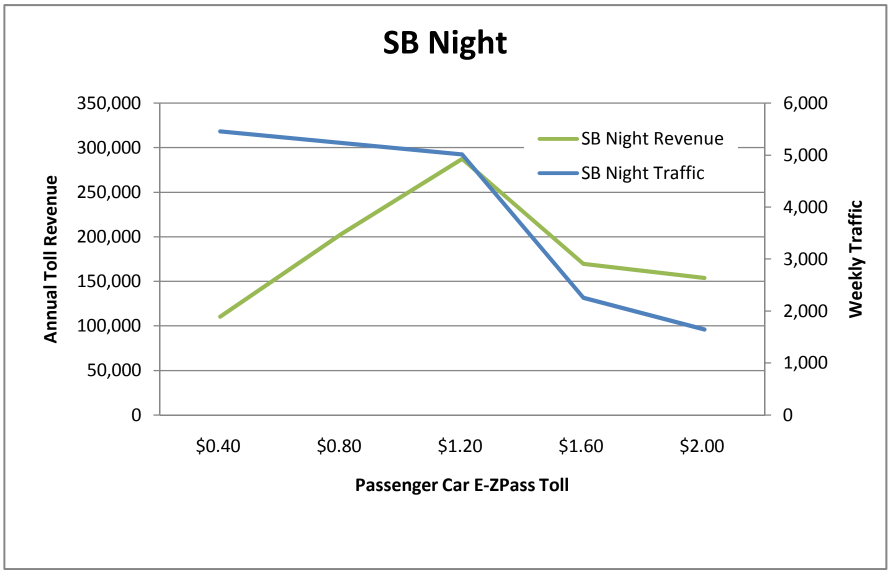

NB Total
Annual Toll Revenue
Weekly Traffic
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
NB Total Revenue
NB Total Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00 $4.40 $4.80 $5.20 $5.60 $6.00 $6.40 $6.80 $7.20 $7.60 $8.00
Passenger Car E-ZPass Toll


Total
Annual Toll Revenue
Weekly Traffic
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Total Revenue
Total Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00 $4.40 $4.80 $5.20 $5.60 $6.00 $6.40 $6.80 $7.20 $7.60 $8.00
Passenger Car E-ZPass Toll

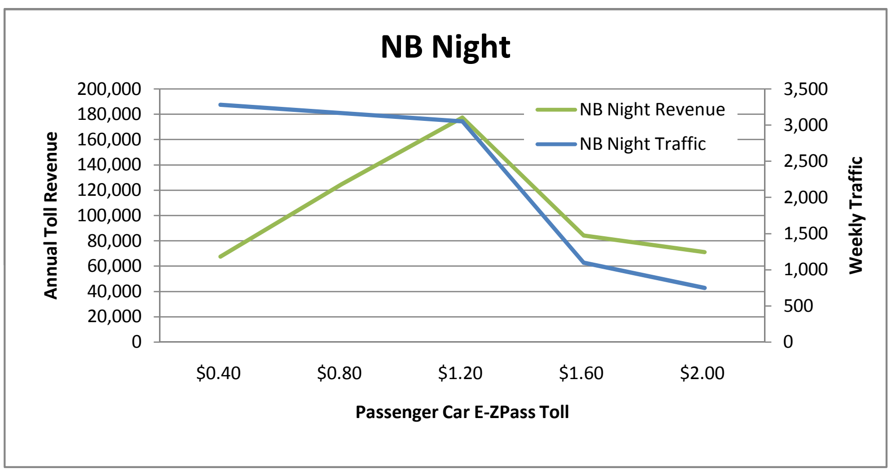
MDTA I-95 ETL T&R Study

2025 Toll Sensitivity Graphs

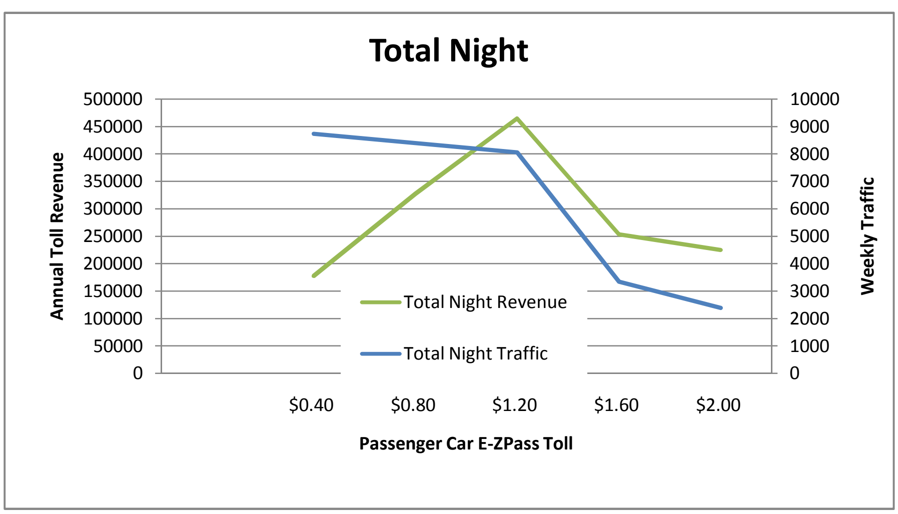
Time Period Definition by Day and Direction		
Time Period	**Southbound**	**Northbound**
Night (Weekday and Weekend)	6 pm to 5 am	8 pm to 6 am
Weekday Peak (Mon-Thurs)	6 am to 8:30 am	3 pm to 7 pm
Weekday Peak (Fri)	6 am to 8:30 am	3 pm to 7 pm
Weekday Off-Peak	5 am to 6 am; 8:30 am to 6 pm	6 am to 3 pm; 7pm to 8 pm
Weekend Peak (Sat)	5 am to 12 pm; 2 pm to 6 pm	5 am to 12 pm; 2 pm to 8 pm
Weekend Off-Peak (Sat)	12 pm to 2 pm	12 pm to 2 pm
Weekend Peak (Sun)	5 am to 2 pm; 5 pm to 6 pm	5 am to 2 pm; 5 pm to 8 pm
Weekend Off-Peak (Sun)	2 pm to 5 pm	2 pm to 5 pm



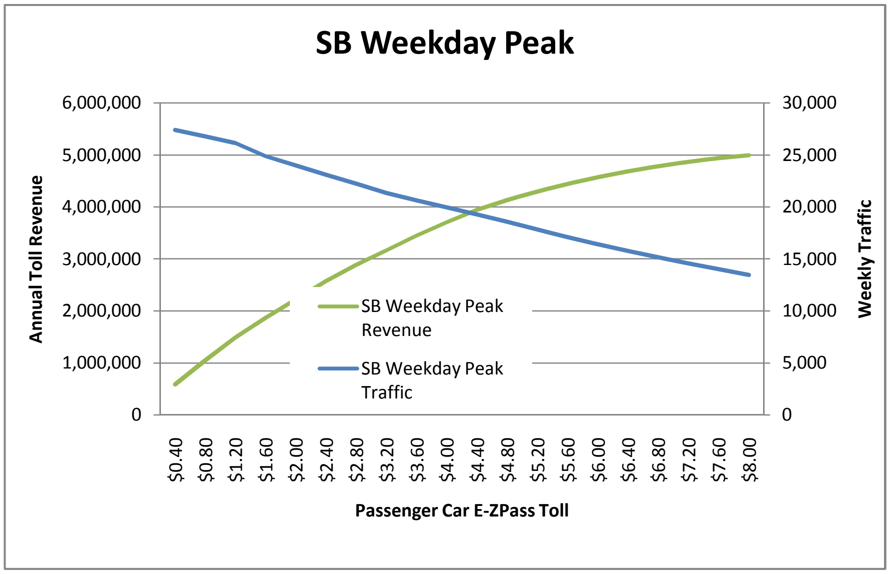
SB Night
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
6,000
5,000
4,000
3,000
2,000
1,000
0
SB Night Revenue
SB Night Traffic
Annual Toll Revenue
Weekly Traffic
$0.40
$0.80
$1.20
$1.60
$2.00
Passenger Car E-ZPass Toll

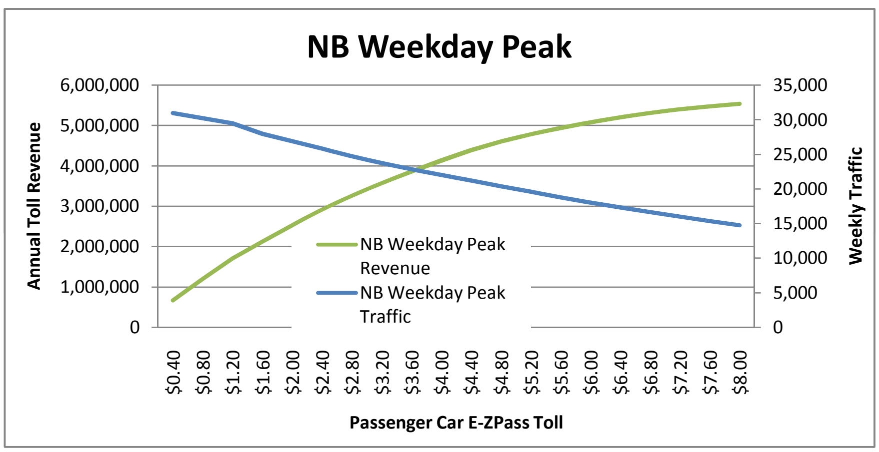


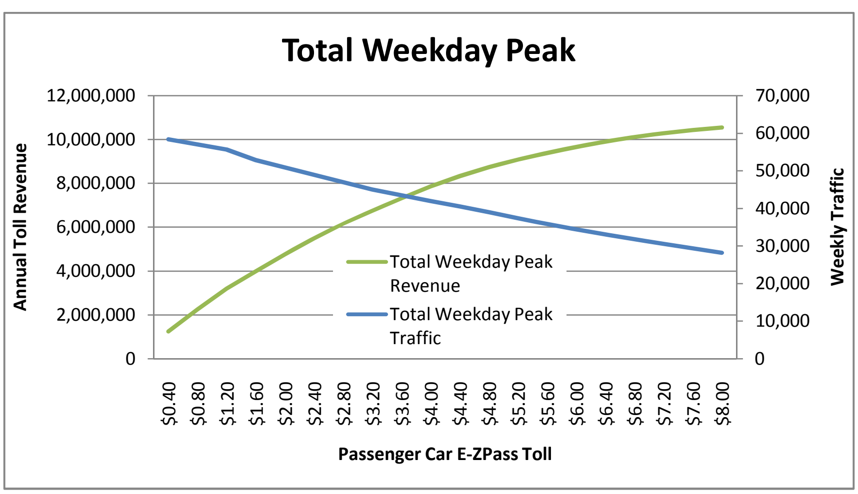
NB Night
200,000
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
3,500
3,000
2,500
2,000
1,500
1,000
500
0
NB Night Revenue
NB Night Traffic
Annual Toll Revenue
Weekly Traffic
$0.40
$0.80
$1.20
$1.60
$2.00
Passenger Car E-ZPass Toll

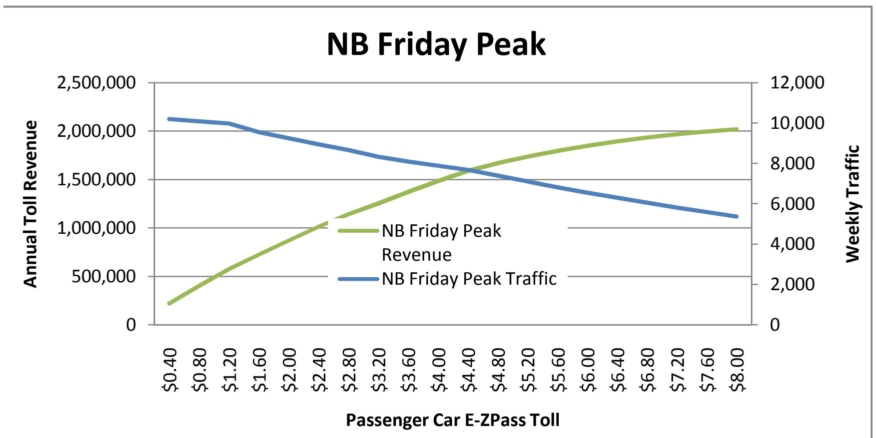


Total Night
500000
450000
400000
350000
300000
250000
200000
150000
100000
50000
0
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Total Night Revenue
Total Night Traffic
Annual Toll Revenue
Weekly Traffic
$0.40
$0.80
$1.20
$1.60
$2.00
Passenger Car E-ZPass Toll

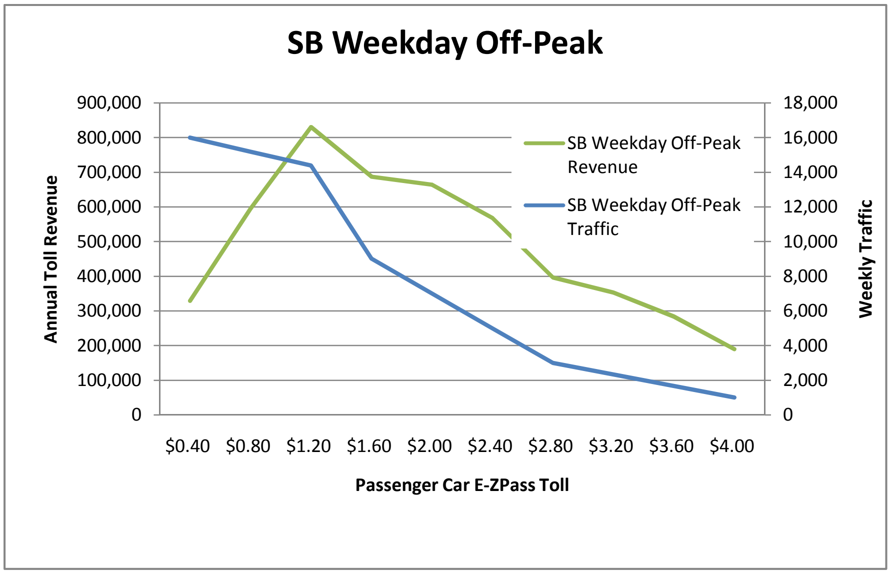

SB Weekday Peak
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
30,000
25,000
20,000
15,000
10,000
5,000
0
Annual Toll Revenue
Weekly Traffic
SB Weekday Peak Revenue
SB Weekday Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00 $4.40 $4.80 $5.20 $5.60 $6.00 $6.40 $6.80 $7.20 $7.60 $8.00
Passenger Car E-ZPass Toll

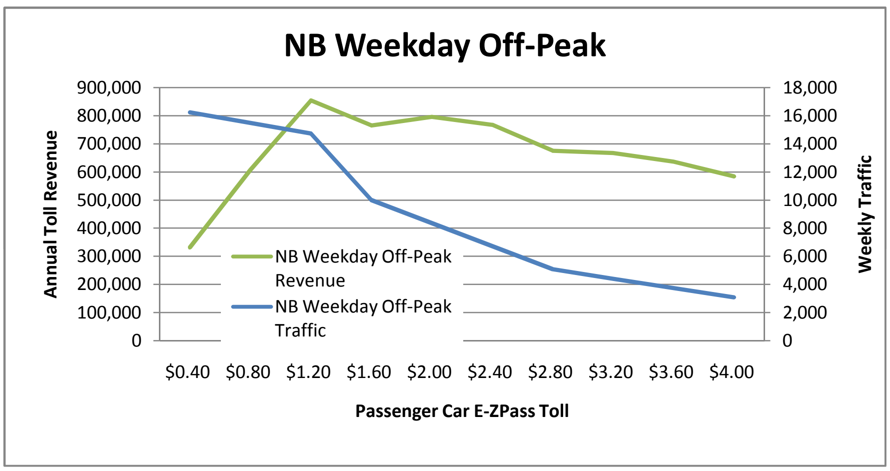

NB Weekday Peak
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Annual Toll Revenue
Weekly Traffic
NB Weekday Peak Revenue
NB Weekday Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00 $4.40 $4.80 $5.20 $5.60 $6.00 $6.40 $6.80 $7.20 $7.60 $8.00
Passenger Car E-ZPass Toll

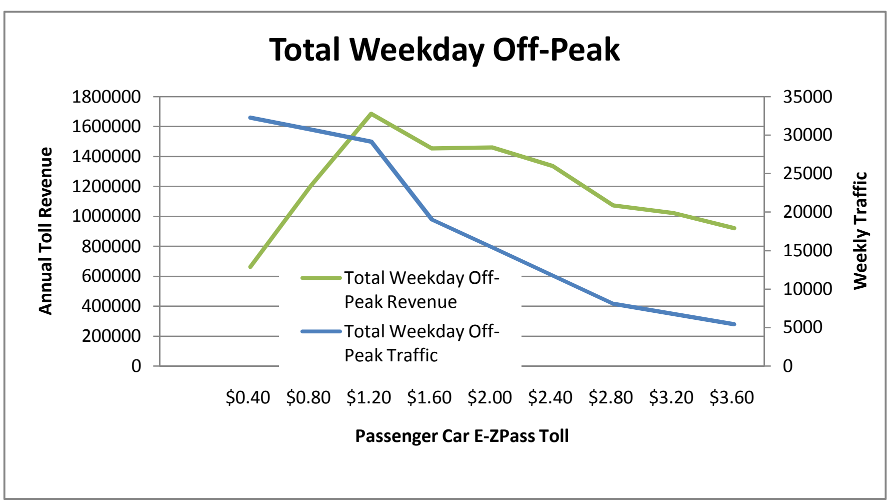

Total Weekday Peak
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Annual Toll Revenue
Weekly Traffic
Total Weekday Peak Revenue
Total Weekday Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00 $4.40 $4.80 $5.20 $5.60 $6.00 $6.40 $6.80 $7.20 $7.60 $8.00
Passenger Car E-ZPass Toll

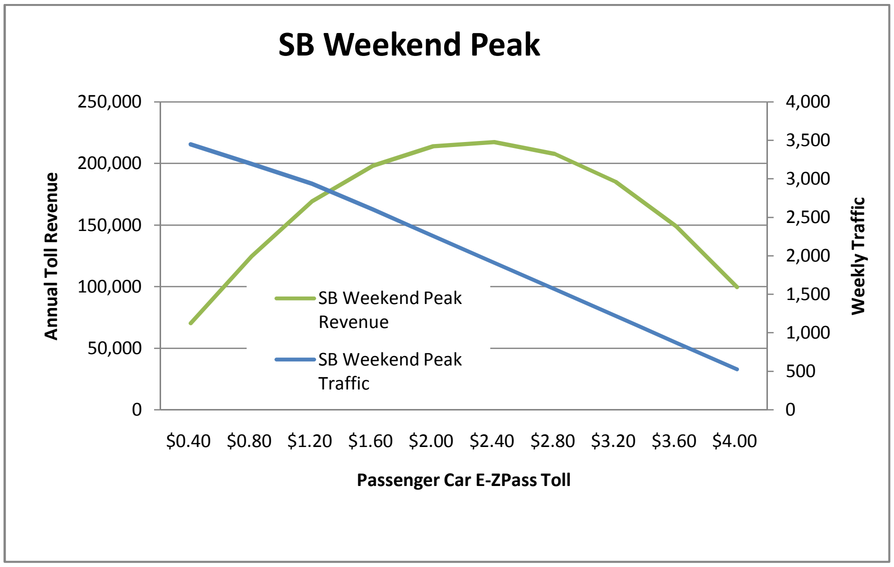


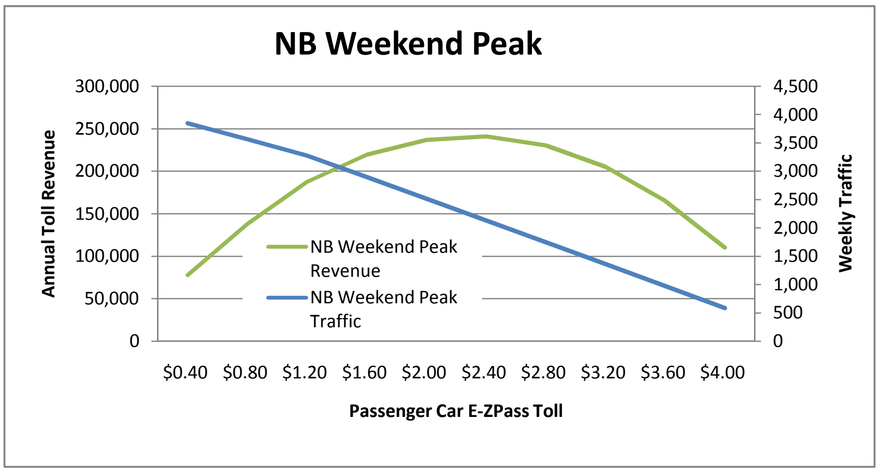
NB Friday Peak
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Annual Toll Revenue
12,000
10,000
8,000
6,000
4,000
2,000
0
Weekly Traffic
NB Friday Peak Revenue
NB Friday Peak Traffic
$0.40
$0.80
$1.20
$1.60
$2.00
$2.40
$2.80
$3.20
$3.60
$4.00
$4.40
$4.80
$5.20
$5.60
$6.00
$6.40
$6.80
$7.20
$7.60
$8.00
Passenger Car E-ZPass Toll

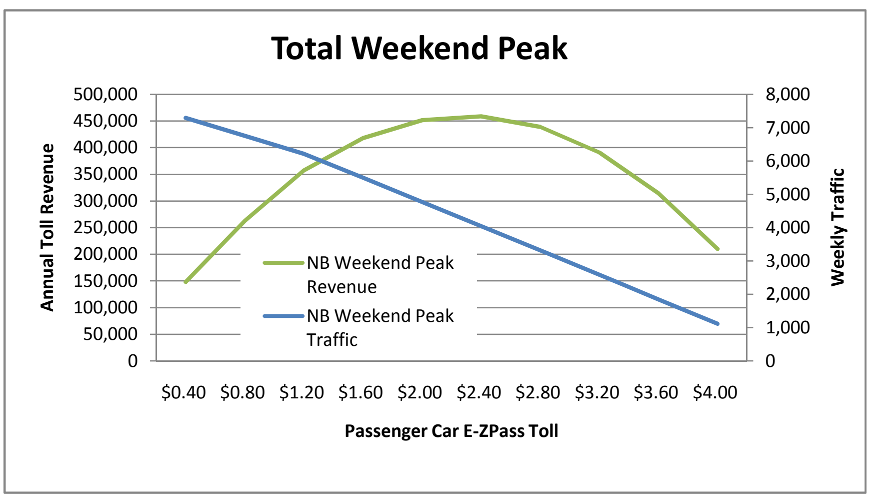

SB Weekday Off-Peak
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
SB Weekday Off-Peak Revenue
SB Weekday Off-Peak Traffic
Annual Toll Revenue
Weekly Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll

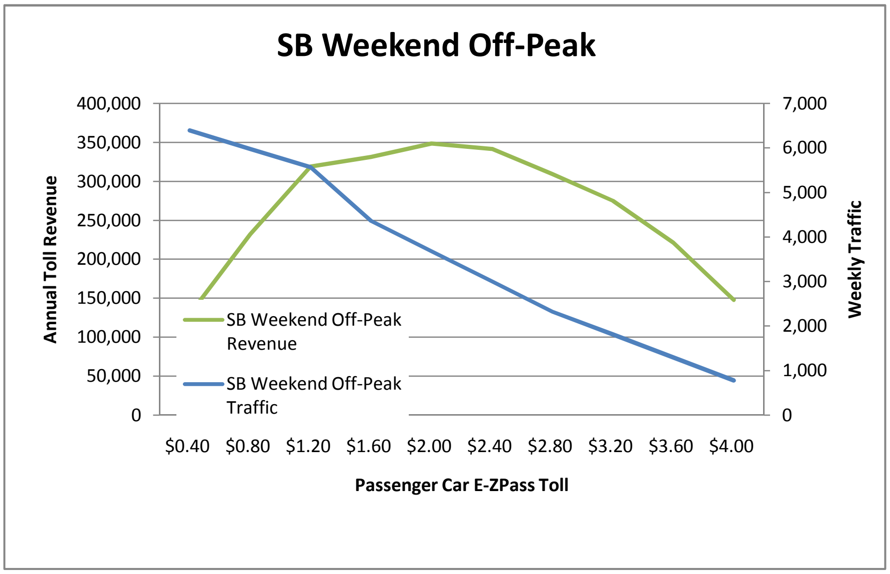

NB Weekday Off-Peak
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
NB Weekday Off-Peak Revenue
NB Weekday Off-Peak Traffic
Annual Toll Revenue
Weekly Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll

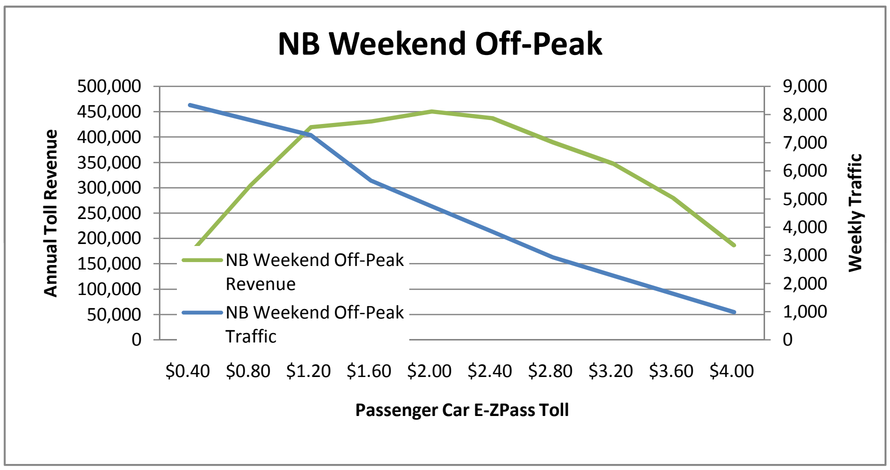

Total Weekday Off-Peak
1800000
1600000
1400000
1200000
1000000
800000
600000
400000
200000
0
35000
30000
25000
20000
15000
10000
5000
0
Total Weekday Off-Peak Revenue
Total Weekday Off-Peak Traffic
Annual Toll Revenue
Weekly Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60
Passenger Car E-ZPass Toll

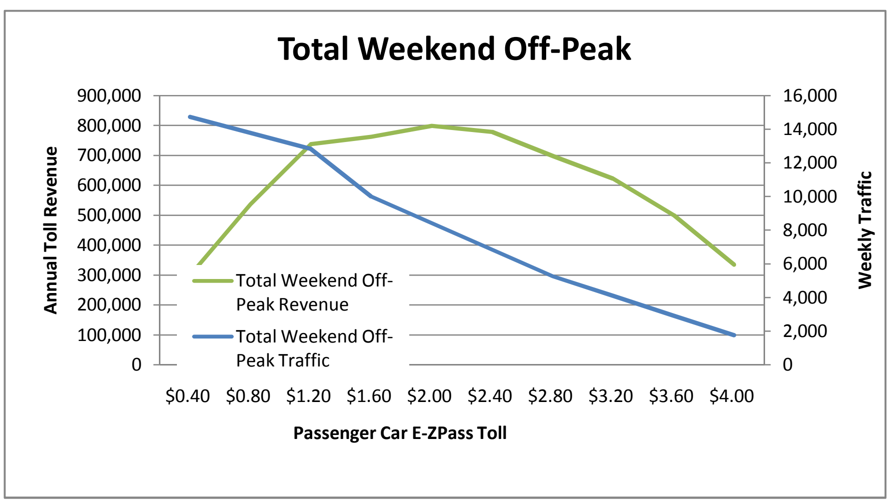

SB Weekend Peak
Annual Toll Revenue
Weekly Traffic
250,000
200,000
150,000
100,000
50,000
0
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
SB Weekend Peak Revenue
SB Weekend Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll

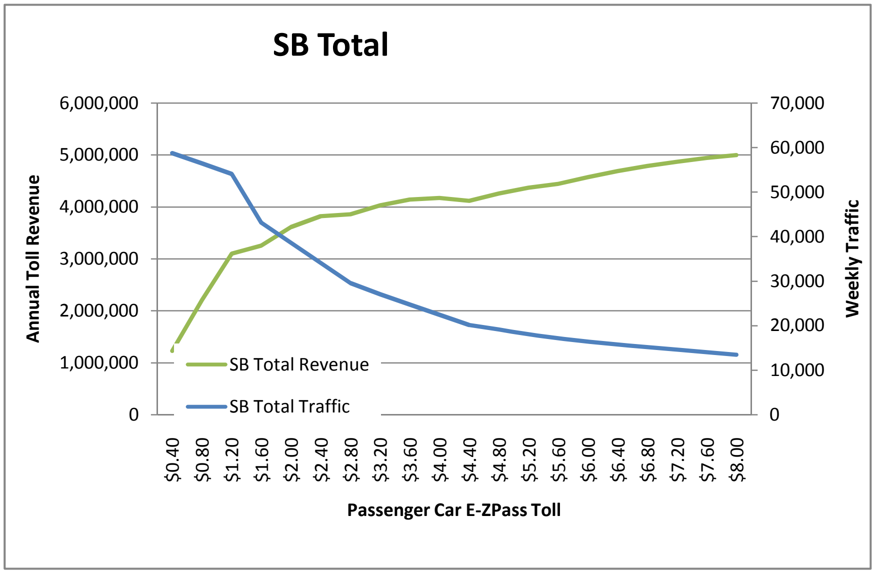

NB Weekend Peak
Annual Toll Revenue
Weekly Traffic
300,000
250,000
200,000
150,000
100,000
50,000
0
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
NB Weekend Peak Revenue
NB Weekend Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll

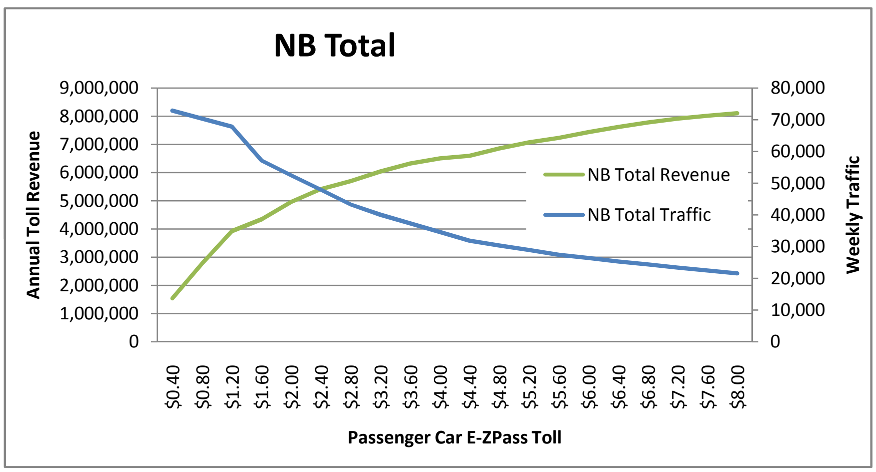

Total Weekend Peak
Annual Toll Revenue
Weekly Traffic
500,000
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
NB Weekend Peak Revenue
NB Weekend Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll

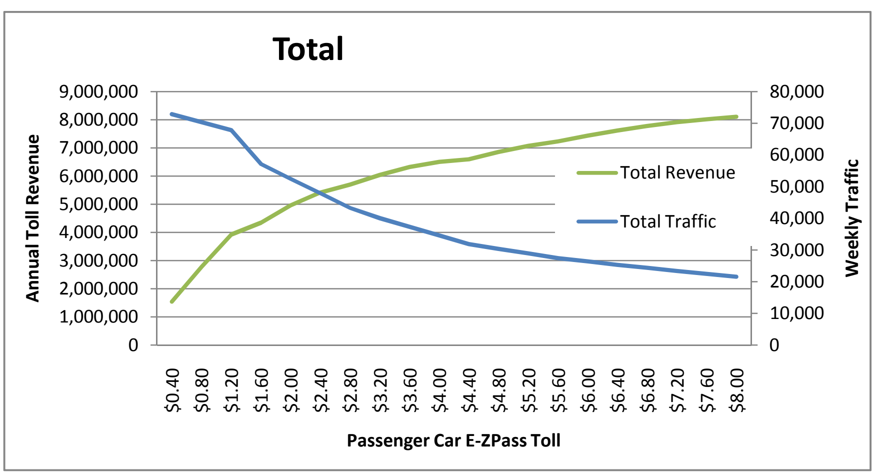

SB Weekend Off-Peak
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
Annual Toll Revenue
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Weekly Traffic
SB Weekend Off-Peak Revenue
SB Weekend Off-Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll


NB Weekend Off-Peak
500,000
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
Annual Toll Revenue
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Weekly Traffic
NB Weekend Off-Peak Revenue
NB Weekend Off-Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll


Total Weekend Off-Peak
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
Annual Toll Revenue
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Weekly Traffic
Total Weekend Off-Peak Revenue
Total Weekend Off-Peak Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00
Passenger Car E-ZPass Toll


SB Total
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Annual Toll Revenue
Weekly Traffic
SB Total Revenue
SB Total Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00 $4.40 $4.80 $5.20 $5.60 $6.00 $6.40 $6.80 $7.20 $7.60 $8.00
Passenger Car E-ZPass Toll


NB Total
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Annual Toll Revenue
Weekly Traffic
NB Total Revenue
NB Total Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00 $4.40 $4.80 $5.20 $5.60 $6.00 $6.40 $6.80 $7.20 $7.60 $8.00
Passenger Car E-ZPass Toll


Total
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Annual Toll Revenue
Weekly Traffic
Total Revenue
Total Traffic
$0.40 $0.80 $1.20 $1.60 $2.00 $2.40 $2.80 $3.20 $3.60 $4.00 $4.40 $4.80 $5.20 $5.60 $6.00 $6.40 $6.80 $7.20 $7.60 $8.00
Passenger Car E-ZPass Toll

APPENDIX D

Acronyms/Abbreviations

List of Acronyms/Abbreviations

MDTA	Maryland Transportation Authority
Jacobs	Jacobs Engineering Group
ETL	Express Toll Lanes
T&R	Traffic and Toll Revenue
BMC Model	Baltimore Metropolitan Council's travel demand model
VISSIM Model	VISSIM micro-simulation model
T&R Model	Toll Schedule and Toll Revenue Model
VOT	Value of Time
JFK	John F. Kennedy Memorial Highway
Hatem	Thomas J. Hatem Memorial Bridge
FMT	Fort McHenry Tunnel
BHT	Baltimore Harbor Tunnel
FSK	Francis Scott Key Bridge
Bay	William Preston Lane Jr. Memorial Bay Bridge
Nice	Governor Harry W. Nice Memorial Bridge
ICC/MD 200	Intercounty Connector
SR	State Route
BRT	Bus Rapid Transit
GDP	Gross Domestic Product
NBER	National Bureau of Economic Research
CBO	Congressional Budget Office
FRB	Federal Reserve Bank
IMF	International Monetary Fund
IPI	Industrial Production Index
VMT	Vehicle Miles Traveled
EIA	Energy Information Administration
WTI	West Texas Intermediate Crude Oil Price
GTL	Gas-to-Liquid
APTA	American Public Transportation Association
PMT	Passenger Miles Traveled
SIQSS	Stanford Institute for the Quantitative Study of Society
GSP	Gross State Product
MSAs	Metropolitan Statistical Areas
GRP	Gross Regional Product
BLS	Bureau of Labor Statistics
ETC	Electronic Toll Collection