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**Date** December 5, 2016  
**To** Melissa Williams  
**From** Phil Eshelman  
**Subject** **I-95 ETL T&R Update – Fall 2016**

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Jacobs was retained to conduct an update to the traffic and toll revenue estimates for Interstate 95 Express Toll Lanes (ETLs) operated and maintained by the Maryland Transportation Authority (MDTA).

Jacobs conducted and developed the original forecast of traffic and toll revenue for the I-95 ETLs in 2013 in anticipation of the opening in late 2014. The original analysis is documented in the report titled "I-95 Express Toll Lanes Comprehensive Traffic and Toll Revenue Study" dated December 2013. The majority of the analysis was conducted in the spring of 2013 with finalization of the report at the end of the year.

Jacobs updated the analysis in the fall of 2015 documented in the memo titled "I-95 ETL T&R Update" dated February 8, 2016.

This current analysis conducted in the fall of 2016 provides revised traffic and toll revenue (T&R) estimates for budgeting purposes accommodating the performance of the facility over the last year.

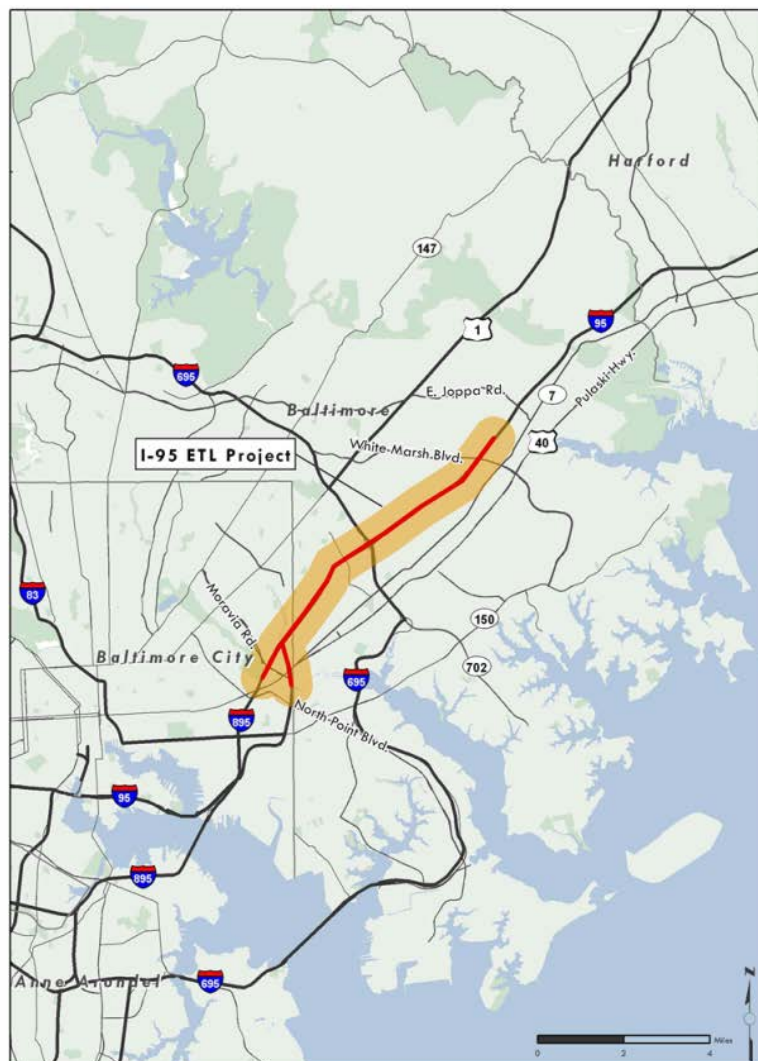
This memo reviews the existing conditions of the facility including traffic levels, speeds and frequency of use, and revised estimates of traffic and toll revenue for the facility. Thus the sections are as follows:

1. Project Description
2. Data Collection/Summary
3. Updated Traffic and Toll Revenue Forecasts

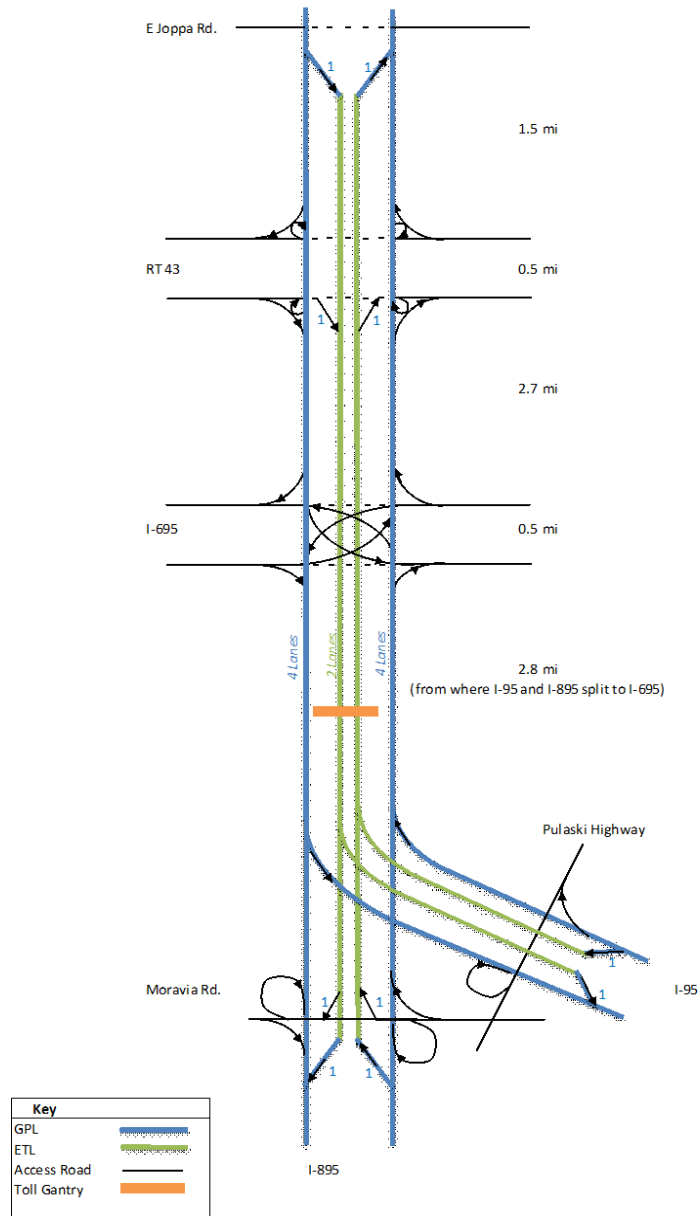
## 1. Project Description

The I-95 Express Toll Lanes (ETLs) are two lanes in each direction running parallel to the I-95 general purpose (GP) lanes for approximately 7.5 miles north of Baltimore from north of White Marsh Boulevard (MD 43) to the split of I-95/I-895 about 4 miles north of the Baltimore Harbor. Figure 1 and Figure 2 provide the project location and the details as to access to the ETLs from the GP lanes, respectively.

**Figure 1: I-95 ETL Project Location Map**



**Figure 2: I-95 ETL Stick Diagram**



The facility offers faster travel speeds as compared to the general purpose lanes during congested times of the day. Key to the forecast of traffic and toll revenue on these ETLs is the determination of the levels of congestion on the GP lanes into the future and the propensity for motorists to pay a toll to avoid such congestion.

The toll schedule for the I-95 ETLs is by time of day, specific by direction and day of the week. The toll rates were lowered in FY16 (July 1, 2015). The passenger car toll rates and time period for the toll rates are shown in the following tables.

**Table 1: I-95 ETL Passenger Car Toll Rates**

Time Period	FY15 Rates	FY16 Rates
Peak	\$1.75	\$1.54
Off-Peak	\$1.40	\$1.19
Night	\$0.70	\$0.49

**Table 2: I-95 ETL Toll Schedule Time Periods**

Time Period	Weekday	Saturday	Sunday
	Southbound		
Peak	6 AM to 9 AM	12 PM to 2 PM	2 PM to 5 PM
Off-Peak	5 AM to 6 AM; 9 AM to 9 PM	5 AM to 12 PM; 2 PM to 9 PM	5 AM to 2 PM; 5 PM to 9 PM
Night	9 PM to 5 AM		
Northbound			
Peak	3 PM to 7 PM	12 PM to 2 PM	2 PM to 5 PM
Off-Peak	5 AM to 3 PM; 7 PM to 9 PM	5 AM to 12 PM; 2 PM to 9 PM	5 AM to 2 PM; 5 PM to 9 PM
Night	9 PM to 5 AM		

## **2. Data Collection/Summary**

In this section the data that was collected for this analysis is identified and the salient elements from those data as they affect the T&R forecast are analyzed.

### **2.1 Data Collected**

For this analysis the following data were collected from the MDTA for the time period from September 2015 to August 2016 to supplement our existing databases:

1. Traffic Data
  - a. Hourly ETL traffic by payment type
  - b. Every transaction by payment type and zip code
  - c. SHA traffic counts
  - d. Speed data from MDTA readers on the ETLs and GP lanes separately
2. Revenue Data
  - a. Monthly E-ZPass toll revenue by vehicle class
  - b. Monthly paid video revenue

In addition to the data collected above specifically for this analysis, our databases and experience with existing managed lane systems and usage were used as is typical on these projects.

**2.2 Traffic and Toll Revenue**

The historical annual traffic and toll revenue for FY15 and FY16 are presented by vehicle class and payment type in the following tables. The data show that there is an extremely high passenger car share as well as E-ZPass percentage for both FY15 and FY16. The vehicle class percent share in each table adds to 100% reading down the table with sums provided by car and truck. The percent ETC shown in the final column of the tables is to each specific vehicle class across the rows of the table.

**Table 3: ETL Traffic by Payment and Vehicle Class – FY15 (December 2014 to June 2015)**

Vehicle Class	E-ZPass	Video	Total	% Vehicle Class	% ETC
Class 2 & 8	3,671,262	57,847	3,729,109	94.5%	98.4%
Class 3	64,394	2,938	67,332	1.7%	95.6%
Class 4	18,540	915	19,455	0.5%	95.3%
Class 5	50,023	2,030	52,053	1.3%	96.1%
Class 6	925	72	997	0.0%	92.8%
Official Duty	76,688		76,688	1.9%	100.0%
<b>Total</b>	<b>3,881,832</b>	<b>63,801</b>	<b>3,945,633</b>	<b>100.0%</b>	<b>98.4%</b>

Vehicle Class	E-ZPass	Video	Total	% Vehicle Class	% ETC
Car	7,752,270	204,022	7,956,292	96.3%	97.4%
Truck	295,749	13,584	309,333	3.7%	95.6%
<b>Total</b>	<b>8,048,019</b>	<b>217,606</b>	<b>8,265,625</b>	<b>100.0%</b>	<b>97.4%</b>

**Table 4: ETL Toll Revenue by Payment and Vehicle Class – FY15 (December 2014 to June 2015)**

Vehicle Class	E-ZPass	Video	Total	% Vehicle Clas	% ETC
Class 2 & 8	\$5,244,604	\$120,329	\$5,364,933	87.3%	97.8%
Class 3	\$246,223	\$2,938	\$249,161	4.1%	98.8%
Class 4	\$107,902	\$1,855	\$109,757	1.8%	98.3%
Class 5	\$408,215	\$4,116	\$412,331	6.7%	99.0%
Class 6	\$9,381	\$146	\$9,527	0.2%	98.5%
Official Duty					
<b>Total</b>	<b>\$6,016,325</b>	<b>\$129,384</b>	<b>\$6,145,709</b>	<b>100.0%</b>	<b>97.9%</b>

Vehicle Class	E-ZPass	Video	Total	% Vehicle Class	% ETC
Car	\$5,244,604	\$120,329	\$5,364,933	87.3%	97.8%
Truck	\$771,721	\$9,055	\$780,776	12.7%	98.8%
<b>Total</b>	<b>\$6,016,325</b>	<b>\$129,384</b>	<b>\$6,145,709</b>	<b>100.0%</b>	<b>97.9%</b>

**Table 5: ETL Traffic by Payment and Vehicle Class – FY16 (July 2015 to June 2016)**

Vehicle Class	E-ZPass	Video	Total	% Vehicle Class	% ETC
Class 2 & 8	7,603,563	204,022	7,807,585	94.5%	97.4%
Class 3	134,498	4,003	138,501	1.7%	97.1%
Class 4	39,593	2,183	41,776	0.5%	94.8%
Class 5	119,156	7,159	126,315	1.5%	94.3%
Class 6	2,502	239	2,741	0.0%	91.3%
Official Duty	148,707		148,707	1.8%	100.0%
<b>Total</b>	<b>8,048,019</b>	<b>217,606</b>	<b>8,265,625</b>	<b>100.0%</b>	<b>97.4%</b>

Vehicle Class	E-ZPass	Video	Total	% Vehicle Class	% ETC
Car	3,747,950	57,847	3,805,797	96.5%	98.5%
Truck	133,882	5,954	139,836	3.5%	95.7%
<b>Total</b>	<b>3,881,832</b>	<b>63,801</b>	<b>3,945,633</b>	<b>100.0%</b>	<b>98.4%</b>

**Table 6: ETL Toll Revenue by Payment and Vehicle Class – FY16 (July 2015 to June 2016)**

Vehicle Class	E-ZPass	Video	Total	% Vehicle Class	% ETC
Class 2 & 8	\$9,641,558	\$412,271	\$10,053,829	88.3%	95.9%
Class 3	\$297,804	\$8,090	\$305,894	2.7%	97.4%
Class 4	\$136,181	\$4,412	\$140,593	1.2%	96.9%
Class 5	\$848,696	\$14,467	\$863,163	7.6%	98.3%
Class 6	\$21,232	\$483	\$21,715	0.2%	97.8%
Official Duty					
<b>Total</b>	<b>\$10,945,471</b>	<b>\$439,723</b>	<b>\$11,385,194</b>	<b>100.0%</b>	<b>96.1%</b>

Vehicle Class	E-ZPass	Video	Total	% Vehicle Class	% ETC
Car	\$9,641,558	\$412,271	\$10,053,829	88.3%	95.9%
Truck	\$1,303,913	\$27,452	\$1,331,365	11.7%	97.9%
<b>Total</b>	<b>\$10,945,471</b>	<b>\$439,723</b>	<b>\$11,385,194</b>	<b>100.0%</b>	<b>96.1%</b>

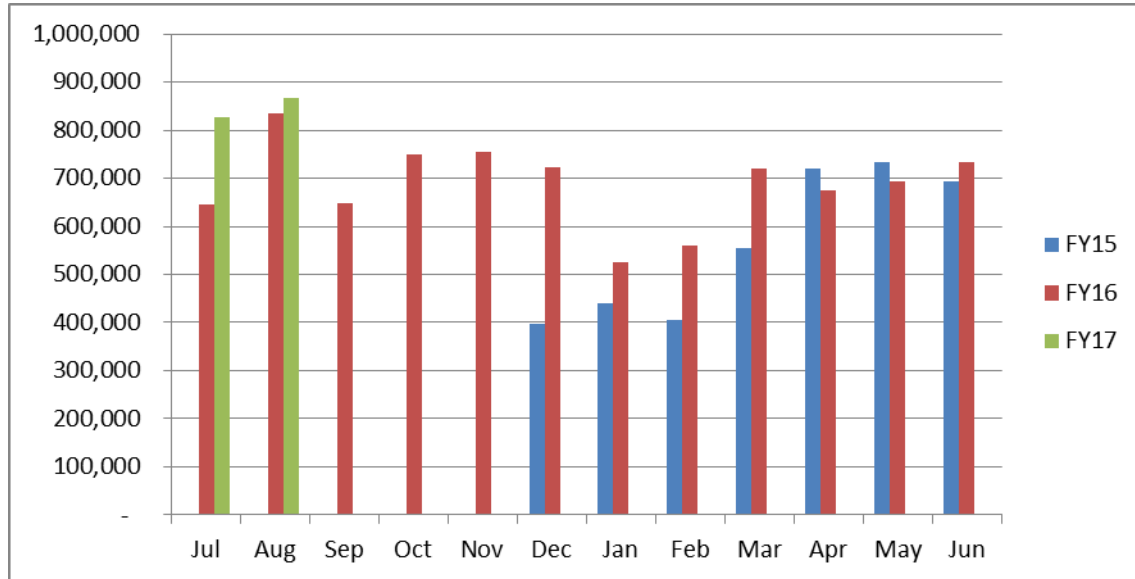
Traffic and toll revenue by month were also reviewed and are presented in the tables and figures that follow. Monthly growth in traffic and toll revenue is quite large in specific months which is common for managed lane facilities, specifically in the early years.

**Table 7: ETL Traffic by Month (FY15 to FY17)**

Traffic							
Month	FY15	Absolute Growth	% Growth	FY16	Absolute Growth	% Growth	FY17
Jul				646,335	180,062	27.9%	826,397
Aug				833,649	32,295	3.9%	865,944
Sep				648,335			
Oct				749,627			
Nov				755,746			
Dec	398,374	324,201	81.4%	722,575			
Jan	439,591	86,760	19.7%	526,351			
Feb	406,215	154,842	38.1%	561,057			
Mar	553,842	167,096	30.2%	720,938			
Apr	719,665	(44,941)	-6.2%	674,724			
May	734,606	(41,005)	-5.6%	693,601			
Jun	693,340	39,347	5.7%	732,687			
<b>Total</b>	<b>3,945,633</b>	<b>4,319,992</b>	<b>109.5%</b>	<b>8,265,625</b>			



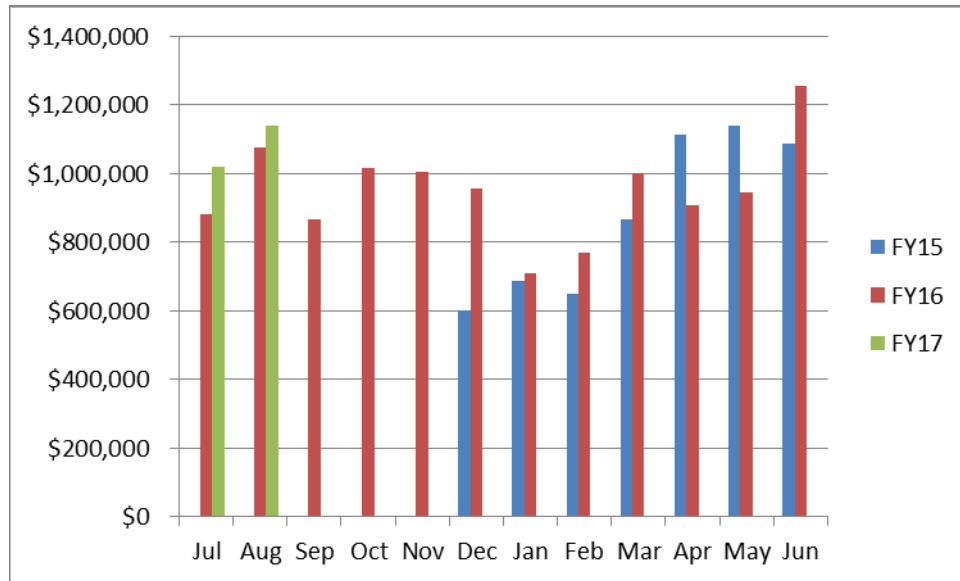
**Figure 3: ETL Traffic by Month (FY15 to FY17)**



**Table 8: ETL Toll Revenue by Month (FY15 to FY17)**

Gross Toll Revenue							
Month	FY15	Absolute Growth	% Growth	FY16	Absolute Growth	% Growth	FY17
Jul				\$882,454	\$135,289	15.3%	\$1,017,743
Aug				\$1,073,767	\$65,809	6.1%	\$1,139,576
Sep				\$864,654			
Oct				\$1,016,845			
Nov				\$1,003,773			
Dec	\$602,088	\$355,609	59.1%	\$957,697			
Jan	\$687,419	\$22,388	3.3%	\$709,807			
Feb	\$650,605	\$116,762	17.9%	\$767,367			
Mar	\$867,064	\$135,188	15.6%	\$1,002,253			
Apr	\$1,112,133	(\$206,064)	-18.5%	\$906,069			
May	\$1,138,891	(\$192,925)	-16.9%	\$945,966			
Jun	\$1,087,509	\$167,033	15.4%	\$1,254,542			
<b>Total</b>	<b>\$6,145,709</b>	<b>5,239,484</b>	<b>85.3%</b>	<b>\$11,385,193</b>			

**Figure 4: ETL Toll Revenue by Month (FY15 to FY17)**

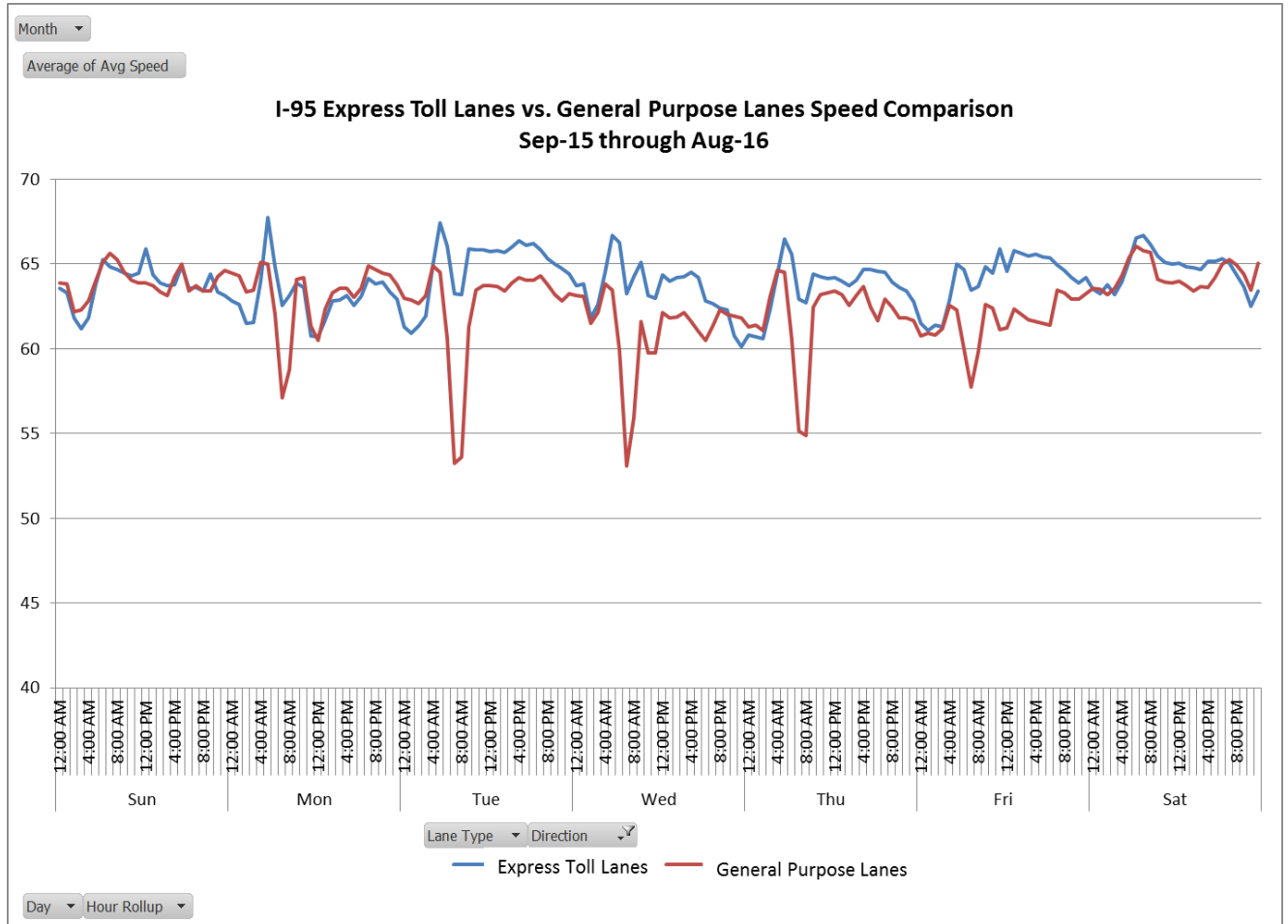


These growth rates were taken into account when considering the continuation of growth on the ETLs outside of that due to benefits of travel time savings from congestion in the general purpose lanes, discussed in the next section.

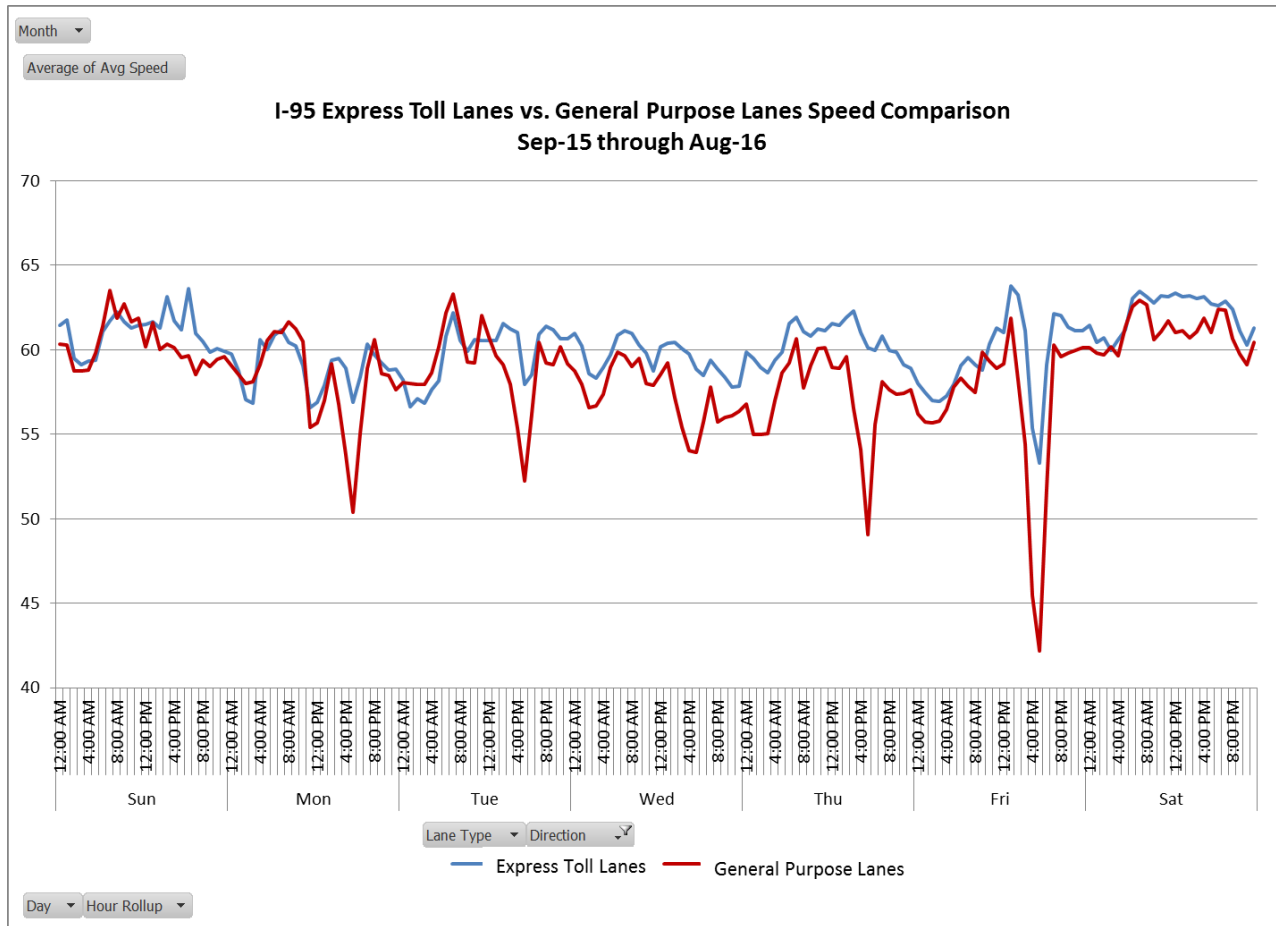
**2.3 Speed Review**

One of the critical data to review are the speeds in the ETLs and the general purpose lanes by time of day and day of the week. As the tolled ETLs are adjacent to the toll-free general purpose lanes, it is the travel time savings in the form of higher travel speeds that provide value to motorists. A small portion of travel time savings is imbedded in the speed limit differential, such that the ETLs have a speed limit that is 5 miles per hour (mph) higher than the GPs. There are other benefits as well such as an increase in perceived safety, ease of use and other items detailed later in this memo. For the purely quantitative part of the analysis Figure 5 and Figure 6 present the average southbound and northbound speeds for the ETLs as well as the general purpose lanes. Note that the average speeds in the general purpose lanes dip to 55 mph during the SB peak period and 45 mph for the NB peak period during the week. During off-peak times the speeds are very similar. These speed differentials from the ETLs provide about a 1 to 3 minute time savings on average during the peak period. There is certainly volatility to those peak periods speeds over the course of a year and perceived time savings could be slightly more as a result.

**Figure 5: Average Southbound Speeds by Hour and Day of the Week in the Corridor**



**Figure 6: Average Northbound Speeds by Hour and Day of the Week in the Corridor**



**2.4 Frequency of Use**

The limited time savings presented in the previous section requires us to look elsewhere for less straight-forward reasons for usage. Last year and again this year we reviewed the frequency of use of the ETLs by unique transponder and license plate to understand the potential sustainability of usage of the ETLs as motorists become more familiar with the relative benefits.

Last year, 9 months of data (January 2015 to September 2015) was expanded to a full year to estimate full year frequency. This year we reviewed the most recent 12 months from September 2015 to August 2016 for comparative purposes.

The following tables present the previous annualized estimates from the 9 months of data and the most recent analysis from the most recent 12 months. As can be seen, the results are almost identical when considering infrequent users, indicating that users that use one time per month or less represent over 95 percent of the unique users and about 60 percent of the transactions. While infrequent use is common on managed lanes operated like the ETLs, it is the one time users that are the most concerning with regard to the forecast. Again, as familiarity with the value of the ETLs increases it is possible that these one-time users do not continue to show up year after year. It should also be noted that the frequency data includes both directions, meaning those one time users did not take the ETLs on their return trip.

**Table 9: ETL Frequency of Use – Estimated Annually from January 2015 to September 2015 Data**

ETL Frequency of Use - Estimated Annual from January 2015 to September 2015				
Frequency	Individual Transponder or License Plate	Trips	Individual Transponder or License Plate	Trips
4+ per week	560	165,735	0.0%	2.3%
2-4x week	8,364	1,106,436	0.4%	15.4%
1 x per week	9,033	522,797	0.4%	7.3%
2 to 3x per month	20,147	573,860	0.9%	8.0%
1 x per month	1,051,402	3,746,997	49.1%	52.3%
1 time per year	1,050,494	1,050,494	49.1%	14.7%
Total	2,140,000	7,166,319	100.0%	100.0%

**Table 10: ETL Frequency of Use – Annual from September 2015 to August 2016**

ETL Frequency of Use - Annual from September 2015 to August 2016				
Frequency	Individual Transponder or License Plate	Trips	Individual Transponder or License Plate	Trips
4+ per week	1,789	675,460	0.1%	8.0%
2-4x week	8,865	1,230,575	0.4%	14.5%
1 x per week	8,302	490,221	0.3%	5.8%
2 to 3x per month	24,705	730,074	1.0%	8.6%
1 x per month	1,110,911	4,023,081	44.7%	47.5%
1 time per year	1,328,571	1,328,571	53.5%	15.7%
Total	2,483,142	8,477,982	100.0%	100.0%

Furthermore, the frequent users (2-3 transactions per month or more), some 42,000 motorists that make up the remaining 37 percent of trips are estimated to be less than one percent of the total motorists in the corridor. The inability to predict the decisions of a very small selection of the population (frequent users) coupled with large usage of the facility by non-repeat customers (infrequent users) continues to provide reasons for conservatism in the forecast going forward.

With these data and previous frequency data for the Baltimore Harbor Tunnel, Fort McHenry Tunnel and John F. Kennedy Memorial Highway motorists, it is estimated that the total number of unique motorists in the I-95 corridor each year adjacent to the ETLs is approximately 4 million. With about 1 to 1.5 M one time ETL users in a year it will take a few years for all users to understand the new system. Of course new users will enter the corridor each year; therefore the forecast extends the time for removal of unfamiliar motorists from the ETLs and keeps a portion of the lanes filled with those motorists who choose the lanes for a number of reasons that are outside of time savings. A more detailed list of these reasons and the cause for such decision making is provided in a subsequent section of this documentation.

**2.5 Possible Reasons for ETL Usage Apart from Time Savings**

During the course of the analysis we reviewed potential reasons for high ETL usage in the face of limited time savings so as to mitigate these during the modeling effort if necessary. The high level of one time users points to a potential correction of behavior after taking it once or twice. The following table provides a description of potential reasons and the resulting action taken for the modeling process. Generally, it is estimated that over time, usage of the ETLs will be more dependent upon travel time savings and not curiosity, unfamiliarity or the like.

**Table 2-11: Possible Reasons for ETL Usage**

Potential Reason	Analysis	Modeling Mitigation
Construction on General Purpose Lanes causing restrictions	No known construction on GP lanes that would encourage ETL usage	None
Spot congestion at entry points	No known spot congestion at entries	None
Confusion over signage	The signs show that E-ZPass should use the left lanes as motorists approach the entries to the ETLs. This signage is similar to signage at the tunnels and JFK Memorial where E-ZPass uses the leftmost lanes. It is possible that motorists with E-ZPass simply follow the signs.	Phase out one time users
Navigation directions pushing motorists into ETLs	Apple Maps, Yahoo Maps and Tom Tom provided guidance to use the ETLs; Google Maps, Mapquest and Bing Maps directs motorists to GP Lanes	Users will use navigation advice once or twice before making decision to take GP Lanes
Perceived value of lanes because of pricing	Possibly a Veblen Good - provides status of relatively low cost	Continue some usage regardless of future time savings
"Tourist" usage - i.e. trying something once to see how it works	Frequency data seems to suggest that this may be the case	Removal of one time users over the years as motorists become familiar with the corridor
Fear of potential slowdown in GP lanes with value seen in the reliability and perceived safety/comfort of the ETLs	This is a reason for managed lane usage across the nation and appears to be applicable to this facility	Continue some usage regardless of future time savings

### 3. Updated Traffic and Revenue Forecasts

Due to the unique nature of the facility, motorists will slowly learn the relative benefit of the facility and for the various reasons stated in the preceding documentation; usage will lower to match actual travel time savings between the ETLs and the general purpose lanes.

The forecasting model was revised to account for the current level of usage with slow removal of that usage over the course of few years as unfamiliar motorists become familiar with the corridor. The forecasting model does take into account the continual introduction of first-time users to the facility, which allows for more usage throughout the forecast.

The forecast assumes the current toll schedule will be in place through 2026. The estimates of traffic and toll revenue are provided in the following table. The figures shown for FY2015 and FY2016 are actual results, as noted. The high growth from FY2015 to FY2016 is mostly a function of FY2015 only being open for 6.5 months. Even with this accommodation there is higher growth than would normally be considered as a function of the ramp-up for any new facility.

The forecast assumes a decline in traffic from FY18 to FY19, as users become more familiar with the corridor. That loss in traffic is estimated to only be 5 percent while those one time users represent approximately 15 percent of transactions. At that point the traffic and toll revenue are estimated to grow based on increasing congestion in the corridor.

**Table 3-1: I-95 ETL Traffic and Toll Revenue Estimates**

Annual T&R Estimates for I-95 Express Toll Lanes				
Fiscal Year	Traffic		Toll Revenue	
	Volume	Annual Growth	Volume	Annual Growth
2015	3,945,633		\$6,145,709	
2016	8,265,625	109.5%	\$11,385,193	85.3%
2017	8,554,000	3.5%	\$11,762,000	3.3%
2018	8,641,000	1.0%	\$11,855,000	0.8%
2019	8,209,000	-5.0%	\$11,239,000	-5.2%
2020	8,291,000	1.0%	\$11,329,000	0.8%
2021	8,457,000	2.0%	\$11,533,000	1.8%
2022	8,711,000	3.0%	\$11,879,000	3.0%
2023	8,972,000	3.0%	\$12,235,000	3.0%
2024	9,241,000	3.0%	\$12,602,000	3.0%
2025	9,518,000	3.0%	\$12,980,000	3.0%
2026	9,804,000	3.0%	\$13,369,000	3.0%

\*FY2015 and FY2016 are actual results



#### **4. Future Toll Schedule Changes to Manage Traffic**

The forecast in the preceding section is predicated on the existing toll schedule being in place for the full forecast period. On average, it is estimated that the current toll schedule by hour by day will be sufficient to manage traffic into the future. Furthermore, for the traffic and toll revenue forecast for the ten year period it is estimated that any small changes to the toll schedule to manage traffic that is discussed in this section will not have a significant impact on revenue.

It is anticipated that there may be individual days into the future that may require increased tolls to effectively manage traffic demand on the ETLs. This would exclude any anomalies such as traffic accidents.

From review of the speed and traffic data on the ETLs on individual days and hours there is currently sufficient capacity to handle the future demands but the Friday PM peak period does demonstrate volatility that could require management techniques if so desired by the MDTA. On average the traffic can double during the Friday PM Peak and speeds in the non-merging section of the ETLs will be maintained to 45 miles per hour. On the most trafficked day recorded on the ETLs through August 31, 2016, there was approximately 20 percent excess capacity for ETL usage. This occurred on Friday, March 14, 2016 during the 4 pm hour.

It is recommended that any changes to the toll schedule for the Friday PM Peak be consistent with overall goals of the corridor and project. There would be opportunities to manage traffic in real time, through dynamic pricing, if the MDTA would like to do so. However if the MDTA would consider the average day as the basis for any toll changes then the current schedule should be sufficient for the forecast period.

## **5. 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 limited synopsis presents the highlighted 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

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