Maine Turnpike Needs Assessment

Systemwide Traffic Operation and Safety Study

Prepared for:

Maine Turnpike Authority

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HNTB

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1 EXECUTIVE SUMMARY

The system-wide traffic operation and safety study of the Maine Turnpike includes an assessment of both current and future operating conditions of all interchanges, mainline sections, ramps, and toll plazas on the Turnpike between Kittery and Augusta. The study also includes an assessment of safety for all mainline sections, ramps, toll plazas, and intersections of local roads with Turnpike ramps.

The study is intended to present a broad look at safety and capacity needs on the Turnpike over the next 30 years. The purpose of the study is to provide information on needed capital improvements to help guide the Authority in the drafting of the 30-Year Capital Plan.

The parameters presented within the study include:

- A summary of current design hour traffic volumes (2011) for each mainline and ramp segment between Kittery and Augusta. Design hour volumes are the 30th highest hour traffic volumes of a year.
- A forecast of future design hour traffic volumes at 10, 20, and 30 year horizons using applicable peak hour traffic growth rates and available forecasts.
- A highway and interchange capacity analyses for existing 10, 20, and 30 year design hour traffic volumes for mainline and ramps.
- A toll plaza operational analysis for existing, 10, 20, and 30 year design hour traffic volumes at each existing toll plaza location.
- An analysis of crash data from the most recent three year period for which data are available (2009-2011) along the Turnpike from Kittery to Augusta using data from the Maine Department of Transportation (MaineDOT).
- An analysis of Park and Ride lots adjacent to the Turnpike
- An evaluation of speeds from Exits 80-102
- Information from municipalities adjacent to the Turnpike regarding short or long term transportation improvements or problem areas

The study identifies the approximate timeframe and costs for needed capacity and safety improvements on the Turnpike. While other programs and/or policies might be developed to help address safety and capacity, including alternative transportation methods, this report provides information on when these issues are expected to arise and also provides basic estimates for the engineering and construction costs of adding these improvements to the highway.

Maine's Sensible Transportation Policy Act requires transportation agencies to identify and analyze alternatives to widening roadways in order to achieve capacity and safety needs. These alternatives have not been identified as part of this evaluation, however, will be done as a separate planning effort when necessary.

CAPACITY IMPROVEMENTS

Capacity improvements, presented in Table 1-1, are based on the results of capacity analyses performed as part of the study. Included in Table 1-1 are possible future improvements, an approximate time table of when the improvements will become necessary, and an estimate of the forecasted construction costs. The costs have been forecasted to the year that construction is

proposed to begin. To summarize for budgeting purposes Table 1-1 combines the cost of all projects proposed to begin in the same year.

Table 1-1 – Cost of Proposed Improvements by Year

Year	Total Forecasted Cost	Location of Proposed Improvement
2017[1]	$ 2,996,700	NH State Line to Kittery Exit 2 – NB Mainline
2018	$ 3,617,500	Exit 36 Saco – Toll Lanes **and** NB On-ramp
2021	$ 2,423,000	Exit 36 Saco – NB Off Ramp
2022[1]	$ 7,962,600	NH State Line to Kittery Exit 2 – SB Mainline **and** Exit 2 SB-On-ramp
2023	$ 1,366,200	Exit 44 I-295 Scarborough SB On-Ramp
2025	$ 16,058,000	Jetport to Westbrook – NB Mainline
2030	$ 3,360,000	Exit 36 Saco – SB Off Ramp
2031	$ 25,062,900	Kittery Exit 2 to York – NB Mainline **and** Biddeford NB on-ramp
2034	$ 50,366,500	I-295 Scarborough to Jetport – NB Mainline **and** Exit 32 Biddeford – SB off-ramp
2035	$ 26,446,000	Kittery Exit 2 to York – SB Mainline
2037	$21,880,000	I-295 Scarborough to Rand Rd – SB Mainline
2038	$ 2,838,100	Exit 36 Saco – SB On Ramp

[1]Traffic between Exits 0-7 is constrained by the Piscataqua River Bridge. Peak hour northbound traffic will not reach forecasted levels due to the traffic capacity constraint of the bridge. Conversely, peak hour traffic southbound will not benefit from widening if the capacity of the bridge is less than the mainline (i.e. if the bridge is not widened). Because of capacity issues, coordination with the New Hampshire Department of Transportation will be needed in the near future.

In additions, three toll plazas (Biddeford, Scarborough, and Gray) were found to operate at over 75% capacity and lie in close proximity to a local signalized intersection. Operations at these plazas should be monitored to ensure that the toll plaza operations don't interfere with the flow of traffic on local roads. It will also be important to monitor development in order to assess impact fees when necessary. This will be particularly important at Biddeford and Gray[1], because these plazas will be operating at 80-90% capacity during peak periods. Periodic surges at these plazas could result in temporary interference with the local roads.

HIGH CRASH LOCATIONS

The safety analysis for this study determined if there are locations with a high crash history; determined if there are measures that can be taken to alleviate the number of crashes; and examined the current safety practices of the Authority. All mainline miles, interchanges, ramps and toll plazas on the Maine Turnpike as well as adjacent intersections to the Turnpike were analyzed for this study. As a result of the analysis, improvements were suggested to improve high crash locations. The suggested improvements are the following:

- Advanced overhead signing for the York interchange on the southbound approach to the interchange.
- Modifying the acceleration lane at Wells to I-95 northbound from a taper to a parallel ramp
- A pavement sensor in the northbound lanes just north of the Wells interchange
- A pavement sensor in the southbound lanes north of Mayall Road in New Gloucester

[1] Capacity improvements to the Gray interchange and subsequently the Gray Toll Plaza are currently being studied separately.

- Deer crossing warning signs at Mile 71 north of Shaker Hill
- Sonic Nap Alert Patterns (SNAPS) on the shoulder of the southbound off-ramp in Wells
- Changes to guide signs at Exit 25 southbound off-ramp
- Overhead lane use signs at Exit 48 off-ramps right after the toll plaza

PARK AND RIDE LOTS

All of the park and ride lots owned by the Authority were found to be utilized at a rate of less than 75% of available capacity for every year of the last three years with exceptions of the lots at Gray and Lewiston. The Gray Interchange is currently being studied. Possible relocation of the park and ride lot is part of that study. A new interchange in Lewiston is currently in the 30-year plan. Due to the re-design of the Exit 80interchange, a larger, single, relocated, park and ride lot is being built and is scheduled to be open in late fall 2012.

SPEED EVALUATION

Before a decision is made on maintaining or increasing the speed limit, the horizontal and vertical alignment should be evaluated. However, the evaluation did not find a design criteria and corresponding existing condition that prevents the speed limit from being raised in the section of roadway from Exit 80-102.

OFF SYSTEM NEEDS

The Authority took a proactive approach to identify proposed projects that could adversely affect various aspects of Turnpike operations. The Authority obtained a list of current traffic movement permits, issued by MaineDOT for planned developments in the communities along the Turnpike corridor. The Authority also reviewed MaineDOT's State Transportation Improvement Program (STIP), for projects that may affect the turnpikes operations. Additionally, the Authority sent a letter to communities and Metropolitan Planning Organizations (MPO's) along the Turnpike corridor requesting information regarding existing reports or studies identifying short or long term transportation improvements or problem areas that are adjacent to the Turnpike. The following information received may impact the timeline for capacity improvements.

- Additional traffic generated by the proposed Technology Park will impact Turnpike traffic at and near Exit 47
- The proposed Stroudwater Place Development will also impact Turnpike traffic at and near Exit 47
- The cities of Saco and Scarborough are considering a study that will evaluate traffic congestion in their respective communities.
- Proposed developments along the Haigis Parkway will likely increase traffic volumes at or near Exit 42

A point of considerable interest, which arose during the research for this study, is the possible need for improvements that would involve the need for advanced planning with MaineDOT and local municipalities. These include, but are not limited to:

- Capacity needs on the Piscataqua River Bridge (also includes New Hampshire Department of Transportation)
- Study of traffic congestion in Saco

- Possible improvements to intersections adjacent to the Turnpike in Kittery, Wells, Westbrook, and Biddeford

OTHER STUDIES

Outside of the course of this study, specific projects and issues have been identified that are being analyzed separately. The results of these studies could influence the timeline for capacity improvements on the Turnpike. They include the following studies:

- Relocation of the York Toll Plaza (MM 7.3)
- Improvements to the Gray Interchange (Exit 63)
- Improvements to the Lewiston Interchange (Exit 80)
- Improvements to the Gardiner I-295 Toll Plaza (MM 103.0)
- Exit 103/Route 126 intersection improvements
- Gorham East-West Corridor Feasibility Study
- Central York County Connections Study

2 INTRODUCTION

The following is a system-wide traffic operation and safety study of the Maine Turnpike (Turnpike) by HNTB Corporation, as requested by the Maine Turnpike Authority (Authority). This study includes an assessment of both current and future operating conditions of all interchanges, mainline sections, ramps, and toll plazas on the Turnpike between Kittery and Augusta. This study also includes an assessment of safety for all mainline sections, ramps, toll plazas, and intersections of local roads with Turnpike ramps.

This study is intended to present a broad look at safety and capacity needs on the Turnpike over the next 30 years. The purpose of this study is to provide information on needed capital improvements to help guide the Authority in the drafting of the 30-Year Capital Plan. The Authority may also use this document for other purposes such as:

- Financial planning
- Construction planning
- Engineering
- Operations
- Maintenance
- Overall guidance

The parameters presented within this study include:

- A summary of current design hour traffic volumes (2011) for each mainline and ramp segment between Kittery and Augusta. Design hour volumes are the 30th highest hour traffic volumes of a year.
- A forecast of future design hour traffic volumes at 10, 20, and 30 year horizons using applicable peak hour traffic growth rates and available forecasts.
- A highway and interchange capacity analyses for existing 10, 20, and 30 year design hour traffic volumes for mainline and ramps.
- A toll plaza operational analysis for existing, 10, 20, and 30 year design hour traffic volumes at each existing toll plaza location.
- An analysis of crash data from the most recent three year period for which data are available (2009-2011) along the Turnpike from Kittery to Augusta using data from the Maine Department of Transportation (MaineDOT).
- An analysis of Park and Ride lots adjacent to the Turnpike
- An evaluation of speeds from Exits 80-102
- Information from municipalities adjacent to the Turnpike regarding short or long term transportation improvements or problem areas

A series of recommendations are presented based on the data collected and results of the analyses performed. These include possible future improvements, an approximate time table of when the improvements will become necessary, and an estimate of the forecasted construction costs. Recommendations are also provided to address current safety needs at critical mainline, ramp, and intersection locations along the Turnpike.

It is important to note that, due to limitations in forecasting, the only solution to projected capacity constraints analyzed in this study is the physical addition of capacity. The Authority remains engaged in the ongoing process of exploring options which allow the existing roadway to operate more efficiently which can, in turn, delay the need for additional capacity. Several of these options have already been implemented and are continuously being considered for upgrades. Current programs include the following:

- Programs designed to encourage alternatives to single-occupant vehicles such as carpooling and rideshare through GOMaine, Zoom Bus Turnpike Express and attention to the maintenance and expansion of park and ride lots.
- Utilizing social media to inform Turnpike patrons (who have signed up for the service) of traffic issues on the Turnpike
- VMS (Variable Message Signs) in locations where unexpected changes in traffic flow are being experienced. Common examples are lane closures and detours.
- HAR (Highway Advisory Radio) System. This is a radio frequency which is accessible to patrons at most points along the Turnpike. The AM station is constantly broadcasting. Warnings are broadcast whenever there are traffic delays, construction activity, or weather related issues.
- CCTV (Closed Circuit Television) which is used to continually monitor six areas along the Turnpike. When traffic problems occur, a broadcast can be quickly recorded and played over the HAR system to alert patrons.

These programs are examples of the Authority's ongoing practice of taking a proactive stance when exploring alternative methods to improve capacity constraints.

The limitations in the scope of this study make it important to consider that it is only one of several planning tools used by the Authority. An example of an existing planning tool is the annual inspection report. The annual inspection report is used to determine capital and reserve maintenance needs based on the *physical condition* of the infrastructure assets.

In summary, this study identifies the approximate timeframe and cost for needed capacity and safety improvements on the Turnpike. While other programs and/or policies might be developed to help address safety and capacity, including alternative transportation methods, this report provides information on when these issues will arise and also provides basic estimates for the engineering and construction costs of adding these improvements to the highway.

Maine's Sensible Transportation Policy Act requires transportation agencies to identify and analyze alternatives to widening roadways in order to achieve capacity and safety needs. These alternatives have not been identified as part of this evaluation, however, will be done as a separate planning effort when necessary.

Outside of the course of this study, specific projects and issues have been identified that are being analyzed separately. They include the following studies:

- Relocation of the York Toll Plaza (MM 7.3)
- Improvements to the Gray Interchange (Exit 63)

- Improvements to the Lewiston Interchange (Exit 80)
- Improvements to the Gardiner I-295 Toll Plaza (MM 103.0)
- Exit 103/Route 126 intersection improvements
- Gorham East-West Corridor Feasibility Study
- Central York County Connections Study

Additionally, other possible improvements or projects may involve the need for advanced planning with MaineDOT and local municipalities including:

- Capacity needs on the Piscataqua River Bridge (also includes New Hampshire Department of Transportation)
- Study of traffic congestion in Saco
- Possible improvements to intersections adjacent to the Turnpike in Kittery, Wells, Biddeford, and Westbrook.

This study is written from a 2012 perspective using the most recent data available at the time. This study is an update to the previous Systemwide Traffic Operation and Safety Study that was completed in 2007. It is intended to be a working document which should be updated at regular intervals to account for changes in policy, traffic, and safety.

3 EXISTING CONDITIONS

In 1941, the Maine Turnpike Authority was created as an independent state agency and given the mandate to construct a turnpike "from some point at or near Kittery to a point at or near Fort Kent" as a means to help relieve congestion along coastal Route 1. The legislature intentionally delegated the responsibility for Turnpike construction, operation, and maintenance to the Authority and precluded any financial commitment by the state or federal government.

The original 45 miles of Turnpike from Kittery to Portland was opened to traffic in 1947 and Section II, from Portland to Augusta, was completed in 1955. The northern two-thirds of the 109-mile Turnpike is a four-lane divided highway. The southern one-third is a six-lane divided highway. Turnpike facilities include 177 bridges (defined as any structure greater than 20 feet in length), 19 minor spans (defined as any structure 10-20 feet in length), 19 interchanges, 19 toll plazas, five service areas, nine maintenance facilities, and an administration building which includes retail space for Electronic Toll Collection (ETC), known as E-ZPass, and a State Police headquarters.

The Maine Turnpike is the major north-south highway in the state, extending from Kittery 200 feet north of Spruce Creek, to Augusta just south of Exit 109 (see Figure 3-1). The Turnpike today also includes a three-mile spur to Route 1 and Interstate 295 in Falmouth. The entire length of the Turnpike, from Kittery to Augusta is designated I-95. From Kittery to Portland, the Turnpike is the only interstate highway, making it one of the most critical elements of Maine's transportation network. The Authority is currently reviewing the possibility of purchasing an additional 1.9 miles of interstate from the MaineDOT in Kittery which will extend the Turnpike closer to the New Hampshire state border. For the purposes of this report that section of Interstate 95 is included.

Figure 3-1 – Map of Maine Turnpike

The demands placed on Turnpike facilities are enormous. Its roadways, bridges, interchanges, toll plazas, service areas, and maintenance areas are subjected to increasing stress due to age, traffic, and the demands of the harsh northern New England climate. To ensure the sound condition and effective operation of the Turnpike, the Authority has developed a 30 year plan which merges funding and the implementation of aggressive Operation and Maintenance, Reserve Maintenance, and Capital Improvement programs. The vigilance of the Authority through these programs has resulted in a well-maintained and efficiently operated Turnpike. The Authority will continue to improve Turnpike facilities regarding safety standards and projected demands.

3.1 Data Collection

The Authority collects and organizes extensive amounts of traffic data Turnpike-wide each year. The data being utilized in this study consists of those hourly traffic volumes continuously collected by the Authority's traffic count stations. These stations are located at every interchange and collect data from every on ramp, off ramp and mainline section of highway.

3.2 Traffic Characteristics

From the traffic data, the Authority can better understand the traffic patterns and historic growth of the Turnpike. The data provides information regarding variations throughout the mainline and among the interchanges. For example, some locations experience peak traffic during typical commuting periods, while other locations experience peak traffic that is more recreational or seasonal.

3.2.1 Average Annual Daily Traffic

Average Annual Daily Traffic (AADT) is the total volume of traffic on a highway segment for one year, divided by the number of days in the year. The AADT for 2011 was summarized for each highway segment and interchange ramp along the Turnpike. This AADT data indicates approximately how many vehicles are moving through a section of the mainline on an 'average' day of the year and can assist with future planning by providing a baseline number.

Figure 3-2 provides a tabular summary of AADT for the Turnpike in 2011. Each interchange is illustrated by a cluster of four boxes, each representing a ramp merging or diverging to and from the mainline. The boxes to the left of the center line represent the southbound (SB) ramps and the boxes to the right represent the northbound (NB) ramps. The boxes between each cluster represent the AADT for the section of mainline it is adjacent to. A legend is provided in the bottom right hand corner of the figure.

Figure 3-2 – 2011 AADT Summary

	14,642	**14,989**
Gardiner I-95	10,271	10,618
Exit 103		
	4,370	**4,371**
Gardiner Remote		
Exit 102	744	940
West Gardiner Barrier	**5,115**	**5,312**
Sabattus	491	463
Exit 86	1,590	1,417
	6,214	**6,266**
Lewiston	1,507	1,423
Exit 80	4,430	3,926
	9,137	**8,769**
Auburn	3,691	3,503
Exit 75	4,444	4,229
New Gloucester Barrier	**9,891**	**9,496**
Gray	1,490	1,472
Exit 63	5,897	5,692
	14,298	**13,716**
West Falmouth	1,800	1,838
Exit 53	3,593	3,380
	16,091	**15,258**
Falmouth	1,218	792*
Exit 52	5,558	4,201
	20,431	**18,667**
Portland/Westbrook	3,376	989*
Exit 48	5,775	5,362
	22,831	**23,040**
Rand Rd.	1,089	2,640
Exit 47	3,028	3,114

Legend		
	SB Off	NB On
	SB On	NB Off
	SB Mainline	NB Mainline

*Note: The NB on-ramps of Exits 48 and 52 were closed for part of the year due to construction

	24,770	**23,514**
Congress St./Jetport	5,442	4,980
Exit 46	2,537	2,989
	21,865	**21,523**
South Portland	5,419	5,435
Exit 45	4,781	8,355
	21,227	**24,444**
I-295		
Exit 44	11,715	8,376
	32,942	**32,820**
Scarborough	2,312	2,297
Exit 42	3,196	3,093
	33,826	**33,616**
Saco	8,220	8,158
Exit 36	4,573	4,659
	30,179	**30,117**
Biddeford	8,864	8,861
Exit 32	2,508	2,633
	23,823	**23,889**
Kennebunk	2,959	2,989
Exit 25	1,645	1,632
	22,509	**22,531**
Wells	3,627	3,929
Exit 19	2,930	3,000
York Barrier	**21,812**	**21,602**
Chases Pond Rd. /	1,767	1,750
Route 1 Connector	7,533	7,344
	27,578	**27,196**
Kittery		
Exit 3		6,800
	27,578	**33,996**
Kittery	4,090	4,800
Exit 2	10,370	2,880
	33,858	**32,076**
Dennett Road		
Exit 1	3,230	2,450
	37,088	**34,526**

Figure 3-2 illustrates the following traffic information for the year 2011:

- Total Recorded Vehicles/Day: 206,182
- Northbound Vehicles: 101,463
- Southbound Vehicles: 104,719
- Total Vehicles for 2011: 75,256,430
- The mainline link between the New Hampshire border and Exit 1 carried the heaviest average volume: 71,614 vehicles.
- Wells, Kennebunk, Biddeford and Saco interchanges have heavier traffic volumes to and from the North (Portland area) than to the South.
- All northern interchanges from Rand Rd to Sabattus have heavier traffic volumes to and from the South (Portland area) than to the North.

Table 3-1 compares AADT volumes for all mainline sections from 2001-2011. This data identifies overall growth for each mainline section of the Turnpike as well as the overall growth for the entire Turnpike.

Table 3-1 demonstrates that AADT on the various segments of the Turnpike grew in the early part of the decade until about 2004. Since that time, traffic levels have seen little growth. The section of the Turnpike south of Exit 32 had lower levels of daily traffic in 2011 than in 2001. The traffic levels on most of the mainline sections of the Turnpike north of Exit 32 are about 5-10% higher in 2011 than in 2001.

Table 3-1 – AADT Mainline Volumes (Vehicles/Day)

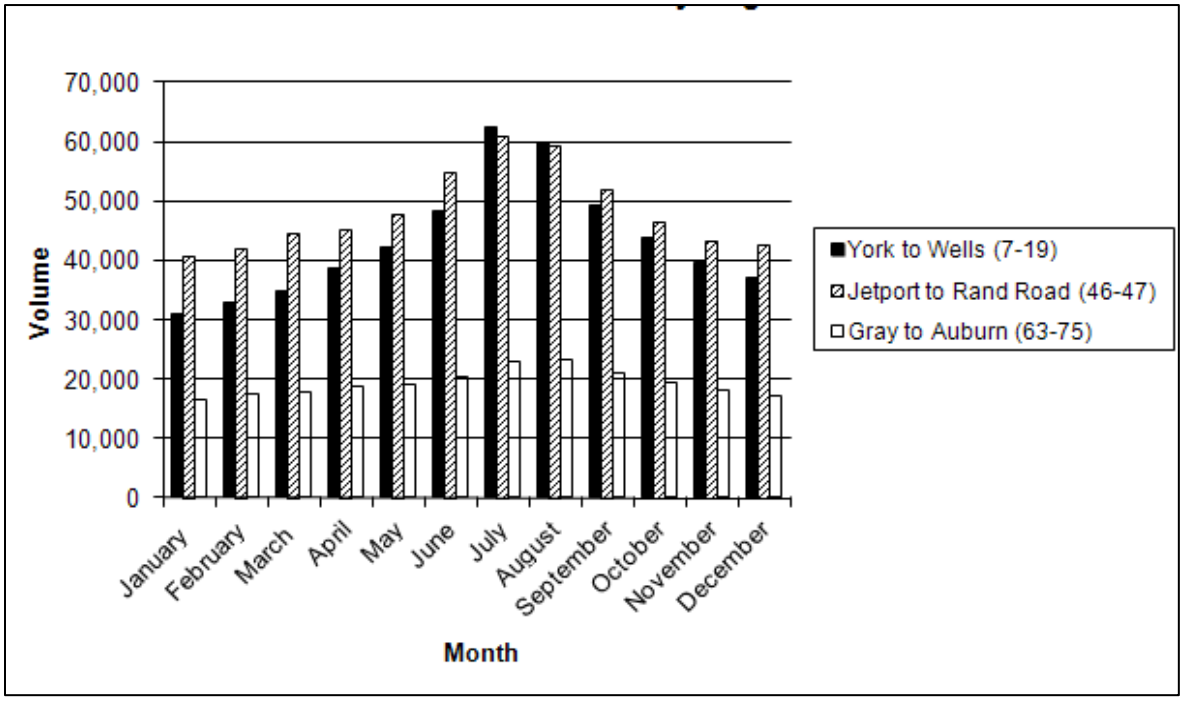
Beginning Exit	Ending Exit	2001	2003	2005	2007	2009	2011	% Change from 01-11
Exit 2 - Kittery	Exit 7 - York	55,465	57,789	56,988	56,963	53,656	54,774	-1.25%
Exit 7 - York	Exit 19 - Wells	43,448	45,630	45,366	45,587	43,046	43,415	-0.08%
Exit 19 - Wells	Exit 25 - Kennebunk	45,083	47,066	47,163	47,534	44,902	45,041	-0.09%
Exit 25 - Kennebunk	Exit 32 - Biddeford	47,973	49,660	50,169	50,843	47,801	47,712	-0.54%
Exit 32 - Biddeford	Exit 36 - Saco	56,752	60,450	61,620	62,939	59,813	60,296	6.24%
Exit 36 - Saco	Exit 42 - Scarborough	62,614	68,337	68,921	69,425	66,247	67,442	7.71%
Exit 42 - Scarborough	Exit 44 - I295	61,546	66,976	67,503	68,136	64,806	65,762	6.85%
Exit 44 - I295	Exit 45 - South Portland	41,817	46,674	47,532	47,376	44,548	45,671	9.22%
Exit 45 - South Portland	Exit 46 - Jetport	39,665	44,746	45,171	45,551	42,170	43,388	9.39%
Exit 46 - Jetport	Exit 47 - Rand Rd	*n/a*	49,812	50,651	51,036	47,237	48,284	-3.07%
Exit 47 - Rand Rd	Exit 48 - Westbrook	43,425	47,660	47,658	47,674	44,000	45,871	5.63%
Exit 48 - Westbrook	Exit 52 - Falmouth	39,594	42,699	42,710	42,006	38,950	39,098	-1.25%
Exit 52 - Falmouth	Exit 53 - West Falmouth	29,841	32,046	34,372	33,950	32,634	31,349	5.05%
Exit 53 - West Falmouth	Exit 63 - Gray	26,960	28,229	30,372	30,102	28,925	28,014	3.91%
Exit 63 - Gray	Exit 75 - Auburn	19,051	20,243	21,641	20,960	20,241	19,387	1.76%
Exit 75 - Auburn	Exit 80 - Lewiston	16,664	17,520	19,682	19,551	18,867	17,906	7.46%
Exit 80 - Lewiston	Exit 86 - Sabattus	*n/a*	*n/a*	13,070	13,195	13,287	12,480	-4.52%
Exit 86 - Sabattus	Exit 102 - Gardiner	9,420	9,453	11,300	11,036	11,055	10,427	10.69%
Exit 102 - Gardiner	Exit 103 - West Gardiner	8,351	8,311	10,068	9,862	9,335	8,742	4.68%
Exit 103 - West Gardiner	Exit 109 - End of Turnpike	28,006	29,317	29,989	30,781	28,920	29,631	5.80%
I-295 Gardiner Toll Barrier Volume		19,655	21,006	19,921	20,918	19,585	20,889	6.28%
Total Trips for Year		**55,662,689**	**60,670,705**	**62,045,274**	**63,387,474**	**59,950,727**	**60,435,771**	**8.58%**

3.2.2 Seasonal Variation

The Turnpike was originally opened with the intention of accommodating seasonal traffic and still exhibits a strong tourism component. It is important to understand the seasonal variations in traffic levels on the Maine Turnpike. Because of fluctuations in traffic levels an average summer weekday is sometimes much higher than an average winter weekday.

To demonstrate how traffic fluctuates seasonally on the Turnpike, three sections of the Turnpike were selected to display traffic variations. The section from the York to Wells Interchanges (miles 7-19) was chosen to represent the southern section of the Turnpike, which receives a lot of summer tourism traffic. The section from the Jetport to Rand Road Interchanges (miles 46-47) was chosen to represent the Portland region, which receives a lot of commuter traffic, but also summer tourism traffic. The section from the Gray to Auburn Interchanges (miles 63-75) represents the northern section, which receives less summer tourism traffic and a fair amount of commuter traffic. The seasonal traffic for each of these sections is shown in Figure 3-3.

Figure 3-3 – Seasonal Variation (Mainline Segments)



A few observations can be drawn from Figure 3-3:

- During the busy summer months of July and August the highest volumes occur in the southern end of the Turnpike.
- During the remaining months (September through June) the 2 lane central section carries higher average traffic volumes.
- All regions peak during the summer tourist season.

- The summer month increase is less dramatic in the central section and the northern section. The southern section increases by over 50% while the central and northern sections increase by 33% and 28%, respectively.
- Approximately 31% of trips on the Turnpike occur during the months of June, July and August.

3.3 Existing Level of Service Analysis

The existing traffic conditions of all merge, diverge, and mainline travel areas (also known as basic freeway segments) were analyzed using current Highway Capacity Manual[2] methods. The existing volume conditions evaluated in this document are the 30th highest volumes occurring in the year 2011 as reported by the Authority's traffic count stations. 30th highest volumes are calculated as the number of vehicles traveling a roadway segment during the 30th ranked hour when the hours are organized from highest volume experienced to lowest. This design hour volume is a common industry standard in highway design.

All results are reported in terms of *Level of Service* (LOS), a qualitative measure describing operational conditions within a traffic stream. LOS is based on service measures such as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience. Letters designate each level ranging from A to F where a LOS of A represents the best operating conditions and LOS F the worst. Most design or planning efforts typically use flow rates at LOS C or D to ensure adequate operating conditions. LOS of F represents unstable flows or a vehicle delay that is considered unacceptable. A more detailed description of LOS can be found in Appendix A. The general methodology and results of the analyses are outlined below.

3.3.1 LOS Analysis Assumptions

The parameters affecting Level of Service analysis consist of lane geometry, free-flow speed, driver familiarity with the roadway, the peak 15 minute traffic volume, and traffic composition (trucks, RV's and passenger car percentages). In this analysis the design hour volume was calculated for the 30th highest hour from the year 2011 data and a peak hour factor of 0.95 was used to compute the peak 15 minute volume. Listed below are the assumptions which were made based on current traffic data to complete the Level of Service analysis.

- Based on previous speed studies taken on the Turnpike, a free-flow speed of 62 mph was used in all zones with a posted speed limit of 55 mph. In 65 mph speed limit zones a free-flow speed of 70 mph was used.
- Driver familiarity is captured in the model through a 'driver population adjustment factor'. A value of 1.0 is used when the drivers during the design hour are very familiar with the roadway i.e. commuter. A roadway with a majority of recreational drivers who are not familiar with the roadway would have a driver factor of 0.85. In order to determine the appropriate driver factor, the 30 busiest hours at each location were analyzed. The following criteria was used:

[2]Transportation Research Board. *Highway Capacity Manual,* Washington, D.C.: 2010

- If most of the 30 busiest hours were related to weekend traffic (Friday PM, Saturday, Sunday, or holidays), a factor of 0.85 was used.
- If the busiest hours were evenly split between weekdays and weekends, a factor of 0.90 was used.
- If the busiest hours were not closely correlated to weekend traffic at all, a factor of 1.00 was used.

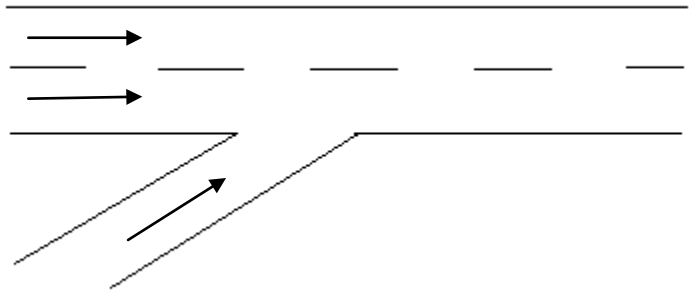
- To determine a reasonable estimate for the ratio of trucks, recreational vehicles, and passenger cars operating on the mainline, average heavy vehicle percentages were obtained from toll plazas on the Turnpike that collect heavy vehicle data. From the traffic data, the following criteria was established:
  - If the design hour is on a weekend afternoon, a ratio of 6% trucks - 3% RV's is used.
  - If the design hour is on a weekday, a ratio of 7% trucks - 2% RV's is used.

The driver population adjustment factors, and the percentages of trucks and recreational vehicles that were used in the analysis, are located in Appendix B.

3.3.2 Interchange Merge Sections

A merge is defined as a movement in which two separate lanes of traffic combine to form a single lane without the aid of traffic signals or other right-of-way controls. In this situation the merge sections analyzed are on ramps at each interchange. The 30th highest hour traffic volumes for both the ramp traffic and the mainline volume were analyzed for every case. A visual representation of a typical merge area is shown in Figure 3-4.

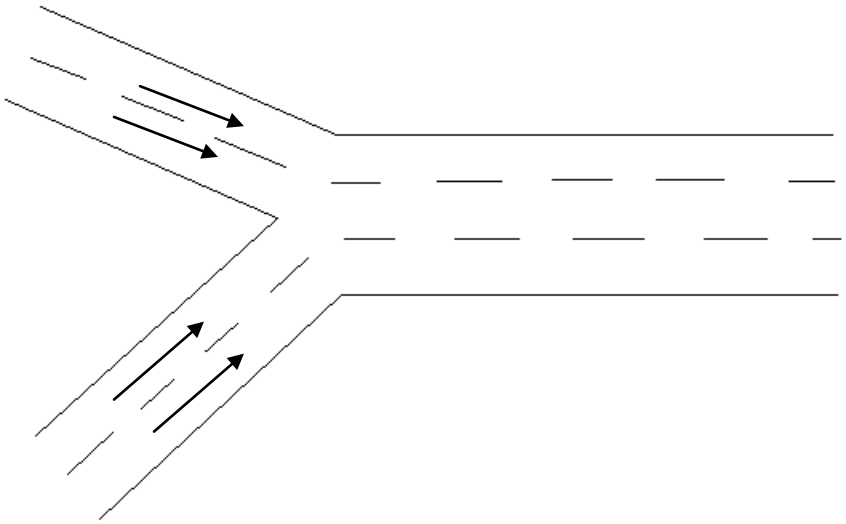
Figure 3-4 – Typical Merge Area



NON-TYPICAL MERGE CASES

The merge point at Exit 103 in the northbound travel lane where I-295 merges with the Turnpike is considered a major merge area and was analyzed as a non-typical case. In a major merge, two primary roadways—each having multiple lanes—merge to form a single freeway segment. A visual of this form of major merge section is shown in Figure 3-5.

Figure 3-5– Major Merge Section



MERGE ANALYSIS RESULTS

Table 3-2 displays both the 30th highest hour 2011 traffic volumes for each on ramp and the corresponding volume on the mainline at that time. It also shows the 30th highest hour traffic volume for the mainline segment at the merge point and the corresponding volume on the on ramp at that time. These volumes were determined by organizing all hourly volumes for a single year and selecting the 30th highest volume. From these volumes the 'worst case scenario' – the situation which produced the lowest level of service at each merge section was selected. The calculations and analysis will be based on these worst case scenario values throughout the remainder of the document. The current LOS values for the worst case scenarios at each merge section are provided in Table 3-3.

SUMMARY OF FINDINGS

As can be seen from Table 3-3, all of the merge areas are currently operating at acceptable levels of service.

Table 3-2– 2011 Volumes at Merge Sections

Location	Exit #	Segment	NB-On 30th High Ramp	NB-On 30th High ML	SB-On 30th High Ramp	SB-On 30th High ML
Kittery	Exit 1	Ramp	*N/A*		*N/A*	*157*
		ML				*4,838*
Kittery	Exit 2	Ramp	*N/A*	*393*	*N/A*	*965*
		ML		*3,680*		*3,578*
York	Exit 7	Ramp	303	*218*	995	*883*
		ML	1,778	*3,366*	3,349	*3,438*
Wells	Exit 19	Ramp	475	*347*	480	*420*
		ML	952	*3,100*	3,478	*3,291*
Kennebunk	Exit 25	Ramp	498	*268*	235	*162*
		ML	1,196	*3,170*	2,280	*3,455*
Biddeford	Exit 32	Ramp	1,322	*827*	255	*235*
		ML	1,495	*3,107*	1,817	*3,335*
Saco	Exit 36	Ramp	1,520	*706*	675	*526*
		ML	1,424	*3,251*	3,547	*3,466*
Scarborough	Exit 42	Ramp	304	*286*	394	*280*
		ML	2,813	*3,559*	3,540	*3,852*
I-295	Exit 44	Ramp	*N/A*		1,454	*1,356*
		ML			2,262	*2,514*
South Portland	Exit 45	Ramp	821	*554*	647	*627*
		ML	1,422	*2,129*	1,390	*2,064*
Jetport	Exit 46	Ramp	838	*809*	506	*627*
		ML	1,769	*2,251*	1,921	*1,965*
Rand Road	Exit 47	Ramp	180	*156*	367	*276*
		ML	2,074	*2,754*	1,803	*2,587*
Riverside	Exit 48	Ramp	385	*361*	615	*550*
		ML	1,872	*2,189*	1,914	*2,141*
Falmouth	Exit 52	Ramp	267	*205*	710	*564*
		ML	1,673	*2,065*	1,510	*2,024*
West Falmouth	Exit 53	Ramp	337	*229*	734	*720*
		ML	1,216	*1,966*	1,689	*1,680*
Gray	Exit 63	Ramp	247	*140*	1,034	*1,041*
		ML	571	*1,031*	899	*920*
Auburn	Exit 75	Ramp	448	*428*	532	*426*
		ML	403	*599*	252	*620*
Lewiston	Exit 80	Ramp	204	*199*	520	*487*
		ML	298	*608*	359	*512*
Sabattus	Exit 86	Ramp	93	*40*	337	*101*
		ML	393	*643*	251	*677*
West Gardiner	Exit 102	Ramp	*N/A*		98	*82*
		ML			625	*617*
Gardiner	Exit 103	Ramp	1,317	*1,317*	*N/A*	
		ML	555	*555*		

Note: ML indicates Mainline.

[1]Not enough count information was provided to develop a 30th highest design hour for the ramp

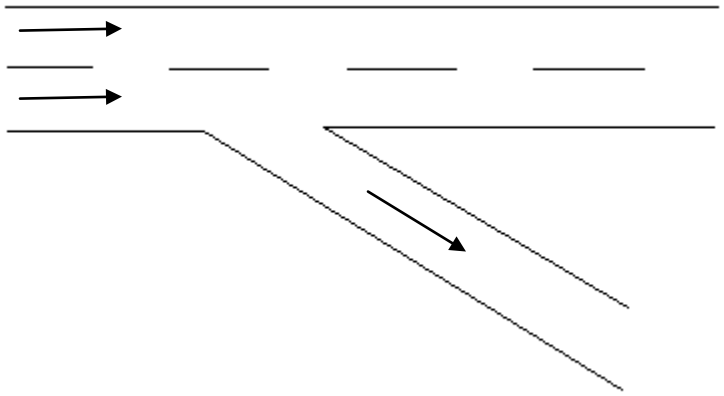
Table 3-3– 2011 LOS at Merge Sections

L:ocation	Exit #	NB-On	SB-On
Kittery	Exit 1	*N/A*	***D***
Kittery	Exit 2	***C***	***D***
Kittery	Exit 3	*N/A*	*N/A*
York	Exit 7	***C***	***D***
Wells	Exit 19	***C***	***C***
Kennebunk	Exit 25	***C***	***C***
Biddeford	Exit 32	***D***	***C***
Saco	Exit 36	***C***	***C***
Scarborough	Exit 42	***C***	***C***
I-295	Exit 44	*N/A*	***C***
S. Portland	Exit 45	***D***	***C***
Jetport	Exit 46	***C***	***C***
Rand Road	Exit 47	***D***	***D***
Riverside	Exit 48	***C***	***C***
Falmouth	Exit 52	***C***	***C***
W. Falmouth	Exit 53	***C***	***C***
Gray	Exit 63	***B***	***C***
Auburn	Exit 75	***B***	***B***
Lewiston	Exit 80	***A***	***B***
Sabattus	Exit 86	***B***	***B***
W. Gardiner	Exit 102	*N/A*	***B***
Gardiner	Exit 103	***B***	*N/A*

3.3.3 Interchange Diverge Sections

A diverge is defined as a movement in which a single traffic stream separates into two traffic streams without the aid of traffic control devices. The diverge sections analyzed are off ramps at each interchange. The 30th highest hour 2011 traffic volumes were found for both the ramp traffic and the mainline traffic. Both of these scenarios were analyzed for every diverge section. A visual representation of a typical diverge area is represented in Figure 3-6.

Figure 3-6 – Typical Diverge Section



NON-TYPICAL DIVERGE CASES

Three interchanges along the Turnpike have diverge areas that are considered non-typical, Exits 36, 44, and 103. These diverge areas were analyzed by methods described in the following sections.

Exit 36

The exit 36 northbound off ramp is preceded by an on ramp which services the Saco Conference Center. Since these two ramps fall within a 1,500 foot distance of each other the area is classified as a weave section and analyzed using a different method. Figure 3-7 depicts a Type A weave area (as defined by the Highway Capacity Manual). Figure 3-8 shows the paths of travel analyzed as inputs.

Figure 3-7– Type A Traffic Weave Segment

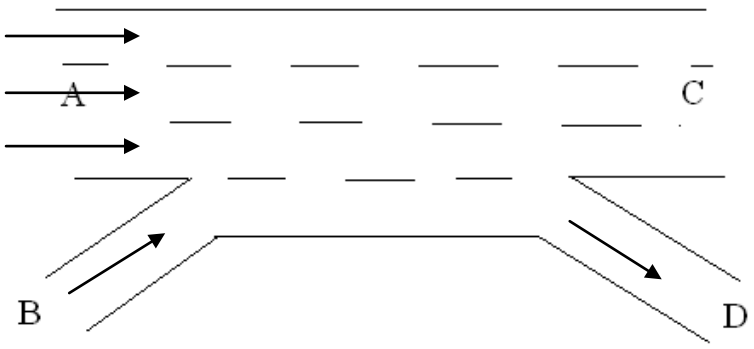
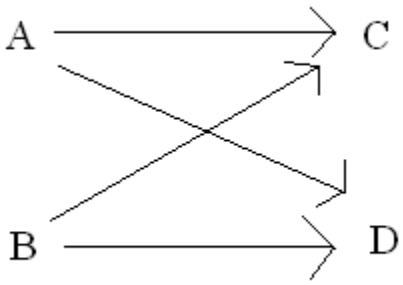


Figure 3-8– Travel Paths in Type A Traffic Weave Segment

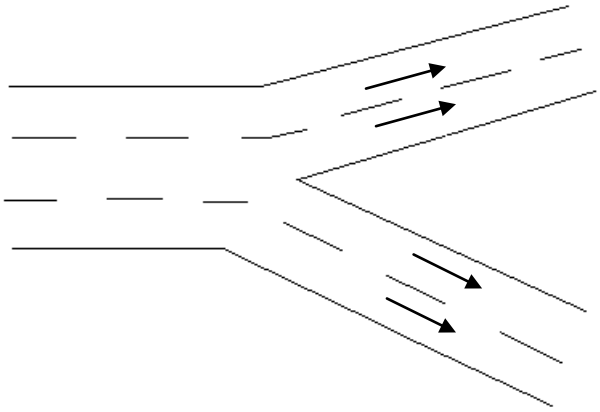


Specific data concerning the volumes of traffic from stations A-D, A-C, B-D, and B-C as shown in the above diagram were not known. The volume from station B-D was assumed to be small amount of traffic, about 5% of the 687 vehicles counted at point D. Volume B-C was assumed to be a traffic volume similar to volume B-D, which is a relatively small fraction compared to the known mainline volume A-C of 3,900 vph.

Exits 44 & 103

Exit 44 in the northbound direction and Exit 103 in the southbound direction are two-lane off ramps. The geometry of this configuration is shown in Figure 3-9.

Figure 3-9– Major Diverge Section



To analyze this case, equation 13-26 from the Highway Capacity Manual was used. The equation reads:

$$D_{MD}=0.0175*V_f/N$$

where

N=number of lanes approaching major diverge

V_f=demand flow rate immediately upstream, of the major diverge influence area (pc/h)

D_{MD}=density in the major diverge influence area (which includes all approaching freeway lanes) in passenger cars/hour

The density value calculated was then converted into a LOS rating using Exhibit 25-4 in the Highway Capacity Manual. The detailed calculations can be found in Appendix C.

Table 3-4 displays the current 30th hour 2011 traffic volumes for each off ramp and the corresponding volume on the mainline at that time. It also shows the 30th highest hour traffic volume for the mainline segment at the point of divergence and the corresponding traffic volume on the off ramp at that time. From these volumes the 'worst case scenario' (the situation which produced the lowest level of service at each diverge section) was selected. The calculations and analysis will be based on these worst case scenario values throughout the remainder of the document. The current LOS values for the worst case scenarios at each diverge section are provided in Table 3-5.

Table 3-4– 2011 Volumes at Diverge Sections

Location	Exit #	Segment	NB-Off		SB-Off	
			30th High Ramp	30th High ML	30th High Ramp	30th High ML
Kittery	Exit 1	Ramp	*N/A*[1]	*101*	*N/A*	
		ML*		*5,099*		
Kittery	Exit 2	Ramp	*N/A*[1]	*208*	*N/A*[1]	*319*
		ML		*4,756*		*4,321*
Kittery	Exit 3	Ramp	*N/A*[1]	*737*	*N/A*	
		ML		*4,548*		
York	Exit 7	Ramp	1,089	*959*	303	*416*
		ML	4,518	*4,281*	3,789	*3,711*
Wells	Exit 19	Ramp	595	*441*	479	*544*
		ML	3,280	*3,584*	1,617	*3,617*
Kennebunk	Exit 25	Ramp	259	*227*	416	*170*
		ML	3,251	*3,447*	1,641	*3,570*
Biddeford	Exit 32	Ramp	323	*298*	1,284	*597*
		ML	2,208	*3,438*	3,256	*3,992*
Saco	Exit 36	Ramp	732	*687*	1,335	*1,299*
		ML	3,637	*3,934*	3,821	*4,132*
Scarborough	Exit 42	Ramp	370	*354*	323	*140*
		ML	2,680	*3,957*	3,651	*3,870*
I-295	Exit 44	Ramp	1,162	*1,105*	*N/A*	
		ML	3,284	*3,845*		
South Portland	Exit 45	Ramp	914	*668*	757	*528*
		ML	2,522	*2,783*	1,936	*2,592*
Jetport	Exit 46	Ramp	602	*188*	1,015	*421*
		ML	1,257	*2,415*	2,792	*2,863*
Rand Road	Exit 47	Ramp	394	*387*	170	*175*
		ML	774	*3,060*	2,364	*2,691*
Riverside	Exit 48	Ramp	695	*706*	506	*426*
		ML	2,937	*2,910*	2,477	*2,588*
Falmouth	Exit 52	Ramp	523	*467*	274	*300*
		ML	2,183	*2,550*	2,231	*2,339*
West Falmouth	Exit 53	Ramp	620	*540*	360	*279*
		ML	2,289	*2,523*	1,208	*1,961*
Gray	Exit 63	Ramp	975	*1,043*	223	*93*
		ML	1,958	*1,948*	913	*1,046*
Auburn	Exit 75	Ramp	557	*504*	456	*363*
		ML	1,091	*1,164*	665	*999*
Lewiston	Exit 80	Ramp	479	*368*	238	*96*
		ML	780	*1,028*	579	*778*
Sabattus	Exit 86	Ramp	265	*241*	82	*78*
		ML	655	*807*	456	*699*
West Gardiner	Exit 102	Ramp	145	*134*	*N/A*	
		ML	616	*683*		
Gardiner	Exit 103	Ramp	*N/A*		1,321	*1,250*
		ML			1,340	*1,876*

Note: ML indicates Mainline.

[1]Not enough count information was provided to develop a 30th highest design hour for the ramp

Table 3-5– 2011 LOS at Diverge Sections

Location	Exit #	NB-Off	SB-Off
Kittery	Exit 1	**D**	*N/A*
Kittery	Exit 2	**D**	**D**
Kittery	Exit 3	**D**	*N/A*
York	Exit 7	**D**	**D**
Wells	Exit 19	**C**	**D**
Kennebunk	Exit 25	**C**	**C**
Biddeford	Exit 32	**C**	**C**
Saco	Exit 36	**D**	**D**
Scarborough	Exit 42	**C**	**C**
I-295	Exit 44	**C**	*N/A*
South Portland	Exit 45	**D**	**B**
Jetport	Exit 46	**C**	**C**
Rand Road	Exit 47	**D**	**C**
Riverside	Exit 48	**D**	**B**
Falmouth	Exit 52	**C**	**B**
West Falmouth	Exit 53	**C**	**B**
Gray	Exit 63	**B**	**A**
Auburn	Exit 75	**A**	**A**
Lewiston	Exit 80	**A**	**A**
Sabattus	Exit 86	**A**	**A**
West Gardiner	Exit 102	**A**	*N/A*
Gardiner	Exit 103	*N/A*	**B**

SUMMARY OF FINDINGS
As can be seen from Table 3-5, under current traffic conditions, all of the diverge areas are operating at acceptable levels of service.

3.3.4 Mainline Travel Sections

A basic freeway segment is defined as a length of freeway facility whose operations are unaffected by weaving, diverging or merging. These occur between all interchanges along the freeway. The parameters affecting this analysis are lane geometry, free-flow speed, an adjustment factor for driver's familiarity with the roadway, and the peak 15 minute volume. In this analysis, the design hour traffic volume was calculated for the 30th highest hour from the year 2011 data and a peak hour factor of 0.95 was used to compute the peak 15 minute volume. Table 3-6 shows the design hour volumes and the level of service for all of the mainline sections of the Turnpike.

SUMMARY OF FINDINGS
All sections of mainline are operating at or above the desired levels of service with the exception of miles 0-2 in the northbound direction and 0-1 in the southbound direction. These are busy 3 lane sections that are also impacted by the adjacent bridge over the Piscataqua River. Traffic between Exits 0-2 is constrained by the Piscataqua River Bridge. Because of capacity issues, coordination with the

New Hampshire Department of Transportation will be needed in the near future concerning the Piscataqua River Bridge.

Table 3-6 – 2011 Volumes and LOS for Mainline Sections

Segment	Northbound Mainline		Southbound Mainline	
	Vol.	LOS	Vol.	LOS
0 to 1	5,099	E	4,995	E
1 to 2	4,756	E	4,543	D
2 to 7	4,281	D	4,321	D
7 to 19	3,584	C	3,711	C
19 to 25	3,447	C	3,617	C
25 to 32	3,438	C	3,570	C
32 to 36	3,934	C	3,992	C
36 to 42	3,957	C	4,132	C
42 to 44	3,845	C	3,870	C
44 to 45	2,783	D	2,691	D
45 to 46	2,683	D	2,592	D
46 to 47	3,060	D	2,863	D
47 to 48	2,910	D	2,691	D
48 to 52	2,550	D	2,588	D
52 to 53	2,523	C	2,400	C
53 to 63	2,195	C	1,961	B
63 to 75	1,171	A	1,046	A
75 to 80	1,028	A	999	A
80 to 86	807	A	778	A
86 to 102	683	A	699	A
102 to 103	547	A	612	A
103 to 109	1,872	B	1,876	B

3.3.5 Summary – Existing Level of Service Analysis

Overall the Maine Turnpike is currently functioning at acceptable Levels of Service.

- All merge segments meet or exceed the LOS grade of D which provides acceptable operating conditions.
- All diverge segments meet or exceed the LOS grade of D which provides acceptable operating conditions.
- Three mainline segments (all of which were located south of Exit 2 in Kittery) received a grade of E which is characterized by significant delays and average travel speeds of 33% or less of the free flow speed. All other segments fell in or above the desired level of service.

4 FUTURE CONDITIONS

Future traffic volumes on the Maine Turnpike were calculated using a fixed annual growth rate. Forecasted 10, 20, and 30 year volumes were compounded annually using the 2011 data as base volumes. The following sections detail the calculations and assumptions used to establish the growth rate and show the forecasted volumes and corresponding levels of service.

Other projects and developments may have an impact on future traffic, such as the Gorham East-West Corridor Study, but those impacts are not yet established. These studies and potential developments are discussed further in Sections 7 and 9.

4.1 Growth Rate Calculations

In order to calculate the forecasted traffic volumes in 10, 20, and 30 years, a peak hour growth rate was determined. A summary of peak hour annual growth rates for all mainline sections on the Turnpike is shown in Table 4-1.

Different regions of the Turnpike have varying growth rates, with most mainline sections growing an average of 0-2% per year. The overall average peak hour growth rate for the Turnpike between 2000 and 2011 was 1.1%. It was decided that the overall annual growth rate of 1.1% for the Turnpike should be used to estimate future peak hour traffic growth instead of varying growth rates for the different regions of the Turnpike. Recent toll rate adjustments have had varying impacts on traffic growth in the different regions of the Turnpike, and it can be expected that the upcoming November 2012 toll adjustment will not have similar impacts to the different regions. The assumed growth rate value of 1.1% is comparable to the traffic growth rate used in recent traffic and revenue projections.

Table 4-1 – Annual Peak Hour Growth Calculations

Region	Link	Direction	30th highest hour					
			2000	*2005*	*2011*	*% Diff '00-'05*	*% Diff '05-'11*	*% Diff '00-'11*
Southern Region	7-19	NB	3,164	3,561	3,584	2.4%	0.11%	1.1%
	7-19	SB	3,292	3,705	3,711	2.4%	0.0%	1.1%
	19-25	NB	3,222	3,369	3,447	0.9%	0.4%	0.6%
	19-25	SB	2,978	3,500	3,617	3.3%	0.5%	1.8%
	25-32	NB	3,052	3,394	3,438	2.1%	0.2%	1.1%
	25-32	SB	3,158	3,517	3,570	2.2%	0.2%	1.1%
	32-36	NB	3,299	3,872	3,934	3.3%	0.3%	1.6%
	32-36	SB	3,442	3,878	3,992	2.4%	0.5%	1.4%
	36-42	NB	3,404	3,923	3,957	2.9%	0.14%	1.4%
	36-42	SB	3,616	4,023	4,132	2.2%	0.4%	1.2%
	42-44	NB	3,304	3,864	3,845	3.2%	-0.1%	1.4%
	42-44	SB	3,851	4,273	3,870	2.1%	-1.64%	0.0%
Central Region	44-45	NB	2,339	2,749	2,783	3.3%	0.2%	1.6%
	44-45	SB	2,396	2,674	2,691	2.2%	0.11%	1.1%
	45-46	NB	2,401	2,633	2,683	1.9%	0.3%	1.0%
	45-46	SB	2,401	2,630	2,592	1.8%	-0.24%	0.7%
	46-47	NB	2,905	3,268	3,060	2.4%	-1.1%	0.5%
	46-47	SB	2,569	2,910	2,863	2.5%	-0.3%	1.0%
	47-48	NB	2,905	3,076	2,910	1.2%	-0.9%	0.0%
	47-48	SB	2,569	2,790	2,691	1.7%	-0.6%	0.4%
	48-52	NB	2,550	2,822	2,550	2.0%	-1.7%	0.0%
	48-52	SB	2,408	2,727	2,588	2.5%	-0.9%	0.7%
	52-53	NB	1,919	2,354	2,523	4.2%	1.2%	2.5%
	52-53	SB	1,980	2,449	2,400	4.3%	-0.3%	1.8%
Northern Region	53-63	NB	1,633	2,011	2,195	4.3%	1.5%	2.7%
	53-63	SB	1,740	2,053	1,961	3.4%	-0.8%	1.1%
	63-75	NB	1,188	1,453	1,171	4.1%	-3.5%	-0.1%
	63-75	SB	1,059	1,198	1,046	2.5%	-2.2%	-0.1%
	75-80	NB	959	1,175	1,027	4.1%	-2.2%	0.6%
	75-80	SB	864	1,067	999	4.3%	-1.1%	1.3%
	80-86	NB	569	876	807	9.0%	-1.4%	3.2%
	80-86	SB	600	834	778	6.8%	-1.2%	2.4%
	86-102	NB	565	781	683	6.7%	-2.2%	1.7%
	86-102	SB	609	775	699	4.9%	-1.7%	1.3%
	102-103	NB	509	718	547	7.1%	-4.4%	0.7%
	102-103	SB	582	736	612	4.8%	-3.0%	0.5%
	103-109	NB	1,695	1,868	1,872	2.0%	0.0%	0.9%
	103-109	SB	1,749	1,814	1,876	0.7%	0.6%	0.6%
				Overall		**2.8%**	**-0.2%**	**1.1%**

4.2 Interchange Merge Sections

A forecasted timeline was established for each merge section regarding when it is expected to receive a Level of Service rating of E and F. LOS E indicates that the section of roadway is at capacity. At LOS E small interruptions in traffic flow can cause traffic congestion. LOS E, therefore, is a good indicator that improvements will need to be made in the near future and the permitting process should begin. The year that a merge section is forecasted to reach LOS F is a desirable time to begin construction. Table 4-2 illustrates this timeline. LOS values in Table 4-2 are based on predicted volumes from the 'worst case scenario' presented in Section 3.3.2. The volumes used as well as a table presenting the 10, 20, and 30 year forecasted levels-of-service can be found in Appendix D.

There are a few important trends to note about Table 4-2:

- Most merge areas will not reach capacity within the 30 year scope.
- All merge areas at Exits 1 and 2 will need attention within the next 30 years.
- The York southbound, Saco southbound, South Portland northbound, Jetport northbound, Rand Road northbound and southbound merge areas are expected to reach capacity within 30 years.

It is possible for either a mainline segment or a ramp segment to reach capacity before the ramp's merge area does. In these cases widening of the segment that is operating at capacity will prevent the predicted merge area failure. A timeline displaying the estimated year for each on-ramp segment to reach capacity is shown in Table 4-3.

The ramp segments were assessed in a different manner than the merge areas. Level-of-service can be calculated for merge areas. Conversely, there is no method for calculating LOS for ramp segments. The ramps were analyzed as having a fixed capacity (1,650 vehicles per lane per hour[3]) and they are either above or below capacity.

Table 4-3 suggests the following on ramp segments are expected to reach capacity within 30 years:

- Exit 2 – Kittery – Southbound
- Exit 32 – Biddeford – Northbound
- Exit 36 – Saco – Northbound
- Exit 44 – I-295 – Southbound

[3] 1,650 vehicles per lane per hour is the observed practical capacity of Turnpike ramps.

Table 4-2 – Year When Merge Areas Reach LOS E and F

Exit #	Location	Ramp	Year Forecasted to reach LOS E	Year Forecasted to reach LOS F
Exit 1	Kittery	SB-On	2022	2024
Exit 2	Kittery	NB-On	2037	2038
		SB-On	2021	2033
Exit 7	York	NB-On	Beyond 2041	Beyond 2041
		SB-On	2021	2035
Exit 19	Wells	NB-On	Beyond 2041	Beyond 2041
		SB-On	2040	Beyond 2041
Exit 25	Kennebunk	NB-On	Beyond 2041	Beyond 2041
		SB-On	Beyond 2041	Beyond 2041
Exit 32	Biddeford	NB-On	2028	Beyond 2041
		SB-On	Beyond 2041	Beyond 2041
Exit 36	Saco	NB-On	Beyond 2041	Beyond 2041
		SB-On	2036	2038
Exit 42	Scarborough	NB-On	Beyond 2041	Beyond 2041
		SB-On	Beyond 2041	Beyond 2041
Exit 44	I-295 (South Portland)	SB-On	Beyond 2041	Beyond 2041
Exit 45	Maine Mall Road (South Portland)	NB-On	2027	2039
		SB-On	Beyond 2041	Beyond 2041
Exit 46	Jetport (Portland)	NB-On	2033	2036
		SB-On	Beyond 2041	Beyond 2041
Exit 47	Rand Road (Portland)	NB-On	2021	2031
		SB-On	2031	2041
Exit 48	Riverside (Portland)	NB-On	2038	Beyond 2041
		SB-On	Beyond 2041	Beyond 2041
Exit 52	Falmouth	NB-On	Beyond 2041	Beyond 2041
		SB-On	Beyond 2041	Beyond 2041
Exit 53	West Falmouth	NB-On	Beyond 2041	Beyond 2041
		SB-On	Beyond 2041	Beyond 2041
Exit 63	Gray	NB-On	Beyond 2041	Beyond 2041
		SB-On	Beyond 2041	Beyond 2041
Exit 75	Auburn	NB-On	Beyond 2041	Beyond 2041
		SB-On	Beyond 2041	Beyond 2041
Exit 80	Lewiston	NB-On	Beyond 2041	Beyond 2041
		SB-On	Beyond 2041	Beyond 2041
Exit 86	Sabattus	NB-On	Beyond 2041	Beyond 2041
		SB-On	Beyond 2041	Beyond 2041
Exit 102	West Gardiner	SB-On	Beyond 2041	Beyond 2041
Exit 103	Gardiner (Major Merge with I-295)	NB-On	Beyond 2041	Beyond 2041

Table 4-3 –Year When Merge Area Ramps Reach Capacity

Exit #	Location	Ramp	Current Volume	Number of Lanes	Ramp Capacity	Year when Expected to Reach Capacity
Exit 1	Kittery	SB-On	452	1	1,650	Beyond 2041
Exit 2	Kittery	NB-On	672	1	1,650	Beyond 2041
		SB-On	1,452	1	1,650	2023
Exit 7	York	NB-On	303	1	1,650	Beyond 2041
		SB-On	995	1	1,650	Beyond 2041
Exit 19	Wells	NB-On	475	1	1,650	Beyond 2041
		SB-On	480	1	1,650	Beyond 2041
Exit 25	Kennebunk	NB-On	498	1	1,650	Beyond 2041
		SB-On	235	1	1,650	Beyond 2041
Exit 32	Biddeford	NB-On	1,322	1	1,650	2031
		SB-On	255	1	1,650	Beyond 2041
Exit 36	Saco	NB-On	1,520	1	1,650	2019
		SB-On	675	1	1,650	Beyond 2041
Exit 42	Scarborough	NB-On	304	1	1,650	Beyond 2041
		SB-On	394	1	1,650	Beyond 2041
Exit 44	I-295	SB-On	1,454	1*	1,650	2023
Exit 45	South Portland	NB-On	821	1	1,650	Beyond 2041
		SB-On	647	1	1,650	Beyond 2041
Exit 46	Jetport	NB-On	838	1	1,650	Beyond 2041
		SB-On	506	1	1,650	Beyond 2041
Exit 47	Rand Road	NB-On	180	1	1,650	Beyond 2041
		SB-On	367	1	1,650	Beyond 2041
Exit 48	Riverside	NB-On	385	1	1,650	Beyond 2041
		SB-On	615	1	1,650	Beyond 2041
Exit 52	Falmouth Spur	NB-On	267	1	1,650	Beyond 2041
		SB-On	710	1	1,650	Beyond 2041
Exit 53	West Falmouth	NB-On	337	1	1,650	Beyond 2041
		SB-On	734	1	1,650	Beyond 2041
Exit 63	Gray	NB-On	247	1	1,650	Beyond 2041
		SB-On	1,034	1	1,650	Beyond 2041
Exit 75	Auburn	NB-On	448	1	1,650	Beyond 2041
		SB-On	532	1	1,650	Beyond 2041
Exit 80	Lewiston	NB-On	204	1	1,650	Beyond 2041
		SB-On	520	1	1,650	Beyond 2041
Exit 86	Sabattus	NB-On	93	1	1,650	Beyond 2041
		SB-On	337	1	1,650	Beyond 2041
Exit 102	West Gardiner	SB-On	98	1	1,650	Beyond 2041
Exit 103	Gardiner	NB-On	1,317	2	3,300	Beyond 2041

*Exit 44 southbound on-ramp is a two-lane ramp that becomes one lane before the merge with the Turnpike. It therefore effectively acts as a one lane ramp.

4.3 Interchange Diverge Sections

A forecasted timeline was established for each diverge section regarding when it is expected to receive a Level of Service rating of E and F. LOS E indicates that the section of roadway is at capacity. At LOS E small interruptions in traffic flow can cause traffic congestion. LOS E, therefore, is a good indicator that improvements will need to be made in the near future and the permitting process should begin. The year that a diverge section is forecasted to reach LOS F is a desirable time to begin construction. Table 4-4 illustrates this timeline. LOS values are based on predicted volumes from the 'worst case scenario' presented in Section 3.3.2. The volumes used as well as a table presenting the 10, 20, and 30 year forecasted Levels of Service can be found in Appendix D.

Table 4-4 illustrates the diverge areas that will receive a Level of Service rating of E or F within the next 30 years. A few important trends to note:

- Four diverge areas within the central portion of the Turnpike between Scarborough and Falmouth are expected to reach capacity within 30 years.
- All of the diverge areas in the town of Kittery are expected to reach capacity within the 30 year scope.
- Within the next 30 years all diverge areas at the Saco interchange are forecasted to experience failing design hour LOS ratings.
- The York northbound off-ramp diverge area is expected to receive a failing LOS grade within 30 years.
- Exits north of Falmouth are not expected to receive a failing LOS grade within 30 years.

It is possible for either a mainline segment or a ramp segment to reach capacity before the ramp's diverge area does. In these cases widening of the segment that is operating at capacity will prevent the predicted diverge area failure. A timeline displaying the estimated year for each off-ramp segment to reach capacity is shown in Table 4-5.

The ramp segments were assessed in a different manner than the diverge areas. Level-of-service can be calculated for diverge areas. Conversely, there is no method for calculating LOS for ramp segments. The ramps were analyzed as having a fixed capacity (in this case 1,650 vehicles per lane per hour[4]) and they are either above or below capacity.

Only two diverge ramps are expected to reach capacity in the next 30 years: Biddeford southbound and Saco southbound.

[4] As stated in footnote 3, 1,650 vehicles per lane per hour is the observed practical capacity of Turnpike ramps.

Table 4-4 – Year When Diverge Areas Reach LOS E and F

Exit #	Location	Ramp	Year Forecasted to reach LOS E	Year Forecasted to reach LOS F
Exit 1	Kittery	NB-Off	2016	2017
Exit 2	Kittery	NB-Off	2019	2024
		SB-Off	2031	2037
Exit 3	Kittery	NB-Off	2017	2028
Exit 7	York	NB-Off	2013	2031
		SB-Off	2033	Beyond 2041
Exit 19	Wells	NB-Off	Beyond 2041	Beyond 2041
		SB-Off	2040	Beyond 2041
Exit 25	Kennebunk	NB-Off	Beyond 2041	Beyond 2041
		SB-Off	Beyond 2041	Beyond 2041
Exit 32	Biddeford	NB-Off	Beyond 2041	Beyond 2041
		SB-Off	2039	Beyond 2041
Exit 36	Saco	NB-Off	2017	2021
		SB-Off	2038	2040
Exit 42	Scarborough	NB-Off	Beyond 2041	Beyond 2041
		SB-Off	Beyond 2041	Beyond 2041
Exit 44	I-295 (South Portland)	NB-Off	Beyond 2041	Beyond 2041
Exit 45	Maine Mall Road (South Portland)	NB-Off	2021	2035
		SB-Off	Beyond 2041	Beyond 2041
Exit 46	Jetport (Portland)	NB-Off	2035	Beyond 2041
		SB-Off	2032	2040
Exit 47	Rand Road (Portland)	NB-Off	2022	2034
		SB-Off	Beyond 2041	Beyond 2041
Exit 48	Riverside (Portland)	NB-Off	2019	2031
		SB-Off	Beyond 2041	Beyond 2041
Exit 52	Falmouth	NB-Off	2033	Beyond 2041
		SB-Off	Beyond 2041	Beyond 2041
Exit 53	West Falmouth	NB-Off	Beyond 2041	Beyond 2041
		SB-Off	Beyond 2041	Beyond 2041
Exit 63	Gray	NB-Off	Beyond 2041	Beyond 2041
		SB-Off	Beyond 2041	Beyond 2041
Exit 75	Auburn	NB-Off	Beyond 2041	Beyond 2041
		SB-Off	Beyond 2041	Beyond 2041
Exit 80	Lewiston	NB-Off	Beyond 2041	Beyond 2041
		SB-Off	Beyond 2041	Beyond 2041
Exit 86	Sabattus	NB-Off	Beyond 2041	Beyond 2041
		SB-Off	Beyond 2041	Beyond 2041
Exit 102	West Gardiner	NB-Off	Beyond 2041	Beyond 2041
Exit 103	Gardiner (Major Merge with I-295)	SB-Off	Beyond 2041	Beyond 2041

Table 4-5 – Year When Diverge Area Ramps Reach Capacity

Exit #	Location	Ramp	Current Volume	Number of Lanes	Ramp Capacity	Year when Expected to Reach Capacity
Exit 1	Kittery	NB-Off	343	1	1,650	Beyond 2041
Exit 2	Kittery	NB-Off	403	1	1,650	Beyond 2041
		SB-Off	573	1	1,650	Beyond 2041
Exit 3	Kittery	NB-Off	952	1	1,650	Beyond 2041
Exit 7	York	NB-Off	1,089	1	1,650	Beyond 2041
		SB-Off	303	1	1,650	Beyond 2041
Exit 19	Wells	NB-Off	595	1	1,650	Beyond 2041
		SB-Off	544	1	1,650	Beyond 2041
Exit 25	Kennebunk	NB-Off	259	1	1,650	Beyond 2041
		SB-Off	416	1	1,650	Beyond 2041
Exit 32	Biddeford	NB-Off	323	1	1,650	Beyond 2041
		SB-Off	1,284	1	1,650	2034
Exit 36	Saco	NB-Off	732	1	1,650	Beyond 2041
		SB-Off	1,335	1	1,650	2030
Exit 42	Scarborough	NB-Off	370	1	1,650	Beyond 2041
		SB-Off	323	1	1,650	Beyond 2041
Exit 44	I-295	NB-Off	1,162	2	3,300	Beyond 2041
Exit 45	South Portland	NB-Off	914	1	1,650	Beyond 2041
		SB-Off	757	1	1,650	Beyond 2041
Exit 46	Jetport	NB-Off	602	1	1,650	Beyond 2041
		SB-Off	1,015	1	1,650	Beyond 2041
Exit 47	Rand Road	NB-Off	394	1	1,650	Beyond 2041
		SB-Off	175	1	1,650	Beyond 2041
Exit 48	Riverside	NB-Off	706	1	1,650	Beyond 2041
		SB-Off	506	1	1,650	Beyond 2041
Exit 52	Falmouth Spur	NB-Off	523	1	1,650	Beyond 2041
		SB-Off	300	1	1,650	Beyond 2041
Exit 53	West Falmouth	NB-Off	620	1	1,650	Beyond 2041
		SB-Off	360	1	1,650	Beyond 2041
Exit 63	Gray	NB-Off	1,043	1	1,650	Beyond 2041
		SB-Off	223	1	1,650	Beyond 2041
Exit 75	Auburn	NB-Off	557	1	1,650	Beyond 2041
		SB-Off	456	1	1,650	Beyond 2041
Exit 80	Lewiston	NB-Off	479	1	1,650	Beyond 2041
		SB-Off	238	1	1,650	Beyond 2041
Exit 86	Sabattus	NB-Off	265	1	1,650	Beyond 2041
		SB-Off	82	1	1,650	Beyond 2041
Exit 102	West Gardiner	NB-Off	145	1	1,650	Beyond 2041
Exit 103	Gardiner	SB-Off	1,321	2	3,300	Beyond 2041

4.4 Mainline Sections

LOS values are based on predicted mainline volumes from Section 3.3.4. A forecasted timeline was established for each mainline section regarding when it is expected to receive a Level of Service rating of E and F. LOS E is a good indicator that improvements will need to be made in the near future and

the permitting process should begin. It is desirable to begin construction before a mainline section reaches LOS F to avoid unreasonable delays and situations which could compromise safety.

Table 4-6 summarizes the calendar years during which each segment is anticipated to be servicing a volume high enough to produce a LOS rating of E and F. The volumes used as well as a table presenting the 10, 20, and 30 year forecasted Levels of Service can be found in Appendix D.

Table 4-6 illustrates which mainline sections of the Turnpike will receive a LOS grade of E or F due to capacity within the next 30 years. Below is a summary of when capacity improvements will be needed:

- Within 10 years:
  - Miles 0-1 between the New Hampshire state line and Kittery in the NB direction.
- Within 20 years:
  - Miles 1-2 between the two Kittery exits in the NB direction
  - Miles 0-2 between the New Hampshire state line and Kittery in the SB direction.
  - Miles 46-48 from the Jetport interchange to the Riverside interchange in the NB direction.
- Within 30 years:
  - Miles 2-7 from Kittery to York in both directions.
  - Miles 44-46 from the I-295 interchange to the Jetport interchange in the NB direction.
  - Miles 44-47 from the I-295 interchange to the Rand Road interchange in the SB direction.

In general, mainline sections for the northbound travel direction reach capacity several years before the southbound travel direction. For the purposes of permitting, the northbound and southbound sections should be grouped together. However, for construction planning, one travel direction on the Turnpike could be widened at a different time from the other.

Table 4-6 - Year When Mainline Segments Reach LOS E and F

Segment	Location	NB Mainline		SB Mainline	
		LOS E	LOS F	LOS E	LOS F
0-1	NH Border to Kittery Exit 1	2008	2020	2010	2022
1-2	Kittery Exit 1 to 2	2015	2026	2019	2030
2-7	Kittery to York	2024	2036	2023	2035
7-19	York to Wells	2040	Beyond 2041	2037	Beyond 2041
19-25	Wells to Kennebunk	Beyond 2041	Beyond 2041	2040	Beyond 2041
25-32	Kennebunk to Biddeford	Beyond 2041	Beyond 2041	2041	Beyond 2041
32-36	Biddeford to Saco	2032	Beyond 2041	2031	Beyond 2041
36-42	Saco to Scarborough	2036	Beyond 2041	2032	Beyond 2041
42-44	Scarborough to I-295	2039	Beyond 2041	2038	Beyond 2041
44-45	I-295 to Maine Mall Rd.	2021	2034	2024	2037
45-46	Maine Mall Rd. to Jetport	2025	2038	2028	2040
46-47	Jetport to Rand Rd.	2012	2025	2024	2037
47-48	Rand Rd. to Riverside	2017	2030	2029	Beyond 2041
48-52	Riverside to Falmouth	2029	Beyond 2041	2033	Beyond 2041
52-53	Falmouth to West Falmouth	2035	Beyond 2041	Beyond 2041	Beyond 2041
53-63	West Falmouth to Gray	Beyond 2041	Beyond 2041	Beyond 2041	Beyond 2041
63-75	Gray to Auburn	Beyond 2041	Beyond 2041	Beyond 2041	Beyond 2041
75-80	Auburn to Lewiston	Beyond 2041	Beyond 2041	Beyond 2041	Beyond 2041
80-86	Lewiston to Sabattus	Beyond 2041	Beyond 2041	Beyond 2041	Beyond 2041
86-102	Sabattus to West Gardiner	Beyond 2041	Beyond 2041	Beyond 2041	Beyond 2041
102-103	West Gardiner to Gardiner	Beyond 2041	Beyond 2041	Beyond 2041	Beyond 2041
103-109	Gardiner to End of Turnpike	Beyond 2041	Beyond 2041	Beyond 2041	Beyond 2041

*The mainline segment from Spruce Creek to the York Interchange will eventually be metered by the number of lanes on the Piscataqua Bridge at the NH border. This bottleneck effect may cause growth in this region to slow and keep LOS volumes from reaching a failing grade when anticipated. It is recommended that this area be monitored and assessed during the coming years.

4.5 Summary of Future Conditions

Table 4-7 and Table 4-8 each present a year-by-year summary of when each interchange, mainline, and ramp on the Turnpike is forecasted to reach LOS F. The evaluated areas include on- and off-ramps, diverge and merge areas, and mainline segments.

Table 4-7 – Areas between Kittery & Exit 44 Reaching LOS F, 2011-2041

Physical Location	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
NH Border to Exit 1 (Kittery)						NB ML		SB ML																			
Exit 1 - Dennett Road			NB-Off Diverge Area							SB-On Merge Area																	
Exit 1 to Exit 2 (Kittery)												NB ML				SB ML											
Exit 2 - Kittery									SB-On Ramp	NB-Off Diverge Area (Exit 2)				NB-Off Diverge Area (Exit 3)					SB-On Merge Area				SB-Off Diverge Area	NB-On Merge Area			
Kittery to York (2-7)																					SB ML	NB ML					
York Exit 7																	NB-Off Diverge Area				SB-On Merge Area						
York to Wells (7-19)																											
Wells Exit 19																											
Wells to Kennebunk (19-25)																											
Kennebunk Exit 25																											
Kennebunk to Biddeford (25-32)																											
Biddeford Exit 32																	NB-On Ramp			SB-Off Ramp							
Biddeford to Saco (32-36)																											
Saco Exit 36					NB-On Ramp		NB-Off Diverge Area									SB-Off Ramp								SB-On Merge Area		SB-Off Diverge Area	
Saco to Scarborough (36-42)																											
Scarborough Exit 42																											
Scarborough to I-295 (42-44)																											
I-295 Exit 44									SB-On Ramp																		

Table 4-8 – Areas between Exit 44 & Augusta Reaching LOS F during Years 2011-2041[1]

Physical Location	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
I-295 to South Portland (44-45)																				NB ML			SB ML				
South Portland Exit 45																					NB-Off Diverge Area				NB-On Merge Area		
South Portland to Jetport (45-46)																								NB ML		SB ML	
Jetport Exit 46																						NB-On Merge Area				SB-Off Diverge Area	
Jetport to Rand Road (46-47)											NB ML												SB ML				
Rand Road Exit 47																	NB-On Merge Area			NB-Off Diverge Area							SB-On Merge Area
Rand Road to Riverside (47-48)																NB ML											
Riverside Exit 48																	NB-Off Diverge Area										
Riverside to Falmouth (48-52)																											
Falmouth Exit 52																											
Falmouth to West Falmouth (52-53)																											
West Falmouth Exit 53																											
West Falmouth to Gray (53-63)																											
Gray Exit 63																											
Gray to Auburn (63-75)																											
Auburn Exit 75																											
Auburn to Lewiston (75-80)																											
Lewiston Exit 80																											
Lewiston to Sabattus (80-86)																											
Sabattus Exit 86																											
Sabattus to West Gardiner (86-102)																											
West Gardiner Exit 102																											
West Gardiner to Gardiner (102-103)																											
Gardiner Exit 103																											
Gardiner to End of Turnpike (103-109)																											

1 The timeline for capacity improvements in the Portland area could be affected by the results of the Gorham East-West Corridor Feasibility Study

As can be seen from Table 4-7 and Table 4-8, a few large project groups that may be reasonably planned together include the following:

- The southern portion of the mainline from the New Hampshire state line to the York interchange may need to be widened beginning in 2017.
- The Saco interchange may need to be updated beginning in 2019.
- The SB I-295 Exit 44 on ramp may need to be widened to accommodate two merging lanes in the year 2023.
- The Portland area widening, from Exit 44 (I-295) to Exit 48 (Westbrook), may need to begin in the year 2025 to avoid capacity constraints.
- The Biddeford interchange may need to be updated beginning in 2031.

5 PARK AND RIDE ANALYSIS

The Authority builds and maintains eleven Park and Ride lots for patrons. The MaineDOT maintains an additional six Park and Ride lots located adjacent to the Turnpike. As a result, a Park and Ride lot is located near most Turnpike interchanges.

Every year a survey of Park and Ride lot usage is conducted in conjunction with the Authority's annual report[5]. The count is always completed in the spring, generally during the months of April or May. Vehicle counts at each lot are taken during the mid-day hours (9am-3pm) on weekdays in order to capture commuting vehicles. This count is performed as a way to monitor lot usage; although, it only provides a snapshot of the overall usage of the lots. The location, capacity, and historical usage of each lot are shown in Table 5-1. Table 5-2 shows the utilization of the park and ride lots since 2001.

[5] Additionally, the Authority in coordination with MaineDOT count all of the Park and Ride lots in the State of Maine bi-annually

Table 5-1– Park and Ride Locations, Capacities & Usage

Town	Location	Owner	Capacity	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
York	Chases Pond Road, US-1 Connector	MaineDOT	26	20	17	16	9	15	8	11	26	22	16	15	26
Wells	Maine Turnpike Exit 19, adj. to Wells Trans Ctr.	MTA	100	35	30	32	16	30	33	49	54	70	56	35	34
Kennebunk	Maine Turnpike Exit 25 SB, on Rt. 35	MTA	52	24	24	22	19	28	26	19	22	35	27	33	31
Biddeford	Maine Turnpike Exit 32, on Rt. 111	MTA	155	138	115	114	105	137	99	120	100	108	111	109	90
Saco	I-195 Exit 1, on Industrial Park Road	MaineDOT	135	112	105	94	98	113	117	106	110	103	87	113	123
Saco	I-195 Exit 1, overflow lot off Rte. 112	MaineDOT	52												2
Scarborough	Maine Turnpike Exit 42, adj. to toll plaza	MTA	65	25	16	13	24	30	18	27	17	23	20	30	26
South Portland	Maine Turnpike Exit 45, on Rt. 703	MaineDOT	111	24	23	42	29	32	22	24	28	20	26	32	37
Portland	Maine Turnpike Exit 46, adj. to toll plaza	MTA	68	8	14	8	21	17	17	21	20	19	25	8	21
Westbrook	Larrabee Road, near Maine Turnpike Exit 47	MaineDOT	91			46	43	43	51	43	53	47	36	26	48
W. Falmouth	Maine Turnpike Exit 53, adj. to toll plaza	MTA	19	4	14	15	14	19	13	15	20	15	12	6	8
Gray	Maine Turnpike Exit 63, on US-202	MTA	75	45	29	41	57	59	46	34	77	50	68	57	64
Auburn	Maine Turnpike Exit 75, on US-202	MTA	137	57	81	75	68	92	76	71	106	72	71	94	82
Lewiston-1	Maine Turnpike Exit 80 NB on Plourde Pkwy	MTA	62	26	44	41	53	38	56	28	47	27	25	35	60
Lewiston-2	Maine Turnpike Exit 80 SB on Plourde Pkwy	MTA	27	16	17	23	22		21	21	28	22	20	26	25
Sabattus	Maine Turnpike Exit 86, intersection of Rt. 9 & 126	MaineDOT	30												26
W. Gardiner	Maine Turnpike Exit 102, near Rt. 126	MTA	54		25	28	34	43	27	28	50	29	25	24	30

A few things to note about Table 5-1 are:

- In 2012, 733 vehicles were counted in lots located throughout the Maine Turnpike corridor, which is about 58% of the available capacity of the Park & Ride lots.
- The Saco lot was recently expanded to include a second lot near Route 112. This lot is not heavily used yet, possibly due to patrons not being aware of its location.
- Though the Sabattus lot has been open for several years, this is the first year this lot was counted as part of the Maine Turnpike's annual inspection.

Table 5-2 – Surveyed Percent Usage of Park & Ride Lots

Town	Location	Owner	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
York	Chases Pond Road, US-1 Connector	MaineDOT	77%	65%	62%	35%	58%	31%	42%	100%	85%	62%	58%	100%
Wells	Maine Turnpike Exit 19, adj. to Wells Trans Ctr.	MTA	35%	30%	32%	16%	30%	33%	49%	54%	70%	56%	35%	34%
Kennebunk	Maine Turnpike Exit 25 SB, on Rt. 35	MTA	46%	46%	42%	37%	54%	50%	37%	42%	67%	52%	63%	60%
Biddeford	Maine Turnpike Exit 32, on Rt. 111	MTA	89%	74%	74%	68%	88%	64%	77%	65%	70%	72%	70%	58%
Saco	I-195 Exit 1, on Industrial Park Road	MaineDOT	83%	78%	70%	73%	84%	87%	79%	81%	76%	64%	84%	91%
Saco	I-195 Exit 1, overflow lot off Rte. 112	MaineDOT												4%
Scarborough	Maine Turnpike Exit 42, adj. to toll plaza	MTA	109%	70%	57%	104%	130%	78%	117%	74%	35%	31%	46%	40%
South Portland	Maine Turnpike Exit 45, on Rt. 703	MaineDOT	22%	21%	38%	26%	29%	20%	22%	25%	18%	23%	29%	33%
Portland	Maine Turnpike Exit 46, adj. to toll plaza	MTA	12%	21%	12%	31%	25%	25%	31%	29%	28%	37%	12%	31%
Westbrook	Larrabee Road, near Maine Turnpike Exit 47	MaineDOT			51%	47%	47%	56%	47%	58%	52%	40%	29%	53%
W. Falmouth	Maine Turnpike Exit 53, adj. to toll plaza	MTA	21%	74%	79%	74%	100%	68%	79%	105%	79%	63%	32%	42%
Gray	Maine Turnpike Exit 63, on US-202	MTA	60%	39%	55%	76%	79%	61%	45%	103%	67%	91%	76%	85%
Auburn	Maine Turnpike Exit 75, on US-202	MTA	42%	59%	55%	50%	67%	55%	52%	77%	53%	52%	69%	60%
Lewiston-1	Maine Turnpike Exit 80 NB on Plourde Pkwy	MTA	42%	71%	66%	85%	61%	90%	45%	76%	44%	40%	56%	97%
Lewiston-2	Maine Turnpike Exit 80 SB on Plourde Pkwy	MTA	59%	63%	85%	81%		78%	78%	104%	81%	74%	96%	93%
Sabattus	Maine Turnpike Exit 86, intersection of Rt. 9 & 126	MaineDOT												87%
W. Gardiner	Maine Turnpike Exit 102, near Rt. 126	MTA		46%	52%	63%	80%	50%	52%	93%	54%	46%	44%	56%

Note: Highlighted cells indicate the surveyed usage was found to be greater than 75%.

Some historical trends and information for the Turnpike's lots were observed when looking over the last 12 years:

- The lots that have the most available capacity and not currently a concern are Wells, Kennebunk, Scarborough (which was recently expanded), and Portland/Jetport.
- The Biddeford lot does not seem to be in need of immediate expansion even though the percent usage was above 75% three times between 2001 and 2007. In the past five years the counts have declined. This lot should be watched closely, if usage rebounds capacity may become an issue.
- The Saco lot on Industrial Park road is well utilized (over 75% of capacity in 9 of the last 12 years). This lot is DOT owned. The DOT has recently constructed a smaller lot nearby on Route 112 in response to the heavy demand.
- The West Falmouth lot does not seem to be in need of immediate expansion even though the percent usage was above 75% five times between 2003 and 2009. In the past three years the counts have declined considerably. This lot has been studied in the past. It was determined that the lot cannot be expanded at its current location and that no suitable nearby sites were found for another park and ride lot.
- The Gray lot has been above 75% of capacity for four out of the last five years. The Gray Interchange is being studied. Possible relocation of the park and ride lot is part of that study.
- The Auburn lot has exceeded 75% of its capacity in only one of the years studied.
- The two lots near the Lewiston exit are consistently above 75% capacity. A new interchange in Lewiston is currently in the 30-year plan. Due to the re-design of the Exit 80 interchange, a larger, single, relocated, park and ride lot is being built and is scheduled to be open late fall 2012
- The West Gardiner lot was counted at 80% and 93% capacity in 2005 and 2008, respectively. Since 2009 usage has been closer to 50% and no longer appears to be a problem.

Some historical trends and information for the MaineDOT owned lots can also be recognized when looking over the last 12 years:

- The lots that are least used and not currently a concern are the newly created Saco (Route 112), South Portland, and Westbrook.
- Usage at the York lot has been above 75% of capacity during 3 of the last 5 years.
- The Saco lot on Industrial Park road is well utilized (over 75% of capacity in 9 of the last 12 years). The DOT has recently constructed a smaller lot nearby on Route 112 in response to the heavy demand.
- The Sabattus lot was surveyed at 87% of capacity in 2012 but there is no historical data to verify this as a trend.

6 TOLL PLAZA ANALYSIS

The Maine Turnpike Authority operates 19 toll plazas. Six of these plazas are located on the highway itself, tolling traffic in both directions. These larger plazas, sometimes referred to as "mainline toll plazas", range in size from 6 lanes to 17 lanes. The remaining 13 plazas are located on various interchange ramps and are responsible for tolling patrons that enter the Turnpike. These "side toll plazas" do not collect tolls on the lanes that exit the Turnpike. These smaller plazas are between 2 and 4 tolled lanes wide. Table 6-1 summarizes the MTA's toll plaza locations and sizes.

Table 6-1 –Toll Plaza Location and Size Summary

Mainline Toll Plazas		**Side Toll Plazas**	
Location	*# of Lanes*	*Location*	*# of Lanes*
York	17	Wells (Exit 19)	2
I-295 (Exit 44)	8	Kennebunk (Exit 25-NB Ramp)	2
Falmouth Spur	6	Kennebunk (Exit 25-SB Ramp)	2
New Gloucester	10	Biddeford (Exit 32)	3
W. Gardiner (I-95)	8	Saco (Exit 36)	3
Gardiner (I-295)	7	Scarborough (Exit 42)	3
		South Portland (Exit 45)	4
		Jetport (Exit 46-NB Ramp)	2
		Jetport (Exit 46-SB Ramp)	2
		Rand Rd. (Exit 47)	3
		Riverside (Exit 48)	4
		W. Falmouth (Exit 53)	2
		Gray (Exit 63)	2

The purpose of HNTB's analysis was to identify which (if any) plazas will need to be expanded or otherwise improved over the next 30 years. The scope of the analysis covered all plazas except York, W. Gardiner (I-95), and Gardiner (I-295). These plazas are being evaluated under two separate ongoing studies.[6]

The toll plaza analysis involved three basic steps for each toll plaza:

- First, the design-hour volume for 2011 was identified. In keeping with standard traffic engineering practice, the design hour volume is considered to be the 30th highest hour experienced by the plaza over a year. The design hour volume was broken down into two categories:
  - Cash patrons (i.e. patrons that hand a cash fare directly to a toll attendant)
  - ETC patrons (i.e. patrons that pay their fare via Electronic Toll Collection)

[6] Gray Interchange is also currently being studied which may result in moving the southbound ramps and toll plaza to the west side of the Turnpike.

- Second, the current-year design hour volumes were projected out over a 30-year period, from 2011 through 2041. This required estimating both the *overall* growth in traffic levels and the growth of ETC usage over time.
- Third, the volume-to-capacity ratio was calculated for each year between 2011 and 2041. The evaluation was based on the existing configuration of the toll plaza (that is, the existing mix of cash and dedicated E-ZPass lanes). If at any time a plaza's demand exceeded its capacity—that is, if the volume-to-capacity ratio was greater than one—then the plaza was identified as being in need of improvement.

6.1 Design-Hour Volume Summary

Table 6-2 identifies the design hour volumes (DHV's) for each plaza in 2011. The table also identifies the day of the week on which the design hour volume typically occurs. At the mainline toll plazas, both the northbound and southbound DHV's are provided.

Table 6-2 – Toll Plaza Design-Hour Volume Summary

Location	Peak Period	Design Hour Volume			%ETC
		Cash	*ETC*	*Total*	
Mainline Toll Plazas *(excluding York, W. Gardiner (I-95), and Gardiner (I-295)*					
I-295 (SB entering Tpk)	Summer Weekend (PM)	511	921	1,432	64.3%
I-295 (NB exiting Tpk)	Spring/Fall Weekday (AM)	440	671	1,111	60.4%
Falmouth Spur (entering Tpk)	Summer Weekend (Midday)	385	450	835	53.9%
Falmouth Spur (exiting Tpk)	Summer Weekend (Midday)	314	455	768	59.2%
New Gloucester (NB)	Summer Friday (PM)	487	411	898	45.8%
New Gloucester (SB)	Summer Sunday (Midday)	576	474	1,050	45.1%
Side Toll Plazas					
Wells	Summer Weekend (PM)	199	240	439	54.7%
Kennebunk (NB Ramps)	Spring/Fall Weekday (AM)	87	411	498	82.4%
Kennebunk (SB Ramps)	Summer Sunday (Midday)	97	156	253	61.6%
Biddeford	Spring/Fall Weekday (AM)	362	1,158	1,520	76.2%
Saco	Spring/Fall Weekday (AM)	440	1,531	1,971	77.7%
Scarborough	Summer Weekday (PM)	255	413	668	61.8%
South Portland	Summer Weekday (PM)	467	1,004	1,471	68.3%
Jetport (NB Ramps)	Weekday (PM)	213	716	930	77.1%
Jetport (SB Ramps)	Weekday (PM)	91	430	521	82.5%
Rand Road	Weekday (PM)	241	448	689	65.0%
Riverside Street	Summer Friday (PM)	351	449	800	56.1%
West Falmouth	Spring/Fall Weekday (AM)	155	749	904	82.9%
Gray	Spring/Fall Weekday (AM)	256	783	1,039	75.4%

The following observations may be drawn from Table 6-2:

- The side toll plazas tend to experience their peak volumes during weekdays. This is because these plazas serve a significant number of commuters, and commuting volumes are higher on

weekdays than weekends. By contrast, mainline toll plazas serve a greater proportion of recreational travelers from out-of-state, and these customers tend to travel in greater numbers on weekends.

- The side toll plazas tend to have a higher percentage of ETC usage during peak periods, as compared to the mainline toll plazas. In fact, seven of the thirteen side toll plazas have design-hour ETC usage in the 75-85% range. The design-hour ETC usage exceeds 60% at all but one side toll plaza (Riverside St.).
- The busiest side toll plaza is Saco, which has 3 lanes serving nearly 2,000 vehicles during the design hour.
- Three side toll plazas (Jetport NB, W. Falmouth, and Gray) serve over 900 design-hour vehicles despite only having two lanes. This is only possible because of the high level of ETC usage.

6.2 Toll Plaza Traffic Projections

After identifying the current-year design hour volumes, it was necessary to develop 30-year projections. These projections would serve as the basis for the plaza capacity analysis.

The projections were based on the following assumptions:

- Design-hour traffic would grow at an annual rate of 1.1% for all locations, consistent with the growth rate documented in Section 4.1.
- The percentage of ETC traffic would increase over time. However, this rate of increase would decline over time, and it would reach a practical maximum value of 80%.

Table 6-3 provides a year-by-year projection of design-hour volumes and ETC usage for each mainline toll plaza through 2041. Table 6-4 provides the same information for the side toll plazas. **The plazas at York, West Gardiner and Gardiner are not included in this analysis; separate detailed studies are being completed to address these locations.**

All volumes are based on 2011 data, since 2011 was the last full calendar year for which toll plaza data was available. The only exceptions to this are the plazas at Exit 47 (Rand Rd.) and Exit 48 (Riverside St.). The volumes at these plazas are based on 2010 data. This is because the 2011 data at these plazas was distorted by construction at Exit 48. Since the northbound on-ramp at Exit 48 was closed for most of 2011, a significant volume of traffic shifted from Exit 48 over to Exit 47. Once the northbound on-ramp re-opened in November 2011, traffic patterns at both plazas returned to normal.

Table 6-3 - Mainline Toll Plaza Design Hour Traffic Projections

Year	I-295 (NB)		I-295 (SB)		Falmouth Spur (Enter)		Falmouth Spur (Exit)		New Gloucester (NB)		New Gloucester (SB)	
	Vol.	ETC%	Vol.	ETC%	Vol.	ETC%	Vol.	ETC%	Vol.	ETC%	Vol.	ETC%
2011	1,111	60.4%	1,432	64.3%	835	53.9%	768	59.2%	1,175	61.8%	1,047	45.1%
2012	1,123	61.6%	1,448	65.1%	844	56.0%	777	61.3%	1,188	63.1%	1,059	47.2%
2013	1,135	62.9%	1,464	66.0%	853	58.2%	786	62.6%	1,201	64.3%	1,071	49.4%
2014	1,147	64.1%	1,480	66.8%	862	60.3%	795	63.8%	1,214	65.6%	1,083	51.5%
2015	1,160	65.4%	1,496	67.6%	871	61.6%	804	65.1%	1,227	66.8%	1,095	53.7%
2016	1,173	66.6%	1,512	68.5%	881	62.8%	813	66.3%	1,240	68.1%	1,107	55.8%
2017	1,186	67.9%	1,529	69.3%	891	64.1%	822	67.6%	1,254	69.3%	1,119	58.0%
2018	1,199	69.1%	1,546	70.2%	901	65.3%	831	68.8%	1,268	70.6%	1,131	60.1%
2019	1,212	70.4%	1,563	71.1%	911	66.6%	840	70.1%	1,282	71.8%	1,143	61.4%
2020	1,225	71.6%	1,580	72.0%	921	67.8%	849	71.3%	1,296	73.1%	1,156	62.6%
2021	1,238	72.9%	1,597	72.8%	931	69.1%	858	72.6%	1,310	74.3%	1,169	63.9%
2022	1,252	74.1%	1,615	73.8%	941	70.3%	867	73.8%	1,324	75.6%	1,182	65.1%
2023	1,266	75.4%	1,633	74.7%	951	71.6%	877	75.1%	1,339	76.8%	1,195	66.4%
2024	1,280	76.6%	1,651	75.6%	961	72.8%	887	76.3%	1,354	77.2%	1,208	67.6%
2025	1,294	77.0%	1,669	76.6%	972	74.1%	897	76.7%	1,369	77.6%	1,221	68.9%
2026	1,308	77.4%	1,687	76.9%	983	75.3%	907	77.1%	1,384	78.0%	1,234	70.1%
2027	1,322	77.8%	1,706	77.2%	994	76.6%	917	77.5%	1,399	78.4%	1,248	71.4%
2028	1,337	78.2%	1,725	77.5%	1,005	77.0%	927	77.9%	1,414	78.8%	1,262	72.6%
2029	1,352	78.6%	1,744	77.8%	1,016	77.4%	937	78.3%	1,430	79.2%	1,276	73.9%
2030	1,367	79.0%	1,763	78.1%	1,027	77.8%	947	78.7%	1,446	79.6%	1,290	75.1%
2031	1,382	79.4%	1,782	78.4%	1,038	78.2%	957	79.1%	1,462	80.0%	1,304	76.4%
2032	1,397	79.8%	1,802	78.7%	1,049	78.6%	968	79.5%	1,478	80.0%	1,318	76.8%
2033	1,412	80.0%	1,822	79.0%	1,061	79.0%	979	79.9%	1,494	80.0%	1,332	77.2%
2034	1,428	80.0%	1,842	79.4%	1,073	79.4%	990	80.0%	1,510	80.0%	1,347	77.6%
2035	1,444	80.0%	1,862	79.7%	1,085	79.8%	1,001	80.0%	1,527	80.0%	1,362	78.0%
2036	1,460	80.0%	1,882	80.0%	1,097	80.0%	1,012	80.0%	1,544	80.0%	1,377	78.4%
2037	1,476	80.0%	1,903	80.0%	1,109	80.0%	1,023	80.0%	1,561	80.0%	1,392	78.8%
2038	1,492	80.0%	1,924	80.0%	1,121	80.0%	1,034	80.0%	1,578	80.0%	1,407	79.2%
2039	1,508	80.0%	1,945	80.0%	1,133	80.0%	1,045	80.0%	1,595	80.0%	1,422	79.6%
2040	1,525	80.0%	1,966	80.0%	1,145	80.0%	1,056	80.0%	1,613	80.0%	1,438	80.0%
2041	1,542	80.0%	1,988	80.0%	1,158	80.0%	1,068	80.0%	1,631	80.0%	1,454	80.0%

Table 6-4 – Entering Side Toll Plaza Design Hour Traffic Projections

Year	Wells		Kenn (NB)		Kenn (SB)		Biddeford		Saco		Scarborough		S. Portland		Jetport (NB)		Jetport (SB)		Rand Road		Riverside		W. Falmouth		Gray	
	Vol.	ETC%	Vol.	ETC%	Vol.	ETC%	Vol.	ETC%	Vol.	ETC%	Vol.	ETC%	Vol.	ETC%	Vol.	ETC%	Vol.	ETC%	Vol.	ETC%	Vol.	ETC%	Vol.	ETC%	Vol.	ETC%
2011	439	54.7%	498	82.4%	253	61.6%	1,520	76.2%	1,971	77.7%	668	61.8%	1,471	68.3%	930	77.1%	521	82.5%	436	64.3%	800	56.1%	904	82.9%	1,039	75.4%
2012	444	56.8%	504	80.0%	256	62.9%	1,537	76.6%	1,993	78.1%	675	63.0%	1,487	69.5%	940	77.5%	526	80.0%	440	65.5%	809	58.3%	914	80.0%	1,050	76.6%
2013	449	59.0%	510	80.0%	259	64.1%	1,554	77.0%	2,015	78.5%	682	64.3%	1,503	70.8%	950	77.9%	532	80.0%	445	66.8%	818	60.4%	924	80.0%	1,062	77.0%
2014	454	61.1%	516	80.0%	262	65.4%	1,571	77.4%	2,037	78.9%	690	65.5%	1,520	72.0%	960	78.3%	538	80.0%	450	68.0%	827	61.7%	934	80.0%	1,074	77.4%
2015	459	62.4%	522	80.0%	265	66.6%	1,588	77.8%	2,059	79.3%	698	66.8%	1,537	73.3%	971	78.7%	544	80.0%	455	69.3%	836	62.9%	944	80.0%	1,086	77.8%
2016	464	63.6%	528	80.0%	268	67.9%	1,605	78.2%	2,082	79.7%	706	68.0%	1,554	74.5%	982	79.1%	550	80.0%	460	70.5%	845	64.2%	954	80.0%	1,098	78.2%
2017	469	64.9%	534	80.0%	271	69.1%	1,623	78.6%	2,105	80.0%	714	69.3%	1,571	75.8%	993	79.5%	556	80.0%	465	71.8%	854	65.4%	964	80.0%	1,110	78.6%
2018	474	66.1%	540	80.0%	274	70.4%	1,641	79.0%	2,128	80.0%	722	70.5%	1,588	77.0%	1,004	79.9%	562	80.0%	470	73.0%	863	66.7%	975	80.0%	1,122	79.0%
2019	479	67.4%	546	80.0%	277	71.6%	1,659	79.4%	2,151	80.0%	730	71.8%	1,605	77.4%	1,015	80.0%	568	80.0%	475	74.3%	872	67.9%	986	80.0%	1,134	79.4%
2020	484	68.6%	552	80.0%	280	72.9%	1,677	79.8%	2,175	80.0%	738	73.0%	1,623	77.8%	1,026	80.0%	574	80.0%	480	75.5%	882	69.2%	997	80.0%	1,146	79.8%
2021	489	69.9%	558	80.0%	283	74.1%	1,695	80.0%	2,199	80.0%	746	74.3%	1,641	78.2%	1,037	80.0%	580	80.0%	485	76.8%	892	70.4%	1,008	80.0%	1,159	80.0%
2022	494	71.1%	564	80.0%	286	75.4%	1,714	80.0%	2,223	80.0%	754	75.5%	1,659	78.6%	1,048	80.0%	586	80.0%	490	77.2%	902	71.7%	1,019	80.0%	1,172	80.0%
2023	499	72.4%	570	80.0%	289	76.6%	1,733	80.0%	2,247	80.0%	762	76.8%	1,677	79.0%	1,060	80.0%	592	80.0%	495	77.6%	912	72.9%	1,030	80.0%	1,185	80.0%
2024	504	73.6%	576	80.0%	292	77.0%	1,752	80.0%	2,272	80.0%	770	77.2%	1,695	79.4%	1,072	80.0%	599	80.0%	500	78.0%	922	74.2%	1,041	80.0%	1,198	80.0%
2025	510	74.9%	582	80.0%	295	77.4%	1,771	80.0%	2,297	80.0%	778	77.6%	1,714	79.8%	1,084	80.0%	606	80.0%	506	78.4%	932	75.4%	1,052	80.0%	1,211	80.0%
2026	516	76.1%	588	80.0%	298	77.8%	1,790	80.0%	2,322	80.0%	787	78.0%	1,733	80.0%	1,096	80.0%	613	80.0%	512	78.8%	942	76.7%	1,064	80.0%	1,224	80.0%
2027	522	76.5%	594	80.0%	301	78.2%	1,810	80.0%	2,348	80.0%	796	78.4%	1,752	80.0%	1,108	80.0%	620	80.0%	518	79.2%	952	77.1%	1,076	80.0%	1,237	80.0%
2028	528	76.9%	601	80.0%	304	78.6%	1,830	80.0%	2,374	80.0%	805	78.8%	1,771	80.0%	1,120	80.0%	627	80.0%	524	79.6%	962	77.5%	1,088	80.0%	1,251	80.0%
2029	534	77.3%	608	80.0%	307	79.0%	1,850	80.0%	2,400	80.0%	814	79.2%	1,790	80.0%	1,132	80.0%	634	80.0%	530	80.0%	973	77.9%	1,100	80.0%	1,265	80.0%
2030	540	77.7%	615	80.0%	310	79.4%	1,870	80.0%	2,426	80.0%	823	79.6%	1,810	80.0%	1,144	80.0%	641	80.0%	536	80.0%	984	78.3%	1,112	80.0%	1,279	80.0%
2031	546	78.1%	622	80.0%	313	79.8%	1,891	80.0%	2,453	80.0%	832	80.0%	1,830	80.0%	1,157	80.0%	648	80.0%	542	80.0%	995	78.7%	1,124	80.0%	1,293	80.0%
2032	552	78.5%	629	80.0%	316	80.0%	1,912	80.0%	2,480	80.0%	841	80.0%	1,850	80.0%	1,170	80.0%	655	80.0%	548	80.0%	1,006	79.1%	1,136	80.0%	1,307	80.0%
2033	558	78.9%	636	80.0%	319	80.0%	1,933	80.0%	2,507	80.0%	850	80.0%	1,870	80.0%	1,183	80.0%	662	80.0%	554	80.0%	1,017	79.5%	1,148	80.0%	1,321	80.0%
2034	564	79.3%	643	80.0%	323	80.0%	1,954	80.0%	2,535	80.0%	859	80.0%	1,891	80.0%	1,196	80.0%	669	80.0%	560	80.0%	1,028	79.9%	1,161	80.0%	1,336	80.0%
2035	570	79.7%	650	80.0%	327	80.0%	1,975	80.0%	2,563	80.0%	868	80.0%	1,912	80.0%	1,209	80.0%	676	80.0%	566	80.0%	1,039	80.0%	1,174	80.0%	1,351	80.0%
2036	576	80.0%	657	80.0%	331	80.0%	1,997	80.0%	2,591	80.0%	878	80.0%	1,933	80.0%	1,222	80.0%	683	80.0%	572	80.0%	1,050	80.0%	1,187	80.0%	1,366	80.0%
2037	582	80.0%	664	80.0%	335	80.0%	2,019	80.0%	2,620	80.0%	888	80.0%	1,954	80.0%	1,235	80.0%	691	80.0%	578	80.0%	1,062	80.0%	1,200	80.0%	1,381	80.0%
2038	588	80.0%	671	80.0%	339	80.0%	2,041	80.0%	2,649	80.0%	898	80.0%	1,975	80.0%	1,249	80.0%	699	80.0%	584	80.0%	1,074	80.0%	1,213	80.0%	1,396	80.0%
2039	594	80.0%	678	80.0%	343	80.0%	2,063	80.0%	2,678	80.0%	908	80.0%	1,997	80.0%	1,263	80.0%	707	80.0%	590	80.0%	1,086	80.0%	1,226	80.0%	1,411	80.0%
2040	601	80.0%	685	80.0%	347	80.0%	2,086	80.0%	2,707	80.0%	918	80.0%	2,019	80.0%	1,277	80.0%	715	80.0%	596	80.0%	1,098	80.0%	1,239	80.0%	1,427	80.0%
2041	608	80.0%	693	80.0%	351	80.0%	2,109	80.0%	2,737	80.0%	928	80.0%	2,041	80.0%	1,291	80.0%	723	80.0%	603	80.0%	1,110	80.0%	1,253	80.0%	1,443	80.0%

In general terms, HNTB expects the following changes to occur over the next 30 years:

- Overall design hour traffic will increase by about 39%.
- At the *mainline* plazas, the share of ETC traffic will increase by an average of about 22% over the current average share of 58%.
- At the *side toll* plazas, where ETC usage during the design hour already averages over 70%, the share of ETC traffic at the side toll plazas will increase by an average of about 10%.

It is important to recognize that, at most toll plazas, *the volume of cash-paying traffic will be lower in 2041 than it is today*. The trend of declining cash volumes has been observed in recent years and is expected to continue at most locations into the future. The only locations where HNTB expects cash volumes to be higher in 2041 than today are at toll plazas that are already near the expected maximum E-ZPass penetration rate of 80%.

6.3 Toll Plaza Capacity Analysis

The final step was to assess the extent to which each toll plaza would be able to handle the projected design-hour demand over the next 30 years. This assessment was based on the following capacities:

Cash-paying vehicles pass through cash lanes at a rate of 325 vehicles per hour (vph). This capacity for cash lanes is a planning-level estimate used by the Authority in determining staffing requirements. In actuality, the capacity is closely tied to the fare that is charged. If cash fares are an even denomination (like the existing rate of $1.00 at the side toll plazas), then capacities can be very high, occasionally exceeding 400 vph. On the other hand, if cash fares require the handling of change (such as the $1.75 fare currently charged at New Gloucester), then the capacities lie closer to the threshold of 325 vph. The actual capacity can vary throughout the day, based on such factors as the mix of cars vs. trucks and the experience level of the toll attendants.

E-ZPass vehicles pass through dedicated ETC lanes at a rate of 1,150 vph. The assumed capacity of dedicated ETC lanes is based on observations of such lanes at various facilities throughout the northeast. The capacity of these lanes—whether at the York toll plaza, at the Saco toll plaza, on the Massachusetts Turnpike, or on the New York State Thruway—is consistently in the range of 1,100-1,200 vph.

E-ZPass vehicles pass through cash lanes at a rate of 800 vph. E-ZPass vehicles are currently allowed to drive through cash lanes on the Maine Turnpike. Experience has shown that E-ZPass vehicles do not pass through cash lanes quite as efficiently as they pass through dedicated ETC lanes. Because they are required to repeatedly stop and start again as they mix with cash traffic waiting in the queue, they pass through the cash lanes at a slightly diminished rate of 800 vph.

E-ZPass vehicles pass through open road tolling (ORT) lanes at a rate of 1,800 vph.[7] An ORT lane essentially functions as a regular highway lane. A historical analysis of peak traffic levels on the

[7] This capacity is only relevant at New Gloucester. Once construction is complete, the facility will operate with 1 ORT lane and 3 cash lanes in each direction.

Maine Turnpike suggests that a lane can carry roughly 1,800 vehicles per hour before travel conditions start to significantly deteriorate.

Table 6-5 (mainline plazas) and Table 6-6 (side toll plazas) present a summary of the toll plaza capacity analysis. For each plaza, the following information is provided:

- **Configuration**. Each column identifies the configuration of the plaza *as it is currently operated during peak periods*. The exception is New Gloucester, in which we analyzed the configuration that will be in effect after the conversion to ORT is complete. Please note that, as currently designed, vehicles equipped with an E-ZPass are permitted to use cash lanes at all plazas on the Maine Turnpike.
- **V/C (volume-to-capacity ratio)**. If the value in this column is equal to or greater than 100%, then the capacity of the plaza has been exceeded. In such instances, the MTA should consider improving the plaza.
- **RC (reserve capacity)**. This column identifies the *number of additional vehicles* that the plaza could accommodate before reaching its practical capacity. A negative value indicates that the plaza is operating above its capacity.

The "RC" or "Reserve Capacity" concept is a useful tool for evaluating the impact of developments that may occur in the vicinity of a particular toll plaza. If a development is projected to generate traffic in excess of the Reserve Capacity, then one could consider holding the development partially responsible for expanding (or otherwise improving) the plaza[8].

In the following two tables, any values that have light shading and bold, black print represent years in which a particular plaza is operating between 90-100% capacity[9]. Queues start to build during such conditions and can occasionally be lengthy. Values that have dark shading and bold, white print represent years in which a particular plaza is over-capacity; travelers will likely face lengthy peak-hour queues and delays in such conditions.[10]

[8] MaineDOT reviews all traffic permits for development in Maine. MaineDOT coordinates with the Authority regarding developments which could potentially impact the Turnpike.

[9] Toll plazas in this range could be problematic particularly if adjacent to a traffic signal. Further study would be needed to determine effects of traffic signals on toll plaza operations.

[10] The anticipated length of the peak-hour queues would need to be determined by traffic simulation modeling, using a program such as *Vissim*.

Table 6-5 – Toll Plaza Capacity Analysis, Mainline Toll Plazas

Year	I-295 (NB) *2 cash, 2 E-Z*		I-295 (SB) *2 cash, 2 E-Z*		Falmouth Spur (Enter) *1 cash, 2 E-Z*[1]		Falmouth Spur (Exit) *1 cash, 2 E-Z*[1]		New Gloucester (NB) *3 cash, 1 ORT*		New Gloucester (SB) *3 cash, 1 ORT*	
	V/C	RC	V/C	RC	V/C	RC	V/C	RC	V/C	RC	V/C	RC
2011	69%	500	80%	351	120%	-142	**99%**	**12**	47%	1,328	60%	707
2012	68%	533	80%	369	116%	-118	**94%**	**47**	46%	1,390	58%	768
2013	66%	579	78%	403	112%	-90	**93%**	**63**	45%	1,465	56%	830
2014	65%	625	78%	428	108%	-60	**91%**	**80**	44%	1,542	55%	901
2015	63%	675	77%	456	105%	-44	88%	105	44%	1,548	53%	980
2016	62%	727	75%	491	103%	-26	87%	126	46%	1,484	51%	1,065
2017	60%	785	74%	528	101%	-9	84%	156	47%	1,423	49%	1,158
2018	59%	849	73%	572	**99%**	**11**	82%	183	48%	1,359	47%	1,267
2019	57%	916	72%	617	**96%**	**36**	79%	217	50%	1,301	46%	1,328
2020	55%	998	70%	664	**94%**	**60**	77%	252	51%	1,242	45%	1,399
2021	53%	1,077	69%	715	**91%**	**88**	75%	290	52%	1,186	44%	1,467
2022	52%	1,171	68%	775	88%	122	72%	331	54%	1,129	43%	1,548
2023	50%	1,279	66%	846	86%	154	70%	381	55%	1,074	43%	1,601
2024	48%	1,389	64%	915	83%	197	67%	430	56%	1,045	44%	1,534
2025	48%	1,423	63%	993	80%	238	67%	441	57%	1,020	45%	1,471
2026	47%	1,458	62%	1,016	78%	280	67%	454	58%	992	47%	1,413
2027	47%	1,487	62%	1,032	75%	338	66%	468	59%	965	48%	1,350
2028	47%	1,520	62%	1,045	74%	347	66%	480	60%	936	49%	1,294
2029	47%	1,555	62%	1,064	74%	361	66%	493	61%	911	51%	1,238
2030	46%	1,599	62%	1,081	73%	375	65%	516	62%	885	52%	1,180
2031	46%	1,617	62%	1,094	73%	386	65%	526	63%	855	54%	1,124
2032	46%	1,614	62%	1,117	72%	399	64%	547	64%	842	55%	1,097
2033	47%	1,607	62%	1,139	72%	414	63%	568	64%	825	55%	1,072
2034	47%	1,588	62%	1,153	72%	427	64%	559	65%	808	56%	1,044
2035	48%	1,573	62%	1,145	71%	443	65%	546	66%	791	57%	1,017
2036	48%	1,556	62%	1,135	71%	455	65%	536	67%	775	58%	991
2037	49%	1,541	63%	1,113	72%	438	66%	524	67%	757	59%	963
2038	49%	1,525	64%	1,093	72%	428	67%	512	68%	742	60%	937
2039	50%	1,508	64%	1,072	74%	408	68%	502	69%	724	61%	910
2040	51%	1,491	65%	1,052	74%	401	68%	491	70%	706	62%	880
2041	51%	1,476	66%	1,028	75%	388	69%	475	70%	688	63%	865

[1]One of the lanes at the Falmouth Spur Toll Plaza (in each direction) is interchangeable. This analysis is for the lane configuration that is most frequently used. An extra cash lane can be opened if queues develop.

101%	Plaza is operating over capacity
99%	Plaza is operating at 90-100% capacity

Table 6-6 – Toll Plaza Capacity Analysis, Entering Side Toll Plazas

Year	Wells		Kenn (NB)		Kenn (SB)		Biddeford		Saco		Scarborough		S. Portland		Jetport (NB)		Jetport (SB)		Rand Road		Riverside		W. Falmouth		Gray	
	1 cash, 1 E-Z		*1 cash, 1 E-Z*		*1 cash, 1 E-Z*		*2 cash, 1 E-Z*		*2 cash, 1 E-Z*		*1 cash, 2 E-Z*		*2 cash, 2 E-Z*		*1 cash, 1 E-Z*		*1 cash, 1 E-Z*		*1 cash, 2 E-Z*		*2 cash, 2 E-Z*		*1 cash, 1 E-Z*		*1 cash, 1 E-Z*	
	V/C	RC	V/C	RC	V/C	RC	V/C	RC	V/C	RC	V/C	RC	V/C	RC	V/C	RC	V/C	RC	V/C	RC	V/C	RC	V/C	RC	V/C	RC
2011	62%	266	32%	1,052	30%	578	75%	520	**95%**	**102**	80%	164	74%	522	68%	428	34%	1,031	49%	453	55%	656	58%	654	82%	229
2012	60%	293	33%	1,004	30%	602	75%	512	**96%**	**88**	78%	186	72%	587	68%	442	35%	982	48%	480	53%	720	61%	594	79%	278
2013	58%	328	34%	997	29%	627	76%	502	**96%**	**75**	77%	205	70%	652	68%	454	35%	977	47%	507	51%	792	61%	583	78%	297
2014	56%	363	34%	992	29%	652	76%	495	**97%**	**63**	75%	228	68%	725	67%	466	36%	968	46%	538	50%	835	62%	574	78%	301
2015	54%	386	35%	988	28%	686	77%	486	**98%**	**51**	73%	255	65%	815	67%	486	36%	963	44%	571	49%	879	63%	564	78%	315
2016	53%	406	35%	979	27%	719	77%	480	**98%**	**37**	71%	282	63%	908	66%	496	36%	959	43%	607	48%	928	63%	553	77%	329
2017	52%	434	35%	973	27%	749	78%	471	**99%**	**21**	69%	314	61%	1,005	66%	506	37%	953	42%	651	47%	982	64%	545	76%	344
2018	51%	457	36%	968	26%	790	78%	461	100%	-2	68%	347	58%	1,127	67%	502	37%	948	40%	693	45%	1,036	65%	533	76%	359
2019	50%	489	36%	963	25%	828	79%	453	101%	-26	65%	387	58%	1,149	67%	492	38%	940	39%	743	44%	1,099	65%	523	76%	365
2020	48%	523	37%	957	24%	875	79%	444	102%	-48	63%	428	58%	1,185	68%	482	38%	934	37%	804	43%	1,169	66%	510	76%	359
2021	47%	562	37%	949	23%	934	80%	432	103%	-73	61%	470	58%	1,211	69%	472	38%	929	36%	855	42%	1,240	67%	499	77%	349
2022	45%	593	37%	942	22%	992	81%	413	104%	-96	59%	528	57%	1,244	70%	459	39%	923	36%	872	41%	1,317	68%	489	78%	336
2023	44%	634	38%	938	22%	1,040	81%	393	106%	-119	57%	583	57%	1,283	70%	447	39%	918	36%	891	39%	1,409	68%	478	79%	324
2024	42%	683	38%	933	22%	1,066	82%	375	107%	-145	56%	593	57%	1,302	71%	436	40%	909	35%	910	38%	1,507	69%	468	79%	309
2025	41%	734	39%	927	22%	1,077	83%	356	108%	-170	56%	615	57%	1,297	72%	424	40%	903	35%	934	37%	1,612	70%	457	80%	297
2026	39%	796	39%	919	21%	1,103	84%	337	109%	-195	56%	630	57%	1,282	73%	413	41%	894	35%	947	35%	1,733	71%	444	81%	284
2027	39%	805	39%	914	21%	1,114	85%	317	110%	-221	55%	641	58%	1,267	74%	399	41%	888	35%	969	35%	1,771	71%	433	82%	272
2028	39%	818	40%	908	21%	1,146	86%	296	112%	-247	55%	656	59%	1,245	74%	389	42%	883	35%	990	35%	1,804	72%	413	83%	256
2029	39%	838	40%	899	21%	1,182	87%	278	113%	-274	54%	680	59%	1,226	75%	377	42%	874	34%	1,012	35%	1,834	73%	408	84%	243
2030	39%	859	41%	893	21%	1,187	88%	256	114%	-298	54%	695	60%	1,207	76%	364	42%	868	35%	1,016	34%	1,875	74%	397	85%	229
2031	38%	879	41%	888	21%	1,193	89%	236	115%	-326	54%	720	61%	1,186	77%	352	43%	859	35%	1,014	34%	1,920	75%	383	86%	215
2032	38%	889	42%	879	21%	1,193	90%	214	117%	-355	54%	711	61%	1,167	78%	337	43%	853	36%	992	34%	1,952	75%	373	87%	201
2033	38%	910	42%	873	21%	1,188	**91%**	**193**	118%	-381	55%	697	62%	1,146	78%	324	44%	847	36%	986	34%	1,978	76%	358	88%	188
2034	38%	931	43%	863	21%	1,184	**92%**	**172**	119%	-408	56%	687	63%	1,125	79%	313	44%	839	36%	986	34%	1,984	77%	348	89%	171
2035	38%	932	43%	858	22%	1,182	**93%**	**152**	120%	-436	56%	677	63%	1,105	80%	300	45%	831	36%	985	34%	1,976	78%	335	**90%**	**155**
2036	38%	933	44%	851	22%	1,178	**94%**	**130**	122%	-464	57%	667	64%	1,082	81%	286	45%	824	37%	981	35%	1,966	79%	320	**91%**	**142**
2037	39%	927	44%	843	22%	1,173	**95%**	**107**	123%	-493	57%	657	65%	1,061	82%	272	46%	818	37%	965	35%	1,956	80%	308	**92%**	**127**
2038	39%	918	45%	835	22%	1,168	**96%**	**86**	125%	-522	58%	647	65%	1,041	83%	260	46%	809	38%	961	36%	1,942	80%	295	**93%**	**112**
2039	39%	913	45%	829	23%	1,163	**97%**	**64**	126%	-552	59%	636	66%	1,020	84%	245	47%	802	38%	959	36%	1,931	81%	282	**94%**	**97**
2040	40%	908	45%	823	23%	1,162	**98%**	**42**	127%	-579	60%	624	67%	997	85%	231	47%	794	38%	954	36%	1,916	82%	269	**95%**	**81**
2041	40%	899	46%	814	23%	1,158	**99%**	**17**	129%	-610	60%	617	68%	976	86%	217	48%	784	39%	941	37%	1,907	83%	254	**96%**	**65**

101%	Plaza is operating over capacity
99%	Plaza is operating at 90-100% capacity

The following observations may be drawn from the previous two tables:

- The Falmouth Spur in the entering (WB) direction is the only location that is currently showing to be operating above capacity. However, this is due to the design-hour configuration of the toll plaza. At present, the plaza is usually operated as 1 cash lane and 2 E-ZPass lanes. However, the plaza has an interchangeable lane and it can be operated as 2 cash lanes and 1 E-ZPass lane, which would provide adequate capacity for all customers.
- The Falmouth Spur in the exiting (EB) direction currently operates in excess of 90% capacity. Again, the plaza has an interchangeable lane and can operate with 2 cash lanes and 1 E-ZPass lane during periods of queuing.
- At the Falmouth Spur (in both the entering and exiting directions), the volume-to-capacity ratio declines over time. In other words, we expect the plaza to operate better in the future as vehicles shift from cash into E-ZPass. In four-to-eight years, as cash volumes diminish, the plaza will operate acceptably with 1 cash lane and 2 E-ZPass lanes during peak periods.
- Two plazas are expected to approach their capacity about 20 years in the future: the 3-lane plaza at Biddeford and the 2-lane plaza at Gray. Neither plaza is expected to exceed its capacity, but both will be operating at above 90% capacity by 2035. Gray Interchange is currently being studied which may result in moving the southbound ramps and toll plaza to the west side of the Turnpike. Capacity issues at Gray would be addressed if the southbound ramps were re-located.
- One plaza that faces an imminent capacity constraint is the three-lane plaza at Exit 36 in Saco. The plaza currently operates at 95% capacity, and it will be at its capacity by 2018. There are three avenues for addressing this operational concern:
    - Re-analyze this location with an increased share of E-ZPass usage beyond the assumed limit of 80%.[11]
    - Maintain a toll of an even denomination in order to maximize the processing rate.
    - Add a dedicated E-ZPass lane at the plaza.

6.4 Toll Plaza Analysis – Conclusions and Recommendations

- Three plazas (Biddeford, Scarborough and Gray) are operating at over 75% capacity and lie in close proximity to a local signalized intersection. Operations at these plazas should be monitored to ensure that the toll plaza operations don't interfere with the flow of traffic on local roads. This will be particularly important at Biddeford and Gray, because these plazas will be operating at 80-90% capacity during peak periods. Periodic traffic surges at these plazas could result in temporary interference with the local roads[12]. Furthermore, the adjacent signalized intersections may limit the number of vehicles that are able to get to the toll plazas resulting in a lower than forecasted peak hour volume at the toll plaza.
- During peak periods on summer weekends, operate the Falmouth Spur toll plaza with 2 cash lanes and 1 E-ZPass lane in each direction as needed.

[11] If the actual peak-hour E-ZPass usage reaches beyond the assumed penetration limit of 80%, then the expected volume of cash-paying traffic would be cut. If the share of E-ZPass usage continued to grow at a rate of about 1% per year beyond 2018, then the plaza would be able to operate fairly efficiently with 1 cash lane and 2 E-ZPass lanes in the future.

[12] If the possibility of traffic issues is of concern to the Authority, a more detailed simulation model could be developed in Vissim that could quantify the problem and help identify mitigation measures.

- Program $1,420,900[13] for the addition of a dedicated E-ZPass lane at the Saco toll plaza in the year 2018. In the interim, continue to monitor operations as well as traffic growth. If conditions deteriorate, the improvement should be implemented. If conditions stabilize, then construction could be delayed.
- While monitoring operations at Saco, the Authority should consider altering the configuration during weekday peak periods. Providing two dedicated E-ZPass lanes and only one cash lane may improve the flow of traffic. With a cash toll of $1.00, a single cash lane with an experienced attendant should be adequate to serve the current cash volume of 300-330 vehicles per hour.
- Use the "Reserve Capacity" calculations to help evaluate the potential effect of developments that may be proposed in close proximity to the Turnpike.

[13] The cost for the toll lane is discussed in Section 10.

7 SAFETY CONDITIONS

The safety analysis for this study determined if there are locations with a high crash history, determined if there are measures that can be taken to alleviate the number of crashes, and examined the current safety practices of the Authority and the efficacy of those practices. In addition, HNTB re-examined the safety issues and recommendations identified in the last systemwide traffic operation and safety study and determined the status of those previously identified safety concerns.

All mainline miles, interchanges, ramps and toll plazas on the Maine Turnpike as well as adjacent intersections to the Turnpike were analyzed for this safety analysis. The data used was obtained from MaineDOT: Traffic Engineering, Crash Records Section. The crash study period analyzed is the most recent three year period for which data is available – January 2009 to December 2011.

7.1 Crash Rate Comparison

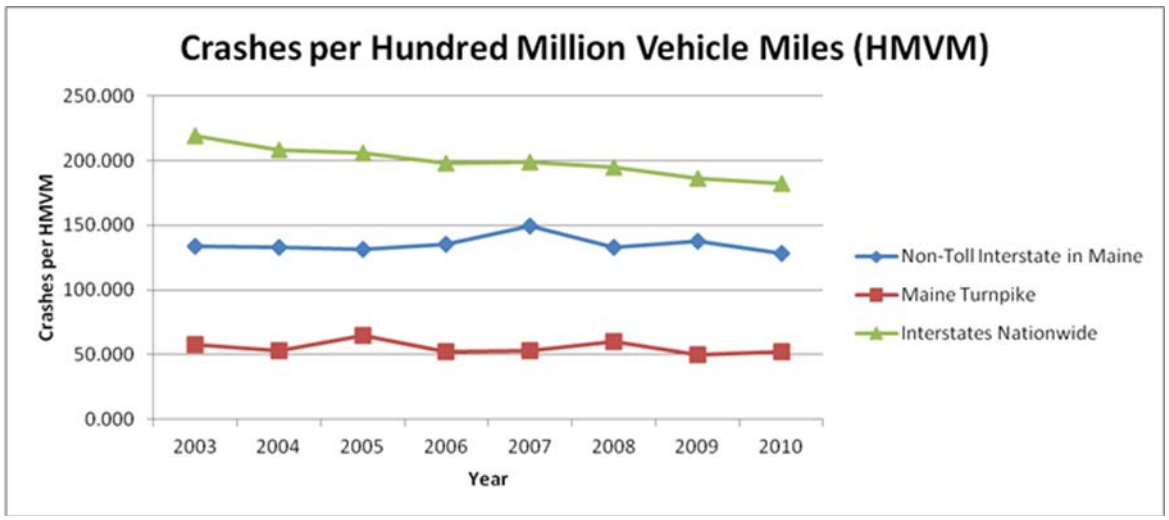
During the 36 month period, a total of 1,922 crashes were recorded on the Turnpike. Of the 1,922 crashes, 965 occurred in the southbound direction of travel while 957 occurred in the northbound direction of travel.

The number of crashes that occur on a roadway is correlated with the amount of traffic on a roadway. In other words, more traffic would generally tend to increase the occurrence of crashes. Similarly, a decline in traffic would generally cause a decrease in the number of crashes. In order to draw comparisons of occurrence of crashes, crash rates are developed, which are the number of crashes divided by the vehicle miles traveled. During the three year period of 2009-2011, there were approximately 52.3 crashes per hundred million vehicle miles traveled on the Turnpike.

For comparison purposes, the same statistics were reviewed from the 2007 systemwide traffic operations and safety study, which analyzed crash data from January 2003 to December 2005. During that time period the crash rate was approximately 58.4 crashes per hundred million vehicle miles traveled. The data shows that the crash rate for the 2009-2011 study period is lower than the crash rate for the 2003-2005 study period.

Data were also gathered on crash rates for the other interstate highways in Maine and the national interstate highways. Figure 7-1 compares the crash rates on the Maine Turnpike with those on Maine's other interstates and the national Interstate System from 2003 through 2010. As can be seen from Figure 7-1, the Turnpike crash rate is lower than the national average crash rate and lower than the other interstate highways in Maine.

Figure 7-1 – Crash Rate Comparison 2003-2010



Note: 2011 crash data was not available for interstates nationwide.

7.2 Current Safety Practices

The Authority has implemented many safety practices to promote safe travel along the highway. Those practices include roadside improvement programs, ITS (Intelligent Transportation Systems) upgrades, maintenance practices, and parallel acceleration ramp construction.

ROADSIDE IMPROVEMENT PROGRAMS

The roadside improvement programs that the Authority is currently undertaking are the following:

- Assessing all median openings for required criteria of sight distance. All openings that do not meet standards are either improved to meet criteria or closed.
- Upgrading all out-of-date guard rail end treatments and adjusting guard rail height where necessary
- Checking all clear zones and increasing distance where practicable. These measures consist mainly of modifying ditching, flattening slopes, and removing ledge. A clear zone study is planned to be conducted this year to identify additional clear zone activities that could be completed cost effectively.

ITS UPGRADES

The Authority has made the following ITS upgrades since 2006 to promote safe and efficient travel:

- Upgrades to the Highway Advisory Radio (HAR) system; stations have been synchronized and one station was added
- Updates to the Variable Message Sign (VMS) links, controllers, and software which results in greater reliability
- Placement of additional VMS (portable and semi-permanent) along the highway at strategic locations to provide motorists with pertinent travel information
- Upgrades to the email alert system allowing messages to be sent to patrons concerning traffic incidents in a faster, more reliable manner

- Utilization of social media to provide near real-time travel information to patrons
- Upgrades to the Authority's website including enhanced travel information and alerting capabilities
- The installation of two Road Weather Information Systems (RWIS) in Saco and Gray which alerts maintenance crews of winter weather situations and decreases crew response times
- Utilization of five additional Closed Circuit Television systems (CCTV) for incident detection and verification. One system was installed in Biddeford, another in Gray and the three remaining systems are portable.

ACCELERATION LANES

Over the past few years, the Authority has focused on converting taper lanes to parallel type lanes. This generally gives patrons a longer merge area and, in turn, more time to make a safe merge maneuver. The following are examples of lanes that have been converted:

- Exit 75 NB was completed in 2012
- Exit 75 SB is currently under construction and due to open later in 2012
- Exit 45 NB is currently under construction
- Exit 45 SB is currently under construction
- Exit 48 NB acceleration lane was extended in 2011
- Exit 48 SB acceleration lane was extended in 2011
- Exit 53 NB acceleration lane is currently under construction and will be open by the end of 2012
- Exit 52 NB was opened in 2011
- MaineDOT extended the acceleration lane at Exit 109 SB in 2011[14]. This location was identified as a high crash location in the previous systemwide traffic operations and safety study.

MAINTENANCE PRACTICES

In addition to these programs, standard maintenance measures are constantly undertaken to improve traveling conditions and, in turn, safety conditions along the length of the Turnpike. Examples of these regular maintenance practices are:

- Re-striping all lines bi-annually
- Repairing pot-holes and filling cracks between scheduled resurfacing projects
- Regularly cleaning/maintaining storm drainage systems
- Pre-treating the roadway before major winter storms
- Sweeping excess sand from the roadway during the spring months
- Selectively choosing when to allow lane closures for both construction and maintenance activities so that the impact on traffic flow is minimal
- Keeping shoulder areas cleared of trash and debris
- Mowing side slopes to increase visibility
- Repairing guardrail as soon as possible following crash damage
- Providing a night patrol to monitor the highway and notify crews of dangerous driving conditions

[14] This location is adjacent to the northern limits of the Turnpike.

- Coordinating with two Traffic Incident Management Committees to improve safety for responders and motorists while minimizing the impact incidents have on the normal flow of traffic
- Maintaining 60 inch Yield signs at every entry ramp
- Reviewing and adding additional Wrong Way signs at off-ramps when appropriate

7.3 Current Safety Studies

The Authority has recently conducted several studies regarding safety issues. Those studies deal with overheight vehicles and improvements to mainline toll plazas, which historically have been high crash locations.

OVERLIMIT VEHICLES

HNTB Corporation completed a study in 2007 looking at the policies of overlimit vehicles (defined as any vehicle that exceeds regulations for width, height, length, or weight) of the Turnpike. Overlimit vehicles present a few safety issues. Some overlimit vehicles are not able to maintain the posted minimum speed of 45 MPH on the Turnpike. Overwidth vehicles sometimes are forced to occupy a second travel lane because law enforcement and disabled vehicles preclude the use of the shoulder. Another concern is that there is limited storage area at Turnpike toll plazas for overlimit vehicles that are waiting to enter the Turnpike. The Authority restricts entry due to weather, time of day, and other regulations specific to overlimit vehicle travel. Overheight vehicles can create another problem—structural damage to bridges. Overheight vehicles have hit Turnpike bridges in the past and have caused significant structural damage. Structurally damaged bridges present a safety concern.

The following conclusions were drawn from the overlimit study:

- The Maine Turnpike Authority is continuing their current policy of:
  - Building new bridges with 16'6" clearance, and increasing clearance on existing bridges to a minimum of 15'0' as part of major rehabs.
  - Constructing new toll plazas with 16' -6" +/- of clearance and maintaining a clear roadway width of 16'-0" in wide load lanes
- The Authority identified a limited number of locations for targeted over-height detection systems, at entry points upstream of structures most prone to vehicle strikes.
- The Authority continues to endorse the BMV's policy to route all possible overlimit vehicles onto the Maine Turnpike rather than local roadways.
- The Authority did not bifurcate the system relative to overlimit regulations.

In 2011, an overheight vehicle detector system was installed on the local road on each side of the Warren Avenue overpass. Signs and flashing beacons alert drivers if their vehicle is too high to safely pass under the Warren Avenue overpass. A similar system has been proposed in the near future for Auburn (Exit 75) and West Gardiner (Exit 103) to alert overheight vehicle drivers to not enter the Turnpike.

WEST GARDINER INTERSECTION STUDY

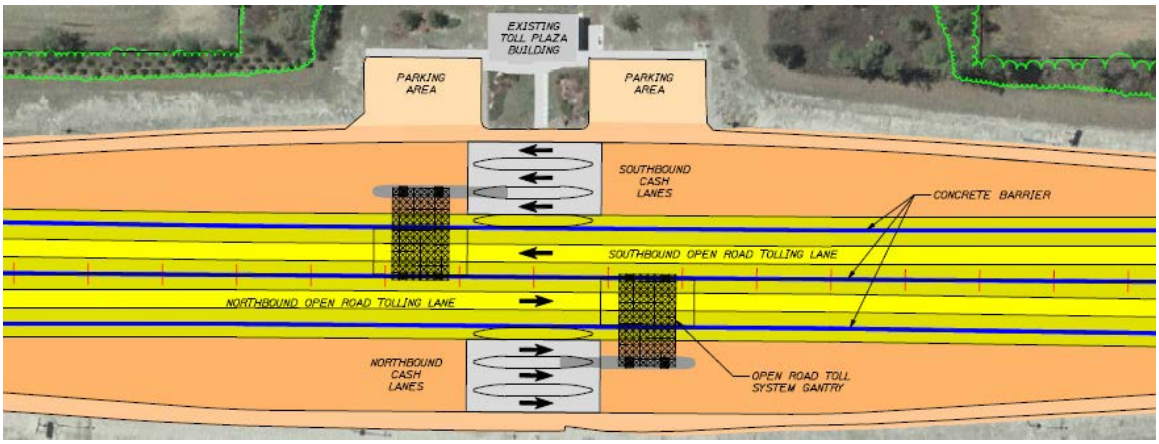
The stop controlled 4-way intersection of Exit 102, Lewiston Road (Routes 9/126) and the West Gardiner service plaza driveway was the high crash location (HCL) with the highest crash rate in the

state during the 2009-2011 study period. Twenty-five crashes occurred at this location in the three year period and the crash rate factor (CRF) is reported as 19.91. This indicates that crashes occur at this location at approximately 20 times as much as similar locations in the state over the three year reporting period. Twenty-three of the twenty-five crashes at the location were angle crashes. Due to the severity of these ratings a signal warrant analysis was completed in February 2012 by HNTB Corporation. A traffic signal warrant was met for this location, in accordance with the guidelines set forth in the MUTCD,[15] and a signal was recommended in a memorandum addressed to the Authority dated February 21st, 2012. However, meeting a traffic signal warrant does not in itself justify a signal. A meeting was held with MaineDOT. During that meeting, MaineDOT recommended changes to the pavement markings, including re-positioning the stop bars, as a method to improve the safety at this location. As a result, the Authority has implemented the pavement marking recommendations.

NEW GLOUCESTER ORT CONVERSION

The Authority is currently in the process of converting the New Gloucester toll plaza to allow for open road tolling (ORT). The project involves the removal of the four middle toll lanes at the plaza and replacing them with one highway speed ORT E-ZPass Only lane in each direction. These ORT lanes will include concrete barrier walls separating each direction as well as separation from the remaining cash toll lanes. Customers with E-ZPass will no longer be required to slow down or stop at the toll plaza. These customers will be able to use specially designed barrier separated toll lanes for non-stop tolling as shown in Figure 7-2

Figure 7-2 – ORT Tolling Layout



Once completed, the New Gloucester toll plaza ORT conversion will provide multiple safety improvements. With roughly half of the transactions at the plaza paid via E-ZPass, the potential for reducing traffic crashes at the plaza is significant. On approach to the toll plaza, the driver is directed to select either the ORT or cash side of the plaza well in advance of the plaza itself. From a traffic operations and crash potential perspective, these plazas are more akin to a highway split or interchange ramp than a traditional toll plaza. The result is a reduction in conflicts between vehicles of differing speeds and reduced weaving in the cash lanes related to lane changing. Based on historical data reported by major facility conversions to ORT in states such as Florida, New Jersey,

[15] U.S. Department of Transportation Federal Highway Administration. *Manual on Uniform Traffic Control Devices,* Washington, D.C. 2009

Texas and Illinois, crashes have been reduced by as much as 50-60%. Therefore ORT has significant opportunity to improve the safety of the traveling public.

In addition to reducing vehicle crashes at the toll plaza, ORT will also reduce the exposure of toll collectors to non-stop traffic and total traffic in general. Toll collectors will continue to have the benefit of the tunnel to access the plaza. In some cases, the safety of the tunnel will be the only means of access since the ORT lanes will eliminate the option for collectors to cross the entire plaza at the roadway level to access toll lanes. A reduction in exposure to cash traffic coupled with virtual elimination of exposure to E-ZPass traffic will improve the safety of toll collectors.

YORK TOLL STUDY

In June, 2010 HNTB Corporation summarized the safety and capacity issues at the York Toll plaza in the report titled "Maine Turnpike – Southern Toll Plaza" at the request of the Authority. The document stated:

"The York Toll Plaza began as a temporary 11-lane structure constructed on the Turnpike in York, Maine in 1969 as part of the continuation of Interstate 95 and the construction of the Piscataqua River Bridge. Numerous maintenance and rehabilitation projects have been undertaken to improve the capacity of the plaza, to cope with its aging components, and to provide safety for both the traveling public and toll plaza staff. However, the ongoing maintenance and rehabilitation projects can no longer effectively keep up with the York Toll Plaza's deterioration; its life expectancy has been exceeded and it is no longer able to provide adequate safety for staff or the millions of vehicles that pass through it each year, nor is it able to provide for efficient traffic operations."

There are a number of operational issues related to the plaza's location that seriously affect safety of patrons and staff and require attention:

1) The plaza is located 500 to 700 feet north of the Exit 7 Interchange, causing additional merging and weaving of traffic within the plaza limits. This also leads to an inefficient use of toll lanes, causing traffic back-ups before the plaza has reached capacity volumes.
2) The plaza is on a horizontal curve. Southbound traffic tends to drift to the outside of the curve, reducing utilization of all tollbooths, i.e. left side lanes become over-utilized and right side lanes underutilized. The curve also blocks sight to all southbound lanes/tollbooths until an approaching vehicle is approximately 1,500 feet away. This does not allow adequate time to make efficient lane choice decisions and can cause sudden unsafe lane changes.
3) The plaza is at the base of a hill. This creates a safety concern due to the potential of heavy vehicles losing their brakes and striking the plaza or stopped traffic, drainage issues, and pavement "shoving", leading to excess rutting and the potential for hydroplaning. The hill also leads to heavy engine braking noise southbound and heavy acceleration noise northbound as commercial vehicles negotiate the only truck climbing lane on the Turnpike.
4) The plaza is approximately 2,200 feet north of the Chases Pond Road Bridge over the Turnpike. This bridge essentially hides the merging on-ramp traffic at Exit 7 from view of northbound travelers, and reduces visibility of traffic queues at the toll booths. A driver's ability to adequately comprehend (and react to) roadway signage is also compromised due to a need to sign for both the toll plaza and the interchange within a very short distance. The

proximity of the toll plaza and interchange requires double the number of signs at less than desirable spacing.

All four of these characteristics; nearby interchange, roadway curve, bottom of a hill, and nearby bridge contribute to increased crashes and decreased operational efficiency. This has led to the south side of the toll plaza, either the northbound or southbound lanes, or both, to be classified as High Crash Locations for the last 10 years by MaineDOT.

The Authority is currently reviewing the York Toll Study.

7.4 Other Studies

The Authority has also recently conducted several studies regarding mobility and safety issues. Those studies deal with improvements to some of the intersections adjacent to the Turnpike as well as future transportation needs in identified corridors.

EXIT 75 STUDY

HNTB Corporation studied the Exit 75 (Auburn) interchange and presented results in a two phase report. Phase I was published in December 2009 and identified short term transportation needs. Phase II was published in March 2010 and identified long term transportation needs.

Phase I investigated concerns regarding the interchange and the surrounding area which were raised by local residents and officials. These concerns included:

- The condition of the pavement and adequacy of signing
- Difficult traffic maneuvers due to the limited distance for traffic weaving patterns combined with the high number of heavy trucks that use the interchange
- The overall condition/appearance of the interchange

Based on a condition assessment and comparison, the following improvements were recommended in Phase I at Exit 75:

- Paving
- Installation of guide signs
- Moving guardrail/edge of pavement
- Removing the existing utility building.

These improvements were approved by the Authority and have been implemented.

Phase II evaluated the future transportation needs of the Exit 75 study area as well as the needs of Greater Auburn. Six different build alternatives were evaluated based on their ability to reduce the expected traffic congestion, estimated cost to implement, and potential right-of-way impacts.

Based on the analysis and evaluation conducted in the Phase II Study, the following improvements were recommended:

- Exit 75 at Route 202/4/100. Widen the Route 202/4/100 northbound approach to accommodate two left turn lanes for traffic heading toward the Turnpike

- Route 202/4/100 at Kittyhawk Avenue. Widen the Route 202/4/100 northbound approach to accommodate a left turn lane of 150 foot length for traffic heading onto Kittyhawk Avenue and an additional shared through/right lane of 200 feet
- Route 202/4/100 at Kittyhawk Avenue. Widen the Route 202/4/100 southbound approach to accommodate a 150 foot channelized right turn lane for traffic heading onto Kittyhawk Avenue
- Route 202/4/100 at Kittyhawk Avenue. Widen the eastbound Kittyhawk Avenue approach to accommodate two left turn lanes of 550 foot length for traffic heading north on Route 202/4/100

HNTB has completed preliminary design of the improvements. The Authority is coordinating with MaineDOT regarding funding for the improvements.

WEST GARDINER AND GARDINER I-295 DRAFT TOLL STUDY

On July 31, 2012 HNTB Corporation published the 'Gardiner/West Gardiner Toll Plaza Replacement Study' for the Authority. This study documented the feasibility of and options for replacement or rehabilitation of the existing West Gardiner and Gardiner I-295 toll plazas. HNTB Corporation evaluated the following options:

- Option 1: Combining the West Gardiner and Gardiner I-295 toll plazas at a location north of Mile 103.
- Option 2: Upgrade the Gardiner I-295 toll plaza in current location without Open Road Tolling (ORT) and upgrade West Gardiner toll plaza to ORT.
- Option 3: Relocation of the Gardiner I-295 toll plaza to accommodate ORT (2 ramp toll plazas) and upgrade West Gardiner toll plaza to ORT.
- Option 4: Maintain the Gardiner I-295 toll plaza with limited improvements (No new toll lanes for capacity enhancements) and upgrade West Gardiner toll plaza to ORT.

The Authority is currently reviewing the West Gardiner and Gardiner I-295 Toll Study.

GORHAM EAST-WEST CORRIDOR FEASIBILITY STUDY

The purpose of this study was to develop a series of recommendations to enhance, expand, and preserve highway connections between Route 1 and the Maine Turnpike and communities in western Cumberland County. This study focused on the effects that land use has on transportation and developed a coordinated land use, transit, and highway improvement strategy to reduce future demand on the regional transportation network.

The Phase I Study and Report was completed in October 2012. The Authority and MaineDOT are working together to develop the scope of a Phase II study, which is anticipated to begin in the Spring of 2013 pending approval of the Turnpike Authority Board. Results of this study could result in a new connection to the Turnpike, which will have an impact on future traffic estimates in the Portland area.

CENTRAL YORK COUNTY CONNECTIONS STUDY

The MaineDOT and the Authority are currently evaluating strategies to improve mobility between central York County and the coastal highways of Route 1 and the Maine Turnpike. The purpose of

the Central York County Connections Study is to identify, evaluate, and recommend feasible transportation and related land use strategies that will:

- enhance regional economic growth
- increase regional transportation interconnectivity
- improve traffic safety
- direct expected travel demand through a strong mix of multimodal strategies
- preserve and improve existing infrastructure

In addition, it is a goal of the study to strive to maintain the visual, cultural, and historic character of the study area and minimize environmental impacts.

7.5 High Crash Locations

MaineDOT has a system of classifying whether or not a particular roadway location is considered a high-crash location (HCL). MaineDOT's Crash Records Section summarizes all reported crashes in which there is property damage in excess of $1000, or in which there has been personal injury. In order to summarize this information, the MaineDOT has established a Node and Element System. This system assigns a four or five-digit node number to each intersection, major bridge, railroad crossing, and crossing of town, county, or urban compact lines as a node. The segments of road that connect the nodes are referred to as elements. As crash reports are received by MaineDOT, the information is assigned to the corresponding element or node at which they occurred.

A designation of HCL warrants an analysis for patterns of crashes associated with possible geometric issues. If crash history of a particular element or node meets two criteria, then MaineDOT would classify it as a high-crash location (HCL). The criteria are:

- The element or node must have eight or more reported crashes over the past three years
- The element or node must have a "critical rate factor" (CRF) greater than 1.00. (The critical rate factor relates the crash rate at a particular element or node to the statewide crash rate average for a similar type of facility)[16].

The previous systemwide traffic operations and safety study identified all of the high crash locations on the mainline of the Turnpike. This study identifies not only the mainline segments, but also the ramps and the intersections adjacent to the Turnpike which are HCLs. The following sections show how the mainline HCLs have changed in the past 6 years and provide an analysis for the current HCLs.

[16] Critical rate factors are computed differently for nodes and elements. The calculation for a critical rate factor for an element includes the length of the element. Nodes essentially have no length. Therefore, the critical rate factors for nodes are not necessarily comparable to the critical rate factors for elements.

7.5.1 High Crash Locations 2003-2005 Update

Table 7-1 lists the high crash locations on the Turnpike mainline for the period 2003-2005. This was the period studied in the previous systemwide traffic operations and safety study published in 2007.

Table 7-1 – 2003-2005 HCLs on Mainline

	Town	*Description*	*Crashes*	*CRF*
Toll Plaza Node	York	North of York Interchange near Toll Plaza	18	4.45
NB Segments	Wells	North of Wells Interchange	13	1.20
	Biddeford	South of Biddeford Interchange	10	1.75
	Portland	South of Rand Road Interchange	8	1.30
	Cumberland	North of Falmouth /Cumberland Town Line	22	1.01
	Gray	South of Gray Interchange	23	1.03
	Gray	North of Gray Interchange	14	1.01
	New Gloucester	North of New Gloucester/Gray Town Line near Toll Plaza	11	1.33
SB Segments	Saco	North of Biddeford/Saco Town Line	16	1.04
	New Gloucester	North of New Gloucester/Gray Town Line near Toll Plaza	13	1.52
	Augusta	North of Augusta/Hallowell Town Line at Merge Area	16	1.37

Each of the 2003-2005 HCLs will be discussed briefly to review the recommendations that were made previously and the current status of those locations.

1. North of the York Interchange NB, York

Original Recommendation: It was expected that a potential increase in E-ZPass usage at the plaza would help to reduce crash rates.

Status: York Barrier Toll plaza is still an HCL, but now in both the northbound and southbound directions south of the Barrier Toll plaza.

2. North of the Wells Interchange in the NB Lanes – Mile 19

Original Recommendation: Given the fact that there were a large number of coincidental occurrences and no obvious physical problems at this location, HNTB Corporation recommended watching this site in the future to see if the problem persisted or if this particular site was an anomaly.

Status: This location is still an HCL and will be discussed further in this study.

3. South of the Biddeford Interchange in the NB Lanes – Mile 31

Original Recommendation: Since 50% of the crashes at this location were due to drivers making unsafe lane changes or operating vehicles at illegal and unsafe speeds, HNTB Corporation recommended that this location be reviewed with the state police for further evaluation.

Status: This location is no longer an HCL.

4. North of the Biddeford/Saco town line in the SB Lanes – Mile 33

Original Recommendation: Seventy-five% of the crashes at this location occurred when road conditions were classified as wet, snow, or ice. HNTB Corporation recommended that a pavement sensor be installed to alert Turnpike staff of freezing conditions at this location.

Status: A pavement sensor was installed. This location is no longer an HCL.

5. South of the Rand Road Interchange in the NB Lanes – Mile 47

Original Recommendation: During the 2003-2005 study period this interchange was quite new; having just been completed in December of 2002. Some crashes were suspected to have been caused by driver unfamiliarity. HNTB Corporation recommended watching this site in the future to see if the problem persisted.

Status: This location is no longer an HCL.

6. North of the Falmouth/Cumberland town line in the NB Lanes – Mile 57

Original Recommendation: At this location the highway ascends up a fairly long, steep incline known as 'Morrison Hill'. Forty percent of the total crashes were related to poor weather conditions. HNTB Corporation recommended additional signing in this area to warn drivers of the potentially dangerous conditions during inclement weather.

Status: This location is no longer an HCL.

7. South of the Gray Interchange in the NB Lanes – Mile 62

Original Recommendation: Almost 70% of crashes at this location were related to poor weather conditions and 48% of crashes occurred during snow or ice conditions. During the winter months this section of the roadway remains very shaded during the morning daylight hours due to high embankments. HNTB Corporation recommended applying anti-icing solution prior to snowstorms and installation of a pavement sensor which could alert Turnpike staff of freezing conditions when precipitation is not present.

Status: A pavement sensor was installed. This location is no longer an HCL.

8. North of the Gray Interchange in the NB Lanes – Mile 63

Original Recommendation: Fifty percent of all crashes at this location were related to poor weather conditions and 21% of all crashes occurred during snow/ice conditions. HNTB Corporation recommended applying anti-icing solution prior to snowstorms and installation of a pavement sensor which could alert Turnpike staff of freezing conditions when precipitation is not present.

Status: A pavement sensor was not installed at this location. However, a pavement sensor was installed south of the interchanges (mentioned previously). This location is no longer an HCL.

9. North of the New Gloucester/Gray town line in the NB Lanes – Mile 66

Original Recommendation: It was expected that a potential increase in E-ZPass usage at the New Gloucester Toll Plaza would help to reduce crash rates. Toll plazas commonly experience high crash rates due to the disruption to traffic flow. Also, the MTA had planned to test 'E-ZPass purple' pavement markings at this location to make E-ZPass lanes more noticeable.

Status: This location is still an HCL and will be discussed further in this study.

10. North of the New Gloucester/Gray town line in the SB Lanes – Mile 66

Original Recommendation: It was expected that a potential increase in E-ZPass usage at the New Gloucester Toll Plaza would help to reduce crash rates. Toll plazas commonly experience high crash rates due to the disruption to traffic flow. Also, the MTA had planned to test 'E-ZPass purple' pavement markings at this location to make E-ZPass lanes more noticeable.

Status: This location is still an HCL and will be discussed further in this study.

11. North of the Augusta/Hallowell town line in the SB Lanes – Mile 108

Original Recommendation: While no obvious geometric flaw or other cause (i.e. weather) could be identified at this merge area, HNTB Corporation recommended watching this site in future years to see if it continued to be classified as an HCL and if a pattern developed.

Status: This location is no longer an HCL.

7.5.2 Current High Crash Locations of the Maine Turnpike and Ramp Intersections

This safety analysis examined the crash data of designated high crash locations to determine patterns and potential remedies. According to the most recent MaineDOT data available which dates from January 2009 through December 2011 there are nine areas classified as HCLs on the Turnpike mainline. The northbound travel lane has three HCLs while the southbound travel lane has six. An additional five entry and exit ramp locations and four intersections with local roads were identified as HCLs. Recommendations for safety improvements are presented; however, costs for the improvements were not estimated.

HIGH CRASH LOCATIONS - MAINLINE SEGMENTS

Table 7-2 shows a summary of the Turnpike mainline segments that are currently considered high crash locations. Each high crash location of the mainline is discussed in the following paragraphs.

Table 7-2 – 2009-2011 HCLs on Mainline

	Town	*Node/Element*	*Description*	*Crashes*	*CRF*
Toll Plaza Nodes	York	57692	Mile post 7.13 - NB approach to York Barrier Toll plaza	11	3.73
	York	57693	Mile post 7.13 - SB approach to York Barrier Toll plaza	10	3.36
NB segments	Wells	239695	Exit 19 NB merge area to Burnt Mill Rd	10	1.04
	Gray	195030	0.5 miles from New Gloucester Barrier Toll plaza to Mayall Rd.	9	1.29
SB segments	West Gardiner	2524169	0.78 miles from High Street to West Gardiner/Farmingdale TL	17	1.24
	New Gloucester	2523347	0.84 miles from Shaker Road to Bald Hill Road	11	1.03
	New Gloucester	2523359	1.14 miles from Mayall Road to Bennett Road	17	1.25
	New Gloucester	2523361	0.48 miles from New Gloucester Barrier Toll plaza to Mayall Rd.	13	1.86
	York	2522897	York Barrier Toll Plaza to York Interchange	10	2.38

A few facts to note about the data in Table 7-2 are:

- The southbound mainline direction has more than twice as many HCLs as the northbound direction
- The York Barrier Toll plaza and adjacent sections make up three of the nine HCLs and have the highest CRF ratings.

1. York Interchange to York Barrier Toll plaza in the NB Lanes – Mile 7

This brief section of highway encompasses the area from the York interchange to the York Barrier Toll plaza. The types of crashes recorded are similar at most toll plazas where mainline traffic flow is interrupted: two crashes were classified as rear ends, two crashes were backing, two crashes sideswipes, four crashes involved a fixed object, and one crash a driver lost control. The close proximity of the barrier toll plaza to the York interchange contributes to lane change issues by adding another stream of traffic flow accessing lanes to the plaza over a short distance.

The area between the York Barrier Toll Plaza and the York interchange has been a high crash location for a number of years. Improvements to the York toll plaza are currently being considered, including the possibility of rebuilding the York toll plaza as an ORT facility.
Total number of crashes: 11, CRF: 3.73

2. Approach to the York Barrier Toll Plaza in the SB Lanes – Mile 7

This brief section of highway is the approach to the York Barrier Toll Plaza. The types of crashes recorded are similar at most toll plazas where mainline traffic flow is interrupted: six crashes were classified as rear ends, two crashes were sideswipes and two crashes involved a fixed object. The geometry at this location is not ideal. The toll plaza is on a curve at the bottom of an incline.

The area between the York Barrier Toll Plaza and the York interchange has been a high crash location for a number of years. Improvements to the York toll plaza are currently being considered, including the possibility of rebuilding the York toll plaza as an ORT facility.
Total number of crashes: 10, CRF: 3.36

3. York Barrier Toll plaza to York Interchange in the SB Lanes – Mile 7

This 0.11 mile section of highway is on the departing side of the York Barrier Toll plaza to the SB Off ramp at the York interchange. The most common type of crash (five of ten) was sideswipes as drivers try to merge into three departing lanes. The other types of crashes were one rear-end, two off-the-road, one rollover, and one vehicle fire. The close proximity of this York Barrier Toll plaza to the York interchange contributes to the lane change issues by forcing exiting traffic to move to the rightmost lane in a short distance after exiting the York Barrier Toll plaza.

Advanced overhead signing with a clear message about which plaza lanes are best to use for accessing York interchange may help to improve traffic flow at this location. The area surrounding the York Barrier Toll Plaza has been a high crash location for a number of years. Improvements to the York toll plaza are currently being considered, including the possibility of rebuilding the York toll plaza as an ORT facility.

Total number of crashes: 10, CRF: 2.38

4. North of the Wells Interchange in the NB Lanes – Mile 19

This area, 0.32 miles in length, is a typical merge section in the southern region of the Turnpike; the on ramp merges with a three lane mainline. Five of the ten crashes occurred during inclement weather conditions. Crash types varied considerably: four of the crashes were classified as ran off road, two were animal hits, two were fixed object hits, one was a sideswipe and one was a rollover. Despite no obvious physical problems at this location it was also ranked as an HCL in the last systemwide traffic operations and safety study covering 2003-2005 data.

It may be beneficial for maintenance to pay particular attention to this area during inclement weather conditions. This would also be a reasonable location to consider for installation of a pavement sensor which could alert Turnpike staff of freezing conditions when precipitation is not present. Also, the northbound acceleration lane is a taper lane. This location would be a reasonable location to convert from a taper to a parallel acceleration lane. The Authority has converted taper lanes to parallel acceleration lanes at other locations on the Turnpike. A parallel lane generally gives patrons a longer merge area and, in turn, more time to make a safe merge maneuver.

Total number of crashes: 10, CRF: 1.04

5. New Gloucester Barrier plaza to Mayall Road in the NB Lanes – Mile 66

This section is a 0.50 mile area just south of the New Gloucester Barrier Toll Plaza. Toll plazas commonly experience high crash rates due to the disruption to mainline traffic flow. The crash types recorded were: two sideswipes, two backing, three hitting fixed objects, and two ran-off-road crashes.

The New Gloucester Barrier plaza is currently being modified and will operate as an Open Road Tolling facility with one highway speed lane in each direction and a barrier separated traditional plaza for cash paying patrons. It is expected that this facility change will reduce the crashes occurring at this location.

Total number of crashes: 9, CRF: 1.29

6. New Gloucester Barrier plaza to Mayall Rd in SB Lanes – Mile 67

This section is a 0.48 mile area from Mayall Road to the New Gloucester Barrier Toll Plaza. The types of crashes recorded were similar at most toll plazas where mainline traffic flow is interrupted: seven

crashes were classified as 'rear ends', two crashes were sideswipes and two crashes involved an animal (deer) collision.

The New Gloucester Barrier plaza is currently being modified and will operate as an Open Road Tolling facility with one highway speed lane in each direction and a barrier separated traditional plaza for cash paying patrons. It is expected that this facility change will reduce the crashes occurring at this location.
Total number of crashes: 13, CRF: 1.86

7. North of Mayall Road to Bennett Road in the SB Lanes – Mile 68
This section encompasses a 1.14 mile long section of highway north of the New Gloucester Barrier Toll plaza. Four drivers noted they were distracted, merging or slowing for traffic due to the New Gloucester Barrier Toll plaza. Six crashes occurred during inclement weather conditions and four of these six drivers were noted as exceeding the posted speed limit or driving too fast for the inclement weather conditions. Nine of the crashes involved vehicles that went off of the road, three were rear-end/side-swipe, three crashes were animal collisions (two moose and one deer), and two of the collisions involved hitting objects in the road.

It is expected that modification to the New Gloucester Barrier Toll plaza will reduce the number of crashes at this location. This would also be a reasonable location to consider for installation of a pavement sensor which could alert Turnpike staff of freezing conditions when precipitation is not present. It may also be beneficial to review this location with the state police for further evaluation, specifically during inclement weather.
Total number of crashes: 17, CRF: 1.25

8. North of Shaker Road to Bald Hill Road in the SB Lanes – Mile 71
This 0.84 mile section of roadway is fairly straight and has a bridge over one waterway; the Royal River Reserve. Four of the eleven crashes at this location occurred during snow or ice conditions. Five of the crashes were vehicles that went off the road, four crashes were collisions with deer, one crash involved a vehicle hitting an object in the road, and one crash was a sideswipe.

It may be beneficial for maintenance to pay particular attention to this area during inclement weather conditions. Two W11-3 (Deer) warning signs could also be installed on either side of the roadway in advance of this area.
Total number of crashes: 11, CRF: 1.03

9. North of High Street to W. Gardiner/Farmingdale town line in the SB Lanes – Mile 104
Fourteen of the seventeen crashes at this 0.78 mile roadway section occurred when the roadway was classified as 'wet' during a rain event. Hydroplaning was also mentioned in the crash descriptions numerous times. The evidence suggests that water pooling in the wheel ruts is a contributing factor to the majority of the crashes along this highway section.

Resurfacing of this section of highway is planned for 2014. The resurfacing would eliminate the wheel ruts and should reduce the crashes along this highway segment.
Total number of crashes: 17, CRF: 1.24

The detailed collision diagrams for each of these mainline locations can be found in Appendix E. These diagrams provide extensive details concerning each crash that occurs at these high crash locations.

HIGH CRASH LOCATIONS – TURNPIKE RAMPS

Table 7-3 shows a summary of the Turnpike ramps that are currently considered high crash locations. Each high crash ramp is discussed in the following paragraphs.

Table 7-3 - 2009-2011 HCLs on Turnpike Entrance and Exit Ramps

Town	*Node/Element*	*Description*	*Crashes*	*CRF*
Wells	239745	0.27 miles, Exit 19 SB Off Ramp	8	3.71
Kennebunk	239756	0.51 miles, Exit 25 SB Off Ramp	9	2.57
Biddeford	239715	0.13 miles from local street (toll plaza), Exit 32 On Ramp	8	1.62
Falmouth	2036928	0.17 miles from local street (toll plaza), Exit 53 On Ramp	8	2.00
Portland	2836952	0.07 miles from local street (toll plaza), Exit 48 Off Ramp	8	2.92

1. Exit 19 SB Off Ramp, Wells

This section of the Exit 19 southbound off-ramp is 0.27 miles long. Half of the crashes at this location (four of eight) were caused by asleep or fatigued drivers. Seven of the eight crashes were classified as 'went off road' and one classified as a vehicle fire. No apparent geometric reasons for these types of crashes were found during an on-site investigation.

While not standard on Turnpike entrance and exit ramps, it is recommended that Sonic Nap Alert Patterns (SNAPS) be installed at this location. The addition of SNAPS on the shoulders of the exit ramp may reduce the number of crashes due to fatigued drivers or driver inattention.
Total number of crashes: 8, CRF: 3.71

2. Exit 25 SB Off Ramp, Kennebunk

This section of the Exit 25 southbound off-ramp is 0.51 miles long. This ramp accesses both a service plaza and local roadways. The ramp splits after 120 feet leaving a very short distance for drivers to decide which direction they want to travel. Eight of the nine crashes on the ramp were caused by drivers backing up with the other crash being a sideswipe. This is most likely due to driver unfamiliarity and the need for quick decision making.

This service plaza/Kennebunk exit area contains both a Service Plaza ramp and a ramp for Exit 25 which may be confusing for the unfamiliar motorist. Changes to the guide signs may help. It is recommended that the guide signs at this exit be reviewed for effectiveness and clarity.
Total number of crashes: 9, CRF: 2.57

3. Exit 32 Ramps, Biddeford

This section is described as the Exit 32 ramps from the intersection with the local road for a distance of 0.13 miles. This covers both entering and exiting directions of traffic. Crashes in this location vary considerably: three crashes are on the exiting ramp and five are on the entering ramp. Two crashes were classified as hitting a fixed object; three were sideswipes; one was backing, one was a rear-end and one was classified as head on. All crashes occurred during clear weather conditions and seven of the eight crashes occurred while the roadway was dry.

There is no obvious crash pattern or other cause (e.g. weather) identified at this HCL. HNTB Corporation recommends monitoring this ramp in future years to see if it continues to be classified as a HCL and if a pattern develops. If so it may become necessary to conduct a more detailed safety assessment to identify safety-related improvements.
Total number of crashes: 8, CRF: 1.62

4. Exit 48 Ramps, Westbrook

This section is described as the Exit 48 ramps from the intersection with the local road for a distance of 0.07 miles. This covers both entering and exiting directions of traffic. The types of crashes recorded were similar at most toll plazas where traffic flow is interrupted: Two crashes classified as rear ends, four crashes were sideswipes, one crash was due to backing and one crash involved a fixed object. The decision making distance between the intersection with the local road and the toll plaza is very short (less than 1/10 of a mile) which likely leads to confusion, braking and rear end/sideswipe collisions at this location.

Improved advanced signing on all legs of the intersection with the local road could help to improve safety by encouraging unfamiliar drivers to choose the correct lane well in advance. Improved lane striping in the decision making area between the intersection and the toll plaza may also help.
Total number of crashes: 8, CRF: 2.92

5. Exit 53 Ramps, West Falmouth

This section is described as the Exit 53 ramps from the intersection with the local road for a distance of 0.17 miles. This covers both entering and exiting directions of traffic. Crashes in this location vary considerably: three crashes are on the exiting ramp while five are on the entering ramp. Two crashes were classified as hitting a fixed object; four were sideswipes; one was backing and one was a 'rear-end'. Two crashes occurred during rainy weather, the rest during clear weather conditions.

There is no obvious crash pattern or other cause (e.g. weather) identified at this HCL. The interchange bridge serving southbound traffic over the Turnpike is currently being rehabilitated.

HNTB Corporation recommends monitoring this ramp in future years to see if it continues to be classified as an HCL and if a pattern develops. If so it may become necessary to conduct a more detailed safety assessment to identify safety related improvements.
Total number of crashes: 8, CRF: 2.00

The detailed collision diagrams for each of these locations can be found in Appendix F. These diagrams provide extensive details concerning each crash that occurs at these high crash locations.

HIGH CRASH LOCATIONS – LOCAL INTERSECTIONS ADJACENT TO THE TURNPIKE

Table 7-4 shows a summary of the local intersections adjacent to the Turnpike that are considered high crash locations. These intersections are not the jurisdiction of the Authority nor does the Authority assume any responsibility for them. The information on intersections where the Authority connects to local roads or state highways is provided as part of this study so the Authority can assess issues and determine impacts that improvements on Turnpike may have on adjacent roadways. With this information the Authority can plan accordingly and coordinate improvements, where appropriate, with communities and the Maine Department of Transportation. The exception to this would be the intersection of Exit 102 and Rt. 126 in West Gardiner where the Authority built a Service Plaza and assumes some responsibility for the intersection as a condition of the traffic movement permit.

Table 7-4 - 2009-2011 HCLs at local intersections adjacent to the Turnpike

Towns	*Node/Element*	*Description*	*Crashes*	*CRF*
Kittery	58964	Interchange: Exit 2 Off Ramp & Rodgers Road	11	2.42
Wells	58365	Interchange: Exit 19 Off Ramp & Sanford Road	19	1.09
Portland	18670	Interchange: Exit 48 Off Ramp & Riverside Street & Larrabee Road	52	1.91
W. Gardiner	28516	Interchange: Exit 102 Ramps & Routes 9/126	25	19.91

Notes regarding this data are:

- The highest number of crashes (52) occurred at the intersection of Exit 48 and Riverside Street/Larrabee Road. This location experienced more than twice as many crashes as the other high crash intersections that are adjacent to the Turnpike.
- The CRF at the intersection of Exit 102 and Routes 9/126 is 19.91. This location is ranked #1 by MaineDOT as having the highest crash rate of all HCLs in the State of Maine. A study was recently completed to address this location
- Exits 19 and 48 are both signalized intersections while Exits 2 and 102 are not signal controlled.

Each high crash intersection is discussed in the following paragraphs.

1. Exit 2 NB Off Ramp & Rodgers Road, Kittery

The location described is the intersection of the Exit 2 NB Off ramp and Rodgers Road (Route 236) in Kittery. Ten of the eleven crashes at this location were rear-end type crashes occurring at the end of the off ramp as traffic yields to the two lanes of through traffic on Route 236. One of the rear-end collisions occurred in slushy road conditions. There is a short three lane weave section immediately following the intersection with no Yield or Stop sign.

Four specific changes can be made at this intersection to improve traffic flow and safety:

1. There are curve arrow signs present on the ramp that are covered by grass, the grass should be trimmed so that the signs are visible.

2. Trees and shrubs in the gore of the intersection should be trimmed and maintained to improve sight distance for merging traffic.
3. Install advanced signs on the ramp warning of the yield ahead.
4. Reconfigure the ramp to approach Route 236 at a sharper angle to increase vehicle visibility for approaching Route 236 traffic.

MaineDOT, the current owner of the ramp and intersection, is undertaking a Pavement Rehabilitation project for Exit 1, 2 & 3 Southbound as well as the mainline Interstate Southbound in 2013. These changes are recommended to be undertaken as part of that project or by MaineDOT maintenance forces before the Authority considers purchasing this section of the Interstate.
Total number of crashes: 11, CRF: 2.42

2. Exit 19 Ramps, Sanford Road (Route 109/9) & Transportation Center, Wells

The location is the signalized intersection of the Exit 19 Ramps, Sanford Road and the transportation center entrance in Wells. Eight of the nineteen crashes were rear-end type crashes occurring in the eastbound direction approaching the signal on Sanford Road. The eastbound direction is on a downward grade and six of the eight crashes here occurred during inclement weather conditions. In addition, three rear-end crashes occurred on the southbound signal approach where traffic is exiting the Turnpike. Substantial queues were observed during the field visit and have been known to occur at this location. Other crashes at this location include three other rear-end crashes, three crashes were the driver lost control (two went off of the road), one sideswipe, and one turning movement crash.

This location has been observed to have lengthy queues particularly on the off ramps. Signal re-timing and re-striping may improve operations at the intersection and reduce queues on all approaches to the intersection. Improvements for this intersection are suggested in the Central York County Connections Study. Those improvements include creating a double left-turn from the off-ramps to Route 109. Creating a double left turn will reduce delays on all approaches to the intersection.
Total number of crashes: 19, CRF: 1.09

3. Exit 48 Ramps, Riverside Street & Larrabee Road, Westbrook

The location is the signalized intersection of the Exit 48 Ramps, Riverside Street, and Larrabee Road in Westbrook. Twenty of the fifty-two crashes at this location were sideswipes occurring in the southbound direction on Riverside Street approaching the signal. The lane configuration for this approach (from left to right as driving) is left, left/through, and through/right. It seems that a majority of the sideswipes occur when drivers attempt to make left turns side by side; a number of drivers admitted trying to go straight through the intersection from the left only lane.

Twelve crashes were classified as rear-ends on the westbound leg exiting the Turnpike. The lane configuration on this leg is left-through-through-right. The right turn lane is separated by a small island, which is yield controlled causing traffic to generally travel at higher speeds. Other crashes at this intersection included eleven other rear end/sideswipes, eight turning movement crashes, and one vehicle fire.

There are overhead guide signs located on the southbound Riverside Drive. However, there are no standard regulatory overhead lane use signs at this intersection. It could be beneficial if overhead lane

use signs are added on all legs of the intersection to clarify lane use designations. The number of sideswipe crashes is particularly high for vehicles turning left onto the Turnpike from Riverside Street.

Rear-end crashes are of particular concern on the westbound leg of the intersection which serves traffic exiting the Turnpike. It may be possible to decrease the number of crashes at this location by altering the pavement markings.

It is recommended that the signs and pavement markings of the westbound approach be studied further for possible modifications, and that the Authority coordinate with the local municipalities and the MaineDOT regarding improvements for the other legs of the intersection.
Total number of crashes: 52, CRF: 1.91

4. Exit 102 Ramps, Lewiston Road (Route 9/126) & Service Plaza Entrance, West Gardiner
The node described is the stop controlled 4-way intersection of the Exit 102 Ramps, Lewiston Road (Routes 9/126) and the West Gardiner service plaza entrance. Twenty-four of the twenty-five crashes at this location were angle crashes.

Limited sight distance may be the cause for most of these crashes. A signal warrant analysis was completed in February 2012 by HNTB Corporation. A traffic signal warrant was met for this location, in accordance with the guidelines set forth in the MUTCD,[17] and a signal was recommended in a memorandum addressed to the Authority dated February 21st, 2012. However, meeting a traffic signal warrant does not in itself justify a signal. A meeting was held with MaineDOT. During that meeting, MaineDOT recommended changes to the pavement markings, including re-positioning the stop bars, as a method to improve the safety at this location. As a result, the Authority has implemented the pavement marking recommendations.
Total number of crashes: 25, CRF[18]: 19.91

The detailed collision diagrams for each of these locations can be found in Appendix G. These diagrams provide extensive details concerning each crash that occurs at these high crash locations.

[17] U.S. Department of Transportation Federal Highway Administration. *Manual on Uniform Traffic Control Devices,* Washington, D.C. 2009
[18] The CRF has been updated by MaineDOT since publication of the February memorandum.

8 SAFETY AND SPEED EVALUATION – MILE 80 TO 102

HNTB reviewed clear zones, guardrail end treatments, and median openings from the Maine Turnpike Exit 80 in Lewiston to Exit 102 in Gardiner, northbound and southbound. The purpose of the review was to compare the impact on the above noted features of increasing the design speed from 65 mph to 75 mph. The design guidelines used for this review are the *AASHTO's, A Policy on Geometric Design of Highways and Streets, 6th Edition, 2011*, (referred to as the Green Book) and the *Roadside Design Guide, 4th Edition, 2011* (referred to as RDG). This analysis did not include a review of the horizontal and vertical alignment, and acceleration and deceleration lanes.

Clear Zone – A clear zone is the unobstructed, traversable area provided beyond the edge of the through traveled way for the recovery of errant vehicles. From the RDG, Table 3-1 reports for an upper limit speed of 65-70 mph a Clear Zone of 30-34' for side slopes of 1:6 and a clear zone of 38-46' for side slopes of 1:5 to 1:4 (including 1:4). Side slopes of 1:3 up to 1:4 are considered traversable but non-recoverable which means that the slope is not included in the clear zone distance. Slopes steeper than 1:3 should be protected. Note 'a' from Table 3-1 states: *When a site-specific investigation indicates a high probability of continuing crashes or when such occurrences are indicated by crash history, the designer may provide clear-zone distances greater than the clear zone shown in Table 3-1. Clear zones may be limited to 30 feet for practicality and to provide a consistent roadway template if previous experience with similar projects or design indicates satisfactory performance.* Note 'd' from Table 3-1 states: *When design speeds are greater than the values provided, the designer may provide clear-zone distance greater than those shown in Table 3-1.*

Data obtained from the original construction plans indicates typical side slopes of 1:3 to 1:4. These fore slopes typically terminate in a ditch section or extend to the clearing line. The latest three year crash history, 2009 – 2011, indicates no high crash locations identified within this section. Based on this information a typical clear zone of 30' could be applied to the sections where a 1:4 backslope exists and a typical clear zone consisting of a minimum 10' clear recovery area beyond the toe of slope for sections where a 1:3 backslope exists. There are a fair number of locations where these clear zones are not provided and therefore do not meet recommended guidelines for either a 65 or a 75 mph speed limit.

Due to close proximity of the existing roadside ditches and the vegetation line, the existing condition is generally not in conformance with the guidelines for the current speed of 65 mph and will also not be in conformance with a 75 mph design speed.

Guardrail End Treatments – Current MTA practice for new installations of guardrails and end treatments is to comply with the latest MaineDOT policy and the RDG, which is to meet NCHRP 350 TL-3 requirements. The MTA is also routinely modifying existing installations to meet these requirements as part of stand-alone and mainline paving projects. The RDG (and NCHRP 350) do not specify guardrail treatments based on small differences in speed, for example 65 vs 75mph, but rather are based on a low-speed or a high-speed test level, specifically 31 and 62 mph respectively. The NCHRP does not provide test data for speeds over 62 mph.

The current Maine Turnpike end treatments (FLEAT 350 for single face guardrail and CAT's for Double face Guardrail) are in conformance with the NCHRP 350 TL-3 crash test criteria. This is based on a speed of 62 mph.

Median openings – Median openings in the guardrail are legally used by authorized vehicles and illegally used by non-authorized vehicles to reverse direction or to access Turnpike facilities located adjacent to the mainline. The illegal use of these openings presents a safety concern to both the illegal user and the mainline motorists. To provide the greatest amount of safety the MTA is currently reviewing and modifying all median openings to ensure adequate sight distance to and from the opening as well as adequate spacing of these openings to serve the needs of emergency and maintenance personnel. The design variables of interest respective to the openings are: width of opening, guardrail terminal ends and their locations, the decision sight distance (DSD) to and from these openings, and the distances from ramps.

The Maine Turnpike is using an opening width of 80 feet to minimize potential of errant vehicles passing through the opening while providing adequate width for emergency and maintenance vehicles to utilize the opening. A CAT-350 guardrail terminal end, which is designed for NCHRP 350 requirements TL-3-, is the typical end treatment for these openings. These are offset such that the guardrail and terminal ends are closest to the roadway on the approach side of the opening. For example the terminal is adjacent to northbound roadway south of the opening and adjacent to the southbound roadway north of the opening. This minimizes the potential of an errant vehicle passing through the opening and striking the terminal end head-on. The use of DSD versus the Stopping Sight Distance (SSD) is based on the desire to allow a driver to perceive the issue then adjust their speed and path to avoid the obstruction rather than stopping. Based on Green Book, Section 8.3.2 *Maintenance or emergency crossovers generally should not be located closer than 1500 feet to the end of a speed-change taper of a ramp or to any structure.* This is similar to DSDs found in the Green Book Table 3-3, specifically a DSD of 1365 feet for 65 mph and 1545 for 75 mph. For reference the SSDs are 645' and 820' for 65 and 75 mph respectively. Based on these guidelines and the MTA's current speed limit, HNTB has recommended a minimum DSD to and from these opening of 1500 feet as well as locating them 1500 feet from structures and interchange ramps.

We have also evaluated the following as it relates to design speed.

Signing - From the Green Book, Section 2.2.8, *Speed reduces the visual field, restricts peripheral vision, and limits the time available for drivers to receive and process information.* Features related to this are Exits and Exit signing. A typical sign package for an Exit consists of advanced guide signs placed at 2-miles, 1-mile and ½-mile intervals prior to the Exit. Increasing the speed limit from 65 to 75mph could decrease the travel time from the ½-mile sign to the exit from 27.7 seconds to 24.0 seconds. Driver perception time, the time it takes an average driver to perceive then initiate a reaction to some piece of information, is typically estimated at 2.5 seconds. Even from the ½-mile sign an average driver traveling at the higher speed limit would be able to perceive the upcoming Exit and have ample time, over 21 seconds, to prepare for exiting.

Highway Infrastructure - This section of mainline consists of two two-lane roadways with shoulders and a median separating the northbound from southbound. Underpasses and overpasses carry the standard lane and shoulder widths under and over rivers and other roadways. There are only two

locations in this section that contain something other than the typical roadway; one is the Sabattus Interchange and the other is the West Gardiner Toll Plaza. In both of these cases there exists a typical sign package alerting the driver of what to expect. There are no complex features within this section, for example a weaving section between two closely spaced interchanges, therefore an average driver traveling at the higher speed limit would be able to perceive the upcoming roadway and infrastructure with ample time to adjust accordingly.

Current Free Flow Speeds - Speed data was collected from four count stations on the Turnpike near Exits 80, 86, and 102, and near mile marker 98. From this speed data, an 85th percentile free flow speed was calculated. The speed data used to calculate the 85th percentile free flow speed was taken during daylight hours on clear days. Daylight hours from June 10- 12 were analyzed for the locations near Exits 80, 86, and 102. Daylight hours from September 11-13 were analyzed for the location near mile marker 98. Table 7-1 shows the 85th percentile speeds for the travel lane (right lane) and the passing lane (left lane), for both directions of the Turnpike segments. As can be seen from Table 8-1, free flow speeds near Exits 80 and 86 are pretty close to the speed limit. Generally free flow speeds near Exit 102 are 5 to 10 mph over the 65 mph speed limit. Free flow speeds near mile marker 98 are 10-15 mph over the speed limit. These speeds could reflect a tendency to slow down in the vicinity of an interchange.

Table 8-1 – 85th Percentile Speeds (mph) – Mile 80-102

North of Exit 80 SB on-ramp

NB			SB		
Travel	Passing	Both Lanes	Travel	Passing	Both Lanes
64.7	70.8	67.8	66.3	70.0	68.1

South of Exit 86 SB on-ramp

NB			SB		
Travel	Passing	Total	Travel	Passing	Total
59.0	62.8	60.9	66.3	66.6	66.4

North of Exit 102 NB off-ramp

NB			SB		
Travel	Passing	Total	Travel	Passing	Total
66.7	73.5	70.1	72.8	75.1	73.9

Near MM 98

NB			SB		
Travel	Passing	Total	Travel	Passing	Total
76.4	79.2	77.8	76.6	79.6	78.1

Summary – The existing condition for clear zones is generally not in conformance with the guidelines for the current speed of 65 mph and will also not be in conformance with a 75 mph design speed. However, no high crash locations have been designated in this stretch of highway over the last three years.

The current Maine Turnpike guardrail end treatments are in conformance with the NCHRP 350 TL-3 crash test criteria. This is based on a speed of 62 mph. There are no crash test criteria for higher speeds.

HNTB has made recommendations for a minimum DSD to and from median openings of 1500 feet as well as locating the median openings 1500 feet from structures and interchange ramps. This distance meets the Green Book recommendation for 65 mph and is close to the Green Book recommendation for 75 mph.

Before a decision is made on maintaining or increasing the speed limit, the horizontal and vertical alignment should be evaluated. However, the preceding evaluation did not find a design criteria and corresponding existing condition that prevents the speed limit from being raised in this section.

9 OFF SYSTEM NEEDS

Planned and potential off-system highway improvements and planned commercial/retail developments can have an effect on the safety, operation, and demands of the Turnpike and could accelerate the need to make forecasted improvements identified in previous sections. The Authority is taking a proactive approach in maintaining an open dialog with the communities along the Turnpike corridor to identify proposed projects that could adversely affect various aspects of the Turnpike operations, including intersections adjacent to Turnpike interchanges; toll plazas, ramps, and the Turnpike mainline.

The Authority obtained a list of current traffic movement permits, issued by MaineDOT, for planned developments in the communities along the Turnpike corridor. The Authority also reviewed MaineDOT's State Transportation Improvement Program (STIP), which is a list of federally funded transportation projects that are outside MPO's, for projects that may affect the turnpikes operations. It does not appear any of the proposed projects on the MaineDOT lists will have any significant effect on Turnpike operations.

Additionally, the Authority sent a letter on June 22nd, 2012 to communities and Metropolitan Planning Organizations (MPO's) along the Turnpike corridor requesting information regarding existing reports or studies identifying short or long term transportation improvements or problem areas that are adjacent to the Turnpike. The letter also requested copies of land use or zoning plans and any traffic permits for major commercial developments that would need efficient access to the Turnpike.

The Authority received responses from nine communities. The following is a summary of the information received by the communities:

- Auburn
  - 2010 version of the City's Comprehensive Plan. No permitted development addressed in the plan
  - Comprehensive Plan that states new Turnpike access is a priority.
  - Information about continued airport/intermodal facility development. The City believes that it may create increased demand at Exit 75.
- Falmouth
  - Pavement and Transportation Management Plan. The following were identified as needs
    - Eliminate tolls on the Falmouth Spur.
    - Provide an at-grade intersection of the Falmouth Spur and U.S. Route 1.
    - Replace the signalized intersection at Exit 53 and Route 26/100 with a roundabout.
- Gray
  - The Northbrook Traffic Impact Assessment for Potential Area 3 Development. The report identifies the need for an additional eastbound lane on Routes 4/26A/115/202 between the Route 26A intersection and Exit 63.
- New Gloucester
  - Information about the installation of new public water mains in the Upper Village area along Routes 4/100/202 in 2013.

- Portland
    - Information about the construction, in two phases, of a Technology Park located off Rand Road on a parcel abutting Exit 47. The City of Portland will construct the public road into the site with utilities along the road. Under the current plan, the full build out of the park, by developers, will consist of seven buildings with total square footage of approximately 120,000 square feet. Construction of the public road and utilities should be completed in 2013.
- Saco
    - A 2011 updated Comprehensive Plan.
    - Goals that have been updated to reflect the City's desire to have additional Turnpike connections through new interchanges or the reestablishment of old Exit 5 on Route 112.
- Scarborough
    - Recent zoning changes around Exit 42 and along the Haigis Parkway.
        - Proposed service station with fuel and restaurant(s) adjacent to Exit 42 on Payne Road.
        - New recently approved 15,000 -16,000 square foot office building to be located on the Haigis Parkway.
    - Information regarding the Dunstan Corner intersection project.
- Wells
    - Information regarding possible extension of public water and sanitary sewer from Spencer Drive westerly on Routes 9/109 to the Transportation Center located opposite Exit 19.
    - Information regarding the need to widen Routes 9/109 west of Exit 19 to better accommodate the easterly left turn lane into Exit 19.
    - A request to consider an additional interchange in the region to help mitigate traffic congestion along U.S. Route 1 in the Wells, Ogunquit and York region.
    - A request to consider creation of a Transportation Center District at the Wells Transportation Center facility to develop mixed-use businesses to serve travelers.
- Westbrook
    - Information regarding development of Stroudwater Place.
        - Parcel located between Westbrook Arterial and Westbrook Street opposite Larrabee Road.
        - Developer needs approval from MaineDOT for access to parcel from Westbrook Arterial which is a Control of Access right of way. The City expects some development to occur within 10-year time period.
    - Information regarding development/expansion of existing development along the Larrabee Road Corridor between Exit 48 and Westbrook Arterial.

Based on the above responses, the following are possible impacts to the Turnpike that may require operational improvement considerations to accommodate potential traffic increases.

Auburn – The Authority recently evaluated Exit 75, the roadway system and intersections around Exit 75. Expected growth from the airport and industrial parks were included in the evaluation. The recommendations from that study included improvements to two local intersections. The

recommendations were found to provide the most benefit for the cost; have the least impact to parcels that have potential for future economic development; were permittable; and addressed all of the transportation deficiencies identified under the future no-build alternative. Based on the results of this study, MaineDOT is currently developing plans and specifications to implement these improvements. The Authority also recently completed the lengthening of the northbound acceleration ramp and is currently lengthening the southbound acceleration ramp at Exit 75. No additional improvements are planned in the foreseeable future.

Falmouth – There are currently no identified operational or safety deficiencies at locations in Falmouth, with the exception of the Exit 53 ramps between the toll plaza and the adjacent intersection with Route 26/100. HNTB Corporation recommends monitoring this ramp in future years to see if it continues to be classified as a high crash location and if a pattern develops.

Gray – The consideration of an additional eastbound travel lane is currently being evaluated as a part of the Gray Interchange Study.

New Gloucester – The planned water line installation in the Upper Village area may attract development but is not expected to impact Turnpike operations over the next 30 years.

Portland – It is assumed that additional traffic generated by the proposed Technology Park will increase traffic at Exit 47 thereby increasing congestion on the Turnpike through the Portland region. That could accelerate the need for adding capacity along the mainline of the Turnpike in the Portland area.

Saco –The communities of Saco and Scarborough are considering a study that will evaluate traffic congestion in their respective communities.

Scarborough – Proposed developments along the Haigis Parkway resulting from recent zoning changes will likely increase traffic volumes at Exit 42 thereby increasing congestion on the Turnpike north and south of Exit 42. That could reduce the timeframe when this section of the Turnpike is forecasted to reach a failing LOS and may require additional capacity to be added at the Scarborough toll plaza.

Wells – The Authority currently has no plans for evaluating any improvements to Routes 9/109 in the vicinity of Exit 19. However, this area is a high crash location. Some improvements to the intersection and ramps are suggested to improve safety at this location.

Currently, the Authority is not engaged in any studies regarding the need for an additional interchange to serve the Wells, Ogunquit and York communities.

The planned water line extension on Routes 9/109 may attract development but is not expected to impact Turnpike operations over the next 30 years.

Westbrook – The proposed Stroudwater Place Development (a 61 acre site with a proposed 1.7 million square feet of mixed use development) located in the vicinity of Exit 47 coupled with the Portland Technology Park development mentioned above will adversely affect capacity of the

Turnpike. Traffic from these developments could accelerate the need for adding capacity along the mainline of the Turnpike in the Portland area. Proposed development/expansion of existing development along the Larrabee Road corridor could increase traffic volumes at both Exits 47 and 48 that could further increase congestion along the Turnpike through the Portland Region.

Summary – the effects from traffic generated by the proposed and permitted developments in Portland, Scarborough and Westbrook adjacent to Exits 42, 47 and 48 could adversely impact the timelines for which capacity improvements will need to be made in those areas.

10 COST ANALYSIS

Previous sections of this study identified a timeline when the Turnpike mainline segments, ramps, and toll plazas would reach capacity. The timeline for capacity improvements could be hastened depending on the impacts of commercial developments identified in Portland, Westbrook, and Scarborough, as well as the results of other ongoing studies, especially the Gorham East-West Corridor Feasibility Study.

As a result of the forecasted capacity needs, widening projects and cost for those projects were developed for the timelines established. When computing future costs for construction a few key assumptions were made:

- Construction costs and schedules are for the year that a segment, ramp or merge/diverge area reaches a LOS F.
- The cost to add a single lane to either a mainline or ramp in the year 2012 is $2,350,000/mile. Major items for adding a lane considered include clearing, pavement/gravel template, removing the existing shoulder, guardrail, stone ditch protection, loam, pavement markings, mobilization, median guardrail, ROW fence, traffic maintenance, common excavation, common borrow, and rock excavation. The total was then increased by a factor of 15% to account for smaller, miscellaneous costs involved with this type of large scale project.
- Ramp widening will add a 12' lane and a 10' shoulder.
- Ramps being widened to 2 lanes are to be lengthened 400' beyond their current length.
- The mainline widening will add 24' to the existing roadway.
- A conservative 3% inflation factor per year is implemented when forecasting future costs.
- All bridges South of Mile 44 have been designed to handle a mainline widening to four lanes and are not being considered for any replacement or repairs in this study.

Construction of each improvement would ideally begin during the year that an area reaches a failing Level of Service (LOS F). These years have been calculated for each merge/diverge area, ramp and mainline segment and are presented in the tables within Section 3. The following cost calculations are based on the year that a given area is expected to reach LOS F. The construction schedule and forecasted costs are adjusted further to help reduce construction costs by grouping similar projects in adjoining locations in the same year. Table 10-1 displays proposed improvements which would alleviate the inadequate levels of service expected to be produced by forecasted volumes.

In the right hand column of Table 10-1, the total estimated costs of each improvement necessary to create a passing level of service is displayed. It is important to remember that these costs are summarized for the year during which construction is recommended to begin. The actual construction of various improvements may be spread out over more than one construction season.

In general, mainline sections for the northbound travel direction reach capacity several years before the southbound travel direction due to higher design hour volumes. The actual years that directional mainline widening is forecasted is shown in Table 10-1. However, the northbound and southbound sections would likely be permitted and constructed at the same time at a time when both sections reach capacity.

Table 10-1 – Forecasted Problems and Cost of Improvements

Year of Failure (LOS F)	Exit #/ Segment mileage	Location	Reason for failure	Necessary Improvement	Length of Improvement Area (miles)	Cost of Improvement in 2005	Forecasted Cost of Improvement for Year in Question	Necessary Bridge Expansion?	Cost of Bridges in 20012	Forecasted Cost of Bridges for Year in Question	Total Forecasted Cost
2017	0-2	NB Mainline	Mainline Capacity	Mainline Widening[1]	1.1	$ 2,585,000	$ 2,966,700	NO[2]			$ 2,996,700
2018	36	Toll Lanes	Toll Capacity	ETC Lane Widening	0.26	$ 611,000	$ 729,570	YES	$ 579,000	$ 691,360	$ 1,420,900
2019	36	NB On Ramp	Ramp Capacity	Ramp Widening	0.76	$ 1,786,000	$ 2,196,600	NO			$ 2,196,600
2021	36	NB Off Ramp	Diverge Area Capacity	Ramp Widening	0.79	$ 1,857,000	$ 2,423,000	NO			$ 2,423,000
2022	0-2	SB Mainline	Mainline Capacity	Mainline Widening[1]	1.1	$ 2,585,000	$ 3,474,000	NO[2]			$ 3,474,000
2022	2	SB On-Ramp	Ramp Capacity	Ramp Widening	0.57	$ 1,340,000	$ 1,800,00	YES	$ 2,000,000	$ 2,687,800	$ 4,488,600
2023	44	SB On-Ramp	Ramp Capacity	Ramp Widening	0.42	$ 987,000	$ 1,366,200	NO			$ 1,366,200
2025	46-48	NB Mainline	Mainline Capacity	Mainline Widening	2.1	$4,935,000	$ 7,247,200	YES[3]	$ 6,000,000	$ 8,811,200	$ 16,058,000
2030	36	SB Off Ramp	Diverge Area Capacity	Ramp Widening	0.84	$ 1,974,000	$ 3,360,000	NO			$ 3,360,000
2031	2-7	NB Mainline	Mainline Capacity	Mainline Widening	5.7	$ 13,400,000	$ 23,497,000	NO			$ 23,497,000
2031	32	NB On Ramp	Ramp Capacity	Ramp Widening	0.38	$ 893,000	$ 1,565,900	NO			$ 1,565,900
2034	44-46	NB Mainline	Mainline Capacity	Mainline Widening	2.1	$ 4,935,000	$ 9,456,000	YES[3]	$ 17,400,000	$ 33,340,000	$ 42,796,000
2034	32	SB Off Ramp	Ramp Capacity	Ramp Widening	0.83	$ 1,951,000	$ 3,738,300	YES	$ 2,000,000	$ 3,832,200	$ 7,570,500
2035	2-7	SB Mainline	Mainline Capacity	Mainline Widening	5.7	$ 13,400,000	$ 26,446,000	NO			$ 26,446,000
2037	44-47	SB Mainline	Mainline Capacity	Mainline Widening	3	$ 7,050,000	$ 14,761,000	YES[3]	$ 3,400,000	$ 7,118,800	$21,880,000
2038	36	SB On Ramp	Merge Area Capacity	Ramp Widening	0.56	$ 1,316,000	$ 2,838,100	NO			$ 2,838,100

[1]Traffic between Exits 0-7 is constrained by the Piscataqua River Bridge. Peak hour northbound traffic will not reach forecasted levels due to the traffic capacity constraint of the bridge. Conversely, peak hour traffic southbound will not benefit from widening if the capacity of the bridge is less than the mainline (i.e. if the bridge is not widened). Because of capacity issues, coordination with the New Hampshire Department of Transportation will be needed in the near future.
[2]The widening of the bridge over the Piscataqua River is not included in this analysis.
[3]Bridges from MM 44-48 may need work sooner if part of the bridge program.

11 RECOMMENDATIONS/SUMMARY OF FINDINGS

This study assessed operating conditions of all interchanges, mainline sections, ramps, and toll plazas on the Turnpike between Kittery and Augusta. This study also included an assessment of high crash locations for all mainline sections, ramps, toll plazas, and intersections of local roads with Turnpike ramps. In addition, this study also included the following information:

- An analysis of Park and Ride lots adjacent to the Turnpike
- An evaluation of speeds from Exits 80-102
- Information from municipalities adjacent to the Turnpike regarding short or long term transportation improvements or problem areas

CAPACITY IMPROVEMENTS

Capacity improvements, presented in Table 11-1, are based on the results of capacity analyses performed. Included in Table 11-1are possible future improvements, an approximate time table of when the improvements will become necessary, and an estimate of the forecasted construction costs. HNTB Corporation has adjusted the construction schedule and costs previously presented to create an optimal timeline which will minimize construction costs by grouping similar projects in adjacent areas. The costs have been forecasted to the year that construction is proposed to begin. To summarize for budgeting purposes Table 11-1 combines the cost of all projects proposed to begin in the same year.

Table 11-1 – Cost of Proposed Improvements by Year

Year	Total Forecasted Cost	Location of Proposed Improvement
2017[1]	$ 2,996,700	NH State Line to Kittery Exit 2 – NB Mainline
2018	$ 3,617,500	Exit 36 Saco – Toll Lanes **and** NB On-ramp
2021	$ 2,423,000	Exit 36 Saco – NB Off Ramp
2022[1]	$ 7,962,600	NH State Line to Kittery Exit 2 – SB Mainline **and** Exit 2 SB-On-ramp
2023	$ 1,366,200	Exit 44 I-295 Scarborough SB On-Ramp
2025	$ 16,058,000	Jetport to Westbrook – NB Mainline
2030	$ 3,360,000	Exit 36 Saco – SB Off Ramp
2031	$ 25,062,900	Kittery Exit 2 to York – NB Mainline **and** Biddeford NB on-ramp
2034	$ 50,366,500	I-295 Scarborough to Jetport – NB Mainline **and** Exit 32 Biddeford – SB off-ramp
2035	$ 26,446,000	Kittery Exit 2 to York – SB Mainline
2037	$21,880,000	I-295 Scarborough to Rand Rd – SB Mainline
2038	$ 2,838,100	Exit 36 Saco – SB On Ramp

[1]Traffic between Exits 0-7 is constrained by the Piscataqua River Bridge. Peak hour northbound traffic will not reach forecasted levels due to the traffic capacity constraint of the bridge. Conversely, peak hour traffic southbound will not benefit from widening if the capacity of the bridge is less than the mainline (i.e. if the bridge is not widened). Because of capacity issues, coordination with the New Hampshire Department of Transportation will be needed in the near future.

Three toll plazas (Biddeford, Scarborough, and Gray) are operating at over 75% capacity and lie in close proximity to a local signalized intersection. Operations at these plazas should be monitored to ensure that the toll plaza operations do not interfere with the flow of traffic on local roads. This will be particularly important at Biddeford and Gray, because these plazas will be operating at 80-90%

capacity during peak periods. Periodic surges at these plazas could result in temporary interference with the local roads.

HIGH CRASH LOCATIONS

Improvements that could be considered to improve high crash locations are the following:

- Advanced overhead signing for the York interchange on the southbound approach to the interchange.
- Modifying the acceleration lane at Wells to I-95 northbound from a taper to a parallel ramp
- A pavement sensor in the northbound lanes just north of the Wells interchange
- A pavement sensor in the southbound lanes north of Mayall Road in New Gloucester
- Deer crossing warning signs at Mile 71 north of Shaker Hill
- Sonic Nap Alert Patterns (SNAPS) on the shoulder of the southbound off-ramp in Wells
- Changes to guide signs at Exit 25 southbound off-ramp
- Overhead lane use signs at Exit 48 off-ramps right after the toll plaza

PARK AND RIDE LOTS

All of the park and ride lots owned by the Authority have been utilized at a rate of less than 75% of available capacity for every year of the last three years with exceptions of the lots at Gray and Lewiston. The Gray Interchange is being studied. Possible relocation of the park and ride lot is part of that study. A new interchange in Lewiston is currently in the 30-year plan. Due to the re-design of the Exit 80 interchange, a larger, single, relocated, park and ride lot is being built and is scheduled to be open late fall 2012.

SPEED EVALUATION

Before a decision is made on maintaining or increasing the speed limit, the horizontal and vertical alignment should be evaluated. However, the evaluation did not find a design criteria and corresponding existing condition that prevents the speed limit from being raised in the section of roadway from Exit 80-102.

OFF SYSTEM NEEDS

The Authority took a proactive approach to identify proposed projects that could adversely affect various aspects of Turnpike operations. The Authority obtained a list of current traffic movement permits, issued by MaineDOT for planned developments in the communities along the Turnpike corridor. The Authority also reviewed MaineDOT's State Transportation Improvement Program (STIP), for projects that may affect the turnpikes operations. Additionally, the Authority sent a letter to communities and Metropolitan Planning Organizations (MPO's) along the Turnpike corridor requesting information regarding existing reports or studies identifying short or long term transportation improvements or problem areas that are adjacent to the Turnpike. The following information received may impact the timeline for capacity improvements.

- Additional traffic generated by the proposed Technology Park will impact Turnpike traffic at and near Exit 47
- The proposed Stroudwater Place Development will also impact Turnpike traffic at and near Exit 47
- The cities of Saco and Scarborough are considering a study that will evaluate traffic congestion in their respective communities.

- Proposed developments along the Haigis Parkway will likely increase traffic volumes at or near Exit 42

A point of considerable interest, which arose during the research for this study, is the possible need for improvements that would involve the need for advanced planning with MaineDOT and local municipalities. These include, but are not limited to:

- Capacity needs on the Piscataqua River Bridge (also includes New Hampshire Department of Transportation)
- Study of traffic congestion in Saco
- Possible improvements to intersections adjacent to the Turnpike in Kittery, Wells, Westbrook, and Biddeford

OTHER STUDIES

Outside of the course of this study, specific projects and issues have been identified that are being analyzed separately. They include the following studies:

- Relocation of the York Toll Plaza (MM 7.3)
- Improvements to the Gray Interchange (Exit 63)
- Improvements to the Lewiston Interchange (Exit 80)
- Improvements to the Gardiner I-295 Toll Plaza (MM 103.0)
- Exit 103/Route 126 intersection improvements
- Gorham East-West Corridor Feasibility Study
- Central York County Connections Study

The results of these studies could influence the timeline for capacity improvements on the Turnpike.

Appendix A Level of Service Description

TABLE 1-1. TYPES OF FACILITIES

FACILITY	CHAPTER
Uninterrupted Flow Facilities	
Freeways	
Basic freeway segments	3
Weaving areas	4
Ramps and ramp junctions	5
Freeway systems	6
Multilane Highways	7
Two-Lane Highways	8
Interrupted Flow Facilities	
Signalized Intersections	9
Unsignalized Intersections (2-way STOP-YIELD-controlled approaches; 4-way STOP-controlled intersections)	10
Arterials	11
Transit	12
Pedestrians	13
Bicycles	14

essary to examine points of fixed interruption as well as uninterrupted flow segments.

Pedestrian and transit flows are generally considered to be interrupted. Uninterrupted flow can exist under certain circumstances, such as in a long busway without stops or a long pedestrian corridor.

CAPACITY AND LEVEL-OF-SERVICE CONCEPTS

A principal objective of capacity analysis is the estimation of the maximum amount of traffic that can be accommodated by a given facility. Capacity analysis would, however, be of limited utility if this were its only focus. Traffic facilities generally operate poorly at or near capacity, and facilities are rarely designed or planned to operate in this range. Capacity analysis is also intended to estimate the maximum amount of traffic that can be accommodated by a facility while maintaining prescribed operational qualities.

Capacity analysis is, therefore, a set of procedures used to estimate the traffic-carrying ability of facilities over a range of defined operational conditions. It provides tools for the analysis and improvement of existing facilities, and for the planning and design of future facilities.

The definition of operational criteria is accomplished using *levels of service*. Ranges of operating conditions are defined for each type of facility, and are related to amounts of traffic that can be accommodated at each level.

The following sections present and define the two principal concepts of this manual: *capacity* and *level of service*.

Capacity

In general, the *capacity* of a facility is defined as the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions.

The *time period* used in most capacity analysis is 15-min, which is considered to be the shortest interval during which stable flow exists.

Capacity is defined for *prevailing roadway, traffic, and control conditions*, which should be reasonably uniform for any section of facility analyzed. Any change in the prevailing conditions will result in a change in the capacity of the facility. The definition of capacity assumes that good weather and pavement conditions exist.

1. *Roadway conditions*—Roadway conditions refer to the geometric characteristics of the street or highway, including: the type of facility and its development environment, the number of lanes (by direction), lane and shoulder widths, lateral clearances, design speed, and horizontal and vertical alignments.
2. *Traffic conditions*—Traffic conditions refer to the characteristics of the traffic stream using the facility. This is defined by the distribution of vehicle types in the traffic stream, the amount and distribution of traffic in available lanes of a facility, and the directional distribution of traffic.
3. *Control conditions*—Control conditions refer to the types and specific design of control devices and traffic regulations present on a given facility. The location, type, and timing of traffic signals are critical control conditions affecting capacity. Other important controls include STOP and YIELD signs, lane use restrictions, turn restrictions, and similar measures.

These and other factors affecting capacity are discussed in greater detail in a subsequent section of this chapter.

It is also important to note that *capacity* refers to a *rate* of vehicular or person flow during a specified period of interest, which is most often a peak 15-min. period. This recognizes the potential for substantial variations in flow during an hour, and focuses analysis on intervals of maximum flow.

Levels of Service

The concept of *levels of service* is defined as a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers. A level-of-service definition generally describes these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety.

Six levels of service are defined for each type of facility for which analysis procedures are available. They are given letter designations, from A to F, with level-of-service A representing the best operating conditions and level-of-service F the worst.

1. *Level-of-service definitions*—In general, the various levels of service are defined as follows for uninterrupted flow facilities:

- *Level-of-service A* represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to maneuver within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist, passenger, or pedestrian is excellent.
- *Level-of-service B* is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to maneuver within the traffic stream from LOS A. The level of comfort and convenience provided is somewhat less than at LOS A, because the presence of others in the traffic stream begins to affect individual behavior.

• *Level-of-service C* is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream. The selection of speed is now affected by the presence of others, and maneuvering within the traffic stream requires substantial vigilance on the part of the user. The general level of comfort and convenience declines noticeably at this level.

• *Level-of-service D* represents high-density, but stable, flow. Speed and freedom to maneuver are severely restricted, and the driver or pedestrian experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.

• *Level-of-service E* represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Freedom to maneuver within the traffic stream is extremely difficult, and it is generally accomplished by forcing a vehicle or pedestrian to "give way" to accommodate such maneuvers. Comfort and convenience levels are extremely poor, and driver or pedestrian frustration is generally high. Operations at this level are usually unstable, because small increases in flow or minor perturbations within the traffic stream will cause breakdowns.

• *Level-of-service F* is used to define forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount which can traverse the point. Queues form behind such locations. Operations within the queue are characterized by stop-and-go waves, and they are extremely unstable. Vehicles may progress at reasonable speeds for several hundred feet or more, then be required to stop in a cyclic fashion. Level-of-service F is used to describe the operating conditions within the queue, as well as the point of the breakdown. It should be noted, however, that in many cases operating conditions of vehicles or pedestrians discharged from the queue may be quite good. Nevertheless, it is the point at which arrival flow exceeds discharge flow which causes the queue to form, and level-of-service F is an appropriate designation for such points.

These definitions are general and conceptual in nature, and they apply primarily to uninterrupted flow. Levels of service for interrupted flow facilities vary widely in terms of both the user's perception of service quality and the operational variables used to describe them. Each chapter of the manual contains more detailed descriptions of the levels of service as defined for each facility type.

2. *Service flow rates*—The procedures of this manual attempt to establish or predict the maximum rate of flow which can be accommodated by various facilities at each level of service, except level-of-service F, for which flows are unstable. Thus, each facility has five service flow rates, one for each level of service (A through E), defined as follows.

The *service flow rate* is the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions while maintaining a designated level of service. As to capacity, the service flow rate is generally taken for a 15-min time period.

Note that service flow rates are discrete values, while the levels of service represent a range of conditions. Because the service flow rates are defined as maximums for each level of service, they effectively define flow boundaries between the various levels of service.

3. *Measures of effectiveness*—For each type of facility, levels of service are defined based on one or more operational parameters which best describe operating quality for the subject facility type. While the concept of level of service attempts to address a wide range of operating conditions, limitations on data collection and availability make it impractical to treat the full range of operational parameters for every type of facility. The parameters selected to define levels of service for each facility type are called "measures of effectiveness," and represent those available measures that best describe the quality of operation on the subject facility type. Table 1-2 gives the measures of effectiveness used to define levels of service for each facility type.

Each level of service represents a range of conditions, as defined by a range in the parameter(s) given in Table 1-2. Thus, a level of service is not a discrete condition, but rather a range of conditions for which boundaries are established.

TABLE 1-2. MEASURES OF EFFECTIVENESS FOR LEVEL OF SERVICE DEFINITION

TYPE OF FACILITY	MEASURE OF EFFECTIVENESS
Freeways	
Basic freeway segments	Density (pc/mi/ln)
Weaving areas	Average travel speed (mph)
Ramp junctions	Flow rates (pcph)
Multilane Highways	Density (pc/mi/ln)
Two-Lane Highways	Percent time delay (%)
	Average travel speed (mph)
Signalized Intersections	Average individual stopped delay (sec/veh)
Unsignalized Intersections	Reserve capacity (pcph)
Arterials	Average travel speed (mph)
Transit	Load factor (pers/seat)
Pedestrians	Space (sq ft/ped)

BASIC PRINCIPLES OF TRAFFIC FLOW

Traffic Flow Measures

The operational state of any given traffic stream is defined by three primary measures:

1. Speed.
2. Volume and/or rate of flow.
3. Density.

1. *Speed* is defined as a rate of motion expressed as distance per unit time, generally as miles per hour (mph) or kilometers per hour (km/h). In characterizing the speed of a traffic stream, some representative value must be used, as there is generally a broad distribution of individual speeds that may be observed in the traffic stream. For the purposes of this manual, the speed measure used is *average travel speed*. This measure is used because it is easily computed from observation of individual vehicles within the traffic stream, and because it is the most statistically relevant measure in relationships with other varia-

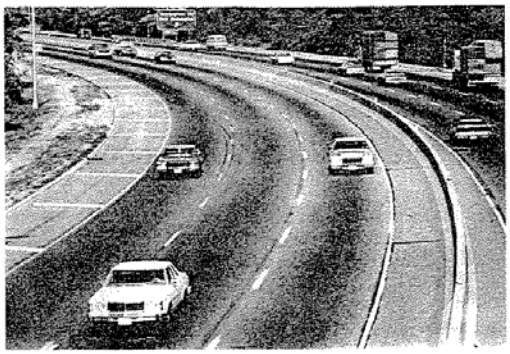


Illustration 3-5. Level-of-service A.

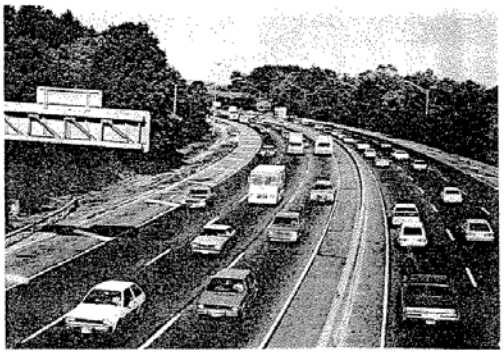


Illustration 3-8. Level-of-service D.

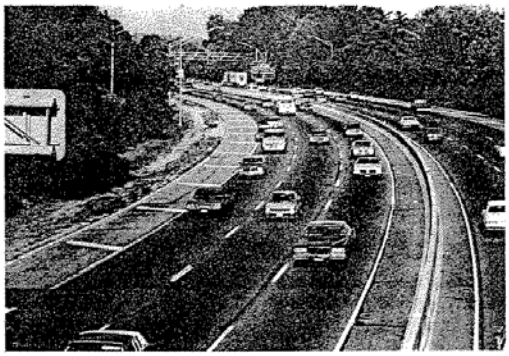


Illustration 3-6. Level-of-service B.

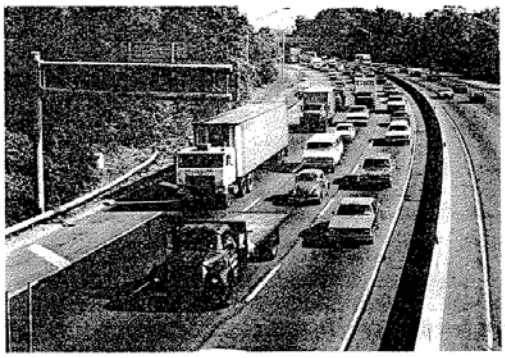


Illustration 3-9. Level-of-service E.

Illustration 3-7. Level-of-service C.

Illustration 3-10. Level-of-service F.

LOS information referenced from the Highway Capacity Manual.

Appendix B Factors & Truck Percentages

Driver Population Factor, Trucks, RV's

	0.85, 6%, 3%	**0.85, 6%, 3%**	**1.00, 7%, 2%**	**1.00, 7%, 2%**	
Exit 103	0.85, 6%, 3%	0.85, 6%, 3%	1.00, 7%, 2%	1.00, 7%, 2%	**Exit 46**
Gardiner I-95			1.00, 7%, 2%	1.00, 7%, 2%	Congress St./Jetport
	0.85, 6%, 3%	**0.85, 6%, 3%**	**1.00, 7%, 2%**	**0.85, 6%, 3%**	
Exit 102			1.00, 7%, 2%	1.00, 7%, 2%	**Exit 45**
Gardiner Remote	0.85, 6%, 3%	0.85, 6%, 3%	1.00, 7%, 2%	1.00, 7%, 2%	South Portland
West Gardiner Barrier	**0.85, 6%, 3%**	**0.85, 6%, 3%**	**1.00, 7%, 2%**	**0.85, 6%, 3%**	
Exit 86	1.00, 7%, 2%	1.00, 7%, 2%			**Exit 44**
Sabattus	1.00, 7%, 2%	1.00, 7%, 2%	1.00, 7%, 2%	1.00, 7%, 2%	I-295
	0.85, 6%, 3%	**0.85, 6%, 3%**	**1.00, 7%, 2%**	**1.00, 7%, 2%**	
Exit 80	1.00, 7%, 2%	1.00, 7%, 2%	1.00, 7%, 2%	1.00, 7%, 2%	**Exit 42**
Lewiston	1.00, 7%, 2%	1.00, 7%, 2%	1.00, 7%, 2%	0.85, 6%, 3%	Scarborough
	0.85, 6%, 3%	**0.85, 6%, 3%**	**1.00, 7%, 2%**	**1.00, 7%, 2%**	
Exit 75	1.00, 7%, 2%	1.00, 7%, 2%	1.00, 7%, 2%	1.00, 7%, 2%	**Exit 36**
Auburn	1.00, 7%, 2%	0.85, 6%, 3%	0.85, 6%, 3%	0.85, 6%, 3%	Saco
New Gloucester Barrier	**0.85, 6%, 3%**	**0.85, 6%, 3%**	**0.85, 6%, 3%**	**0.85, 6%, 3%**	
Exit 63	1.00, 7%, 2%	1.00, 7%, 2%	1.00, 7%, 2%	1.00, 7%, 2%	**Exit 32**
Gray	1.00, 7%, 2%	0.85, 6%, 3%	0.85, 6%, 3%	1.00, 7%, 2%	Biddeford
	1.00, 7%, 2%	**0.85, 6%, 3%**	**0.85, 6%, 3%**	**0.85, 6%, 3%**	
Exit 53	1.00, 7%, 2%	1.00, 7%, 2%	1.00, 7%, 2%	1.00, 7%, 2%	**Exit 25**
West Falmouth	1.00, 7%, 2%	1.00, 7%, 2%	0.85, 6%, 3%	0.85, 6%, 3%	Kennebunk
	1.00, 7%, 2%	**0.85, 6%, 3%**	**0.85, 6%, 3%**	**0.85, 6%, 3%**	
Exit 52	1.00, 7%, 2%	1.00. 7%, 2%	1.00, 7%, 2%	1.00. 7%, 2%	**Exit 19**
Falmouth	0.85, 6%, 3%	0.85, 6%, 3%	0.85, 6%, 3%	0.85, 6%, 3%	Wells
	1.00, 7%, 2%	**0.85, 6%, 3%**	**0.85, 6%, 3%**	**0.85, 6%, 3%**	York Barrier
Exit 48	1.00, 7%, 2%	0.85, 6%, 3%	0.85, 6%, 3%	0.85, 6%, 3%	**Exit 7**
Riverside	1.00, 7%, 2%	0.85, 6%, 3%	0.85, 6%, 3%	0.85, 6%, 3%	Chases Pond Rd.
	1.00, 7%, 2%	**0.85, 6%, 3%**	**0.85, 6%, 3%**	**0.85, 6%, 3%**	
Exit 47	1.00, 7%, 2%	1.00, 7%, 2%	**Legend**	SB Off	NB On
Rand Rd.	1.00, 7%, 2%	1.00, 7%, 2%		SB On	NB Off
				SB Mainline	**NB Mainline**

DRIVER POPULATION ADJUSTMENT FACTOR REASONING:

- If most of the 30 busiest hours were related to weekend traffic (Friday PM, Saturday, Sunday, or holidays), then a factor of 0.85 was used.
- If the busiest hours were evenly split between weekdays and weekends a factor of 0.90 was used.
- If the busiest hours were not closely correlated to weekend traffic at all a factor of 1.00 was used.

Appendix C Non-Typical Diverge Calculations

Non-Typical Diverge Case: Exit 44

See pg. 13-27 of Highway Capacity Manual
Equation 13-27:

$$Dmd=.0175*(Vf/N)$$

Ramps 30th Hour Analysis

INPUT	OUTPUT
Vf= 3,284	Dmd=19.2
N=3	**LOS: B** - per Exhibit 13-2, page 13-4 of HCM

Mainline's 30th Hour Analysis

INPUT	OUTPUT
Vf=3,845	Dmd=22.4
N=3	**LOS: C** – per Exhibit 13-2, page 13-4 of HCM

Non-Typical Diverge Case: Exit 103

See pg. 13-27 of Highway Capacity Manual
Equation 13-27:

$$Dmd=.0175*(Vf/N)$$

Ramps 30th Hour Analysis

INPUT	OUTPUT
Vf= 1,340	Dmd=11.7
N=2	**LOS: B** - per Exhibit 13-2, page 13-4 of HCM

Mainline's 30th Hour Analysis

INPUT	OUTPUT
Vf=1,876	Dmd=16.4
N=2	**LOS: B** – per Exhibit 13-2, page 13-4 of HCM

Appendix D Forecasted Volumes & LOS

Table D-1 – Forecasted Volumes: Merge Areas

Location	Exit #	Segment	NB-On			SB-On		
			10-year	20-year	30-year	10-year	20-year	30-year
Kittery	Exit 1	Ramp	N/A	N/A	N/A	*175*	*195*	*218*
		ML				*5,397*	*6,021*	*6,717*
Kittery	Exit 2	Ramp	N/A	N/A	N/A	N/A	N/A	N/A
		ML						
Kittery	Exit 3	Ramp	N/A	N/A	N/A	N/A	N/A	N/A
		ML						
Kittery	Exit 2	Ramp	*438*	*489*	*546*	*1,077*	*1,201*	*1,340*
		ML	*4,105*	*4,580*	*5,109*	*3,991*	*4,453*	*4,968*
York	Exit 7	Ramp	*243*	*271*	*303*	*1,110*	*1,238*	*1,382*
		ML	*3,755*	*4,189*	*4,674*	*3,736*	*4,168*	*4,650*
Wells	Exit 19	Ramp	*387*	*432*	*482*	*469*	*523*	*583*
		ML	*3,458*	*3,858*	*4,304*	*3,671*	*4,096*	*4,569*
Kennebunk	Exit 25	Ramp	*299*	*334*	*372*	*181*	*202*	*225*
		ML	*3,536*	*3,945*	*4,401*	*3,854*	*4,300*	*4,797*
Biddeford	Exit 32	Ramp	*923*	*1,029*	*1,148*	*262*	*292*	*326*
		ML	*3,466*	*3,867*	*4,314*	*3,721*	*4,151*	*4,631*
Saco	Exit 36	Ramp	*788*	*879*	*980*	753	840	937
		ML	*3,627*	*4,046*	*4,514*	3,957	4,415	4,925
Scarborough	Exit 42	Ramp	*319*	*356*	*397*	*312*	*348*	*389*
		ML	*3,970*	*4,429*	*4,942*	*4,297*	*4,794*	*5,348*
I-295	Exit 44	Ramp	N/A	N/A	N/A	*1,513*	*1,688*	*1,883*
		ML				*2,805*	*3,129*	*3,491*
South Portland	Exit 45	Ramp	*618*	*689*	*769*	*699*	*780*	*871*
		ML	*2,375*	*2,650*	*2,956*	*2,303*	*2,569*	*2,866*
Jetport	Exit 46	Ramp	*903*	*1,007*	*1,123*	*699*	*780*	*871*
		ML	*2,511*	*2,802*	*3,125*	*2,192*	*2,446*	*2,728*
Rand Road	Exit 47	Ramp	*174*	*194*	*217*	*308*	*344*	*383*
		ML	*3,072*	*3,428*	*3,824*	*2,886*	*3,220*	*3,592*
Riverside	Exit 48	Ramp	*403*	*449*	*501*	*614*	*685*	*764*
		ML	*2,442*	*2,724*	*3,039*	*2,389*	*2,665*	*2,973*
Falmouth	Exit 52	Ramp	*229*	*255*	*285*	629	702	783
		ML	*2,304*	*2,570*	*2,867*	2,258	2,519	2,810
West Falmouth	Exit 53	Ramp	*255*	*285*	*318*	*803*	*896*	*1,000*
		ML	*2,193*	*2,447*	*2,730*	*1,874*	*2,091*	*2,333*
Gray	Exit 63	Ramp	*156*	*174*	*194*	*1,161*	*1,296*	*1,445*
		ML	*1,150*	*1,283*	*1,432*	*1,026*	*1,145*	*1,277*
Auburn	Exit 75	Ramp	*477*	*533*	*594*	*475*	*530*	*591*
		ML	*668*	*746*	*832*	*692*	*772*	*861*
Lewiston	Exit 80	Ramp	*222*	*248*	*276*	*543*	*606*	*676*
		ML	*678*	*757*	*844*	*571*	*637*	*711*
Sabattus	Exit 86	Ramp	*45*	*50*	*56*	*113*	*126*	*140*
		ML	*717*	*800*	*893*	*755*	*843*	*940*
West Gardiner	Exit 102	Ramp	N/A	N/A	N/A	*91*	*102*	*114*
		ML				*688*	*768*	*857*
Gardiner	Exit 103	Ramp	*1,469*	*1,639*	*1,829*	N/A	N/A	N/A
		ML	*619*	*691*	*771*			

Table D-1 shows the 'worst case scenario volumes'. Volumes were predicted using the annual growth rate of 1.1% and were calculated using the compounding interest formula:

$$Vf = V_c*(1+g)\text{^}T$$

Where:

- Vf=Forecasted Volume
- Vc=Current Volume (2011 data)
- g=annual growth rate for segment in question (.011)
- T=Year in question (10, 20, or 30 years from 2011)

Table D-2 shows the future LOS values for each merge area based on the predicted volumes.

Table D-2 – Forecasted LOS: Merge Areas

Location	Exit #	NB-On			SB -On		
		10-year	20-year	40-year	10-year	20-year	40-year
Kittery	Exit 1	N/A	N/A	N/A	D	F	F
Kittery	Exit 2	N/A	N/A	N/A	N/A	N/A	N/A
Kittery	Exit 3	N/A	N/A	N/A	N/A	N/A	N/A
Kittery	Exit 2	D	D	F	E	E	F
York	Exit 7	D	D	D	E	E	F
Wells	Exit 19	C	D	D	D	D	E
Kennebunk	Exit 25	C	D	D	C	C	D
Biddeford	Exit 32	D	E	E	D	D	D
Saco	Exit 36	C	D	D	D	D	F
Scarborough	Exit 42	C	D	D	C	D	D
I-295	Exit 44	N/A	N/A	N/A	C	D	D
South Portland	Exit 45	D	E	F	C	D	D
Jetport	Exit 46	D	D	F	C	C	D
Rand Road	Exit 47	E	F	F	D	E	F
Riverside	Exit 48	D	D	E	C	C	D
Falmouth	Exit 52	C	D	D	C	D	D
West Falmouth	Exit 53	C	D	D	C	D	D
Gray	Exit 63	B	B	B	C	C	C
Auburn	Exit 75	B	B	B	B	B	B
Lewiston	Exit 80	A	B	B	B	B	B
Sabattus	Exit 86	B	B	B	B	B	B
West Gardiner	Exit 102	N/A	N/A	N/A	B	B	B
Gardiner	Exit 103	B	B	B	N/A	N/A	N/A

Table D-3 – Forecasted Volumes: Diverge Areas

Location	Exit #	Segment	NB-Off			SB-Off		
			10-year	20-year	40-year	10-year	20-year	40-year
Kittery	Exit 1	Ramp	*113*	*126*	*140*	N/A	N/A	N/A
		ML	*5,688*	*6,346*	*7,080*			
Kittery	Exit 2	Ramp	*232*	*259*	*289*	N/A	N/A	N/A
		ML	*5,306*	*5,919*	*6,604*			
Kittery	Exit 3	Ramp	*822*	*917*	*1,023*	N/A	N/A	N/A
		ML	*5,074*	*5,660*	*6,315*			
Kittery	Exit 2	Ramp	N/A	N/A	N/A	*356*	*397*	*443*
		ML				*4,821*	*5,378*	*6,000*
York	Exit 7	Ramp	*1,215*	*1,355*	*1,512*	*464*	*518*	*578*
		ML	*5,040*	*5,623*	*6,273*	*4,140*	*4,619*	*5,153*
Wells	Exit 19	Ramp	*492*	*549*	*612*	*607*	*677*	*755*
		ML	*3,998*	*4,461*	*4,976*	*4,035*	*4,502*	*5,022*
Kennebunk	Exit 25	Ramp	*253*	*283*	*315*	*190*	*212*	*236*
		ML	*3,846*	*4,290*	*4,786*	*3,983*	*4,443*	*236*
Biddeford	Exit 32	Ramp	*332*	*371*	*414*	*666*	*743*	*829*
		ML	*3,835*	*4,279*	*4,774*	*4,454*	*4,968*	*5,543*
Saco	Exit 36	Ramp	*766*	*855*	*954*	1,489	1,662	1,854
		ML	*4,389*	*4,896*	*5,462*	4,263	4,756	5,305
Scarborough	Exit 42	Ramp	*395*	*441*	*492*	*156*	*174*	*194*
		ML	*4,414*	*4,925*	*5,494*	*4,317*	*4,817*	*5,373*
I-295	Exit 44	Ramp	*1,233*	*1,375*	*1,534*	N/A	N/A	N/A
		ML	*4,290*	*4,785*	*5,339*			
South Portland	Exit 45	Ramp	*745*	*831*	*927*	*589*	*657*	*733*
		ML	*3,105*	*3,464*	*3,864*	*2,892*	*3,226*	*3,599*
Jetport	Exit 46	Ramp	*210*	*234*	*261*	*470*	*524*	*585*
		ML	*2,694*	*3,006*	*3,353*	*3,194*	*3,563*	*3,975*
Rand Road	Exit 47	Ramp	*432*	*482*	*537*	*195*	*218*	*243*
		ML	*3,414*	*3,808*	*4,249*	*3,002*	*3,349*	*3,736*
Riverside	Exit 48	Ramp	*775*	*865*	*965*	*475*	*530*	*591*
		ML	*3,277*	*3,655*	*4,078*	*2,887*	*3,221*	*3,593*
Falmouth	Exit 52	Ramp	*521*	*581*	*648*	335	373	417
		ML	*2,845*	*3,174*	*3,541*	2,609	2,911	3,248
West Falmouth	Exit 53	Ramp	*602*	*672*	*750*	*311*	*347*	*387*
		ML	*2,815*	*3,140*	*3,503*	*2,188*	*2,441*	*2,723*
Gray	Exit 63	Ramp	*1,164*	*1,298*	*1,448*	*104*	*116*	*129*
		ML	*2,173*	*2,424*	*2,705*	*1,167*	*1,302*	*1,452*
Auburn	Exit 75	Ramp	*562*	*627*	*700*	*405*	*452*	*504*
		ML	*1,299*	*1,449*	*1,616*	*1,114*	*1,243*	*1,387*
Lewiston	Exit 80	Ramp	*411*	*458*	*511*	*107*	*119*	*133*
		ML	*1,147*	*1,279*	*1,427*	*868*	*968*	*1,080*
Sabattus	Exit 86	Ramp	*269*	*300*	*335*	*87*	*97*	*108*
		ML	*900*	*1,004*	*1,120*	*780*	*870*	*971*
West Gardiner	Exit 102	Ramp	*149*	*167*	*186*	N/A	N/A	N/A
		ML	*762*	*850*	*948*			
Gardiner	Exit 103	Ramp	N/A	N/A	N/A	*1,395*	*1,556*	*1,736*
		ML				*2,093*	*2,335*	*2,605*

Table D-3 shows the 'worst case scenario volumes'. Volumes were predicted using the annual growth rate of 1.1% and were calculated using the compounding interest formula:

$$V_f = V_c*(1+g)\text{^}T$$

Where:

- V_f=Forecasted Volume
- V_c=Current Volume (2011 data)
- g=annual growth rate for segment in question (e.g. 0.011, or 1.1%)
- T=Year in question (10, 20, or 30 years from 2011)

Table D-4 shows the future LOS values for each merge area based on the predicted volumes.

Table D-4 – Forecasted LOS: Diverge Areas

Location	Exit #	NB-Off			SB -Off		
		10-year	20-year	40-year	10-year	20-year	40-year
Kittery	Exit 1	F	F	F	N/A	N/A	N/A
Kittery	Exit 2	E	F	F	N/A	N/A	N/A
Kittery	Exit 3	E	F	F	N/A	N/A	N/A
Kittery	Exit 2	N/A	N/A	N/A	D	E	F
York	Exit 7	E	F	F	D	D	E
Wells	Exit 19	C	D	D	D	D	E
Kennebunk	Exit 25	C	C	D	C	D	D
Biddeford	Exit 32	C	D	D	D	D	E
Saco	Exit 36	F	F	F	D	D	F
Scarborough	Exit 42	C	D	D	C	D	D
I-295	Exit 44	C	C	D	N/A	N/A	N/A
South Portland	Exit 45	E	E	F	C	C	C
Jetport	Exit 46	D	D	E	D	D	F
Rand Road	Exit 47	D	E	F	C	D	D
Riverside	Exit 48	E	F	F	C	C	D
Falmouth	Exit 52	D	D	E	C	C	C
West Falmouth	Exit 53	C	D	D	B	B	C
Gray	Exit 63	B	C	C	A	A	B
Auburn	Exit 75	A	B	B	A	A	B
Lewiston	Exit 80	A	A	B	A	A	A
Sabattus	Exit 86	A	A	B	A	A	A
West Gardiner	Exit 102	A	A	A	N/A	N/A	N/A
Gardiner	Exit 103	N/A	N/A	N/A	B	C	C

Table D-5 – Forecasted Volumes: Mainline Areas

Location	Segment	Northbound Mainline			Southbound Mainline		
		10-year	20-year	30-year	10-year	20-year	30-year
NH Border to Exit 1, Kittery	0 to 1	5,688	6,346	7,080	5,572	6,217	6,935
Exit 1 to Exit 2, Kittery	1 to 2	5,306	5,919	6,604	5,068	5,654	6,308
Kittery to York	2 to 7	4,776	5,328	5,944	4,821	5,378	6,000
York to Wells	7 to 19	3,998	4,461	4,976	4,140	4,619	5,153
Wells to Kennebunk	19 to 25	3,846	4,290	4,786	4,035	4,502	5,022
Kennebunk to Biddeford	25 to 32	3,835	4,279	4,774	3,983	4,443	4,957
Biddeford to Saco	32 to 36	4,389	4,896	5,462	4,454	4,968	5,543
Saco to Scarborough	36 to 42	4,414	4,925	5,494	4,610	5,143	5,737
Scarborough to I-295	42 to 44	4,290	4,785	5,339	4,317	4,817	5,373
I-295 to South Portland	44 to 45	3,105	3,464	3,864	3,002	3,349	3,736
South Portland to Jetport	45 to 46	2,993	3,339	3,725	2,892	3,226	3,599
Jetport to Rand Road	46 to 47	3,414	3,808	4,249	3,194	3,563	3,975
Rand Road to Riverside	47 to 48	3,246	3,622	4,040	3,002	3,349	3,736
Riverside to Falmouth	48 to 52	2,845	3,174	3,541	2,887	3,221	3,593
Falmouth to West Falmouth	52 to 53	2,815	3,140	3,503	2,677	2,987	3,332
West Falmouth to Gray	53 to 63	2,449	2,732	3,048	2,188	2,441	2,723
Gray to Auburn	63 to 75	1,306	1,457	1,626	1,167	1,302	1,452
Auburn to Lewiston	75 to 80	1,147	1,279	1,427	1,114	1,243	1,387
Lewiston to Sabattus	80 to 86	900	1,004	1,120	868	968	1,080
Sabattus to West Gardiner	86 to 102	762	850	948	780	870	971
West Gardiner to Gardiner	102 to 103	610	681	759	683	762	850
Gardiner to End of Turnpike	103 to 109	2,088	2,330	2,599	2,093	2,335	2,605

Table D-5 shows the 'worst case scenario volumes'. Volumes were predicted using the annual growth rate of 1.1% and were calculated using the compounding interest formula:

$$V_f = V_c*(1+g)\text{^}T$$

Where:

- V_f=Forecasted Volume
- V_c=Current Volume (2011 data)
- g=annual growth rate for segment in question (.011)
- T=Year in question (10, 20, or 30 years from 2011)

Table D-6 shows the future LOS values for each merge area based on the predicted volumes.

Table D-6 – Forecasted LOS: Mainline Areas

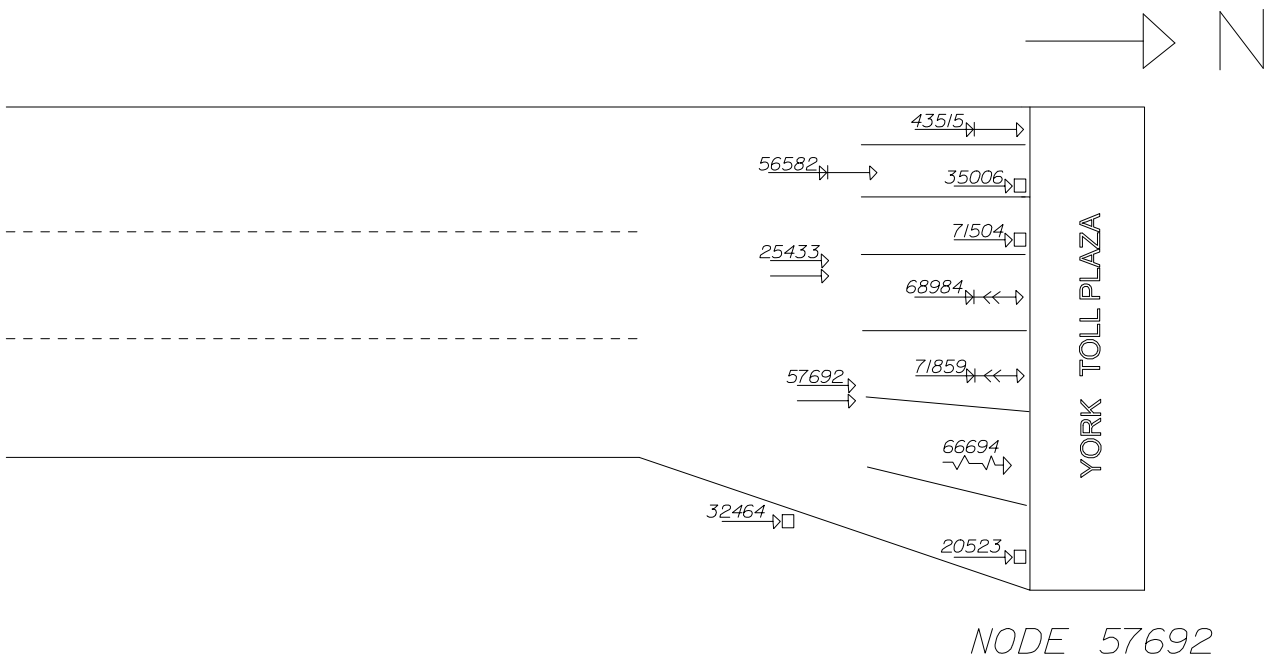
Location	Segment	NB			SB		
		10-year	20-year	30-year	10-year	20-year	30-year
NH Border to Exit 1, Kittery	0-1	F	F	F	E	F	F
Exit 1 to Exit 2, Kittery	1-2	E	F	F	E	E	F
NH Border to York	2-7	D	E	F	D	E	F
York to Wells	7-19	C	D	E	D	D	E
Wells to Kennebunk	19-25	C	D	D	C	D	E
Kennebunk to Biddeford	25-32	C	D	D	C	D	E
Biddeford to Saco	32-36	D	D	E	D	E	E
Saco to Scarborough	36-42	C	D	D	C	D	D
Scarborough to I-295	42-44	C	D	D	C	D	D
I-295 to South Portland	44-45	D	E	F	D	D	E
South Portland to Jetport	45-46	D	E	F	D	D	D
Jetport to Rand Road	46-47	E	E	F	D	E	F
Rand Road to Riverside	47-48	E	F	F	D	D	E
Riverside to Falmouth	48-52	D	E	E	D	D	D
Falmouth to West Falmouth	52-53	D	D	E	C	D	D
West Falmouth to Gray	53-63	C	D	D	B	C	C
Gray to Auburn	63-75	B	B	B	A	B	B
Auburn to Lewiston	75-80	A	B	B	A	B	B
Lewiston to Sabattus	80-86	A	A	A	A	A	A
Sabattus to West Gardiner	86-102	A	A	A	A	A	A
West Gardiner to Gardiner	102-103	A	A	A	A	A	A
Gardiner to End of Turnpike	103-109	C	C	C	C	C	C

Appendix E Mainline High Crash Location Diagrams

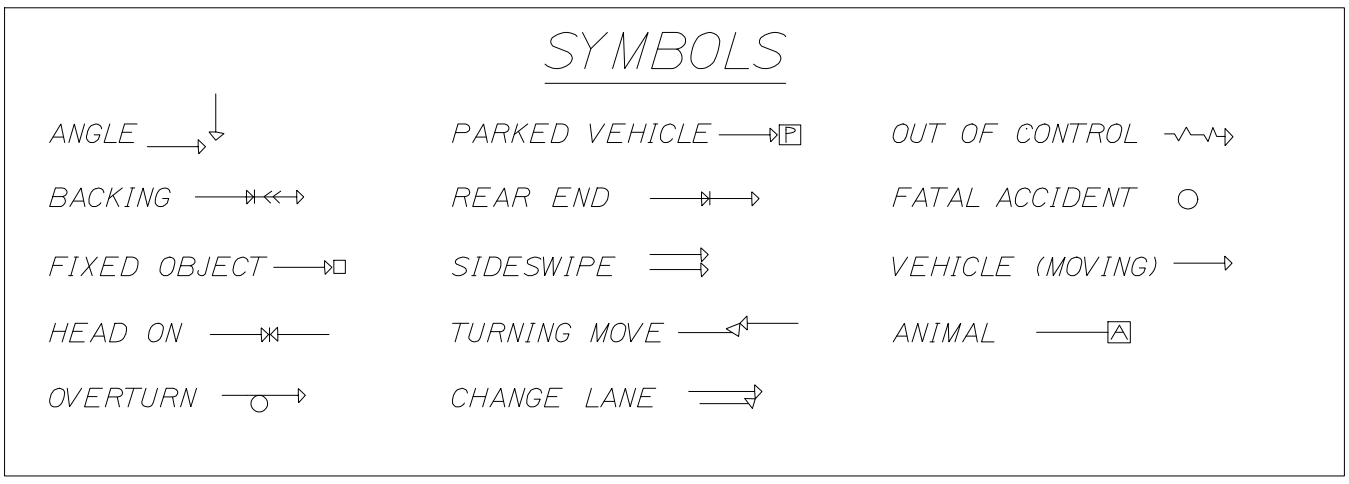
SEGMENT LENGTH: N/A
NUMBER OF CRASHES: 11
CRASH RATE FACTOR: 3.73

NODE: 57692
MILE MARKER: 7.13 NB
LOCATION: YORK TOLL PLAZA

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/24/2012
PREPARED FOR: MTA



NODE 57692



NUMBER	DATE	DAY OF WEEK	TIME OF DAY	LOCATION	TYPE	FIXED OBJECT STRUCK	OTHER PROPERTY DAMAGE
20523	3/30/2009	MON	3:10	OTHER	OTHER	TOLL LIGHT POLE	TOLL LIGHT POLE
43515	6/25/2009	THURS	21:50	OTHER	REAR END/SIDESWIPE		
66694	9/13/2009	SUN	1:09	OTHER	WENT OFF ROAD		
57692	9/13/2009	SUN	12:25	OTHER	REAR END/SIDESWIPE		
71859	10/2/2009	FRI	19:05	OTHER	REAR END/SIDESWIPE		
25433	4/17/2010	SAT	7:39	OTHER	REAR END/SIDESWIPE		
32464	5/15/2010	SAT	0:25	OTHER	OBJECT IN ROAD	SIGN POST	SIGN POST
68984	9/20/2010	MON	16:30	OTHER	REAR END/SIDESWIPE		
71504	9/30/2010	THURS	0:05	OTHER	OTHER	LANE 8 NB TRAFFIC LIGHT AND SIGN	LANE 8 NB TRAFFIC LIGHT AND SIGN
35006	5/19/2011	THURS	5:20	OTHER	OBJECT IN ROAD	CONCRETE TOLL BARRIER	
56582	7/29/2011	FRI	14:27	OTHER	REAR END/SIDESWIPE		

NUMBER	TRAFFIC CONTROL DEVICE	LIGHT	WEATHER	ROAD SURFACE	ROAD CHARACTER	ROAD WORK	SPEED LIMIT
20523	TRAFFIC SIGNALS (STOP & GO)	DARK-LIGHTED	RAIN	WET	ON GRADE	NO	10
43515	OTHER	DARK-LIGHTED	CLEAR	DRY	LEVEL	NO	10
66694	TRAFFIC SIGNALS (STOP & GO)	DARK-LIGHTED	CLEAR	DRY	ON GRADE	NO	10
57692	OTHER	DAYLIGHT	CLOUDY	DRY	LEVEL	NO	10
71859	OTHER	DARK-LIGHTED	CLEAR	DRY	LEVEL	NO	10
25433	NONE	DAYLIGHT	RAIN	WET	LEVEL	YES	35
32464	OTHER	DARK-LIGHTED	CLOUDY	WET	ON GRADE	NO	10
68984	OTHER	DAYLIGHT	CLEAR	DRY	ON GRADE	NO	10
71504	TRAFFIC SIGNALS (STOP & GO)	DARK-LIGHTED	CLEAR	DRY	ON GRADE	NO	10
35006	NONE	DAWN	RAIN	WET	LEVEL	NO	10
56582	OTHER	DAYLIGHT	CLOUDY	DRY	ON GRADE	NO	10

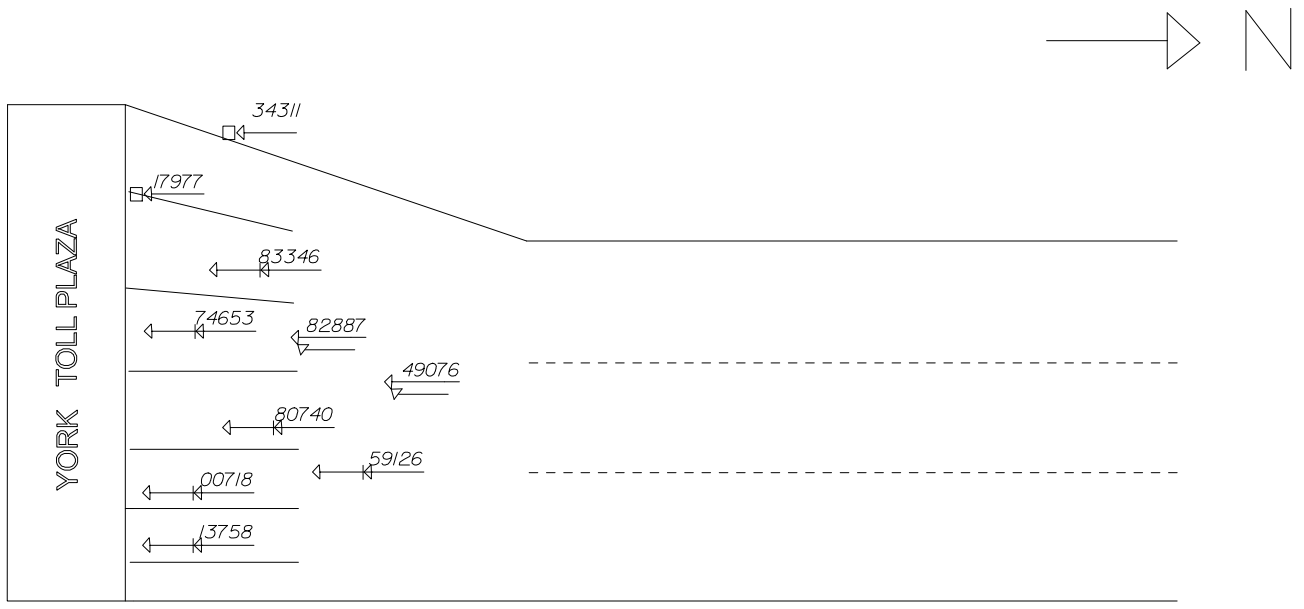
NUMBER	PRE CRASH ACTIONS	CONTRIBUTING CIRCUMSTANCES - VEHICLE	SEQUENCE OF EVENTS 1
20523	FOLLOWING ROADWAY	NONE	OTHER FIXED OBJECT
43515	SLOWING IN TRAFFIC, SLOWING IN TRAFFIC	NONE, NONE	
66694	SKIDDING	NONE	
57692	CHANGING LANES, STOPPED IN TRAFFIC	NONE, NONE	
71859	BACKING, STOPPED IN TRAFFIC	NONE, NONE	
25433	FOLLOWING ROADWAY, CHANGING LANES	NONE, NONE	
32464	OTHER VEHICLE ACTION	NONE	
68984	STOPPED IN TRAFFIC, STOPPED IN TRAFFIC	NONE, NONE	
71504	CHANGING LANES	NONE	OTHER FIXED OBJECT
35006	FOLLOWING ROADWAY	NONE	IMAPCT ATTENUATOR/CRASH CUSHION
56582	FOLLOWING ROADWAY, STOPPED IN TRAFFIC	NONE, NONE	MOTOR VEHICLE IN TRANSPORT, MOTOR VEHICLE IN TRANSPORT

NUMBER	CONDITION AT TIME OF CRASH	DRIVER ACTIONS AT TIME OF CRASH	INJURY DEGREE
20523	APPARENTLY NORMAL		5
43515	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
66694	UNDER THE INFLUENCE OF MEDICATIONS/DRUGS/ALCOHOL	EXCEEDED POSTED SPEED LIMIT	5
57692	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO KEEP IN PROPER LANE, NONE	5,5
71859	APPARENTLY NORMAL, APPARENTLY NORMAL	IMPROPER BACKING, NONE	5,5,5,5,4
25433	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FAILED TO YIELD RIGHT OF WAY/FAILED TO KEEP IN PROPOER LANE	5,5
32464	APPARENTLY NORMAL		5
68984	APPARENTLY NORMAL, APPARENTLY NORMAL	IMPROPER BACKING, NONE	5,5
71504	APPARENTLY NORMAL	FAILED TO KEEP IN PROPER LANE, NONE	5
35006	APPARENTLY NORMAL	RAN OFF ROADWAY	5
56582	APPARENTLY NORMAL, APPARENTLY NORMAL	FOLLOWED TOO CLOSELY, NO CONTRIBUTING ACTION	5,5,5,5,5

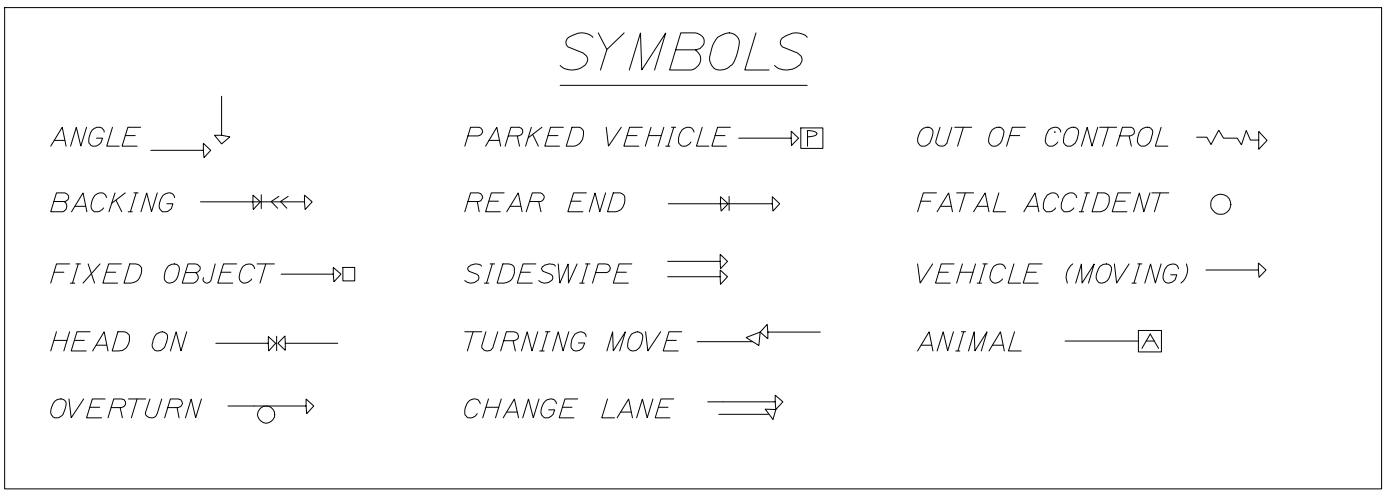
SEGMENT LENGTH: N/A
NUMBER OF CRASHES: 10
CRASH RATE FACTOR: 3.36

NODE: 57693
MILE MARKER: 7.13 SB
LOCATION: YORK TOLL PLAZA

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/24/2012
PREPARED FOR: MTA



NODE 57693



NUMBER	DATE	DAY OF WEEK	TIME OF DAY	LOCATION	TYPE	FIXED OBJECT STRUCK	OTHER PROPERTY DAMAGE
00718	1/4/2009	SUN	15:05	OTHER	REAR END/SIDESWIPE		
13758	3/1/2009	SUN	12:35	OTHER	REAR END/SIDESWIPE		
34311	5/23/2009	SAT	8:00	OTHER	OBJECT IN ROAD	GUARDRAIL	GUARDRAIL
59126	8/18/2009	TUES	14:40	OTHER	REAR END/SIDESWIPE		
80740	11/7/2009	SAT	10:38	OTHER	REAR END/SIDESWIPE		
82887	11/16/2009	MON	9:17	OTHER	REAR END/SIDESWIPE		
74653	10/11/2010	THURS	16:00	OTHER	REAR END/SIDESWIPE		
83346	11/14/2010	SUN	17:29	OTHER	REAR END/SIDESWIPE		
17977	3/12/2011	SAT	2:00	OTHER	OTHER	TOLLING EQUIPMENT	TOLLING EQUIPMENT
49076	7/6/2011	WED	11:10	OTHER	REAR END/SIDESWIPE		

NUMBER	TRAFFIC CONTROL DEVICE	LIGHT	WEATHER	ROAD SURFACE	ROAD CHARACTER	ROAD WORK	SPEED LIMIT
00718	OTHER	DAYLIGHT	CLEAR	DRY	LEVEL	NO	10
13758	OTHER	DAYLIGHT	SNOW	SNOW	ON GRADE	NO	10
34311	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	10
59126	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	10
80740	STOP SIGNS- OTHER	DAYLIGHT	CLEAR	DRY	ON GRADE	NO	10
82887	OTHER	DAYLIGHT	CLEAR	DRY	LEVEL	NO	10
74653	OTHER	DAYLIGHT	CLEAR	DRY	LEVEL	NO	10
83346	TRAFFIC SIGNALS (STOP & GO)	DARK - UNKNOWN LIGHTING	CLEAR	DRY	LEVEL	NO	10
17977	OTHER	DARK-LIGHTED	CLOUDY	WET	TOP OF HILL	NO	10
49076	NONE	DAYLIGHT	CLEAR	DRY	ON GRADE	NO	10

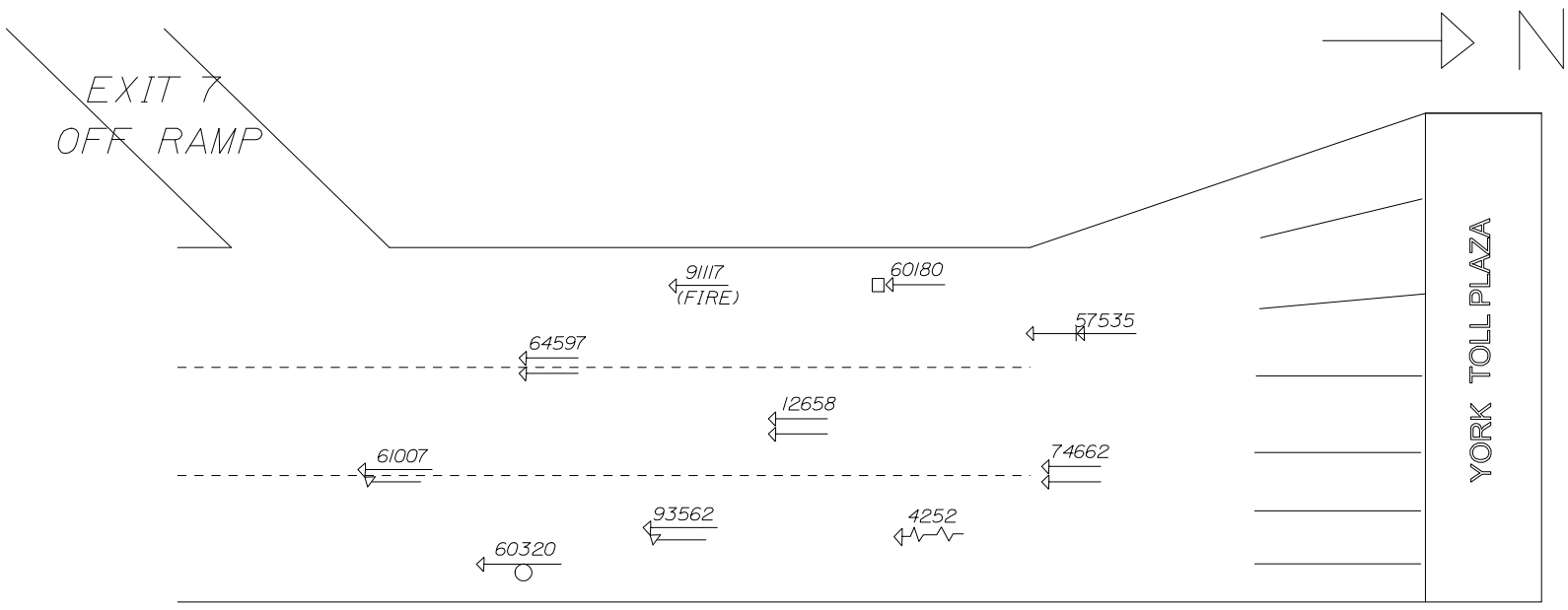
NUMBER	PRE CRASH ACTIONS	CONTRIBUTING CIRCUMSTANCES - VEHICLE	SEQUENCE OF EVENTS 1
00718	SLOWING IN TRAFFIC, NONE	NONE, NONE	
13758	NONE, SLOWING IN TRAFFIC	NONE, NONE	
34311	FOLLOWING ROADWAY	NONE	WENT OFF ROADWAY RIGHT
59126	SLOWING IN TRAFFIC, SLOWING IN TRAFFIC	NONE, NONE	
80740	SLOWING IN TRAFFIC, SLOWING IN TRAFFIC	NONE, NONE	
82887	CHANGING LANES, FOLLOWING ROADWAY	NONE, NONE	
74653	STARTING IN TRAFFIC, STARTING IN TRAFFIC	NONE, NONE	
83346	SLOWING IN TRAFFIC, SLOWING IN TRAFFIC	NONE, BRAKES	
17977	OTHER	NONE	OTHER POST, POLE OR SUPPORT
49076	CHANGING LANES, FOLLOWING ROADWAY	NONE, NONE	MOTOR VEHICLES IN TRANSPORT

NUMBER	CONDITION AT TIME OF CRASH	DRIVER ACTIONS AT TIME OF CRASH	INJURY DEGREE
00718	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5,5,5
13758	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, EXCEEDED POSTED SPEED LIMIT	5,5,5,5,5
34311	ASLEEP OR FATIGUED		5
59126	APPARENTLY NORMAL, APPARENTLY NORMAL	FOLLOWED TOO CLOSELY, NONE	5,5,5,5,5,5
80740	APPARENTLY NORMAL, APPARENTLY NORMAL	FOLLOWED TOO CLOSELY, NONE	5,5,5,5,5,5
82887	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO KEEP IN PROPER LANE, NONE	5,5,5
74653	APPARENTLY NORMAL, APPARENTLY NORMAL	FOLLOWED TOO CLOSELY, NONE	5,5,5,5,5
83346	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FOLLOWED TOO CLOSELY	5,5,5
17977	APPARENTLY NORMAL	FAILED TO KEEP IN PROPOER LANE	5,5
49076	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT OF WAY, NONE	5,5,5

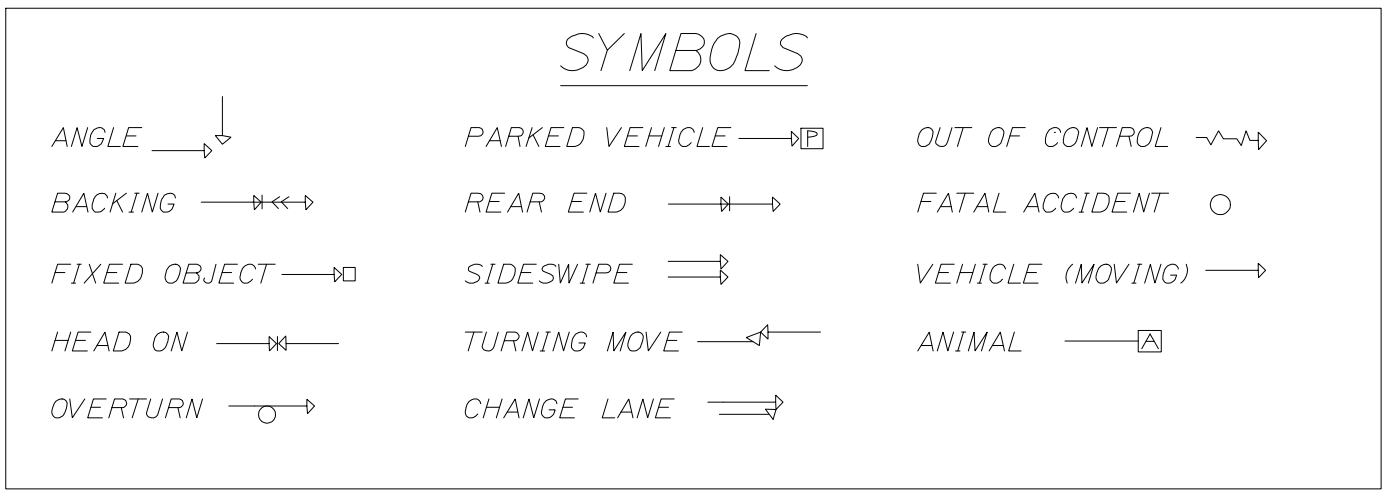
SEGMENT LENGTH: .11 MILES
NUMBER OF CRASHES: 10
CRASH RATE FACTOR: 2.38

ELEMENT: 2522897
MILE MARKER: 7.13 SB
LOCATION: YORK TOLL PLAZA TO EXIT 7 SB OFF RAMP

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/27/2012
PREPARED FOR: MTA



ELEMENT 2522897



NUMBER	DATE	DAY OF WEEK	TIME OF DAY	LOCATION	TYPE	FIXED OBJECT STRUCK	OTHER PROPERTY DAMAGE
64597	9/5/2009	SAT	17:27	STRAIGHT ROAD	REAR END/SIDESWIPE		
91117	12/19/2009	SAT	13:10	STRAIGHT ROAD	FIRE		
60180	8/19/2010	THURS	17:45	CURVED ROAD	OBJECT IN ROAD	MEDIAN GUARDRAIL	MEDIAN GUARDRAIL
61007	8/22/2010	SUN	13:05	STRAIGHT ROAD	REAR END/SIDESWIPE		
74662	10/11/2010	MON	16:25	STRAIGHT ROAD	REAR END/SIDESWIPE		
93562	12/23/2010	THURS	23:15	STRAIGHT ROAD	REAR END/SIDESWIPE		
4252	1/18/2011	TUES	9:55	STRAIGHT ROAD	OBJECT IN ROAD	GUARDRAIL	GUARDRAIL
12658	2/18/2011	FRI	18:42	OTHER	REAR END/SIDESWIPE		
57535	8/1/2011	MON	11:06	STRAIGHT ROAD	REAR END/SIDESWIPE		
60320	8/9/2011	TUES	11:00	STRAIGHT ROAD	ROLLOVER		

NUMBER	TRAFFIC CONTROL DEVICE	LIGHT	WEATHER	ROAD SURFACE	ROAD CHARACTER	ROAD WORK	SPEED LIMIT
64597	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	65
91117	NONE	DAYLIGHT	CLEAR	DRY	ON GRADE	NO	10
60180	OTHER	DUSK	CLEAR	DRY	ON GRADE	NO	35
61007	NONE	DAYLIGHT	CLOUDY	DRY	LEVEL	NO	35
74662	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
93562	NONE	DARK-NOT LIGHTED	CLOUDY	WET	ON GRADE	NO	65
4252	OTHER	DAYLIGHT	SNOW	SNOW	LEVEL	NO	35
12658	NONE	DARK-LIGHTED	CLEAR	DRY	LEVEL	NO	10
57535	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
60320	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35

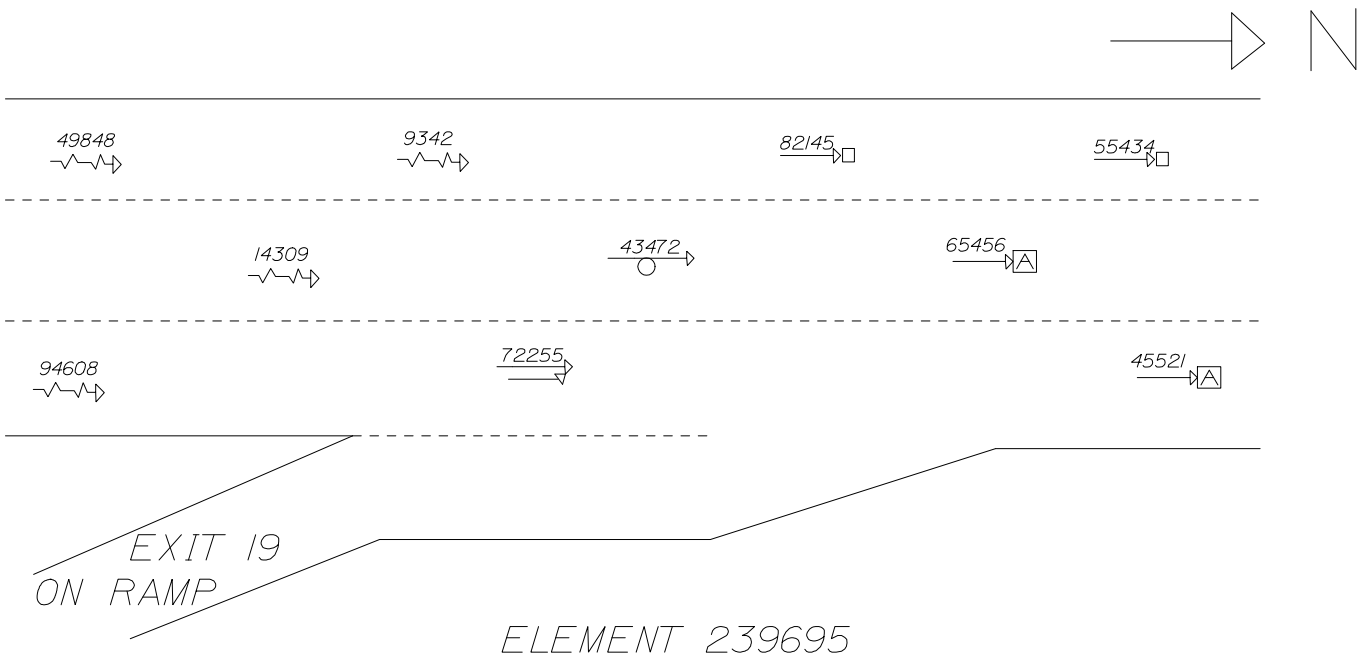
NUMBER	PRE CRASH ACTIONS	CONTRIBUTING CIRCUMSTANCES - VEHICLE	SEQUENCE OF EVENTS 1
64597	FOLLOWING ROADWAY, CHANGING LANES	NONE, NONE	
91117	FOLLOWING ROADWAY	OTHER	
60180	FOLLOWING ROADWAY	NONE	
61007	MERGING, MERGING	NONE, NONE	
74662	CHANGING LANES, FOLLOWING ROADWAY	NONE, NONE	
93562	SKIDDING, FOLLOWING ROADWAY	NONE, NONE	
4252	STARTING IN TRAFFIC	NONE	
12658	MERGING, MERGING	NONE, NONE	NONE, MOTOR VEHICLE IN TRANSPORT
57535	CHANGING LANES, STARTING IN TRAFFIC, AVOIDING VEHICLE IN ROADWAY	NONE, NONE, NONE	UNKNOWN, MOTOR VEHICLES IN TRANSPORT
60320	STARTING IN TRAFFIC	BRAKES	OVERTURN/ROLLOVER

NUMBER	CONDITION AT TIME OF CRASH	DRIVER ACTIONS AT TIME OF CRASH	INJURY DEGREE
64597	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FAILED TO KEEP IN PROPER LANE	5,5,5,5,5,5,5,5,5
91117	APPARENTLY NORMAL		5,5
60180	ASLEEP OR FATIGUED		5
61007	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5,5,5,5
74662	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO KEEP IN PROPER LANE, NONE	5,5
93562	APPARENTLY NORMAL, APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT, NONE	5,5,3,5
4252	APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	5
12658	APPARENTLY NORMAL, APPARENTLY NORMAL	IMPROPER PASSING, NONE	5,5,5,5
57535	UNKNOWN, APPARENTLY NORMAL, APPARENTL	UNKNOWN, NONE, NONE	5,5
60320	APPARENTLY NORMAL	NO CONTRIBUTING ACTION	5

SEGMENT LENGTH: .32 MILES
NUMBER OF CRASHES: 10
CRASH RATE FACTOR: 1.04

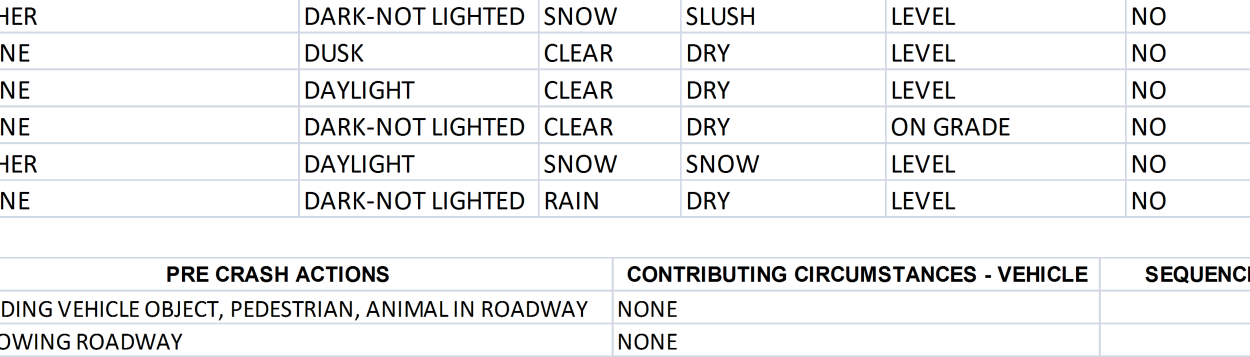
ELEMENT: 239695
MILE MARKER: 17.34 NB
LOCATION: EXIT 19 (WELLS) NB ON RAMP MERGE

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/27/2012
PREPARED FOR: MTA



ELEMENT 239695

SYMBOLS



NUMBER	DATE	DAY OF WEEK	TIME OF DAY	LOCATION	TYPE	FIXED OBJECT STRUCK	OTHER PROPERTY DAMAGE
49848	7/18/2009	SAT	10:45	STRAIGHT ROAD	OBJECT IN ROAD	MEDIAN GUARDRAIL	MEDIAN GUARDRAIL
9342	2/5/2011	SAT	21:57	STRAIGHT ROAD	WENT OFF ROAD		
14309	2/25/2011	FRI	13:31	STRAIGHT ROAD	WENT OFF ROAD	MEDIAN GUARDRAIL	MEDIAN GUARDRAIL
72255	9/19/2011	MON	12:24	STRAIGHT ROAD	REAR END/SIDESWIPE		
82145	10/29/2011	SAT	22:30	STRAIGHT ROAD	WENT OFF ROAD	MEDIAN GUARDRAIL	MEDIAN GUARDRAIL
43472	6/25/2009	THURS	19:15	STRAIGHT ROAD	ROLLOVER		
55434	8/6/2009	THURS	15:35	STRAIGHT ROAD	OBJECT IN ROAD	MEDIAN GUARDRAIL	MEDIAN GUARDRAIL
65456	9/2/2009	WEDS	0:50	STRAIGHT ROAD	MOOSE		
94608	12/27/2010	MON	11:40	STRAIGHT ROAD	OBJECT IN ROAD	GUARDRAIL	GUARDRAIL
45521	6/30/2010	WEDS	22:15	STRAIGHT ROAD	MOOSE		

NUMBER	TRAFFIC CONTROL DEVICE	LIGHT	WEATHER	ROAD SURFACE	ROAD CHARACTER	ROAD WORK	SPEED LIMIT
49848	NONE	DAYLIGHT	CLOUDY	DRY	LEVEL	NO	65
9342	OTHER	DARK-LIGHTED	RAIN	ICE/FROST	LEVEL	NO	65
14309	OTHER	DAYLIGHT	SLEET, HAIL	SNOW	ON GRADE	NO	65
72255	NONE	DAYLIGHT	CLEAR	DRY	ON GRADE	NO	65
82145	OTHER	DARK-NOT LIGHTED	SNOW	SLUSH	LEVEL	NO	65
43472	NONE	DUSK	CLEAR	DRY	LEVEL	NO	65
55434	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	65
65456	NONE	DARK-NOT LIGHTED	CLEAR	DRY	ON GRADE	NO	5
94608	OTHER	DAYLIGHT	SNOW	SNOW	LEVEL	NO	65
45521	NONE	DARK-NOT LIGHTED	RAIN	DRY	LEVEL	NO	65

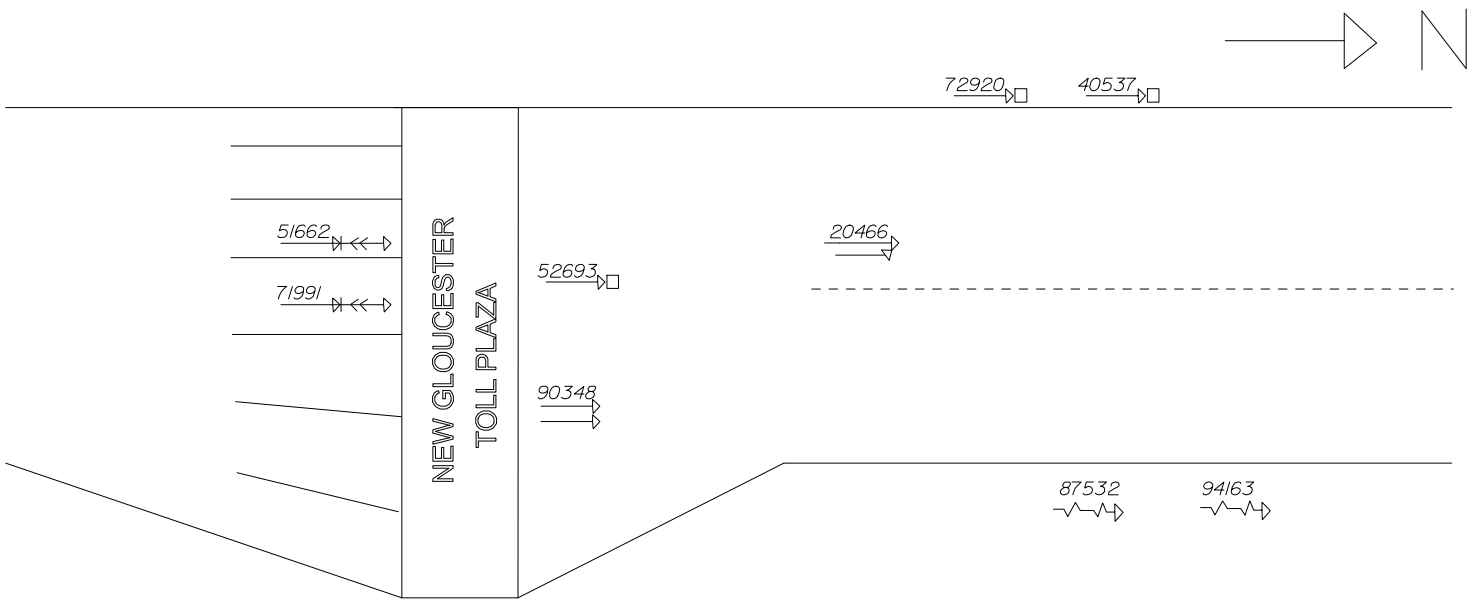
NUMBER	PRE CRASH ACTIONS	CONTRIBUTING CIRCUMSTANCES - VEHICLE	SEQUENCE OF EVENTS 1
49848	AVOIDING VEHICLE OBJECT, PEDESTRIAN, ANIMAL IN ROADWAY	NONE	
9342	FOLLOWING ROADWAY	NONE	
14309	FOLLOWING ROADWAY	NONE	
72255	CHANGING LANES, FOLLOWING ROADWAY	NONE, NONE	MOTOR VEHICLES IN TRANSPORT
82145	FOLLOWING ROADWAY	NONE	WENT OFF ROADWAY LEFT
43472	SKIDDING	TIRES	
55434	FOLLOWING ROADWAY	NONE	
65456	FOLLOWING ROADWAY	NONE	
94608	FOLLOWING ROADWAY	NONE	
45521	FOLLOWING ROADWAY	NONE	

NUMBER	CONDITION AT TIME OF CRASH	DRIVER ACTIONS AT TIME OF CRASH	INJURY DEGREE
49848	APPARENTLY NORMAL		5,5
9342	APPARENTLY NORMAL	EXEEDED POSTED SPEED LIMIT	5
14309	APPARENTLY NORMAL	EXEEDED POSTED SPEED LIMIT	5
72255	APPARENTLY NORMAL, APPARENTLY NORMAL	OTHER CONTRIBUTING ACTION, NO CONTRIBUTING ACTION	5,5
82145	APPARENTLY NORMAL	DOVE TOO FAST FOR CONDITIONS	5
43472	APPARENTLY NORMAL		3,5
55434	APPARENTLY NORMAL		5,5
65456	APPARENTLY NORMAL		5,5
94608	APPARENTLY NORMAL	EXEEDED POSTED SPEED LIMIT	5,5
45521	APPARENTLY NORMAL		5

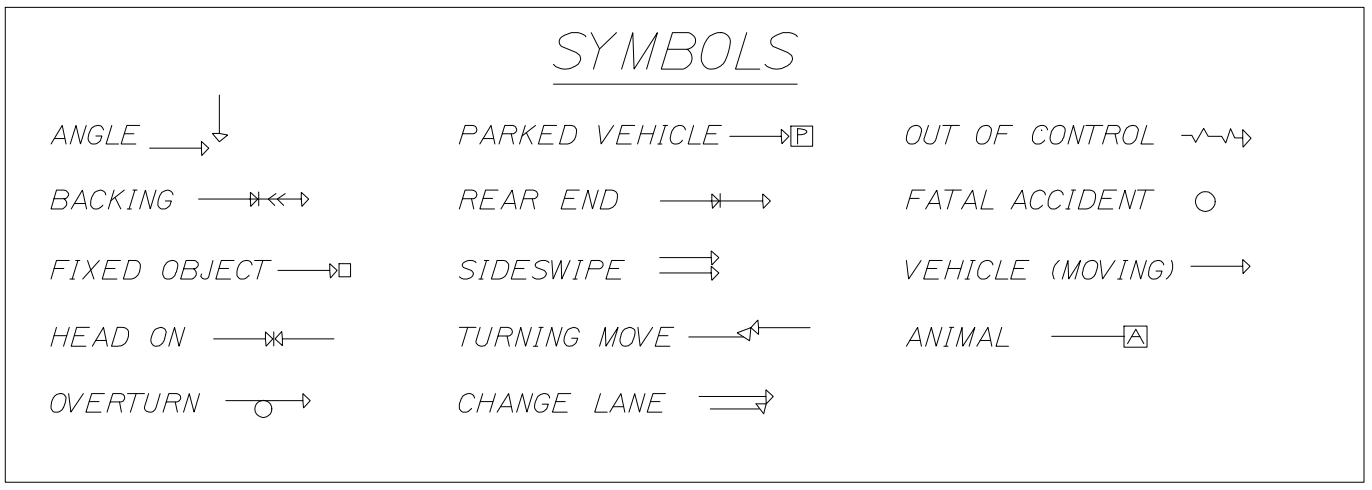
SEGMENT LENGTH: 0.5 MILES
NUMBER OF CRASHES: 9
CRASH RATE FACTOR: 1.29

ELEMENT: 195030
MILE MARKER: 66.14 NB
LOCATION: NEW GLOUCESTER TOLL PLAZA

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/24/2012
PREPARED FOR: MTA



ELEMENT 195030



NUMBER	DATE	DAY OF WEEK	TIME OF DAY	LOCATION	TYPE	FIXED OBJECT STRUCK	OTHER PROPERTY DAMAGE
72920	10/7/2009	WED	7:07	STRAIGHT ROAD	OBJECT IN ROAD	MEDIAN GUARDRAIL	MEDIAN GUARDRAIL
87532	12/5/2009	SAT	20:00	STRAIGHT ROAD	WENT OFF ROAD	TREE	
94163	12/31/2009	THURS	19:02	STRAIGHT ROAD	WENT OFF ROAD	TREE	
40537	6/13/2010	SUN	4:00	STRAIGHT ROAD	OBJECT IN ROAD	MEDIAN GUARDRAIL	MEDIAN GUARDRAIL
52693	7/25/2010	SUN	0:45	OTHER	OTHER	ELECTRICAL BOX	ELECTRICAL BOX
71991	10/1/2010	FRI	19:12	OTHER	REAR END/SIDESWIPE		
20466	3/22/2011	TUES	23:40	OTHER	REAR END/SIDESWIPE		
51662	7/14/2011	THURS	15:39	OTHER	REAR END/SIDESWIPE		
90348	12/2/2011	FRI	13:43	OTHER	REAR END/SIDESWIPE		

NUMBER	TRAFFIC CONTROL DEVICE	LIGHT	WEATHER	ROAD SURFACE	ROAD CHARACTER	ROAD WORK	SPEED LIMIT
72920	NONE	DAYLIGHT	RAIN	WET	LEVEL	NO	65
87532	OTHER	DARK-NOT LIGHTED	SNOW	ICE/FROST	LEVEL	NO	65
94163	NONE	DARK-NOT LIGHTED	CLOUDY	WET	LEVEL	NO	65
40537	NONE	DARK-NOT LIGHTED	CLEAR	DRY	LEVEL	NO	65
52693	TRAFFIC SIGNALS (FLASHING)	DARK-LIGHTED	FOG, SMOG, SMOKE	WET	LEVEL	NO	10
71991		DARK-LIGHTED	RAIN	WET	LEVEL	NO	10
20466	OTHER	DARK-LIGHTED	SNOW	WATER (STANDING, MOVING)	LEVEL	NO	45
51662	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	10
90348	OTHER	DAYLIGHT	CLOUDY	DRY	LEVEL	NO	10

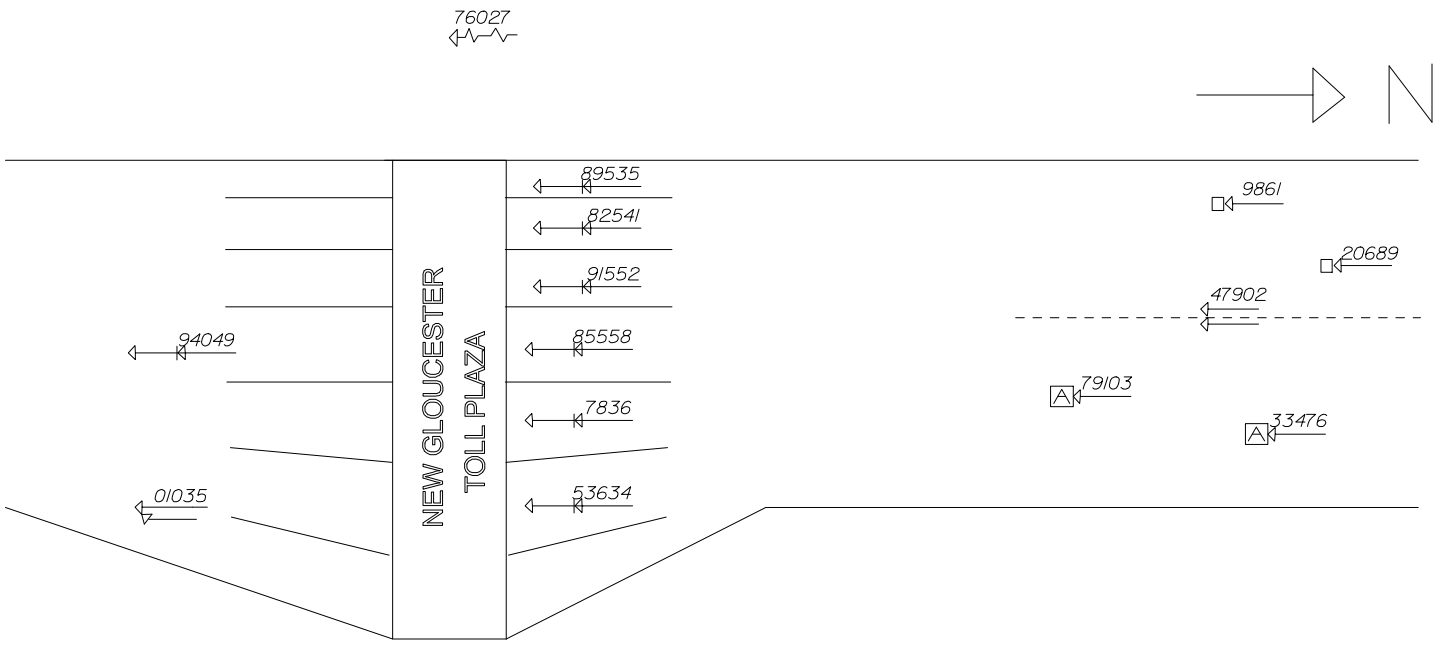
NUMBER	PRE CRASH ACTIONS	CONTRIBUTING CIRCUMSTANCES - VEHICLE	SEQUENCE OF EVENTS 1
72920	FOLLOWING ROADWAY, FOLLOWING ROADWAY	OTHER, NONE	
87532	SKIDDING	NONE	
94163	FOLLOWING ROADWAY	NONE	
40537	FOLLOWING ROADWAY	NONE	
52693	FOLLOWING ROADWAY	NONE	
71991	BACKING, SLOWING IN TRAFFIC	NONE, NONE	
20466	CHANGING LANES, OVERTAKING PASSING	NONE, NONE	MOTOR VEHICLES IN TRANSPORT
51662	BACKING, STOPPED IN TRAFFIC	NONE, NONE	MOTOR VEHICLES IN TRANSPORT
90348	FOLLOWING ROADWAY, STARTING IN TRAFFIC	NONE, NONE	MOTOR VEHICLES IN TRANSPORT

NUMBER	CONDITION AT TIME OF CRASH	DRIVER ACTIONS AT TIME OF CRASH	INJURY DEGREE
72920	APPARENTLY NORMAL, APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT, NONE	5,4
87532	APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	5,5,5,3
94163	APPARENTLY NORMAL		3
40537	APPARENTLY NORMAL		5
52693	APPARENTLY NORMAL		5
71991	APPARENTLY NORMAL, APPARENTLY NORMAL	IMPROPER BACKING, NONE	5,5,5
20466	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT OF WAY, NONE	5,5
51662	APPARENTLY NORMAL, APPARENTLY NORMAL	IMPROPER BACKING, NONE	5,5,5
90348	ASLEEP OR FATIGUED, APPARENTLY NORMAL	OTHER CONTRIBUTING ACTION, NONE	3,5

SEGMENT LENGTH: 0.48 MILES
NUMBER OF CRASHES: 13
CRASH RATE FACTOR: 1.86

ELEMENT: 252336I
MILE MARKER: 66.14 SB
LOCATION: NEW GLOUCESTER TOLL PLAZA TO MAYALL ROAD

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/27/2012
PREPARED FOR: MTA



ELEMENT 252336I

SYMBOLS

ANGLE
PARKED VEHICLE
OUT OF CONTROL
BACKING
REAR END
FATAL ACCIDENT
FIXED OBJECT
SIDESWIPE
VEHICLE (MOVING)
HEAD ON
TURNING MOVE
ANIMAL
OVERTURN
CHANGE LANE

NUMBER	DATE	DAY OF WEEK	TIME OF DAY	LOCATION	TYPE	FIXED OBJECT STRUCK	OTHER PROPERTY DAMAGE
01035	1/6/2009	TUES	6:55	STRAIGHT ROAD	REAR END/SIDESWIPE		
9861	2/12/2009	THURS	17:36	STRAIGHT ROAD	WENT OFF ROAD	GUARDRAIL	GUARDRAIL
20689	3/30/2009	MON	20:00	STRAIGHT ROAD	OBJECT IN ROAD		
47902	7/11/2009	SAT	13:05	OTHER	REAR END/SIDESWIPE		
91552	12/21/2009	MON	13:16	STRAIGHT ROAD	REAR END/SIDESWIPE		
94049	12/31/2009	THURS	15:00	STRAIGHT ROAD	REAR END/SIDESWIPE		
7836	2/2/2010	TUES	16:30	OTHER	REAR END/SIDESWIPE		
33476	5/21/2010	FRI	5:10	STRAIGHT ROAD	DEER		
79103	10/29/2010	FRI	4:30	STRAIGHT ROAD	DEER		
85558	11/23/2010	TUES	8:33	OTHER	REAR END/SIDESWIPE		
53634	7/20/2011	WEDS	17:20	OTHER	REAR END/SIDESWIPE		
82541	10/31/2011	MON	11:33	OTHER	REAR END/SIDESWIPE		
89535	11/28/2011	MON	19:55	OTHER	REAR END/SIDESWIPE		

NUMBER	TRAFFIC CONTROL DEVICE	LIGHT	WEATHER	ROAD SURFACE	ROAD CHARACTER	ROAD WORK	SPEED LIMIT
01035	NONE	DAWN	CLEAR	DRY	LEVEL	NO	35
9861	NONE	DARK-NOT LIGHTED	RAIN	WET	LEVEL	YES	65
20689	NONE	DARK-NOT LIGHTED	RAIN	WET	LEVEL	NO	65
47902	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
91552		DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
94049	NONE	DAYLIGHT	SNOW	SNOW	LEVEL	NO	65
7836		DUSK	CLEAR	DRY	LEVEL	NO	35
33476	NONE	DAYLIGHT	RAIN	WET	LEVEL	NO	65
79103	NONE	DARK-NOT LIGHTED	CLEAR	DRY	LEVEL	NO	65
85558	OTHER	DAYLIGHT	CLOUDY	WET	LEVEL	NO	10
53634	TRAFFIC SIGNALS (FLASHING)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	10
82541	OTHER	DAYLIGHT	CLEAR	DRY	LEVEL	NO	10
89535	TRAFFIC SIGNALS (FLASHING)	DARK-LIGHTED	CLOUDY	WET	LEVEL	NO	10

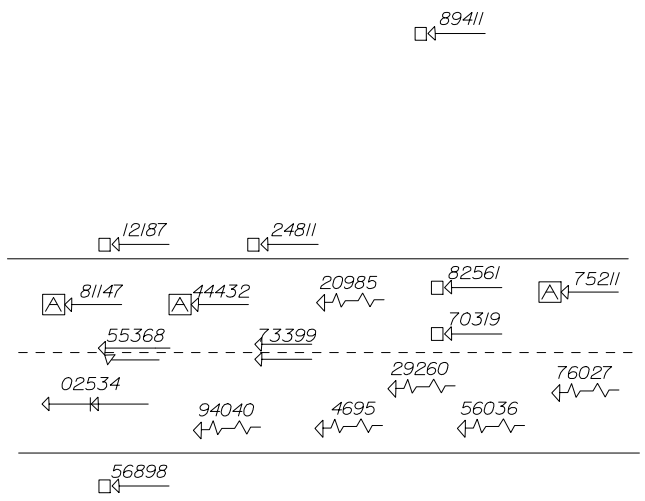
NUMBER	PRE CRASH ACTIONS	CONTRIBUTING CIRCUMSTANCES - VEHICLE	SEQUENCE OF EVENTS 1	SEQUENCE OF EVENTS 2
01035	MERGING, STARTING IN TRAFFIC	NONE, NONE	MOTOR VEHICLE IN TRANSPORT	
9861	FOLLOWING ROADWAY	NONE		
20689	FOLLOWING ROADWAY	NONE		
47902	FOLLOWING ROADWAY, CHANGING LANES	NONE, NONE	MOTOR VEHICLE IN TRANSPORT	
91552	SLOWING IN TRAFFIC, SLOWING IN TRAFFIC	NONE, NONE		
94049	FOLLOWING ROADWAY, FOLLOWING ROADWAY	NONE, NONE	MOTOR VEHICLE IN TRANSPORT	
7836	SLOWING IN TRAFFIC, SLOWING IN TRAFFIC	NONE, NONE		
33476	FOLLOWING ROADWAY	NONE		
79103	FOLLOWING ROADWAY	NONE		
85558	CHANGING LANES, STOPPED IN TRAFFIC (X3)	NONE, NONE, NONE, NONE		
53634	CHANGING LANES, FOLLOWING ROADWAY	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	SEPARATION OF UNITS
82541	FOLLOWING ROADWAY, STOPPED IN TRAFFIC	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	
89535	FOLLOWING ROADWAY, FOLLOWING ROADWAY	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	

NUMBER	CONDITION AT TIME OF CRASH	DRIVER ACTIONS AT TIME OF CRASH	INJURY DEGREE
01035	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO KEEP IN PROPER LANE, NONE	5,5
9861	APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	5
20689	APPARENTLY NORMAL		5
47902	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FAILED TO YIELD RIGHT OF WAY	5,5,5,5,5
91552	OTHER, APPARENTLY NORMAL	FOLLOWED TOO CLOSELY, NONE	5,5
94049	APPARENTLY NORMAL, APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT, NONE	4,4,5
7836	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
33476	APPARENTLY NORMAL		5,5,5
79103	APPARENTLY NORMAL		5
85558	ALL APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT, NONE (X3)	3,2,3,4,4
53634	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT OF WAY AND FAILED TO KEEP IN PROPER LANE, NONE	5,5,5,5,5,5,5
82541	APPARENTLY NORMAL	OTHER CONTRIBUTING ACTION, NONE	5,5,5
89535	APPARENTLY NORMAL, APPARENTLY NORMAL	DROVE TOO FAST FOR CONDITIONS AND FOLLOWED TOO CLOSELY, NONE	5,5,5,5

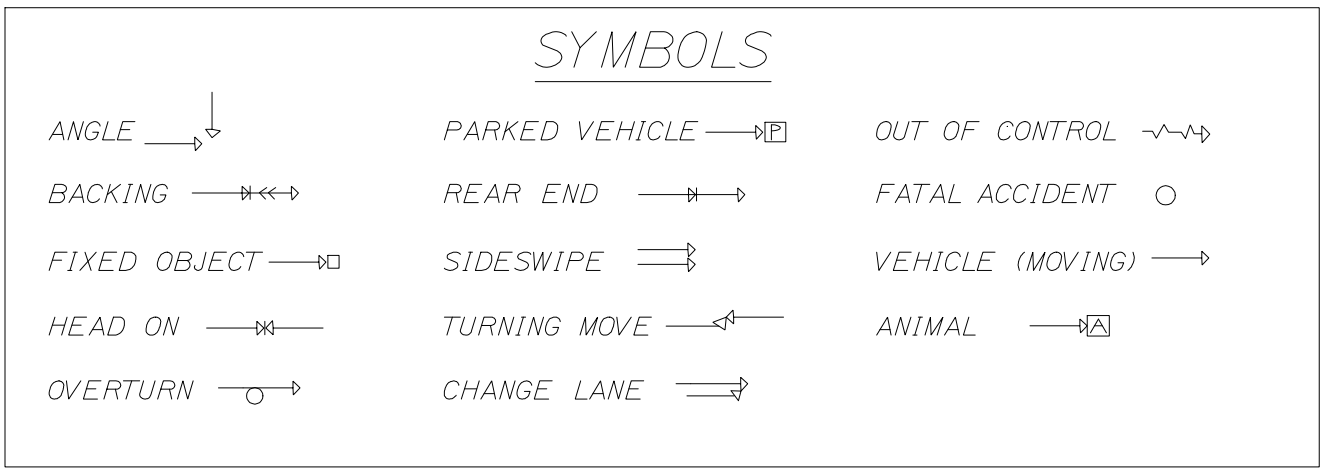
SEGMENT LENGTH: 1.14
NUMBER OF CRASHES: 17
CRASH RATE FACTOR: 1.25

ELEMENT: 2523359
MILE MARKER: 67.5 SB
LOCATION: MAYALL ROAD TO BENNETT ROAD

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/25/2012
PREPARED FOR: MTA



ELEMENT 2523359



NUMBER	DATE	DAY OF WEEK	TIME OF DAY	LOCATION	TYPE	FIXED OBJECT STRUCK	OTHER PROPERTY DAMAGE	TRAFFIC CONTROL DEVICE
02534	1/12/2009	MON	12:00	STRAIGHT ROAD	REAR END/SIDESWIPE			NONE
12187	2/22/2009	SUN	19:00	STRAIGHT ROAD	WENT OFF ROAD	SIGN POST	SIGN POST	NONE
55368	8/6/2009	THURS	12:05	STRAIGHT ROAD	REAR END/SIDESWIPE	GUARDRAIL	GUARDRAIL	NONE
73399	10/9/2009	FRI	1:38	STRAIGHT ROAD	REAR END/SIDESWIPE			NONE
81147	11/9/2009	MON	2:45	STRAIGHT ROAD	MOOSE	GUARDRAIL	GUARDRAIL	NONE
94040	12/31/2009	THURS	15:04	STRAIGHT ROAD	OBJECT IN ROAD	GUARDRAIL	GUARDRAIL	NONE
4695	1/20/2010	WED	7:00	STRAIGHT ROAD	OBJECT IN ROAD	GUARDRAIL	GUARDRAIL	OTHER
44432	6/27/2010	SUN	1:38	STRAIGHT ROAD	MOOSE			NONE
56036	8/5/2010	THURS	18:45	STRAIGHT ROAD	OBJECT IN ROAD	GUARDRAIL	GUARDRAIL	NONE
56898	8/8/2010	SUN	16:30	STRAIGHT ROAD	OBJECT IN ROAD	GUARDRAIL	GUARDRAIL	NONE
20985	3/24/2011	THURS	8:35	STRAIGHT ROAD	WENT OFF ROAD	GUARDRAIL	GUARDRAIL	NONE
24811	4/8/2011	FRI	11:21	STRAIGHT ROAD	WENT OFF ROAD	TREE		NONE
29260	4/26/2011	TUES	22:07	STRAIGHT ROAD	WENT OFF ROAD	GUARDRAIL	GUARDRAIL	NONE
70319	9/12/2011	MON	5:50	STRAIGHT ROAD	OBJECT IN ROAD	CAMPER TOP	CAMPER TOP	NONE
75211	10/1/2011	SAT	8:25	STRAIGHT ROAD	DEER			NONE
76027	10/5/2011	WED	4:20	STRAIGHT ROAD	WENT OFF ROAD			NONE
82561	10/31/2011	MON	11:45	STRAIGHT ROAD	THROWN OR FALLING OBJECT			NONE

NUMBER	LIGHT	WEATHER	ROAD SURFACE	ROAD CHARACTER	ROAD WORK	SPEED LIMIT	PRE CRASH ACTIONS	CONTRIBUTING CIRCUMSTANCES - VEHICLE
02534	DAYLIGHT	CLEAR	DRY	LEVEL	YES	55	STOPPED IN TRAFFIC, SLOWING IN TRAFFIC	NONE, NONE
12187	DARK-NOT LIGHTED	SNOW	SNOW	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
55368	DAYLIGHT	CLEAR	DRY	LEVEL	NO	65	AVOIDING VEHICLE IN ROADWAY, CHANGING LANES	NONE, NONE
73399	DAYLIGHT	CLEAR	DRY	LEVEL	NO	65	FOLLOWING ROADWAY, OVERTAKING PASSING	NONE, NONE
81147	DARK-NOT LIGHTED	CLEAR	DRY	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
94040	DAYLIGHT	SNOW	ICE/FROST	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
4695	DAYLIGHT	SNOW	SNOW	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
44432	DARK-NOT LIGHTED	CLEAR	DRY	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
56036	DAYLIGHT	CLEAR	DRY	LEVEL	NO	65	SLOWING IN TRAFFIC	NONE
56898	DAYLIGHT	CLEAR	DRY	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
20985	DAYLIGHT	SNOW	WET	LEVEL	NO	65	SKIDDING	NONE
24811	DAYLIGHT	CLEAR	DRY	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
29260	DARK-NOT LIGHTED	RAIN	WET	LEVEL	NO	65	SKIDDING	NONE
70319	DAWN	CLEAR	DRY	LEVEL	NO	65	FOLLOWING ROADWAY	OTHER
75211	DAYLIGHT	RAIN	WET	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
76027	DARK-NOT LIGHTED	CLEAR	DRY	LEVEL	NO	65	FOLLOWING ROADWAY, FOLLOWING ROADWAY	NONE, NONE
82561	DAYLIGHT	CLEAR	DRY	LEVEL	NO	65	FOLLOWING ROADWAY	NONE

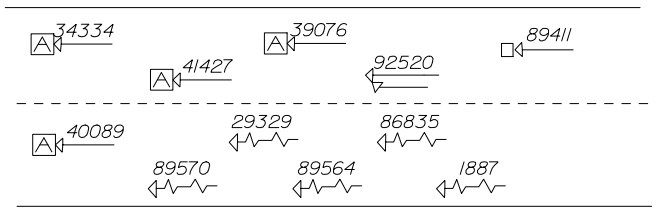
NUMBER	SEQUENCE OF EVENTS 1	SEQUENCE OF EVENTS 2	CONDITION AT TIME OF CRASH	DRIVER ACTIONS AT TIME OF CRASH	INJURY DEGREE
02534			APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
12187			APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	5
55368	MOTOR VEHICLE IN TRANSPORT	OTHER FIXED OBJECT	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FAILED TO YIELD RIGHT OF WAY	5,5,5,5,5,5
73399	MOTOR VEHICLE IN TRANSPORT		APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, IMPROPER PASSING	5,5,5,5
81147			APPARENTLY NORMAL		4
94040			APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	5
4695			APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	5,5,5
44432	ANIMAL		APPARENTLY NORMAL		5
56036			APPARENTLY NORMAL		5
56898			ASLEEP OR FATIGUED		3,4
20985	WENT OFF ROADWAY INTO GUARDRAIL	OVERTURN/ROLLOVER	APPARENTLY NORMAL	OVER-CORRECTING/OVER-STEERING	3
24811	WENT OFF ROADWAY RIGHT	DITCH, TREE	ASLEEP OR FATIGUED	RAN OFF ROADWAY AND FOLLOWED TOO CLOSELY	4
29260	WENT OFF ROADWAY	GUARDRAIL FACE	APPARENTLY NORMAL	DROVE TOO FAST FOR CONDITIONS	4
70319	CARGO/EQUIPMENT LOSS OR SHIFT		APPARENTLY NORMAL	NO CONTRIBUTING ACTION	5
75211	ANIMAL		APPARENTLY NORMAL	NO CONTRIBUTING ACTION	5,5
76027	WENT OFF ROADWAY LEFT		APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FAILED TO KEEP IN PROPER LANE AND OVER-CORRECTING	5,2
82561	MOTOR VEHICLE IN TRANSPORT		APPARENTLY NORMAL	NO CONTRIBUTING ACTION	5

SEGMENT LENGTH: 0.84
NUMBER OF CRASHES: 11
CRASH RATE FACTOR: 1.03

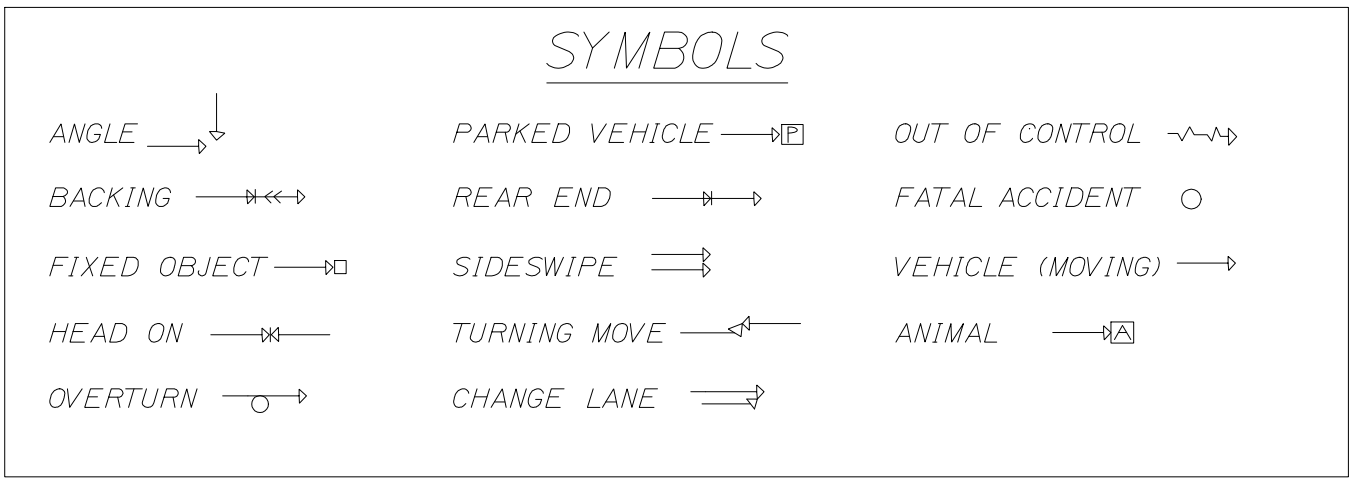
ELEMENT: 2523347
MILE MARKER: 64.3 SB
LOCATION: SHAKER ROAD TO BALD HILL ROAD

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/25/2012
PREPARED FOR: MTA

N



ELEMENT 2523347



NUMBER	DATE	DAY OF WEEK	TIME OF DAY	LOCATION	TYPE	FIXED OBJECT STRUCK	OTHER PROPERTY DAMAGE	TRAFFIC CONTROL DEVICE
40089	6/13/2009	SAT	5:50	STRAIGHT ROAD	DEER			NONE
41427	6/18/2009	THURS	2:00	STRAIGHT ROAD	DEER			NONE
89570	12/13/2009	SUN	16:15	CURVED ROAD	OBJECT IN ROAD	GUARDRAIL	GUARDRAIL	NONE
89564	12/13/2009	SUN	16:10	CURVED ROAD	WENT OFF ROAD		GUARDRAIL	NONE
1887	1/8/2010	FRI	17:14	CURVED ROAD	OBJECT IN ROAD	GUARDRAIL	GUARDRAIL	NONE
29329	5/3/2010	MON	7:10	CURVED ROAD	WENT OFF ROAD		GUARDRAIL	NONE
34344	5/22/2010	SAT	4:58	STRAIGHT ROAD	DEER			NONE
39076	6/7/2010	MON	21:10	STRAIGHT ROAD	DEER			NONE
86835	11/27/2010	SAT	17:43	CURVED ROAD	WENT OFF ROAD			NONE
92520	12/19/2010	SUN	14:55	STRAIGHT ROAD	REAR END/SIDESWIPE			NONE
89411	11/27/2011	SUN	23:00	STRAIGHT ROAD	OBJECT IN ROAD			NONE

NUMBER	LIGHT	WEATHER	ROAD SURFACE	ROAD CHARACTER	ROAD WORK	SPEED LIMIT	PRE CRASH ACTIONS	CONTRIBUTING CIRCUMSTANCES - VEHICLE
40089	DAYLIGHT	CLEAR	DRY	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
41427	DARK-NOT LIGHTED	CLEAR	DRY	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
89570	DARK-NOT LIGHTED	SNOW	SNOW	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
89564	DARK-NOT LIGHTED	SNOW	SNOW	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
1887	DARK-LIGHTED	SNOW	SNOW	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
29329	DAYLIGHT	CLEAR	DRY	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
34344	DAWN	CLOUDY	DRY	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
39076	DARK-NOT LIGHTED	CLEAR	DRY	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
86835	DARK-NOT LIGHTED	CLEAR	ICE/FROST	LEVEL	NO	65	SKIDDING	NONE
92520	DAYLIGHT	CLEAR	DRY	LEVEL	NO	65	CHANGING LANES, OVERTAKING PASSING	NONE, NONE
89411	DARK-NOT LIGHTED	CLEAR	DRY	LEVEL	NO	65	FOLLOWING ROADWAY	NONE

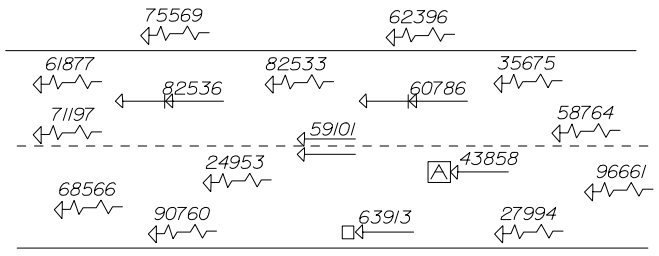
NUMBER	SEQUENCE OF EVENTS 1	CONDITION AT TIME OF CRASH	DRIVER ACTIONS AT TIME OF CRASH	INJURY DEGREE
40089		APPARENTLY NORMAL		5
41427		APPARENTLY NORMAL		5
89570		APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	5
89564		APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	5
1887		APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	5
29329		APPARENTLY NORMAL	IMPROPER PASSING	5,5,4,5,5
34344		APPARENTLY NORMAL		5
39076		APPARENTLY NORMAL		5,5
86835		APPARENTLY NORMAL		3
92520	MOTOR VEHICLE IN TRANSPORT	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO KEEP IN PROPER LANE, NONE	5,5
89411	STRUCK BY FALLING, SHIFTING CARGO OR ANYTHING SET IN MOTION BY MOTOR VEHICLE	APPARENTLY NORMAL	NO CONTRIBUTING ACTION	5,5

SEGMENT LENGTH: 0.78
NUMBER OF CRASHES: 17
CRASH RATE FACTOR: 1.24

ELEMENT: 2524169
MILE MARKER: 104.4 SB
LOCATION: HIGH ST. TO WEST GARDINER/FARMINGDALE TOWN LINE

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/25/2012
PREPARED FOR: MTA

N



ELEMENT 2524169

SYMBOLS

ANGLE
PARKED VEHICLE P
OUT OF CONTROL
BACKING
REAR END
FATAL ACCIDENT
FIXED OBJECT
SIDESWIPE
VEHICLE (MOVING)
HEAD ON
TURNING MOVE
ANIMAL A
OVERTURN
CHANGE LANE

NUMBER	DATE	DAY OF WEEK	TIME OF DAY	LOCATION	TYPE	FIXED OBJECT STRUCK	OTHER PROPERTY DAMAGE	TRAFFIC CONTROL DEVICE
35675	5/28/2009	THURS	9:22	CURVED ROAD	WENT OFF ROAD			NONE
60786	8/23/2009	SUN	18:31	CURVED ROAD	REAR END/SIDESWIPE			NONE
82533	11/14/2009	SAT	16:52	CURVED ROAD	OBJECT IN ROAD	GUARDRAIL	GUARDRAIL	NONE
82536	11/14/2009	SAT	16:00	STRAIGHT ROAD	REAR END/SIDESWIPE			NONE
27994	4/28/2010	TUES	7:27	OBJECT IN ROAD	OBJECT IN ROAD	MEADIAN GUARDRAIL	MEDIAN GUARDRAIL	NONE
43858	6/25/2010	FRI	3:25	STRAIGHT ROAD	DEER			NONE
59101	8/16/2010	MON	6:00	CURVED ROAD	REAR END/SIDESWIPE			NONE
61877	8/25/2010	WED	15:40	STRAIGHT ROAD	WENT OFF ROAD	GUARDRAIL	GUARDRAIL	NONE
63913	9/1/2010	WED	11:51	CURVED ROAD	OBJECT IN ROAD	GUARDRAIL	GUARDRAIL	NONE
71197	9/28/2010	TUES	20:30	CURVED ROAD	WENT OFF ROAD			NONE
75569	10/15/2010	FRI	8:12	CURVED ROAD	WENT OFF ROAD			NONE
90760	12/13/2010	MON	3:40	CURVED ROAD	WENT OFF ROAD			NONE
24953	4/18/2011	FRI	20:14	CURVED ROAD	WENT OFF ROAD			NONE
58764	8/4/2011	THURS	21:00	CURVED ROAD	WENT OFF ROAD			NONE
62396	8/16/2011	TUES	4:49	CURVED ROAD	WENT OFF ROAD	MEADIAN GUARDRAIL	MEDIAN GUARDRAIL	NONE
68566	9/15/2011	THURS	7:40	CURVED ROAD	WENT OFF ROAD			NONE
96661	12/27/2011	TUES	20:41	CURVED ROAD	WENT OFF ROAD			NONE

NUMBER	LIGHT	WEATHER	ROAD SURFACE	ROAD CHARACTER	ROAD WORK	SPEED LIMIT	PRE CRASH ACTIONS	CONTRIBUTING CIRCUMSTANCES - VEHICLE
35675	DAYLIGHT	RAIN	WET	LEVEL	NO	65	FOLLOWING ROADWAY	TIRES
60786	DAYLIGHT	RAIN	WET	LEVEL	NO	65	AVOIDING VEHICLE IN ROADWAY, SKIDDING	NONE, NONE
82533	DARK-NOT LIGHTED	RAIN	WET	LEVEL	NO	65	OVERTAKING PASSING, FOLLOWING ROADWAY	NONE, NONE
82536	DARK-NOT LIGHTED	RAIN	WET	LEVEL	NO	65	FOLLOWING ROADWAY, SLOWING IN TRAFFIC	NONE, NONE
27994	DAYLIGHT	RAIN	WET	LEVEL	NO	65	OVERTAKING PASSING	NONE, NONE
43858	DARK-NOT LIGHTED	CLEAR	DRY	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
59101	DAYLIGHT	RAIN	WET	LEVEL	NO	65	FOLLOWING ROADWAY, FOLLOWING ROADWAY	NONE, NONE
61877	DAYLIGHT	RAIN	WET	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
63913	DAYLIGHT	CLEAR	DRY	LEVEL	NO	65	OVERTAKING PASSING	NONE
71197	DARK-NOT LIGHTED	RAIN	WET	LEVEL	NO	65	SKIDDING	NONE
75569	DAYLIGHT	RAIN	WET	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
90760	DARK-NOT LIGHTED	RAIN	WET	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
24953	DARK-NOT LIGHTED	CLEAR	DRY	LEVEL	NO	65	AVOIDING VEHICLE IN ROADWAY	NONE
58764	DARK-NOT LIGHTED	RAIN	WET	LEVEL	NO	65	SKIDDING	NONE
62396	DARK-NOT LIGHTED	RAIN	WET	LEVEL	NO	65	FOLLOWING ROADWAY	NONE
68566	DAYLIGHT	RAIN	WET	LEVEL	NO	65	FOLLOWING ROADWAY	TIRES
96661	DARK-NOT LIGHTED	RAIN	WET	LEVEL	NO	65	FOLLOWING ROADWAY	NONE

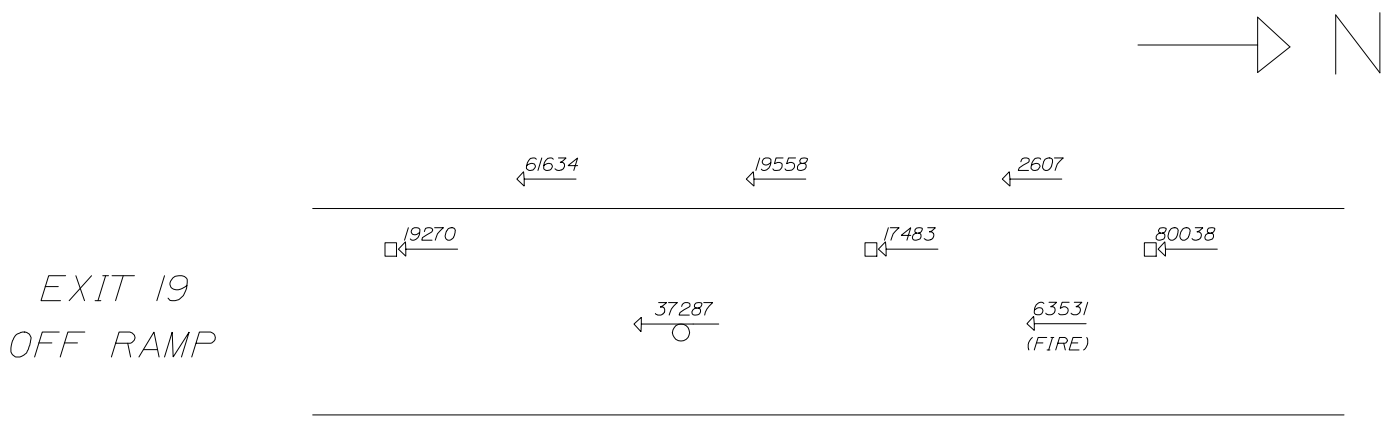
NUMBER	SEQUENCE OF EVENTS 1	SEQUENCE OF EVENTS 2	CONDITION AT TIME OF CRASH	DRIVER ACTIONS AT TIME OF CRASH	INJURY DEGREE
35675			APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	4
60786			APPARENTLY NORMAL, APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT, EXCEEDED POSTED SPEED LIMIT	4,4,5
82533			APPARENTLY NORMAL, APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	5,5
82536			APPARENTLY NORMAL, APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	5,5,5
27994			APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	5
43858	ANIMAL		APPARENTLY NORMAL		5
59101	MOTOR VEHICLE IN TRANSPORT		APPARENTLY NORMAL, APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	5,5
61877			APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	5,5,5
63913			APPARENTLY NORMAL		5,5
71197			APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	4
75569			APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	5,5
90760			APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	5
24953	DITCH	OVERTURN/ROLLOVER	APPARENTLY NORMAL	SWERVED TO AVOID VEHICLE AND FOLLOWED TOO CLOSELY	4
58764	DITCH	OVERTURN/ROLLOVER	APPARENTLY NORMAL	DROVE TOO FAST FOR CONDITIONS	5,5,3,5
62396	WENT OFF ROADWAY	OVERTURN/ROLLOVER	APPARENTLY NORMAL	DROVE TOO FAST FOR CONDITIONS	3
68566	OVERTURN/ROLLOVER		APPARENTLY NORMAL	DROVE TOO FAST FOR CONDITIONS	5
96661	WENT OFF ROADWAY	OVERTURN/ROLLOVER	APPARENTLY NORMAL	DROVE TOO PAST FOR CONDITIONS AND FAILED TO KEEP IN PROPER LANE	3,3

Appendix F Ramp High Crash Location Diagrams

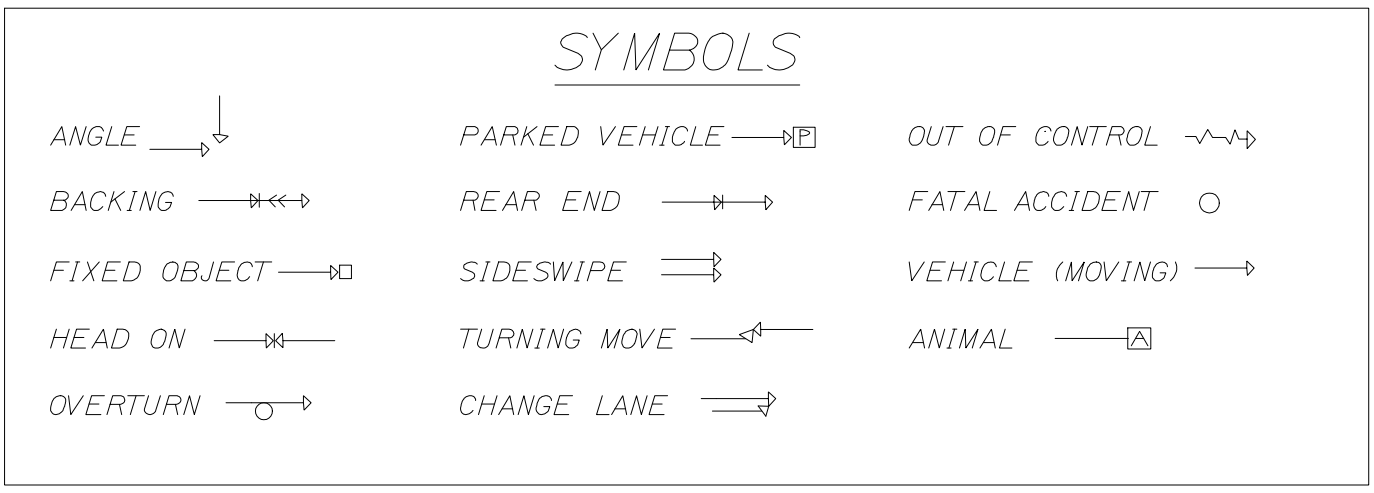
SEGMENT LENGTH: .27 MILES
NUMBER OF CRASHES: 8
CRASH RATE FACTOR: 3.71

ELEMENT: 239745
MILE MARKER: 19.3 SB
LOCATION: EXIT 19 (WELLS) SB OFF RAMP

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/27/2012
PREPARED FOR: MTA



ELEMENT 239745



ELEMENT 239745

NUMBER	DATE	DAY OF WEEK	TIME OF DAY	LOCATION	TYPE	FIXED OBJECT STRUCK	OTHER PROPERTY DAMAGE
19270	3/24/2009	TUES	16:27	INTERCHANGES	WENT OFF ROAD		
61634	8/26/2009	WEDS	16:40	INTERCHANGES	WENT OFF ROAD	TREES	
19558	3/24/2010	WEDS	11:58	INTERCHANGES	WENT OFF ROAD	DELINEATOR POST	DELINEATOR POST
37287	6/1/2010	TUES	11:23	INTERCHANGES	OBJECT IN ROAD		
2607	1/12/2011	WEDS	6:00	INTERCHANGES	OBJECT IN ROAD		
17483	3/10/2011	THURS	8:00	INTERCHANGES	WENT OFF ROAD	DELINEATOR POST	DELINEATOR POST
63531	8/19/2011	FRI	15:45	INTERCHANGES	FIRE		
80038	10/21/2011	FRI	13:33	INTERCHANGES	WENT OFF ROAD	UTILITY POLE	UTILITY POLE

NUMBER	TRAFFIC CONTROL DEVICE	LIGHT	WEATHER	ROAD SURFACE	ROAD CHARACTER	ROAD WORK	SPEED LIMIT
19270	NONE	DAYLIGHT	CLEAR	DRY	ON GRADE	NO	30
61634	NONE	DAYLIGHT	CLOUDY	DRY	LEVEL	NO	65
19558	CURVE WARNING SIGN	DAYLIGHT	RAIN	WET	ON GRADE	NO	35
37287	YIELD SIGN	DAYLIGHT	CLEAR	DRY	ON GRADE	NO	35
2607	NONE	DARK-NOT LIGHTED	SNOW	SNOW	ON GRADE	NO	35
17483	CURVE WARNING SIGN	DAYLIGHT	CLOUDY	DRY	ON GRADE	NO	35
63531	ADVISORY/WARNING SIGN	DAYLIGHT	CLEAR	DRY	ON GRADE	NO	35
80038	NONE	DAYLIGHT	CLEAR	DRY	ON GRADE	NO	30

NUMBER	PRE CRASH ACTIONS	CONTRIBUTING CIRCUMSTANCES - VEHICLE	SEQUENCE OF EVENTS 1	SEQUENCE OF EVENTS 2
19270	SLOWING IN TRAFFIC	NONE		
61634	FOLLOWING ROADWAY	NONE		
19558	FOLLOWING ROADWAY	STEERING		
37287	OVERTAKING PASSING	NONE		
2607	SKIDDING	NONE		
17483	FOLLOWING ROADWAY	TIRES	WENT OFF ROADWAY LEFT	OTHER POST, POLE OR SUPPORT
63531	FOLLOWING ROADWAY	WHEELS	FIRE/EXPLOSION	
80038	FOLLOWING ROADWAY	NONE	WENT OFF ROADWAY RIGHT	UTILITY POLE/LIGHT SUPPORT

NUMBER	CONDITION AT TIME OF CRASH	DRIVER ACTIONS AT TIME OF CRASH	INJURY DEGREE
19270	ASLEEP OR FATIGUED		5
61634	ASLEEP OR FATIGUED		3
19558	APPARENTLY NORMAL		5
37287	APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	2
2607	APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	5
17483	ASLEEP OR FATIGUED	RAN OFF ROADWAY	5
63531	APPARENTLY NORMAL		5
80038	ASLEEP OR FATIGUED	RAN OFF ROADWAY	5

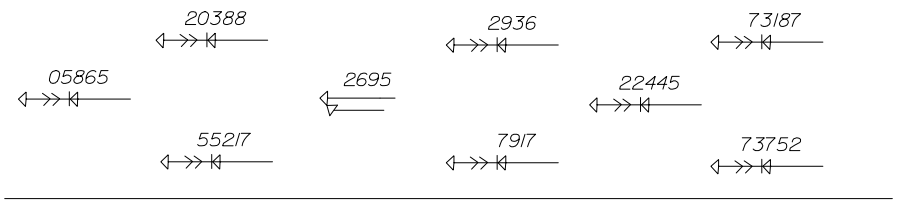
SEGMENT LENGTH: .51 MILES
NUMBER OF CRASHES: 9
CRASH RATE FACTOR: 2.57

ELEMENT: 239756
MILE MARKER: 25.5 SB
LOCATION: EXIT 25 (KENNEBUNK) SB OFF RAMP

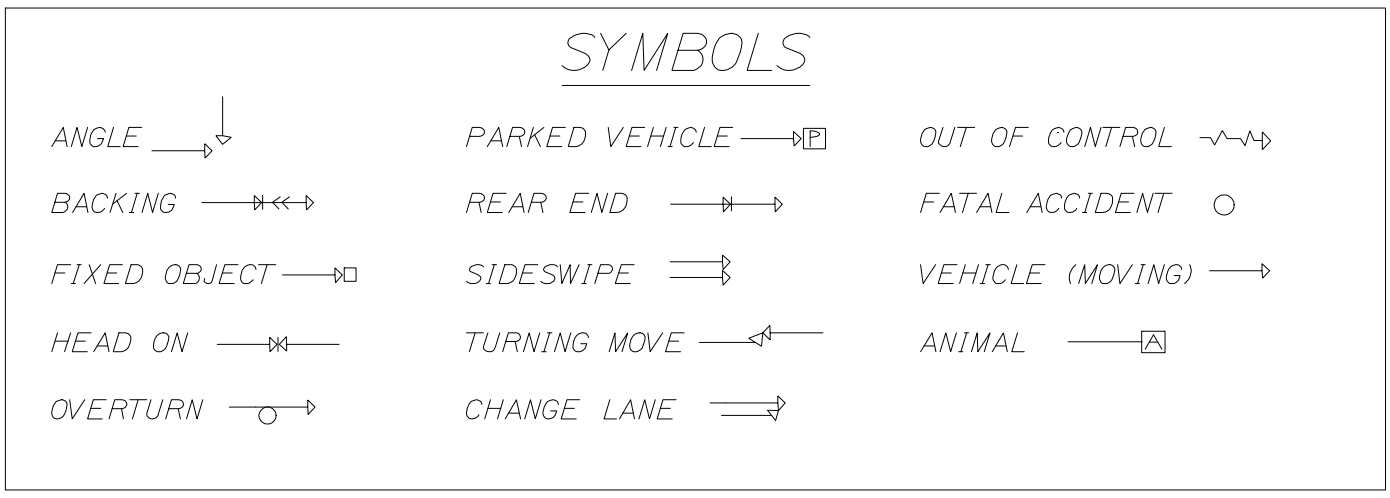
YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/27/2012
PREPARED FOR: MTA

N

EXIT 25
OFF RAMP



ELEMENT 239756



NUMBER	DATE	DAY OF WEEK	TIME OF DAY	LOCATION	TYPE	FIXED OBJECT STRUCK	OTHER PROPERTY DAMAGE
05865	1/25/2009	SUN	18:00	INTERCHANGES	REAR END/SIDESWIPE		
20388	3/29/2009	SUN	9:25	STRAIGHT ROAD	REAR END/SIDESWIPE		
55217	8/5/2009	WEDS	18:40	STRAIGHT ROAD	REAR END/SIDESWIPE		
2695	1/12/2010	TUES	14:20	DRIVEWAYS	REAR END/SIDESWIPE		
2936	1/13/2010	WEDS	15:35	INTERCHANGES	REAR END/SIDESWIPE		
7917	2/3/2010	WEDS	8:10	INTERCHANGES	REAR END/SIDESWIPE		
22445	4/5/2010	MON	11:00	STRAIGHT ROAD	REAR END/SIDESWIPE		
73187	10/6/2010	WEDS	9:05	STRAIGHT ROAD	REAR END/SIDESWIPE		
73752	9/25/2011	SUN	11:38	STRAIGHT ROAD	REAR END/SIDESWIPE		

NUMBER	TRAFFIC CONTROL DEVICE	LIGHT	WEATHER	ROAD SURFACE	ROAD CHARACTER	ROAD WORK	SPEED LIMIT
05865	NONE	DARK-LIGHTED	CLEAR	DRY	LEVEL	NO	30
20388	NONE	DAYLIGHT	RAIN	WET	LEVEL	NO	35
55217	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	
2695	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	30
2936	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	
7917	OTHER	DAYLIGHT	CLOUDY	DRY	LEVEL	NO	25
22445	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
73187	NONE	DAYLIGHT	RAIN	WET	LEVEL	NO	35
73752	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	30

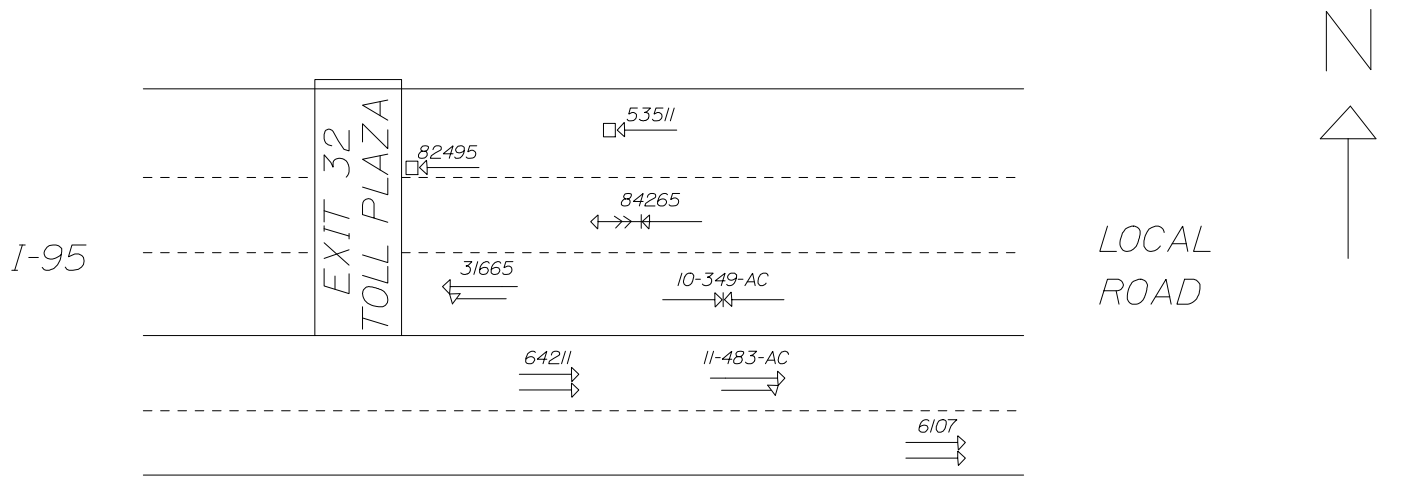
NUMBER	PRE CRASH ACTIONS	CONTRIBUTING CIRCUMSTANCES - VEHICLE	SEQUENCE OF EVENTS 1	SEQUENCE OF EVENTS 2
05865	BACKING, STOPPED IN TRAFFIC	NONE, NONE		
20388	FOLLOWING ROADWAY, BACKING	NONE, NONE	MOTOR VEHICLE IN TRANSPORT	
55217	BACKING, STOPPED IN TRAFFIC	NONE, NONE	MOTOR VEHICLE IN TRANSPORT	
2695	OVERTAKING/PASSING, MAKING LEFT TURN	NONE, NONE	MOTOR VEHICLE IN TRANSPORT	
2936	BACKING, STOPPED IN TRAFFIC	NONE, NONE	OTHER NON-FIXED OBJECT	
7917	BACKING, STOPPED IN TRAFFIC, STOPPED IN TRAFFIC	NONE, NONE, NONE	PARKED MOTOR VEHICLE	
22445	BACKING, FOLLOWING ROADWAY	NONE, NONE	MOTOR VEHICLE IN TRANSPORT	
73187	STARTING FROM PARKED, STOPPED IN TRAFFIC	NONE, NONE	PARKED MOTOR VEHICLE	
73752	BACKING, STOPPED IN TRAFFIC	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	

NUMBER	CONDITION AT TIME OF CRASH	DRIVER ACTIONS AT TIME OF CRASH	INJURY DEGREE
05865	APPARENTLY NORMAL, APPARENTLY NORMAL	IMPROPER BACKING, NONE	5,5,5,4,5
20388	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, IMPROPER BACKING	5,5,5
55217	APPARENTLY NORMAL, APPARENTLY NORMAL	IMPROPER BACKING, NONE	5,5,5,5,5
2695	APPARENTLY NORMAL, APPARENTLY NORMAL	IMPROPER BACKING, NONE	5,5,5
2936	APPARENTLY NORMAL, APPARENTLY NORMAL	IMPROPER BACKING, NONE	5,5,5
7917	ASLEEP OR FATIGUED, APPARLENTLY NORMAL, APPARENTLY NORMAL	IMPROPER BACKING, NONE, NONE	5,5,4
22445	APPARENTLY NORMAL, APPARENTLY NORMAL	BACKING, FOLLOWING ROADWAY	5,5,5
73187	APPARENTLY NORMAL, APPARENTLY NORMAL	IMPROPER BACKING, NONE	5,5
73752	APPARENTLY NORMAL, APPARENTLY NORMAL	IMPROPER BACKING, NONE	5,5,5,5

SEGMENT LENGTH: .13 MILES
NUMBER OF CRASHES: 8
CRASH RATE FACTOR: 1.62

ELEMENT: 239715
MILE MARKER: EXIT 32
LOCATION: EXIT 32 (BIDDEFORD) ON RAMP

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/27/2012
PREPARED FOR: MTA



ELEMENT 239715

SYMBOLS

ANGLE
PARKED VEHICLE
OUT OF CONTROL
BACKING
REAR END
FATAL ACCIDENT
FIXED OBJECT
SIDESWIPE
VEHICLE (MOVING)
HEAD ON
TURNING MOVE
ANIMAL
OVERTURN
CHANGE LANE

NUMBER	DATE	DAY OF WEEK	TIME OF DAY	LOCATION	TYPE	FIXED OBJECT STRUCK	OTHER PROPERTY DAMAGE
31665	5/12/2010	WEDS	10:25	OTHER	REAR END/SIDESWIPE		
10-349-AC	7/27/2010	TUES	11:15	OTHER	HEAD-ON/SIDESWIPE		
53511	7/28/2010	WEDS	11:00	STRAIGHT ROAD	WENT OFF ROAD	LIGHT POLE	LIGHT POLE
64211	9/2/2010	THURS	9:55	STRAIGHT ROAD	REAR END/SIDESWIPE		
84265	11/18/2010	THURS	10:20	OTHER	REAR END/SIDESWIPE		
6107	1/24/2010	SUN	17:10	INTERCHANGES	REAR END/SIDESWIPE		
11-483-AC	9/26/2011	MON	13:25	STRAIGHT ROAD	REAR END/SIDESWIPE		
82495	10/31/2011	MON	7:50	OTHER	OTHER	TOLL BOOTH	TOLL BOOTH

NUMBER	TRAFFIC CONTROL DEVICE	LIGHT	WEATHER	ROAD SURFACE	ROAD CHARACTER	ROAD WORK	SPEED LIMIT
31665	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	10
10-349-AC	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	
53511	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
64211	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
84265		DAYLIGHT	CLEAR	DRY	LEVEL	NO	10
6107	OTHER	DARK-LIGHTED	CLEAR	DRY	ON GRADE	NO	65
11-483-AC	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	
82495	OTHER	DAYLIGHT	CLEAR	ICE/FROST	LEVEL	NO	25

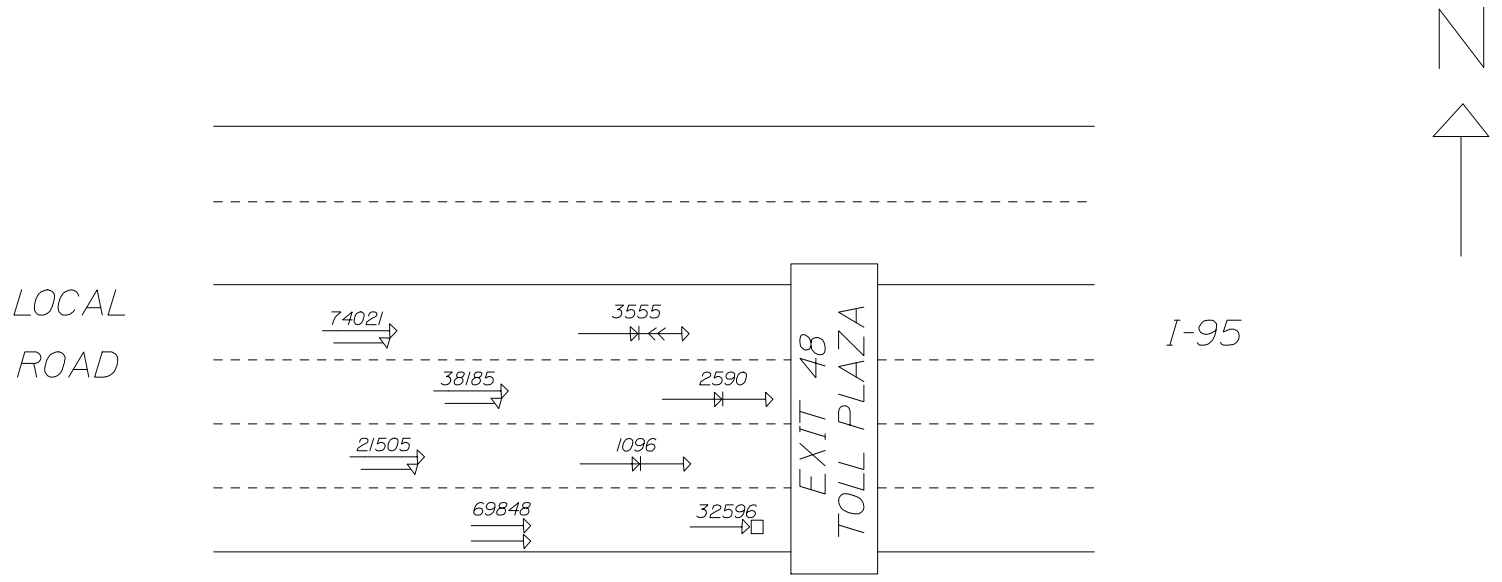
NUMBER	PRE CRASH ACTIONS	CONTRIBUTING CIRCUMSTANCES - VEHICLE	SEQUENCE OF EVENTS 1
31665	CHANGING LANES, FOLLOWING ROADWAY	NONE, NONE	
10-349-AC	WRONG WAY INTO OPPOSING TRAFFIC, AVOIDING VEHICLE, FOLLOWING ROADWAY, FOLLOWING ROADWAY	NONE, NONE, NONE, NONE	
53511	BACKING	NONE	
64211	FOLLOWING ROADWAY, FOLLOWING ROADWAY	NONE, NONE	
84265	BACKING, STOPPED IN TRAFFIC	NONE, NONE	
6107	CHANGING LANES, STOPPED IN TRAFFIC, STOPPED IN TRAFFIC	NONE, NONE, NONE	
11-483-AC	CHANGING LANES, SLOWING IN TRAFFIC	NONE, NONE	MOTOR VEHICLES IN TRANSPORT
82495	CHANGING LANES	NONE	MOTOR VEHICLE IN TRANSPORT

NUMBER	CONDITION AT TIME OF CRASH	DRIVER ACTIONS AT TIME OF CRASH	INJURY DEGREE
31665	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT-OF-WAY, NONE	5,5
10-349-AC	ILL (SICK), APPARENTLY NORMAL, APPARENTLY NORMAL, APPARENTLY NORMAL		4,5,5,5,5,5,5,5,5,5
53511	APPARENTLY NORMAL	IMPROPER BACKING	5
64211	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
84265	APPARENTLY NORMAL, APPARENTLY NORMAL	IMPROPER BACKING, NONE	5,5
6107	APPARENTLY NORMAL, APPARENTLY NORMAL, APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT, NONE, NONE	5,5,5
11-483-AC	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO KEEP IN PROPER LANE, NO CONTRIBUTING ACTION	5,5
82495	APPARENTLY NORMAL	NO CONTRIBUTING ACTION	5

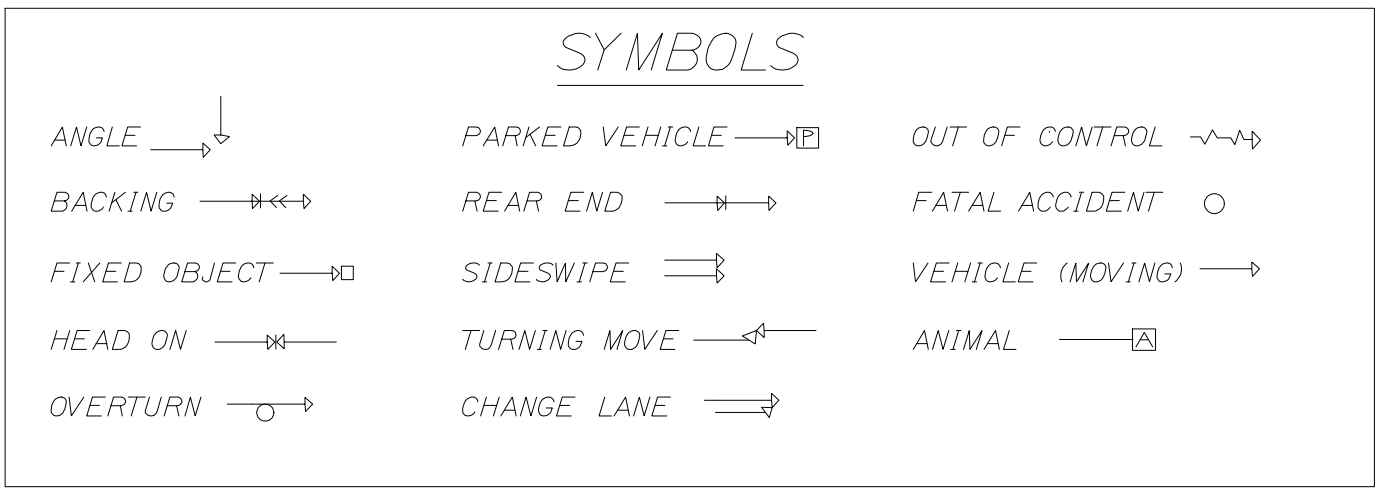
SEGMENT LENGTH: .07 MILES
NUMBER OF CRASHES: 8
CRASH RATE FACTOR: 2.92

ELEMENT: 2836952
MILE MARKER: EXIT 48
LOCATION: EXIT 48 (WESTBROOK) RAMP

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/30/2012
PREPARED FOR: MTA



ELEMENT 2836952



NUMBER	DATE	DAY OF WEEK	TIME OF DAY	LOCATION	TYPE	FIXED OBJECT STRUCK	OTHER PROPERTY DAMAGE
69848	9/25/2009	FRI	7:15	OTHER	REAR END/SIDESWIPE		
74021	10/11/2009	SUN	11:45	STRAIGHT ROAD	REAR END/SIDESWIPE		
1096	5/3/2010	MON	13:34	OTHER	REAR END/SIDESWIPE		
38185	6/4/2010	FRI	13:20	OTHER	REAR END/SIDESWIPE		
2590	10/2/2010	SAT	9:22	STRAIGHT ROAD	REAR END/SIDESWIPE		
3555	1/15/2011	SAT	10:50	OTHER	REAR END/SIDESWIPE		
21505	3/26/2011	SAT	10:00	OTHER	REAR END/SIDESWIPE		
32596	5/9/2011	MON	13:09	OTHER	OTHER	LIGHT BAR	LIGHT BAR

NUMBER	TRAFFIC CONTROL DEVICE	LIGHT	WEATHER	ROAD SURFACE	ROAD CHARACTER	ROAD WORK	SPEED LIMIT
69848	STOP SIGNS - OTHER	DAYLIGHT	CLEAR	DRY	LEVEL	NO	10
74021	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	5
1096	OTHER	DAYLIGHT	CLOUDY	DRY	LEVEL	NO	
38185	OTHER	DAYLIGHT	CLEAR	DRY	LEVEL	NO	10
2590	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	25
3555	OTHER	DAYLIGHT	CLOUDY	DRY	LEVEL	NO	10
21505	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	10
32596	ADVISORY/WARNING SIGN	DAYLIGHT	CLOUDY	DRY	LEVEL	NO	10

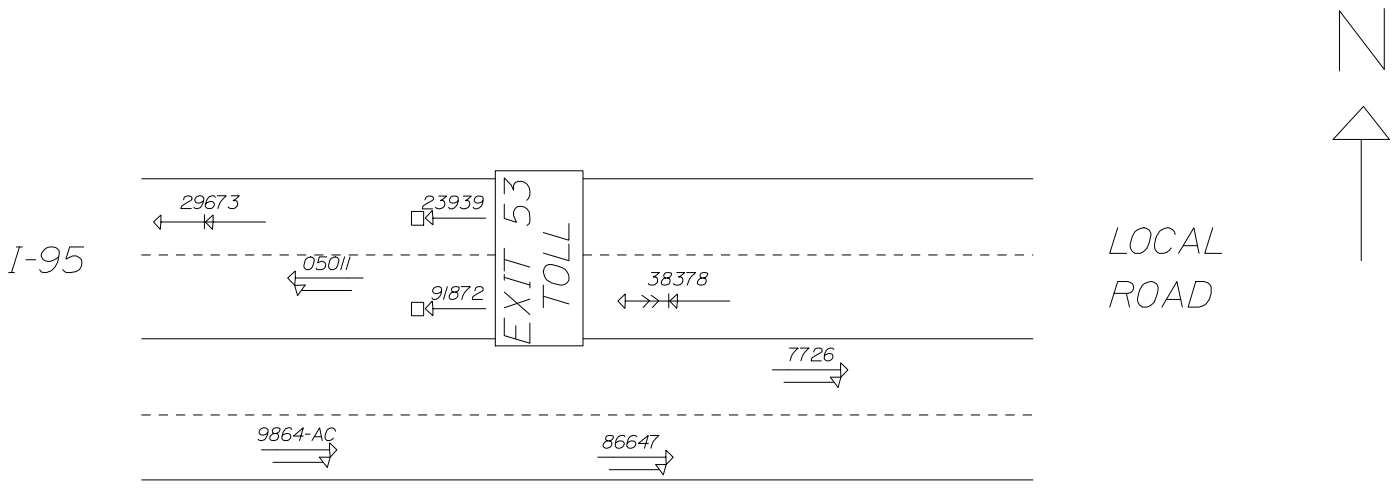
NUMBER	PRE CRASH ACTIONS	CONTRIBUTING CIRCUMSTANCES - VEHICLE	SEQUENCE OF EVENTS 1	SEQUENCE OF EVENTS 2
69848	SLOWING IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE		
74021	MAKING LEFT TURN, MAKING LEFT TURN	NONE, NONE		
1096	STOPPED IN TRAFFIC, STARTING IN TRAFFIC	NONE, NONE		
38185	MERGING, FOLLOWING ROADWAY	NONE, NONE		
2590	FOLLOWING ROADWAY, FOLLOWING ROADWAY	NONE, NONE		
3555	BACKING, FOLLOWING ROADWAY	NONE, NONE		
21505	CHANGING LANES, FOLLOWING ROADWAY	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	
32596	FOLLOWING ROADWAY	BODY, DOORS	EQUIPMENT FAILURE	STRUCK BY FALLING CARGO

NUMBER	CONDITION AT TIME OF CRASH	DRIVER ACTIONS AT TIME OF CRASH	INJURY DEGREE
69848	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO KEEP IN PROPER LANE, NONE	5,5,5,5,5
74021	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FAILED TO YIELD RIGHT-OF-WAY	5,5,5
1096	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5,5
38185	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT-OF-WAY, NONE	5
2590	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FOLLOWED TOO CLOSELY	5,5
3555	APPARENTLY NORMAL, APPARENTLY NORMAL	IMPROPER BACKING, NONE	5,5
21505	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT-OF-WAY, NONE	5,5,5,5,5,5
32596	APPARENTLY NORMAL	NONE	5

SEGMENT LENGTH: .17 MILES
NUMBER OF CRASHES: 8
CRASH RATE FACTOR: 2.00

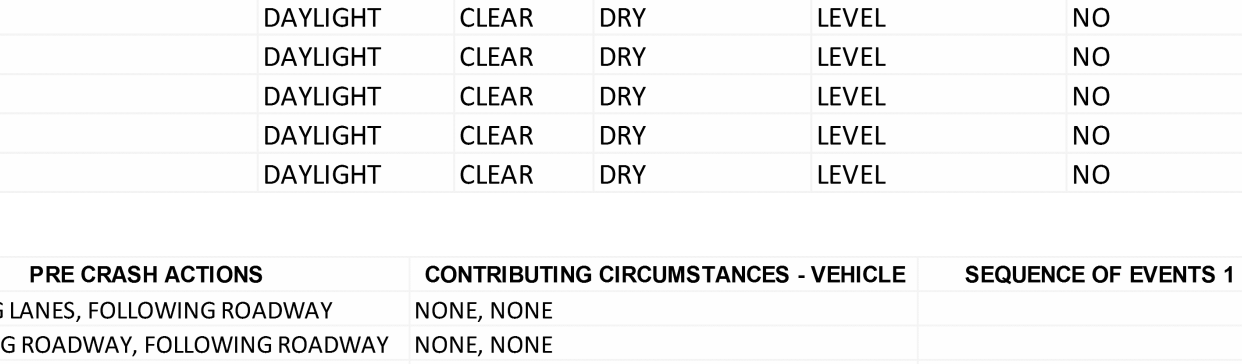
ELEMENT: 2036928
MILE MARKER: EXIT 53
LOCATION: EXIT 53 (WEST FALMOUTH) ON RAMP

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/30/2012
PREPARED FOR: MTA



ELEMENT 2036928

SYMBOLS



NUMBER	DATE	DAY OF WEEK	TIME OF DAY	LOCATION	TYPE	FIXED OBJECT STRUCK	OTHER PROPERTY DAMAGE
05011	3/29/2009	SUN	19:39	STRAIGHT ROAD	REAR END/SIDESWIPE		
7726	5/4/2009	MON	9:00	STRAIGHT ROAD	REAR END/SIDESWIPE		
29673	5/6/2009	WEDS	8:35	STRAIGHT ROAD	REAR END/SIDESWIPE		
9864-AC	5/12/2010	WEDS	9:51	STRAIGHT ROAD	REAR END/SIDESWIPE		
23939	4/11/2010	SUN	11:50	OTHER	WENT OFF ROAD		LIGHT FIXTURE
91872	12/17/2010	FRI	7:49	OTHER	OTHER	E-ZPASS ANTENNA	E-ZPASS ANTENNA
86647	12/2/2009	WEDS	8:50	STRAIGHT ROAD	REAR END/SIDESWIPE		
38378	5/31/2010	MON	12:29	OTHER	REAR END/SIDESWIPE		

NUMBER	TRAFFIC CONTROL DEVICE	LIGHT	WEATHER	ROAD SURFACE	ROAD CHARACTER	ROAD WORK	SPEED LIMIT
05011	NONE	DARK-LIGHTED	RAIN	WET	LEVEL	NO	
7726	NONE	DAWN	CLEAR	DRY	LEVEL	NO	15
29673		DAYLIGHT	RAIN	WET	LEVEL	NO	10
9864-AC	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	
23939	OTHER	DAYLIGHT	CLEAR	DRY	LEVEL	NO	10
91872	OTHER	DAYLIGHT	CLEAR	DRY	LEVEL	NO	10
86647	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
38378	OTHER	DAYLIGHT	CLEAR	DRY	LEVEL	NO	10

NUMBER	PRE CRASH ACTIONS	CONTRIBUTING CIRCUMSTANCES - VEHICLE	SEQUENCE OF EVENTS 1	SEQUENCE OF EVENTS 2
05011	CHANGING LANES, FOLLOWING ROADWAY	NONE, NONE		
7726	FOLLOWING ROADWAY, FOLLOWING ROADWAY	NONE, NONE		
29673	SLOWING IN TRAFFIC, SLOWING IN TRAFFIC	NONE, NONE		
9864-AC	CHANGING LANES, OTHER VEHICLE ACTION	NONE, NONE		
23939	STARTING IN TRAFFIC	NONE		
91872	FOLLOWING ROADWAY	NONE	OTHER FIXED OBJECT	
86647	STOPPED IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE		
38378	BACKING, STOPPED IN TRAFFIC	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	

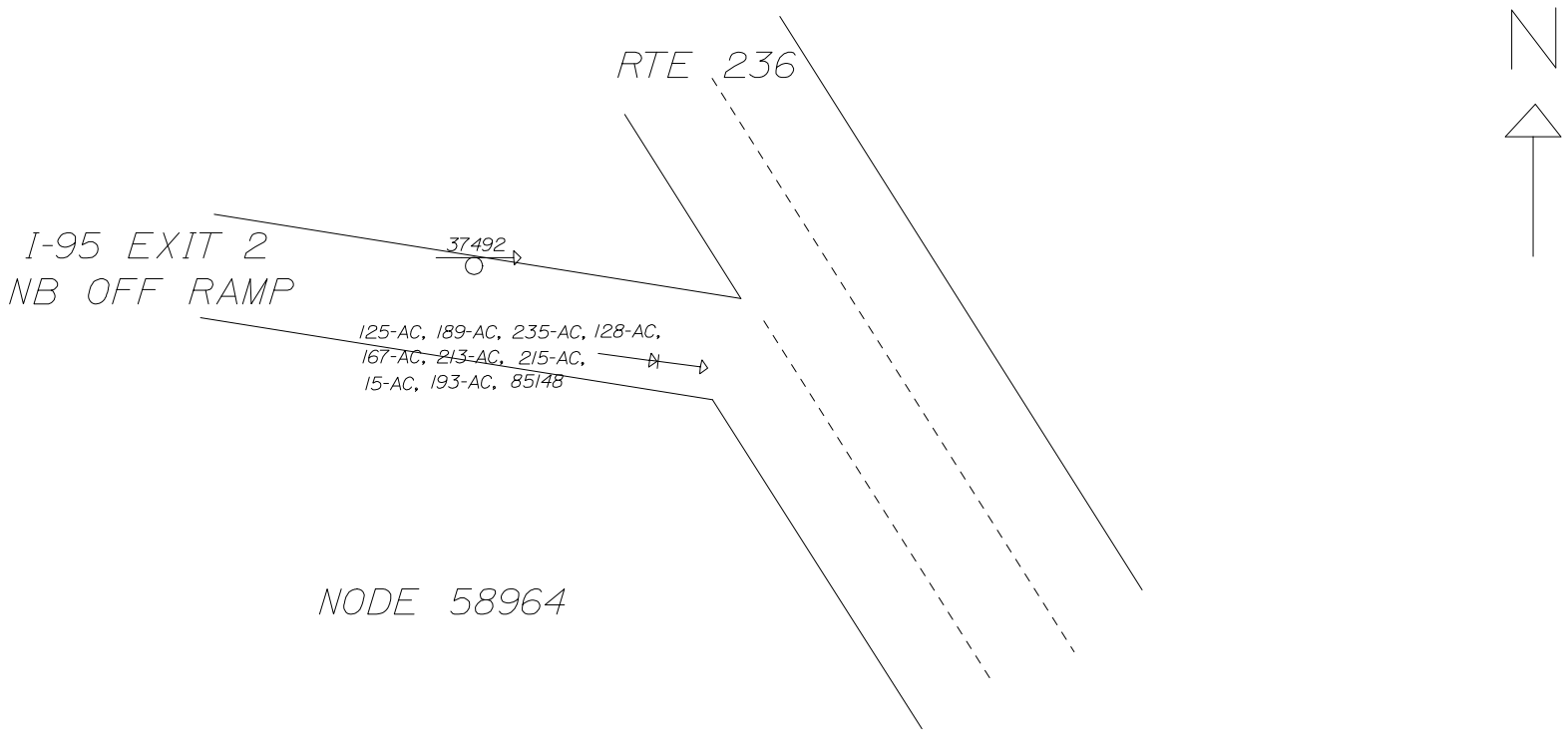
NUMBER	CONDITION AT TIME OF CRASH	DRIVER ACTIONS AT TIME OF CRASH	INJURY DEGREE
05011	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO KEEP IN PROPER LANE, NONE	5,5
7726	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FAILED TO KEEP IN PROPER LANE	5,5,5
29673	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
9864-AC	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5,5,5
23939	APPARENTLY NORMAL		5,5
91872	APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT	5
86647	APPARENTLY NORMAL, APPARENTLY NORMAL	IMPROPER TURN, NONE	5,5,5
38378	APPARENTLY NORMAL, APPARENTLY NORMAL	IMPROPER BACKING, NONE	5,5,5

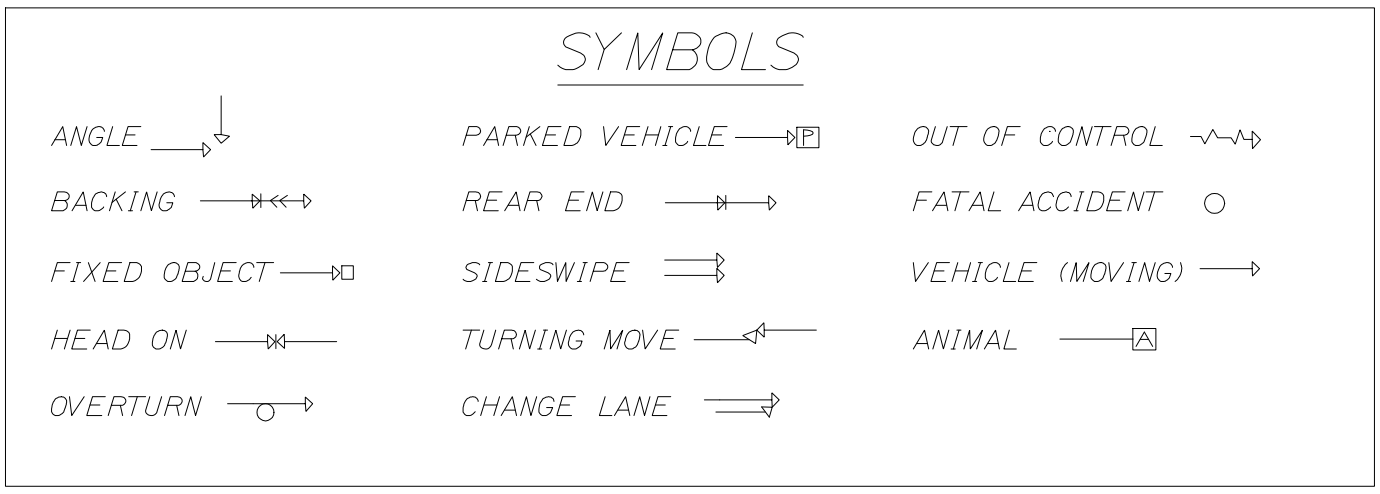
Appendix G Intersection High Crash Location Diagrams

SEGMENT LENGTH: N/A
NUMBER OF CRASHES: 11
CRASH RATE FACTOR: 2.42

NODE: 58964
MILE MARKER: EXIT 2
LOCATION: EXIT 2 NB OFF RAMP & ROUTE 236

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/30/2012
PREPARED FOR: MTA





NUMBER	DATE	DAY OF WEEK	TIME OF DAY	LOCATION	TYPE	FIXED OBJECT STRUCK	OTHER PROPERTY DAMAGE
125-AC	6/21/2009	SUN	15:27	THREE LEG INTERSECTION	REAR END/SIDESWIPE		
189-AC	8/20/2009	THURS	12:20	THREE LEG INTERSECTION	REAR END/SIDESWIPE		
235-AC	10/17/2009	SAT	12:39	THREE LEG INTERSECTION	REAR END/SIDESWIPE		
128-AC	7/11/2010	SUN	12:34	THREE LEG INTERSECTION	REAR END/SIDESWIPE		
167-AC	8/22/2010	SUN	20:03	THREE LEG INTERSECTION	REAR END/SIDESWIPE		
213-AC	10/13/2010	WED	11:23	THREE LEG INTERSECTION	REAR END/SIDESWIPE		
215-AC	10/14/2010	THURS	6:09	THREE LEG INTERSECTION	REAR END/SIDESWIPE		
15-AC	1/20/2011	THURS	12:00	THREE LEG INTERSECTION	REAR END/SIDESWIPE		
37492	5/28/2011	SAT	6:45	THREE LEG INTERSECTION	ROLLOVER		
193-AC	8/28/2011	SUN	16:55	THREE LEG INTERSECTION	REAR END/SIDESWIPE		
85148	11/11/2011	FRI	11:10	THREE LEG INTERSECTION	REAR END/SIDESWIPE		

NUMBER	TRAFFIC CONTROL DEVICE	LIGHT	WEATHER	ROAD SURFACE	ROAD CHARACTER	ROAD WORK	SPEED LIMIT
125-AC	YIELD SIGN	DAYLIGHT	RAIN	WET	LEVEL	NO	
189-AC	STOP SIGNS-OTHER	DAYLIGHT	CLEAR	DRY	LEVEL	NO	25
235-AC	YIELD SIGN	DAYLIGHT	CLEAR	DRY	LEVEL	NO	15
128-AC	YIELD SIGN	DAYLIGHT	CLEAR	DRY	LEVEL	NO	25
167-AC	YIELD SIGN	DARK-LIGHTED	CLEAR	WET	LEVEL	NO	15
213-AC	YIELD SIGN	DAYLIGHT	CLEAR	DRY	LEVEL	NO	45
215-AC	YIELD SIGN	DAWN	CLEAR	DRY	LEVEL	NO	25
15-AC	YIELD SIGN	DAYLIGHT	CLEAR	SLUSH	ON GRADE	NO	30
37492	YIELD SIGN	DAYLIGHT	CLEAR	DRY	ON GRADE	NO	35
193-AC	YIELD SIGN	DAYLIGHT	CLEAR	DRY	ON GRADE	NO	25
85148	YIELD SIGN	DAYLIGHT	CLOUDY	DRY	TOP OF HILL	NO	25

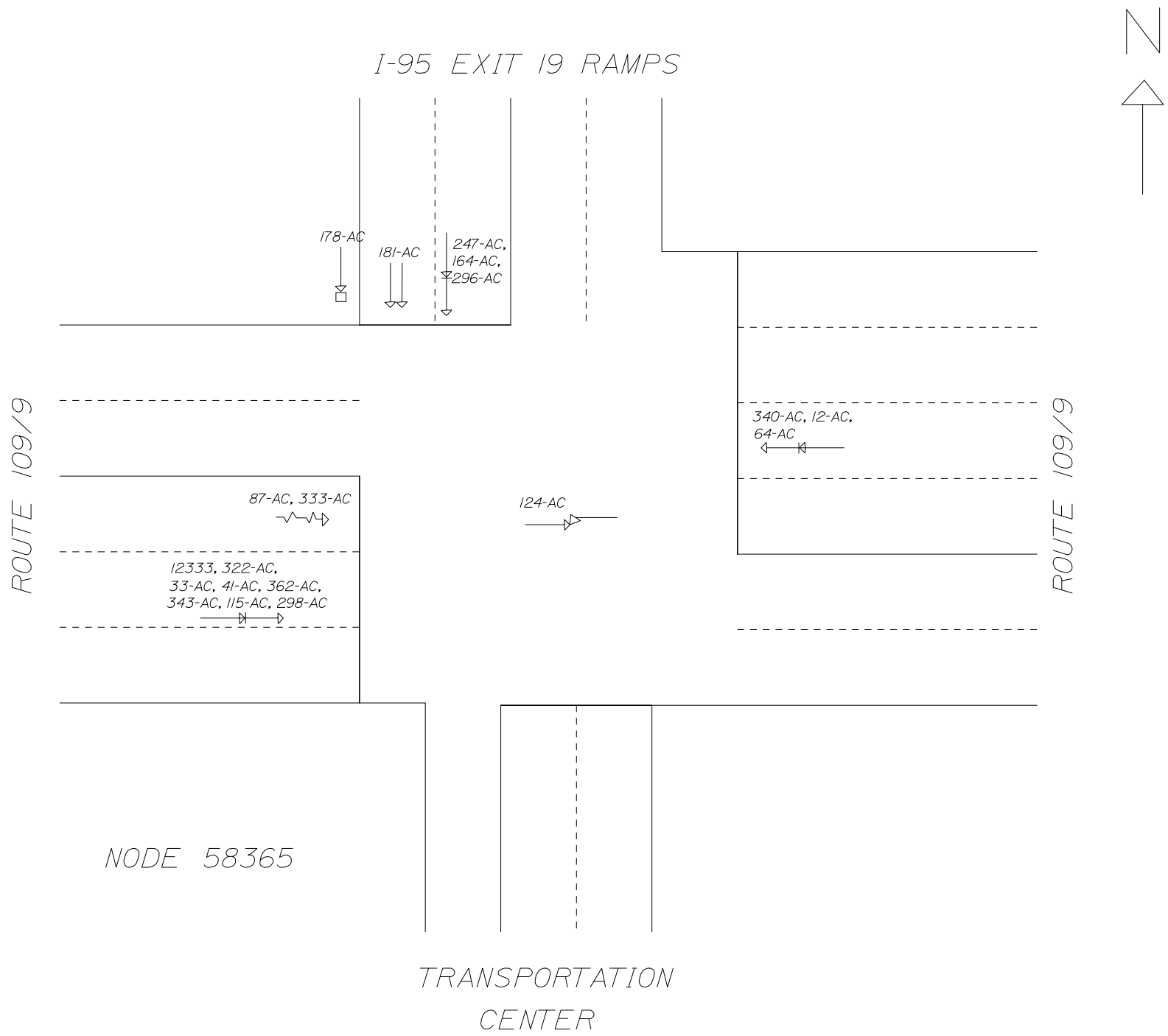
NUMBER	PRE CRASH ACTIONS	CONTRIBUTING CIRCUMSTANCES - VEHICLE	SEQUENCE OF EVENTS 1	SEQUENCE OF EVENTS 2
125-AC	FOLLOWING ROADWAY, STOPPED IN TRAFFIC	NONE, NONE		
189-AC	FOLLOWING ROADWAY, STOPPED IN TRAFFIC	NONE, NONE		
235-AC	FOLLOWING ROADWAY, SLOWING IN TRAFFIC	NONE, NONE		
128-AC	STOPPED IN TRAFFIC, MERGING	NONE, NONE		
167-AC	FOLLOWING ROADWAY, STOPPED IN TRAFFIC	NONE, NONE		
213-AC	MERGING, MERGING	NONE, NONE		
215-AC	MERGING, MERGING	NONE, NONE		
15-AC	STOPPED IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE		
37492	FOLLOWING ROADWAY	NONE	OVERTURN/ROLLOVER	
193-AC	SLOWING IN TRAFFIC, MERGING	NONE, NONE		
85148	STOPPED IN TRAFFIC, STOPPED IN TRAFFIC, SLOWING IN TRAFFIC	NONE, NONE, NONE	MOTOR VEHICLES IN TRANSPORT	

NUMBER	CONDITION AT TIME OF CRASH	DRIVER ACTIONS AT TIME OF CRASH	INJURY DEGREE
125-AC	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
189-AC	APPARENTLY NORMAL, APPARENTLY NORMAL	FOLLOWED TOO CLOSELY, NONE	5,5,5
235-AC	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
128-AC	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FOLLOWED TOO CLOSELY	5,5,5,5
167-AC	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5,3
213-AC	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
215-AC	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
15-AC	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
37492	APPARENTLY NORMAL	DROVE TOO FAST FOR CONDITIONS	2
193-AC	APPARENTLY NORMAL, APPARENTLY NORMAL	FOLLOWED TOO CLOSELY, NONE	5,5
85148	ALL APPARENTLY NORMAL	NONE, NONE, FOLLOWED TOO CLOSELY	5,5,5,5,5,5

SEGMENT LENGTH: N/A
NUMBER OF CRASHES: 19
CRASH RATE FACTOR: 1.09

NODE: 58365
MILE MARKER: EXIT 19
LOCATION: EXIT 19 RAMPS & ROUTE 109/9

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/30/2012
PREPARED FOR: MTA



SYMBOLS

ANGLE
PARKED VEHICLE
OUT OF CONTROL
BACKING
REAR END
FATAL ACCIDENT
FIXED OBJECT
SIDESWIPE
VEHICLE (MOVING)
HEAD ON
TURNING MOVE
ANIMAL
OVERTURN
CHANGE LANE

NUMBER	DATE	DAY OF WEEK	TIME OF DAY	LOCATION	TYPE	FIXED OBJECT STRUCK	OTHER PROPERTY DAMAGE
12333	2/23/2009	MON	6:47	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
247-AC	8/23/2010	MON	14:30	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
340-AC	12/7/2010	TUES	13:19	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
124-AC	6/18/2009	THURS	11:30	FOUR LEG INTERSECTION	INTERSECTION MOVEMENT		
322-AC	11/3/2010	WEDS	14:15	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
164-AC	7/21/2009	TUES	16:07	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
33-AC	2/23/2009	MON	7:20	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
41-AC	3/6/2009	FRI	9:17	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
87-AC	5/19/2009	TUES	5:20	FOUR LEG INTERSECTION	OTHER		
296-AC	10/6/2009	TUES	16:00	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
178-AC	7/13/2011	WEDS	20:35	FOUR LEG INTERSECTION	WENT OFF ROAD	CMP POLE	CMP POLE
333-AC	11/9/2011	WEDS	20:00	FOUR LEG INTERSECTION	WENT OFF ROAD		
181-AC	7/15/2011	FRI	7:50	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
298-AC	10/10/2011	MON	17:44	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
362-AC	12/21/2011	WEDS	7:13	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
343-AC	12/12/2010	SUN	8:22	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
12-AC	1/19/2011	WEDS	7:50	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
64-AC	4/10/2009	FRI	10:14	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
115-AC	6/10/2010	THURS	6:03	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		

SEGMENT LENGTH: N/A
NUMBER OF CRASHES: 19
CRASH RATE FACTOR: 1.09

NODE: 58365
MILE MARKER: EXIT 19
LOCATION: EXIT 19 RAMPS & ROUTE 109/9

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/30/2012
PREPARED FOR: MTA

NUMBER	TRAFFIC CONTROL DEVICE	LIGHT	WEATHER	ROAD SURFACE	ROAD CHARACTER	ROAD WORK	SPEED LIMIT
12333	TRAFFIC SIGNALS (STOP & GO)	DAWN	CLOUDY	ICE/FROST	ON GRADE	NO	35
247-AC	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	
340-AC	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLOUDY	DRY	LEVEL	NO	35
124-AC	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLOUDY	DRY	LEVEL	NO	35
322-AC	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
164-AC	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	RAIN	WET	LEVEL	NO	35
33-AC	TRAFFIC SIGNALS (FLASHING)	DAWN	CLOUDY	ICE/FROST	ON GRADE	NO	35
41-AC	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLOUDY	DRY	ON GRADE	NO	40
87-AC	TRAFFIC SIGNALS (STOP & GO)	DAWN	CLEAR	OTHER	LEVEL	NO	35
296-AC	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
178-AC	TRAFFIC SIGNALS (STOP & GO)	DARK-LIGHTED	RAIN	WET	LEVEL	YES	
333-AC	TRAFFIC SIGNALS (STOP & GO)	DARK-LIGHTED	CLEAR	DRY	ON GRADE	NO	35
181-AC	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	YES	35
298-AC	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	ON GRADE	NO	35
362-AC	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	SLEET, HAIL	ICE/FROST	BOTTOM OF HILL	NO	40
343-AC	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	RAIN	ICE/FROST	ON GRADE	NO	35
12-AC	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLOUDY	WET	ON GRADE	NO	35
64-AC	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
115-AC	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	RAIN	WET	ON GRADE	NO	35

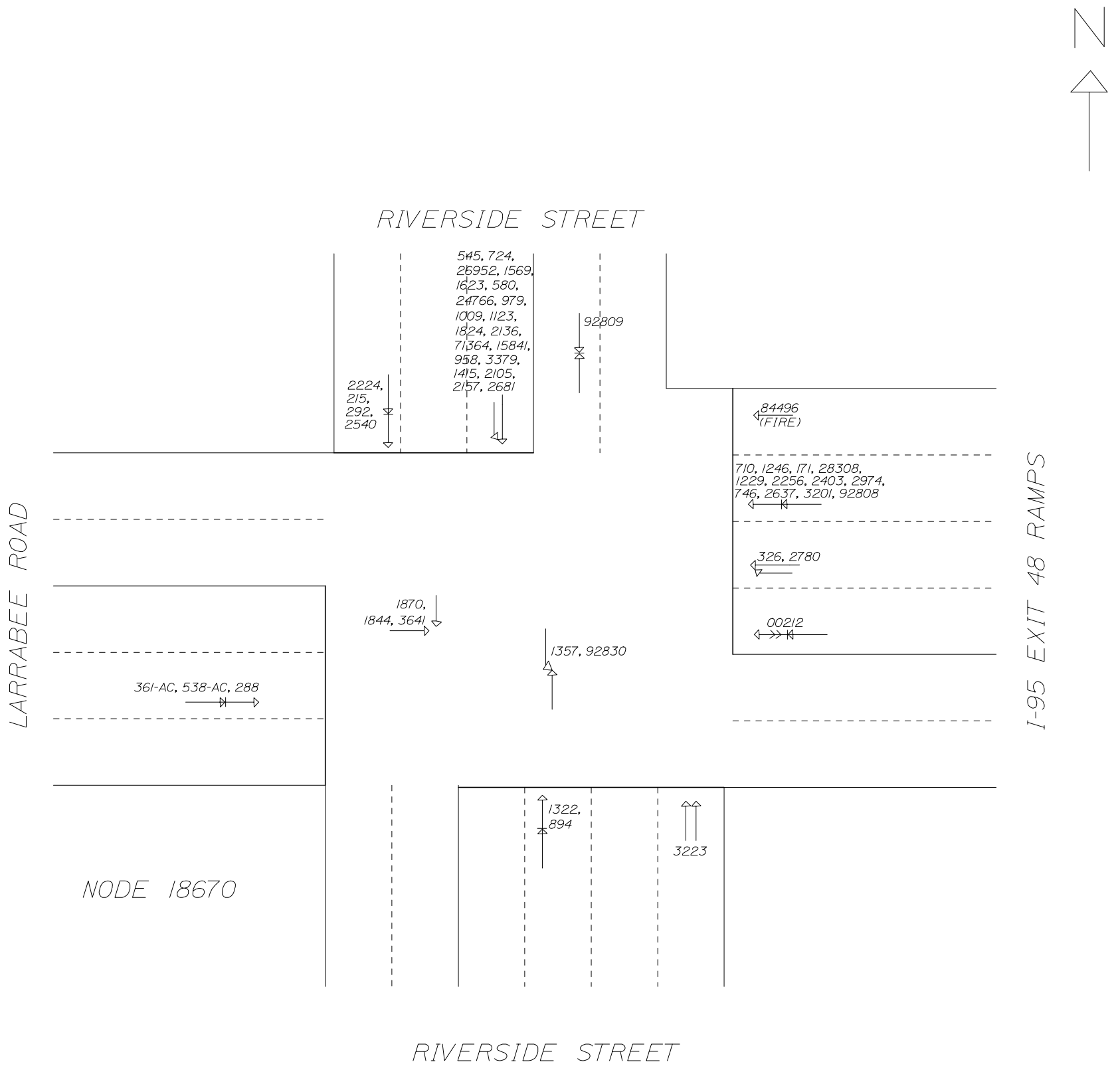
NUMBER	PRE CRASH ACTIONS	CONTRIBUTING CIRCUMSTANCES - VEHICLE	SEQUENCE OF EVENTS 1	SEQUENCE OF EVENTS 2
12333	SLOWING IN TRAFFIC, STOPPED IN TRAFFIC	NONE, NONE		
247-AC	STARTING IN TRAFFIC, STOPPED IN TRAFFIC	NONE, NONE		
340-AC	STOPPED IN TRAFFIC, STOPPED IN TRAFFIC, SLOWING IN TRAFFIC	NONE, NONE, NONE		
124-AC	FOLLOWING ROADWAY, MAKING LEFT TURN	NONE, NONE		
322-AC	SLOWING IN TRAFFIC, STOPPED IN TRAFFIC	NONE, NONE		
164-AC	SLOWING IN TRAFFIC, STOPPED IN TRAFFIC	NONE, NONE		
33-AC	SKIDDING, STOPPED IN TRAFFIC	NONE, NONE		
41-AC	NONE, MAKING LEFT TURN	NONE, NONE		
87-AC	MAKING LEFT TURN	NONE		
296-AC	FOLLOWING ROADWAY, FOLLOWING ROADWAY	NONE, NONE		
178-AC	STARTING IN TRAFFIC	NONE	WENT OFF ROADWAY RIGHT	UTILITY POLE/LIGHT SUPPORT
333-AC	MAKING LEFT TURN	NONE	WENT OFF ROADWAY RIGHT	
181-AC	MAKING RIGHT TURN, MAKING RIGHT TURN	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	
298-AC	FOLLOWING ROADWAY, STOPPED IN TRAFFIC	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	
362-AC	STOPPED IN TRAFFIC, SLOWING IN TRAFFIC	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	
343-AC	SKIDDING, SKIDDING	NONE, NONE		
12-AC	SLOWING IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE		
64-AC	SLOWING IN TRAFFIC, STOPPED IN TRAFFIC	NONE, NONE		
115-AC	SKIDDING, STOPPED IN TRAFFIC	NONE, NONE		

NUMBER	CONDITION AT TIME OF CRASH	DRIVER ACTIONS AT TIME OF CRASH	INJURY DEGREE
12333	APPARENTLY NORMAL, APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT, NONE	5,5
247-AC	APPARENTLY NORMAL, APPARENTLY NORMAL		5,4
340-AC	APPARENTLY NORMAL, APPARENTLY NORMAL, APPARENTLY NORMAL		5,5,5
124-AC	APPARENTLY NORMAL, APPARENTLY NORMAL		3,5,3,3
322-AC	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
164-AC	APPARENTLY NORMAL, APPARENTLY NORMAL	FOLLOWED TOO CLOSELY, NONE	5,5,5
33-AC	APPARENTLY NORMAL, APPARENTLY NORMAL		5,4
41-AC	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FOLLOWED TOO CLOSELY	5,5,5,5,5
87-AC	APPARENTLY NORMAL		3
296-AC	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FOLLOWED TOO CLOSELY	5,5
178-AC	UNDER THE INFLUENCE OF MEDICATIONS/DRUGS/ALCOHOL	RAN OFF ROADWAY	5
333-AC	APPARENTLY NORMAL	OPERATED MOTOR VEHICLE IN ERRATIC, RECKLESS, CARELESS, NEGLIGENT OR AGGRESSIE MANNER	5
181-AC	APPARENTLY NORMAL, APPARENTLY NORMAL	IMPROPER PASSING, NONE	5,5
298-AC	APPARENTLY NORMAL, APPARENTLY NORMAL	FOLLOWED TOO CLOSELY, NONE	5,5
362-AC	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, SWERVED	5,5,5
343-AC	APPARENTLY NORMAL, APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT, FOLLOWED TOO CLOSELY	5,5,5
12-AC	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, EXCEEDED POSTED SPEED LIMIT	5,5
64-AC	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
115-AC	APPARENTLY NORMAL, APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT AND FOLLOWED TOO CLOSELY, NONE	5,5

SEGMENT LENGTH: N/A
NUMBER OF CRASHES: 52
CRASH RATE FACTOR: 1.91

NODE: 18670
MILE MARKER: EXIT 48
LOCATION: EXIT 48 RAMPS & RIVERSIDE STREET

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/30/2012
PREPARED FOR: MTA



SYMBOLS

ANGLE
PARKED VEHICLE
OUT OF CONTROL
BACKING
REAR END
FATAL ACCIDENT
FIXED OBJECT
SIDESWIPE
VEHICLE (MOVING)
HEAD ON
TURNING MOVE
ANIMAL
OVERTURN
CHANGE LANE

SEGMENT LENGTH: N/A
NUMBER OF CRASHES: 52
CRASH RATE FACTOR: 1.91

NODE: 18670
MILE MARKER: EXIT 48
LOCATION: EXIT 48 RAMPS & RIVERSIDE STREET

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/30/2012
PREPARED FOR: MTA

NUMBER	DATE	DAY OF WEEK	TIME OF DAY	LOCATION	TYPE	FIXED OBJECT STRUCK	OTHER PROPERTY DAMAGE
00212	1/18/2009	SUN	13:00	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
326	1/24/2009	SAT	14:58	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
545	2/6/2009	FRI	9:55	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
724	2/20/2009	FRI	21:36	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
710	2/20/2009	FRI	9:44	THREE LEG INTERSECTION	REAR END/SIDESWIPE		
1246	4/10/2009	FRI	16:35	THREE LEG INTERSECTION	REAR END/SIDESWIPE		
1322	4/18/2009	SAT	15:12	THREE LEG INTERSECTION	REAR END/SIDESWIPE		
1357	4/23/2009	THURS	17:06	FOUR LEG INTERSECTION	INTERSECTION MOVEMENT		
26952	4/25/2009	SAT	10:35	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
1569	5/20/2009	WED	16:05	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
1623	5/26/2009	TUES	15:30	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
1870	6/24/2009	WED	6:30	FOUR LEG INTERSECTION	INTERSECTION MOVEMENT		
2224	8/1/2009	SAT	10:44	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
3223	11/14/2009	SAT	19:00	THREE LEG INTERSECTION	REAR END/SIDESWIPE		
171	1/18/2010	MON	10:42	FOUR LEG INTERSECTION	INTERSECTION MOVEMENT		
215	1/19/2010	TUES	15:40	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
292	1/26/2010	TUES	12:20	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
580	3/2/2010	TUES	8:25	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
24766	4/14/2010	WED	17:15	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
979	4/17/2010	SAT	13:45	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
1009	4/22/2010	THURS	8:28	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
28308	4/29/2010	THURS	11:55	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
1123	5/5/2010	WED	17:34	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
1229	5/15/2010	SAT	17:22	THREE LEG INTERSECTION	REAR END/SIDESWIPE		
1824	7/15/2010	THURS	17:40	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
361-AC	7/16/2010	FRI	16:25	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
1844	7/18/2010	SUN	9:39	FOUR LEG INTERSECTION	INTERSECTION MOVEMENT		
2136	8/19/2010	THURS	10:08	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
2256	8/31/2010	TUES	7:37	THREE LEG INTERSECTION	REAR END/SIDESWIPE		
2403	9/15/2010	WED	7:28	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
71364	9/29/2010	WED	14:30	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
538-AC	10/21/2010	THURS	13:10	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
2780	10/22/2010	FRI	15:07	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
2974	11/11/2010	THURS	14:58	THREE LEG INTERSECTION	REAR END/SIDESWIPE		
92809	12/10/2010	FRI	17:05	FOUR LEG INTERSECTION	INTERSECTION MOVEMENT		
92830	12/20/2010	MON	16:35	FOUR LEG INTERSECTION	INTERSECTION MOVEMENT		
288	1/25/2011	TUES	11:15	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
746	3/2/2011	WED	13:32	THREE LEG INTERSECTION	REAR END/SIDESWIPE		
15841	3/3/2011	THURS	14:02	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
894	3/17/2011	THURS	13:43	FOUR LEG INTERSECTION	INTERSECTION MOVEMENT		
958	3/25/2011	FRI	11:56	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
3379	5/12/2011	THURS	11:30	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
1415	5/16/2011	MON	13:11	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
2105	7/23/2011	SAT	16:00	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
2157	7/28/2011	THURS	8:30	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
2540	9/6/2011	TUES	6:39	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
2637	9/14/2011	WED	18:21	THREE LEG INTERSECTION	REAR END/SIDESWIPE		
2681	9/20/2011	TUES	9:53	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
84496	11/8/2011	TUES	17:53	THREE LEG INTERSECTION	FIRE		
3201	11/12/2011	SAT	13:31	THREE LEG INTERSECTION	REAR END/SIDESWIPE		
92808	12/12/2011	MON	16:49	FOUR LEG INTERSECTION	REAR END/SIDESWIPE		
3641	12/26/2011	MON	12:44	FOUR LEG INTERSECTION	INTERSECTION MOVEMENT		

NUMBER	TRAFFIC CONTROL DEVICE	LIGHT	WEATHER	ROAD SURFACE	ROAD CHARACTER	ROAD WORK	SPEED LIMIT
00212	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	SNOW	SNOW	LEVEL	NO	25
326	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	WET	LEVEL	NO	
545	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	30
724	TRAFFIC SIGNALS (STOP & GO)	DARK-LIGHTED	CLEAR	DRY	LEVEL	NO	35
710	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	WET	LEVEL	NO	35
1246	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	25
1322	YIELD SIGN	DAYLIGHT	CLOUDY	DRY	LEVEL	NO	
1357	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
26952	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	
1569	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
1623	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
1870	TRAFFIC SIGNALS (FLASHING)	DAYLIGHT	RAIN	WET	LEVEL	NO	30
2224	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	
3223	YIELD SIGN	DARK-LIGHTED	RAIN	WET	LEVEL	NO	
171	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	SNOW	SNOW	LEVEL	NO	
215	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	SNOW	SNOW	LEVEL	NO	30
292	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	30
580	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
24766	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLOUDY	DRY	LEVEL	NO	35
979	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	RAIN	WET	LEVEL	NO	25
1009	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	30
28308	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
1123	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
1229	YIELD SIGN	DAYLIGHT	CLEAR	DRY	LEVEL	NO	10
1824	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
361-AC	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	25
1844	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
2136	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	30
2256	YIELD SIGN	DAYLIGHT	CLEAR	DRY	LEVEL	NO	10
2403	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	25
71364	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	30
538-AC	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLOUDY	DRY	LEVEL	NO	35
2780	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	
2974	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
92809	TRAFFIC SIGNALS (STOP & GO)	DARK-LIGHTED	SNOW	SNOW	LEVEL	NO	15
92830	TRAFFIC SIGNALS (STOP & GO)	DARK-LIGHTED	SNOW	SNOW	LEVEL	NO	30
288	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	SNOW	WET	LEVEL	NO	25
746	YIELD SIGN	DAYLIGHT	CLOUDY	DRY	LEVEL	NO	30
15841	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
894	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	30
958	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLOUDY	DRY	LEVEL	NO	30
3379	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLOUDY	DRY	LEVEL	NO	35
1415	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	RAIN	WET	LEVEL	NO	30
2105	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	30
2157	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
2540	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	RAIN	WET	LEVEL	NO	35
2637	YIELD SIGN	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
2681	TRAFFIC SIGNALS (STOP & GO)	DAYLIGHT	RAIN	WET	LEVEL	NO	25
84496	YIELD SIGN	DARK-LIGHTED	CLEAR	DRY	LEVEL	NO	35
3201	YIELD SIGN	DAYLIGHT	CLEAR	DRY	LEVEL	NO	30
92808	TRAFFIC SIGNALS (STOP & GO)	DARK-LIGHTED	CLEAR	DRY	LEVEL	NO	
3641	TRAFFIC SIGNALS (FLASHING)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35

SEGMENT LENGTH: N/A
NUMBER OF CRASHES: 52
CRASH RATE FACTOR: 1.91

NODE: 18670
MILE MARKER: EXIT 48
LOCATION: EXIT 48 RAMPS & RIVERSIDE STREET

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/30/2012
PREPARED FOR: MTA

NUMBER	PRE CRASH ACTIONS	CONTRIBUTING CIRCUMSTANCES - VEHICLE	SEQUENCE OF EVENTS 1	SEQUENCE OF EVENTS 2
00212	BACKING, STOPPED IN TRAFFIC	NONE, NONE		
326	MAKING RIGHT TURN, MAKING RIGHT TURN	NONE, NONE		
545	MAKING LEFT TURN, MAKING LEFT TURN	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	
724	FOLLOWING ROADWAY, FOLLOWING ROADWAY	NONE, NONE		
710	STOPPED IN TRAFFIC, STARTING IN TRAFFIC	NONE, NONE		
1246	STOPPED IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE		
1322	MAKING RIGHT TURN, MAKING RIGHT TURN	NONE, NONE		
1357	FOLLOWING ROADWAY, MAKING LEFT TURN	NONE, NONE		
26952	STOPPED IN TRAFFIC, STARTING IN TRAFFIC	NONE, NONE		
1569	MAKING LEFT TURN, MAKING LEFT TURN	NONE, NONE		
1623	CHANGING LANES, FOLLOWING ROADWAY	NONE, NONE		
1870	FOLLOWING ROADWAY, FOLLOWING ROADWAY	NONE, NONE		
2224	SLOWING IN TRAFFIC, STOPPED IN TRAFFIC	BRAKES, NONE		
3223	FOLLOWING ROADWAY, SLOWING IN TRAFFIC	NONE, NONE		
171	FOLLOWING ROADWAY, SKIDDING	NONE, NONE		
215	STOPPED IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE		
292	STOPPED IN TRAFFIC, CHANGING LANES	NONE, NONE		
580	MAKING LEFT TURN, FOLLOWING ROADWAY	NONE, NONE		
24766	MAKING LEFT TURN, MAKING LEFT TURN	NONE, NONE		
979	MAKING LEFT TURN, MAKING LEFT TURN	NONE, NONE		
1009	MAKING LEFT TURN, FOLLOWING ROADWAY	NONE, NONE	MOTOR VEHICLE IN TRANSPORT	
28308	STARTING IN TRAFFIC, STARTING IN TRAFFIC	NONE, NONE		
1123	MAKING LEFT TURN, FOLLOWING ROADWAY	NONE, NONE	MOTOR VEHICLE IN TRANSPORT	
1229	SLOWING IN TRAFFIC, MERGING	NONE, NONE		
1824	MAKING LEFT TURN, FOLLOWING ROADWAY	NONE, NONE		
361-AC	FOLLOWING ROADWAY, STOPPED IN TRAFFIC, STOPPED IN TRAFFIC	NONE, NONE, NONE		
1844	FOLLOWING ROADWAY, FOLLOWING ROADWAY	NONE, NONE		
2136	MAKING LEFT TURN, FOLLOWING ROADWAY	NONE, NONE	MOTOR VEHICLE IN TRANSPORT	
2256	SLOWING IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE		
2403	STOPPED IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE		
71364	MAKING LEFT TURN, MAKING LEFT TURN	NONE, NONE		
538-AC	STOPPED IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE		
2780	FOLLOWING ROADWAY, MERGING	NONE, NONE		
2974	FOLLOWING ROADWAY, STOPPED IN TRAFFIC	NONE, NONE		
92809	MAKING RIGHT TURN, FOLLOWING ROADWAY	NONE, NONE		
92830	MAKING LEFT TURN, FOLLOWING ROADWAY	NONE, NONE	MOTOR VEHICLE IN TRANSPORT	
288	FOLLOWING ROADWAY, STOPPED IN TRAFFIC	OTHER, NONE		
746	STOPPED IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE		
15841	MAKING LEFT TURN, OTHER VEHICLE ACTION	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	
894	MAKING LEFT TURN, SLOWING IN TRAFFIC	NONE, BRAKES		
958	MAKING LEFT TURN, CHANGING LANES	NONE, NONE		
3379	FOLLOWING ROADWAY, FOLLOWING ROADWAY	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	
1415	STOPPED IN TRAFFIC, STOPPED IN TRAFFIC	NONE, NONE	MOTOR VEHICLE IN TRANSPORT	
2105	MAKING LEFT TURN, MAKING LEFT TURN	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	
2157	FOLLOWING ROADWAY, MAKING LEFT TURN	NONE, NONE		
2540	SLOWING IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	
2637	STOPPED IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	
2681	MAKING LEFT TURN, STOPPED IN TRAFFIC	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	
84496	FOLLOWING ROADWAY	OTHER	FIRE/EXPLOSION	
3201	STOPPED IN TRAFFIC, STARTING IN TRAFFIC	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	
92808	MAKING LEFT TURN, STOPPED IN TRAFFIC	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	
3641	FOLLOWING ROADWAY, FOLLOWING ROADWAY	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	

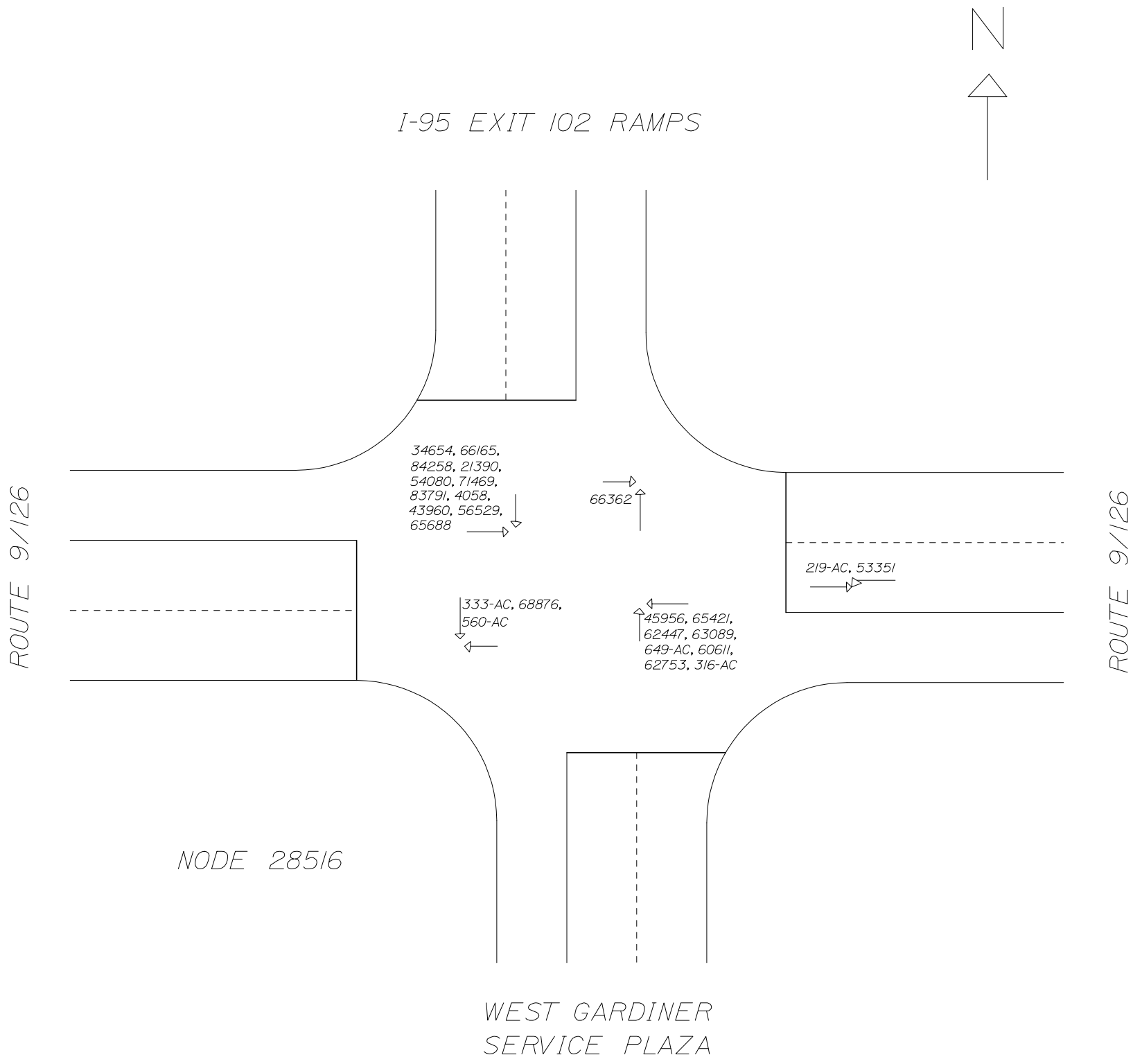
NUMBER	CONDITION AT TIME OF CRASH	DRIVER ACTIONS AT TIME OF CRASH	INJURY DEGREE
00212	APPARENTLY NORMAL, APPARENTLY NORMAL	IMPROPER BACKING, NONE	5,5,5
326	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, IMPROPER TURN	5,5
545	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, IMPROPER TURN	5,5
724	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FAILED TO KEEP IN PROPER LANE	5,5
710	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5,5
1246	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FOLLOWED TOO CLOSELY	5,5
1322	APPARENTLY NORMAL, APPARENTLY NORMAL	FOLLOWED TOO CLOSELY, NONE	5,4,4
1357	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
26952	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
1569	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT OF WAY AND FAILED TO KEEP IN PROPER LANE, NONE	5,5,4
1623	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5,5
1870	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5,5
2224	APPARENTLY NORMAL, APPARENTLY NORMAL		5,4
3223	APPARENTLY NORMAL, APPARENTLY NORMAL	FOLLOWED TOO CLOSELY, NONE	5,5
171	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, EXCEEDED POSTED SPEED LIMIT AND FAILED TO YIELD RIGHT OF WAY	5,5
215	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FOLLOWED TOO CLOSELY	5,5,5,5,5,5
292	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FAILED TO KEEP IN PROPER LANE	5,5
580	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
24766	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FAILED TO KEEP IN PROPER LANE	5,5
979	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT OF WAY, NONE	5,5,5,5,5
1009	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5,5
28308	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
1123	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT OF WAY AND FAILED TO KEEP IN PROPER LANE, NONE	5,5
1229	APPARENTLY NORMAL, APPARENTLY NORMAL	FOLLOWED TOO CLOSELY, NONE	5,5,5
1824	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5,5,5
361-AC	ILL (SICK), APPARENTLY NORMAL, APPARENTLY NORMAL		4,5,5,5,5,4
1844	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FAILED TO YIELD RIGHT OF WAY	5,5,5
2136	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FAILED TO KEEP IN PROPER LANE	5,5
2256	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
2403	APPARENTLY NORMAL, APPARENTLY NORMAL		3,5,5
71364	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO KEEP IN PROPER LANE, NONE	5,5
538-AC	APPARENTLY NORMAL		5,5,5
2780	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
2974	APPARENTLY NORMAL, APPARENTLY NORMAL	FOLLOWED TOO CLOSELY AND FAILED TO YIELD RIGHT OF WAY, NONE	5,5,4
92809	APPARENTLY NORMAL, APPARENTLY NORMAL	EXCEEDED POSTED SPEED LIMIT, NONE	4,5
92830	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT OF WAY, NONE	5,5
288	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
746	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FOLLOWED TOO CLOSELY	5,5
15841	APPARENTLY NORMAL, EMOTIONAL	NONE, FAILED TO KEEP IN PROPER LANE AND DISREGARDED OTHER TRAFFIC SIGN	5,5
894	APPARENTLY NORMAL, APPARENTLY NORMAL		4,5
958	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FAILED TO KEEP IN PROPOER LANE	5,5
3379	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, IMPROPER TURN	5,5
1415	APPARENTLY NORMAL, APPARENTLY NORMAL	IMPROPER PASSING, NONE	5,5,5,5
2105	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FAILED TO KEEP IN PROPER LANE	5,5,5
2157	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT OF WAY, NONE	5,5
2540	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, OPERATED VEHICLE IN ERRATIC, RECKLESS, CARELESS, NEGLIGENT OR AGGRESSIVE MANNER	5,5
2637	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, OTHER CONTRIBUTING ACTION	5,5
2681	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
84496	APPARENTLY NORMAL	NONE	5
3201	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FOLLOWED TOO CLOSELY	5,5
92808	APPARENTLY NORMAL, APPARENTLY NORMAL	FOLLOWED TOO CLOSELY, NONE	5,5
3641	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, RAN RED LIGHT AND FAILED TO YIELD RIGHT OF WAY	5,5,4

SEGMENT LENGTH: N/A
NUMBER OF CRASHES: 25
CRASH RATE FACTOR: 19.91

NODE: 28516
MILE MARKER: EXIT 102
LOCATION: EXIT 102 RAMPS & ROUTE 9/126

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/30/2012
PREPARED FOR: MTA

I-95 EXIT 102 RAMPS



SYMBOLS

ANGLE
PARKED VEHICLE
OUT OF CONTROL
BACKING
REAR END
FATAL ACCIDENT
FIXED OBJECT
SIDESWIPE
VEHICLE (MOVING)
HEAD ON
TURNING MOVE
ANIMAL
OVERTURN
CHANGE LANE

SEGMENT LENGTH: N/A
NUMBER OF CRASHES: 25
CRASH RATE FACTOR: 19.91

NODE: 28516
MILE MARKER: EXIT 102
LOCATION: EXIT 102 RAMPS & ROUTE 9/126

YEARS REVIEWED: 2009 - 2011
DATE PREPARED: 7/30/2012
PREPARED FOR: MTA

NUMBER	DATE	DAY OF WEEK	TIME OF DAY	LOCATION	TYPE	FIXED OBJECT STRUCK	OTHER PROPERTY DAMAGE
34654	5/24/2009	SUN	13:48	DRIVEWAY	INTERSECTION MOVEMENT		
45956	7/4/2009	SAT	14:40	THREE LEG INTERSECTION	INTERSECTION MOVEMENT		
333-AC	8/15/2009	SAT	18:13	THREE LEG INTERSECTION	INTERSECTION MOVEMENT		
65421	9/8/2009	TUES	13:40	THREE LEG INTERSECTION	INTERSECTION MOVEMENT		
66165	9/11/2009	FRI	10:24	DRIVEWAY	INTERSECTION MOVEMENT		
84258	11/21/2009	SAT	12:00	DRIVEWAY	INTERSECTION MOVEMENT		
21390	4/1/2010	THURS	13:10	DRIVEWAY	INTERSECTION MOVEMENT		
54080	7/30/2010	FRI	7:30	DRIVEWAY	INTERSECTION MOVEMENT		
62447	8/27/2010	FRI	15:26	THREE LEG INTERSECTION	INTERSECTION MOVEMENT		
63089	8/29/2010	SUN	15:30	THREE LEG INTERSECTION	INTERSECTION MOVEMENT		
66362	9/10/2010	FRI	12:00	DRIVEWAY	INTERSECTION MOVEMENT		
68876	9/20/2010	MON	9:23	THREE LEG INTERSECTION	INTERSECTION MOVEMENT		
71469	9/29/2010	WEDS	20:10	DRIVEWAY	INTERSECTION MOVEMENT		
83791	11/16/2010	TUES	13:15	DRIVEWAY	INTERSECTION MOVEMENT		
560-AC	12/1/2010	WEDS	17:58	THREE LEG INTERSECTION	INTERSECTION MOVEMENT		
649-AC	12/28/2010	TUES	10:07	THREE LEG INTERSECTION	INTERSECTION MOVEMENT		
4058	1/17/2011	MON	11:55	DRIVEWAY	INTERSECTION MOVEMENT		
219-AC	5/23/2011	MON	7:37	DRIVEWAY	INTERSECTION MOVEMENT		
43960	6/19/2011	SUN	10:02	DRIVEWAY	INTERSECTION MOVEMENT		
53351	7/19/2011	TUES	18:40	DRIVEWAY	INTERSECTION MOVEMENT		
56529	7/29/2011	FRI	12:55	DRIVEWAY	INTERSECTION MOVEMENT		
60611	8/10/2011	WEDS	12:00	THREE LEG INTERSECTION	INTERSECTION MOVEMENT		
62753	8/17/2011	WEDS	12:20	THREE LEG INTERSECTION	INTERSECTION MOVEMENT		
316-AC	8/18/2011	THURS	16:00	THREE LEG INTERSECTION	INTERSECTION MOVEMENT		
65688	8/26/2011	FRI	11:47	DRIVEWAY	INTERSECTION MOVEMENT		

NUMBER	TRAFFIC CONTROL DEVICE	LIGHT	WEATHER	ROAD SURFACE	ROAD CHARACTER	ROAD WORK	SPEED LIMIT
34654	STOP SIGNS - OTHER	DAYLIGHT	CLOUDY	WET	LEVEL	NO	45
45956	STOP SIGNS - OTHER	DAYLIGHT	RAIN	WET	LEVEL	NO	45
333-AC	TRAFFIC SIGNALS (FLASHING)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	40
65421	STOP SIGNS - OTHER	DAYLIGHT	CLEAR	DRY	LEVEL	YES	50
66165	STOP SIGNS - OTHER	DAYLIGHT	CLEAR	DRY	LEVEL	YES	40
84258	TRAFFIC SIGNALS (FLASHING)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	
21390		DAYLIGHT	CLEAR	DRY	LEVEL	NO	65
54080	STOP SIGNS - OTHER	DAYLIGHT	CLEAR	DRY	LEVEL	NO	45
62447	STOP SIGNS - OTHER	DAYLIGHT	CLEAR	DRY	LEVEL	NO	45
63089	STOP SIGNS - OTHER	DAYLIGHT	CLEAR	DRY	LEVEL	NO	
66362	NONE	DAYLIGHT	CLEAR	DRY	LEVEL	NO	45
68876	STOP SIGNS - OTHER	DAYLIGHT	CLEAR	DRY	LEVEL	NO	50
71469		DARK-LIGHTED	CLEAR	DRY	LEVEL	NO	35
83791	STOP SIGNS - OTHER	DAYLIGHT	CLEAR	DRY	LEVEL	NO	35
560-AC	STOP SIGNS - OTHER	DARK-LIGHTED	CLEAR	DRY	LEVEL	NO	45
649-AC		DAYLIGHT	CLEAR	WET	LEVEL	NO	25
4058		DAYLIGHT	CLEAR	DRY	LEVEL	NO	45
219-AC	STOP SIGNS - OTHER	DAYLIGHT	RAIN	WET	LEVEL	NO	
43960	TRAFFIC SIGNALS (FLASHING)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	45
53351	TRAFFIC SIGNALS (FLASHING)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	
56529	TRAFFIC SIGNALS (FLASHING)	DAYLIGHT	CLOUDY	DRY	LEVEL	NO	45
60611	TRAFFIC SIGNALS (FLASHING)	DAYLIGHT	RAIN	WET	LEVEL	NO	45
62753	TRAFFIC SIGNALS (FLASHING)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	45
316-AC	TRAFFIC SIGNALS (FLASHING)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	45
65688	TRAFFIC SIGNALS (FLASHING)	DAYLIGHT	CLEAR	DRY	LEVEL	NO	40

NUMBER	PRE CRASH ACTIONS	CONTRIBUTING CIRCUMSTANCES - VEHICLE	SEQUENCE OF EVENTS 1	SEQUENCE OF EVENTS 2
34654	WRONG WAY INTO OPPOSING TRAFFIC, FOLLOWING ROADWAY	NONE, NONE		
45956	STARTING IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE		
333-AC	STARTING IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE		
65421	STARTING IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE		
66165	FOLLOWING ROADWAY, STARTING IN TRAFFIC	NONE, NONE		
84258	FOLLOWING ROADWAY, NONE	NONE, NONE		
21390	STARTING FROM PARKED, AVOIDING VEHICLE, OBJECT, PEDESTRIAN, ANIMAL IN ROADWAY	NONE, NONE		
54080	FOLLOWING ROADWAY, STOPPED IN TRAFFIC	NONE, NONE	MOTOR VEHICLE IN TRANSPORT	
62447	FOLLOWING ROADWAY, FOLLOWING ROADWAY	NONE, NONE		
63089	AVOIDING VEHICLE, OBJECT, PEDESTRIAN, ANIMAL IN ROADWAY, STARTING IN TRAFFIC	NONE, NONE		
66362	STARTING IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE		
68876	STARTING IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE		
71469	FOLLOWING ROADWAY, FOLLOWING ROADWAY	NONE, NONE		
83791	STARTING IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE		
560-AC	MAKING RIGHT TURN, FOLLOWING ROADWAY	NONE, NONE		
649-AC	FAILED TO YIELD RIGHT OF WAY, FOLLOWING ROADWAY, STOPPED IN TRAFFIC	NONE, NONE, NONE		
4058	STARTING IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE		
219-AC	MAKING LEFT TURN, FOLLOWING ROADWAY	NONE, NONE		
43960	AVOIDING VEHICLE, OBJECT, PEDESTRIAN, ANIMAL IN ROADWAY, STARTING IN TRAFFIC	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	
53351	FOLLOWING ROADWAY, FOLLOWING ROADWAY	NONE, NONE	CROSS CENTERLINE, NO OTHER EVENTS	
56529	AVOIDING VEHICLE, OBJECT, PEDESTRIAN, ANIMAL IN ROADWAY, STARTING IN TRAFFIC	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	
60611	STARTING IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	
62753	AVOIDING VEHICLE, OBJECT, PEDESTRIAN, ANIMAL IN ROADWAY, STARTING IN TRAFFIC	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	
316-AC	STARTING IN TRAFFIC, FOLLOWING ROADWAY	NONE, NONE		
65688	FOLLOWING ROADWAY, FOLLOWING ROADWAY	NONE, NONE	MOTOR VEHICLES IN TRANSPORT	

NUMBER	CONDITION AT TIME OF CRASH	DRIVER ACTIONS AT TIME OF CRASH	INJURY DEGREE
34654	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT-OF-WAY, NONE	5,5,5,5,5,5
45956	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT-OF-WAY, NONE	5,5,5,5,4,5
333-AC	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT-OF-WAY, NONE	4,5,5
65421	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT-OF-WAY, NONE	5,5,5,5
66165	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FAILED TO YIELD RIGHT-OF-WAY	5,5,5,5
84258	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5,5
21390	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT-OF-WAY, NONE	5,5
54080	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FAILED TO YIELD RIGHT-OF-WAY	5,5,5
62447	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT-OF-WAY, NONE	5,5,5
63089	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FAILED TO YIELD RIGHT-OF-WAY	5,4,5,4
66362	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT-OF-WAY, NONE	5,4
68876	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT-OF-WAY, NONE	5,4,5
71469	APPARENTLY NORMAL, APPARENTLY NORMAL		5,5
83791	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT-OF-WAY, NONE	5,5,5
560-AC	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT-OF-WAY, NONE	5,5,5
649-AC	APPARENTLY NORMAL, APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT-OF-WAY, NONE, NONE	5,5,5,5,5,5
4058	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT-OF-WAY, NONE	5,3
219-AC	APPARENTLY NORMAL, APPARENTLY NORMAL	IMPROPER TURN/FAILED TO YIELD RIGHT-OF-WAY, NONE	5,5
43960	APPARENTLY NORMAL, APPARENTLY NORMAL	SWERVED, FAILED TO YIELD RIGHT-OF-WAY.	3,5,5,5
53351	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT-OF-WAY, NONE	5,4
56529	APPARENTLY NORMAL, APPARENTLY NORMAL	NONE, FAILED TO YIELD RIGHT-OF-WAY	5,5,5,2,4,3,4
60611	APPARENTLY NORMAL, APPARENTLY NORAML	FAILED TO YIELD RIGHT-OF-WAY, NONE	(13) 5'S, 4
62753	APPARENTLY NORMAL, APPARENTLY NORAML	NONE, FAILED TO YIELD RIGHT-OF-WAY	3,5,2
316-AC	APPARENTLY NORMAL, APPARENTLY NORAML		5,3
65688	APPARENTLY NORMAL, APPARENTLY NORMAL	FAILED TO YIELD RIGHT-OF-WAY, NONE	5,4,5,5