Memorandum

To: Maine Turnpike Authority: Daniel Wathen, Chair, James Cloutier, Vice Chair, Gerard Conley, John Dority, Robert Stone, Freeman Goodrich, Karen Doyle, MaineDOT

From: MTA Staff: Peter Mills, Executive Director, Doug Davidson, Chief Financial Officer, Peter Merfeld, P.E., Chief Operating Officer, Bruce Van Note, PLS, Esq., Dir, Policy and Planning, Ralph Norwood, P.E., Project Manager, Sara Zografos, Planning and Permitting

Re: Staff Recommendation for the Preferred Site for the New Toll Plaza in York

Date: November 16, 2015

Before the Board is the question of choosing a preferred alternative for permitting and final design of a replacement toll plaza at York. Jacobs Engineering has recommended the site near Mile 8.8, a recommendation that is consistent with the previous analysis by HNTB, the MTA's General Engineering Consultant.

MTA staff recommends that the Board select the Mile 8.8 site as its preferred alternative. It is one of the safest sites; it meets all applicable design standards and guidelines; it has low environmental impacts. It has limited effect on very few abutters, except for those who will benefit from closing the existing plaza at Mile 7.3. It will be straightforward to construct and will impose few challenges for travelers or toll collectors. It will cost less to build and will minimize revenue losses during construction.

Background

The York Toll Plaza, the gateway to Maine, is one of the most important elements of transportation infrastructure in the State. It generates about $56 million in tolls per year (about 45% of all MTA revenue) and is a central reason why two-thirds of all MTA tolls are paid by out-of-staters.

The existing plaza is old and must be replaced. Originally designed in the 1960's as a temporary barrier plaza for all vehicles to stop, take tickets and pay tolls, its approaches are sinking into clay soils. It has a leaking tunnel full of electrical components. Its present suite of outdated toll equipment is held together with used parts. The plaza is located on a curve at the bottom of a hill near an interchange and an overpass. This raises safety concerns and contributes to an environment of unnecessary noise. It is located on poor soils, surrounded by wetlands. It does not provide highway speed electronic tolling that travelers and freight haulers now expect and deserve. The MTA has been seeking to deliver this project for over ten years.

In the early phase of MTA's studies, extensive expert analysis by HNTB supported replacing the current barrier plaza with a new open road toll at any of several locations north of the current plaza, including one at Mile 8.7.

In 2011, MTA decided to take a fresh look at critical project issues such as toll collection systems (ORT vs. AET), plaza sizing, and plaza locations. MTA retained CDM Smith, a nationally known toll consultant, to analyze the impact and consequences of implementing AET.

On July 24, 2014, after three years of study, the Board accepted the recommendation of staff that AET is not feasible on the Maine Turnpike. Nor would it be in the best interests of Turnpike users. Among other things, it would require non E-ZPass toll rates at York initially to double from $3 to $6 to compensate for lost revenue from toll violations and from diversion, estimated at 3,400 to 5,500 vehicles per day. This would further snarl already congested roads like Route 1.

In August 2014, MTA retained Jacobs, another experienced engineering consultant, to obtain more detailed environmental information, reconsider ORT plaza sizing, take a fresh look at options near the current plaza at Mile 7.3, and analyze other plaza locations. In June 2015, after a detailed look at the current plaza site, Jacobs recommended focusing on Mile 8.8 for further evaluation.

Throughout the years, MTA staff has fully engaged the Town of York and its residents. Since the project was first proposed over 10 years ago, MTA staff has met with York officials and residents dozens of times, including about 14 times since Jacobs was retained. On September 3, 2015, 21 York residents expressed concerns at the Board's regular meeting. In a separate Memorandum to the MTA Board, MTA staff has responded to each comment. MTA will continue to listen to concerns arising in York, including those who will benefit from closure of the old plaza at Mile 7.3.

Although local opinions are important, MTA's legal and fiduciary obligations extend to all 1.3 million residents of Maine and to Turnpike customers who make 62 million Turnpike trips each year. It is the Turnpike's obligation to seek a site that is safe, affordable, and least disruptive to travelers, abutters, toll collectors, and the environment.

Mile 8.8 is that site. MTA staff concur with previous expert analyses and recommendations by Jacobs and HNTB, and recommend that the Board do so as well.

Reasons for Recommending the Mile 8.8 Site

Voluminous technical memos, reports, maps, and charts support the selection of the Mile 8.8 site as a preferred alternative. Perhaps the most useful document is the final Evaluation Matrix and its supporting Technical Memorandum dated October 13, 2015, prepared by Jacobs.

MTA staff recommends the Mile 8.8 site because it will be safe and will have low environmental impact with negligible effect on abutters. It will be more straightforward to construct, will reduce impacts on travelers and toll collectors, and will cost less than other sites.

1. Overview of All Sites. The Evaluation Matrix and supporting Technical Memorandum describe commonly accepted criteria for such an alternatives analysis. The matrix identifies 25 evaluation criteria grouped in five categories: (a) Engineering/Safety, (b) Environmental, (c) Abutter Impacts, (d) Logistics During Construction, and (e) Cost/Financial. Each factor is defined. To provide a convenient comparison, relative ratings are color coded. Although not

determinative, a summary of these site suitability rankings for each of the five sites analyzed by Jacobs is illustrative.

York Toll Plaza Replacement Project
Summary of Site Suitability Rankings
From Jacobs matrix

Approximate Location	# Green Ratings	# Yellow Ratings	# Red Ratings	Comment
MM 7.3	4	13	8	Near existing plaza
MM 8.1	11	13	1	
MM 8.8	15	10	0	Recommended for further evaluation
MM 10.0	11	11	3	
MM 13.2	15	7	3	

Two observations are apparent from this chart. First, the Mile 8.8 site has the highest number of green ratings (tied with one other site) and has no red ratings. Second, the Mile 7.3 site – with 4 green and 8 red ratings – is inferior to any of the other four.

2. Engineering/Safety. Mile 8.8 is one of the safest sites for a new ORT plaza. It meets national engineering standards and guidelines and is consistent with the Turnpike's obligations under environmental rules. There will be less braking, weaving, and confusion at Mile 8.8, and thus fewer accidents and less noise. All lanes will be used more fully, thus easing congestion. Regarding engineering and safety considerations as a whole, the bottom line is this: Professional Civil Engineers having substantial experience with such facilities would all agree that an ORT plaza located on a straight section of highway at the crest of a hill away from interchanges and overpasses will be safer than an ORT plaza located on a curve, at the bottom of a hill, near an interchange and overpass, if all other factors are equal. Other sites also have favorable engineering or safety ratings, but they have other less desirable impacts - such as the displacement of a home.

3. Environmental. The Mile 8.8 site has low environmental impact. Applying the conceptual plaza design to field mapping of wetlands and other environmental features yields anticipated impacts to only one acre of wetland, two vernal pools, and 80 feet of stream. These are low for a project of this significance, and will likely be less after mitigation during final design. Environmental rules require regulators to select the least environmentally damaging practicable alternative (LEDPA). MTA staff firmly believe that Mile 8.8 is that site.

4. Abutter Impacts. Although questions from people who live near any site are to be expected, the reality is that impacts to abutters and nearby residents at the Mile 8.8 site are the lowest of

all the five sites examined. The site will not displace any homes. There are only four houses within 1,000 feet of the project limit lines and two of these are at the outer edge of this perimeter. There is one house to the east in the Whippoorwhill subdivision and three houses to the west on the Chase's Pond side.

Although questions from nearby residents are expected, it is important to consider net local impacts. Moving the plaza to Mile 8.8 will lead to demolition of the existing plaza at Mile 7.3. Vehicles will no longer need to brake for a plaza there, nor accelerate as they depart. An ORT plaza, by design, produces less noise and fewer emissions. The result will be fewer impacts overall and fewer residents affected.

5. Logistics During Construction. The project at Mile 8.8 will be straightforward to build and take less time. Like most of the sites considered – other than Mile 7.3 and possibly Mile 8.1 – construction phasing is easier and disruption to travelers and toll collectors will be less because the existing 3 lanes of highway will essentially become the ORT lanes. Soils are more favorable. Traffic from the existing toll booth will not interfere with construction.

6. Costs / Financial. Jacobs's current estimate of the capital cost for Mile 8.8 is $40.8 million, the second lowest of the five sites considered. That estimate includes the cost of demolishing the existing plaza and of narrowing the highway near Mile 7.3. But it does not include the cost of property acquisition to allow "apples-to-apples" comparisons among all sites. (The cost of acquiring the Morrison property was $925,000.) Although the Turnpike must develop all capital projects with a sensitivity to cost, cost alone is not a primary consideration in recommending the site at Mile 8.8. Even if the cost were significantly higher, its safety, environmental, logistical, and other benefits make it far superior to other choices.

   Mile 8.8 and all sites considered – other than Mile 7.3 - will cause minimal loss of toll revenue during construction. Mile 8.8 and all the alternative sites considered – other than Mile 7.3 – are estimated to have similar life cycle and operational costs going forward.

7. Mile 8.8 vs. Mile 7.3 Comparison. Despite the weight and depth of the information outlined above, certain York citizens continue to advocate for building at Mile 7.3 and argue that the MTA Board must evaluate how the two sites compare with each other. By any objective comparison Mile 7.3 is inferior to the Mile 8.8 site and to any of the other sites. More study will not alter that conclusion.

From Jacobs matrix

York Toll Plaza Replacement Project
Comparison of MM 8.8 and MM 7.3 Sites

Evaluation Factor	Jacobs Matrix Col. #	MM 8.8*	MM 7.3	Comments
Engineering / Safety				
Horizontal Alignment	1	On-straight	On curve	MM 8.8 is superior to MM 7.3 from an engineering/safety perspective.
Vertical Align. - Cash Plaza on Crest	2	Good	Average	
Vertical Align. - Approach Grades	2	Average	Poor	
Sight Distance	3	Good	Average	
Separation from Interchange (> 1 mile)	4	Yes	No	
Historical Crash Data	5	Non HCL	HCL	
Geotechnical (soils)	6	Ledge	Clay	
Environmental				
Total Wetland Impact (acres)	7	1.0	5.5	MM 7.3 would impact over 5 times more wetlands.
Wetland Relative Function and Value	9	Average	High	Wetlands at MM 7.3 are higher value.
Stream Impacts (feet)	10	80	360	
Vernal Pool Impact - #	11	2	1	
Vernal Pools of DEP Significance - #	12	1	0	
FEMA Floodplain Impacts (acres)	13	0.3	3.0	
# Potential E/T Species Habitat Impacts	15	3	1	Long-eared bat potentially at all sites.
Abutter Impacts				
Potential R/W Impacts (acres)	16	0.3	0.1	Either option requires minimal land acquisition.
Houses Within 1000 ft	18	4	47	No houses displaced by either option.
Logistics During Construction				
Constructability	19	Conventional	Difficult	MM 8.8 would take significantly less time to build.
Safety of Toll Collectors	20	No Impacts	Caution	Extra precautions required to assure safety.
Traveler Impacts	21	Minor	Intermediate	Substantial disruption to travelers at MM 7.3.
Cost / Financial				
Initial Capital Cost	22	$40.8	$60.4	MM 8.8 would cost almost $20M less.
Revenue Loss During Construction	23	Minimal	Significant	Diversion due to traveler disruption.
Life Cycle Cost / Operations	24	Typical	Not Typical	Settlement not eliminated, more frequent paving.

*Recommended for further design and analysis.

The Mile 7.3 site is inferior in every category.

a) Engineering/Safety. Mile 7.3 is located at the bottom of a hill, on a curve, near an interchange and an overpass on poor soils surrounded by wetland. It was built in the 1960's as a temporary barrier plaza at which all vehicles stopped to take tickets and pay tolls in cash. At that time, high speed tolling, current design standards, and today's environmental rules did not exist. If they had, it would not have been built where it is today.

   The new site selected should meet today's national engineering standards and guidelines, consistent with MTA's obligations under environmental rules. The Mile 7.3 site does not do so. The Mile 8.8 site will.

b) Environmental. Mile 7.3 would impact about 5 times more wetlands and streams. The wetlands at Mile 7.3 have higher function and value than those at Mile 8.8. Environmental rules require the selection of the least environmentally damaging practicable alternative (LEDPA).

c) Abutter Impacts. There are 47 houses within 1,000 feet of the project limit of the plaza at Mile 7.3. There are far fewer houses near other sites. There are only four houses within 1000' of the Mile 8.8 project limits and two of these are at the outer fringe of that perimeter.

d) Logistics During Construction. Construction phasing, maintaining toll collection, and shoring of potentially unstable soils at the Mile 7.3 site would make construction significantly more complicated there. It will take longer and cause more disruption of traffic and the surrounding terrain.

e) Costs/Financial. The estimated capital cost of construction at Mile 7.3 is $60.4 million, as much as 50% more than other alternatives. Mile 7.3 is projected to cause toll revenue losses due to diversion estimated at one to two million dollars per year. The long term cost of maintaining an ORT plaza at Mile 7.3 will be higher than other sites because some continued settlement is anticipated despite soil stabilization. This would likely require more frequent re-paving cycles.

8. All Factors Point Toward Mile 8.8. The site alternatives analysis does not present a significant conflict among the factor categories as sometimes happens with other projects. Mile 8.8 is one of the safest alternatives and has relatively low environmental impact. It is estimated to cost less and it compares well on other factors.

For these reasons, MTA staff recommends that the Board select the Mile 8.8 site for the replacement ORT plaza in York for the purpose of applying for permits and moving to final design.

Turnpike staff remain committed to working with all interested parties, including York officials and nearby residents, in a fair, open and respectful manner toward the goal of replacing the current deteriorating and outdated barrier toll with a modern ORT plaza that is safer, affordable, and less disruptive to travelers, abutters, toll collectors, and the environment.

Extracts from the minutes of a meeting of the Maine Turnpike Authority on November 19, 2015:

5. Chairman Daniel Wathen introduced a memorandum to the board from MTA staff dated November 16, 2015, recommending the selection of Mile 8.8 as the preferred alternative for permitting and final design of a replacement toll plaza in York, a copy of which memorandum is attached to these minutes and incorporated herein.

6. John Dority stated that he had been involved with the York Toll Plaza since 1968 and that he believed that the Mile 8.8 Site, unlike the current site, met all engineering standards for toll plazas.

7. James Cloutier stated that he believed there were three factors to be considered in a decision like this: (1) environmental considerations, (2) engineering and safety, and (3) local opinion. He said he believed there was a very strong technical case to be made for the mile 8.8 site, both as compared to the current site and other locations studied. Mr. Cloutier said that he believed that the the concerns that had been expressed by Think Again and others could not outweigh the fact that the first two factors were so overwhelmingly in favor of mile 8.8. Mr. Cloutier stated that the comparable costs of the site were not as important a factor to him as the environmental and engineering factors.

8. Chairman Wathen stated that Mr. Cloutier had summarized his own opinion well. He said that if there had been a "close call" here between mile 8.8 and the existing site as far as engineering considerations went, then the difference in cost would not be a deciding factor with him. He stated that he agreed with Mr. Cloutier that mile 8.8 was clearly a far superior location.

9. On motion of Rick Goodrich, seconded by Gerard P. Conley, Sr., and with unanimous approval of the members present, it was voted to designate mile 8.8 as the MTA's preferred alternative for replacement of the York Toll Plaza currently located at mile 7.3.

Massachusetts moves ahead on all-electronic, releases details of AET deployment

TollRoadsNews 2013 August 19

Seventeen mixed cash and E-ZPass toll plazas on the Mass Pike's ticket system are being replaced by ten mainline toll points, under the plan for going cashless with all-electronic tolling (AET.) The schedule provides for a Go-Live date for AET systemwide early 2017.

Details of the planning are laid out in a 53-page report [EIS] submitted to the state's environmental permitting agency. The barrier system will also be simplified by ending some ramp plazas and putting all toll equipment on the mainline. Five separate plaza operations in the Allston/Weston area will be replaced by a gantry on the mainline. A total of 24 mixed mode (ET+cash) toll points will be replaced by 18 all-electronic (ET+pay-by-plate) toll points. The plan assumes tolling will be continued throughout beyond 2017 - the year sometimes mentioned as a date for ending tolls on the western ticket system based on the notion it is "paid for."

Tobin Bridge "pilot"

AET will be deployed first on the Tobin Bridge, a toll operation that is on a route of its own to the northeast of the city. In the nature of a "pilot" AET, the report says that will go cashless some time in 2014.

"This pilot will test new AETS (AET System) technologies and business concepts, and provide MassDOT time to gain experience before the systemwide conversion. Through this early implementation of AETS on a smaller scale, MassDOT is better preparing and positioning itself to meet the demands of a system-wide conversion, thereby reduce exposure to potential operational risks." In the design phase a back office and customer service center will be procured, while concurrently design/build RFPs will be issued for toll gantries and system equipment. Factory testing will be followed by construction of the toll zones along the mainline. The plan provides for the AET system to be tested in 'shadow mode' for several months alongside the current ET+cash system to test its performance before the switchover. After the 'Go-Live' day for AET they will take down the old system and demolish the toll booths, canopies and associated structures. Capital cost of the conversion to AET is estimated to cost about $120m. 400 toll collector jobs will end. A number may be redeployed to customer service and image review for the Pay-by-Plate imaging of those motorists without transponders.

Current state

The AET permitting document summarizes the current situation on the Turnpike and tolled bridges and tunnels as difficult to improve further without going cashless. Eight barrier plazas on the metropolitan portion of the Turnpike and at the tunnels and Tobin bridge were a huge source of congestion before electronic tolling. Although dedicated E-ZPass lanes alleviated the worst of the congestion roadway curves and limited space cause traffic to continue to be delayed. Presently 80% of tolls are collected by transponder at the Turnpike's metropolitan mainline plazas, while on the harbor tunnels and in the ticket system heading out west the percentage is only 70%. The system west of MA128 has 17 ticket system toll points which, except at the ends, are side plazas. The report says: "due to the nature of ticket system interchanges and plazas, it is not possible to improve plaza operations adequately via E-ZPass expansion. There often isn't enough space for more E-ZPass lanes, the curves are too tight for extra lanes to help, and cash-paying traffic is too slow to allow efficient operations." Peak hours and holiday periods produce traffic volumes the existing plazas cannot handle without long backups: "Since its introduction, E-ZPass (formerly known as "FAST LANE") non-stop lanes have been implemented where possible. The improvements have increased capacity, but have not helped enough to handle major surges of traffic at many major system interchanges such as Interchange 10 (I-290/I-395) and Interchange 11A (I-495), where traffic congestion and backups onto the mainline are common. These areas then become high-potential

locations for accidents.

Higher crash record with mixed ET, cash

The report cites an ITE presentation on toll plaza accident potential: "As traffic flow diverges into the toll lanes then merges back into the roadway system, conflict points are created . . . As speed differentials within the traffic stream increase, it contributes to increased turbulence in the traffic flow and creates the potential for additional conflict points to occur along a motorist's chosen path." The Mass Pike's Interchanges 14 and 15 in Weston and Allston have an especially bad crash record - some 60% higher than elsewhere: "The higher rate of crashes is due to a combination of higher traffic volumes in the toll plaza area combined with a shorter roadway length. Potential causes of the higher crash rates are the ramp weaving and merge areas at the approaches and departures to the toll plazas and speed differential between cash and E-ZPass vehicles. The easy improvements in safety and smoothing traffic flow have been made over the past ten years and further improvements are very difficult so long as cash and electronic tolling are mixed, the report says. Modernization of mixed mode tolling was examined - including five with open road tolling. This was found to be very expensive in capital and system costs, and probably not feasible because of the extra real estate needed, and the likely cost and community resistance. It was therefore rejected in favor of going the whole way to AET/cashless operations.

Goals of AET conversion

Goals of the AET conversion are set out as: - improving traffic flow and reducing congestion caused by toll collection - improving safety through simplifying interchanges - reducing operations costs through eliminating cash collection - avoiding the alternative of having to acquire right of way and gain permits for the expanded facilities needed to improve mixed toll collection The benefits of AET will be specially large at the Weston and Allston interchanges where traffic operations can be greatly simplified and safety improved, the report says. The project says roadside equipment to support the gantries, and service road access can be provided to avoid environmentally sensitive areas. The end of cash toll plazas will allow impervious pavement and runoff to be reduced. AECOM was the lead toll consultant on the feasibility study. TTI is the lead toll consultant on the RFP with AECOM supporting.

AECOM is the lead civil engineering consultant on the RFP with TTI supporting.

TOLLROADSnews 2013-08-19

http://www.tollroadsnews.com/node/6699?utm_source=feedburner&utm_medium=email&utm_campaign=Feed%3A+tollroadsnews+%28TOLLROADSnews%29

ES Executive Summary

The Massachusetts Department of Transportation (MassDOT) is studying the feasibility of implementing a statewide tolling strategy to improve the safety and efficiency of highway operations. An important element of this study involves developing and comparing alternative tolling methods for the Massachusetts Turnpike system. The system is comprised of the 124-mile Western Turnpike (Interstate Highway I-90) between the New York state line and Exits 14/15/55 in Weston, and the Metropolitan Highway System (MHS) which includes the urbanized part of I-90 as well as the Sumner/Callahan Tunnels, the Ted Williams Tunnel, and the Tobin Bridge. This study focuses on the Western Turnpike (WT).

Toll collection operations between all seventeen toll locations on the WT are closely linked, and improvements made to individual toll locations or interchanges in isolation could have negligible benefits if not negative impacts throughout the system. For this reason, the existing and future baseline conditions of the Western Turnpike were reviewed system-wide, as were the alternatives developed and compared during the course of the study.

The purpose of this study was to consider the potential benefits and costs of replacing today's interchange-based toll system with a new system of mainline-based toll points relying to varying degrees on electronic toll collection. The broad categories of alternatives considered were all electronic tolling (AET) and open road tolling (ORT).

AET is a tolling approach first implemented on the 407 Express Toll Route (ETR) in Toronto, Canada in 1997 and has since been successfully implemented in the United States by various toll agencies. AET eliminates delays associated with tolling, thereby providing convenience and time savings to all customers who are offered two payment options, Electronic Toll Collection (ETC) and video tolling. With AET, there are no parallel service roadways and no cash toll plaza lanes. Vehicles in an AET environment, from which a transponder was not detected, are not immediately treated as violators. Rather, they are invoiced based on the license plate number and address associated with it.

ORT is a tolling approach that has been successfully implemented by many toll agencies. It is a tolling strategy intended to provide maximum convenience and time savings to ETC customers, the payment method exposing an agency to the lowest processing cost, highest accuracy and lowest payment risk to the operating agency. This is accomplished by installing gantry structures above all travel lanes to support toll equipment to identify vehicles by both a transponder and license plate number. ORT lanes have been implemented as ETC-only and combined ETC and video tolling. The "ORT Toll Plaza" design concept has emerged as the best way to accommodate E-ZPass and cash toll collection at a given location. Drivers with E-ZPass are provided high-speed, multi-lane free-flow ORT lanes, and cash-paying drivers are provided adjacent cash toll plaza lanes.

Options were developed for each of the basic ORT and AET concepts to test the effectiveness of varying the number and location of plazas in the case of ORT, and gantries in the case of AET. These "build" alternatives were compared to each other and to the "no-build" alternative, which represented continuation of the existing ticket and interchange based toll system.

In summary, the study found that "No-Build" is the worst alternative. Either ORT or AET would be a clear improvement over doing nothing.

- When comparing the "Build" alternatives the study found that ORT works well, but with important caveats and issues to address.

- AET also works well, and further improves over time with:
  - Higher E-ZPass participation
  - Improved video technology
  - Higher rates of video compliance

AET is the recommended alternative with gantries in all major segments (the "AET MSM Alternative"). It is recommended because it would provide:

- Lowest up-front capital cost
- Highest traffic and environmental benefits
- Least disruptive to implement /shortest schedule
- Reasonable Year 1 performance
- Best long-term net present value
- Other benefits:
  - Rate adjustments based on time-of-day, congestion or other factors possible with AET
  - AET is simple for drivers to navigate.

ES.1 Owner Facilities and Operational Review

1.1 Prior Studies Review

MassDOT and its predecessor agencies have conducted several studies over the past several years on specific issues relevant to tolling on the Western Turnpike, and other states have recently completed similar studies. Together, these studies provided useful background data and information for the new analysis.

1.2 Western Turnpike Overview

The Massachusetts Turnpike, like most toll facilities of its vintage such as the Pennsylvania Turnpike, New Jersey Turnpike, New York Thruway and others from the 1940s and 1950s, was built as a "ticket system" toll road. The toll was set based on the length of the trip and the size of the vehicle. Trip length was determined by issuing the driver a ticket at entry to the toll road which declared the entry point, and then collecting that ticket plus the toll due when the driver would exit.

1.2.1 Traffic Challenges

To economize construction on these early expressways, the limited-access interchanges were designed to funnel all movements, entry and exit, east-bound and west-bound, into a single toll collection point where staffed toll collection operations were conducted. These "trumpet" type interchanges – named for their resemblance to the bell and tubing of a trumpet - are functionally obsolete by today's engineering standards and no longer employed in modern construction. In order to focus all traffic onto a single point, the trumpet interchange ramps are configured with tight-radius curves and short approaches into the toll plaza. Traffic movements are very circuitous and slow.

Added to this disruptive traffic flow is the fact that ticket system tolling is the slowest of all the cash collection methods: issuance of tickets can be fairly quick – up to 600 vehicles per hour in cars-only lanes – but is painfully slow on the exit side because toll rates vary depending on entry plaza. Toll collectors cannot have change ready, and drivers often do not have exact change. Whereas automatic coin machines often process 600 or more vehicles per hour, and even cash collection in manned barrier system lanes with cars and trucks can process 300 to 350 vehicles per hour, manned ticket system exit lanes often process vehicles at a rate of 180 vehicles per hour or less.

As traffic grows, ticket system interchanges cannot be expanded enough to accommodate the increased volume without major ramp modifications, and these interchanges never process traffic as quickly as they could with some directional supplemental ramps or complete reconfigurations.

1.2.2 Obstacles to Improvement

As electronic toll collection was introduced in 1989 and grew in the following few years, it became possible to move traffic through conventional toll plaza lanes without toll collectors, called "dedicated lanes," at over 1,000 vehicles per hour. This number could be even higher for toll plazas with clear approaches and departures. Unfortunately, this is not possible with the old 1950s interchanges and tight ramp curves on most Western Turnpike plazas.

Since initial construction, lanes have been added, electronic toll collection (initially the "FastLane" program, which is part of the E-ZPass network and was rebranded as E-ZPass in 2012) was introduced, and where possible, some higher-speed electronic toll lanes have been added to toll plazas. The improvements have increased capacity, but inadequately for some of the major system interchanges such as Interchange 10 (I-290/I-395) and Interchange 11A (I-495), where traffic congestion and backups onto the mainline are common. These areas then become high-potential locations for accidents.

In addition to processing traffic poorly, ticket system plazas are also very expensive to operate, and old toll plazas require expensive repair and upkeep.

1.3 Existing Facilities Review

The Western Turnpike toll plazas employ lanes with manual, dedicated ETC, automatic ticket issuing machine, or dual mode manual/ETC toll collection. The dual mode lanes provide operational flexibility to handle different payment types and staffing levels. Also, at each plaza one or more of the physical lanes toward the middle of the plaza are reversible to better match transaction processing capacity to the directionality of the traffic flow.

1.3.1 Plaza Facilities Assessment

As part of a 1997 Series A bond refunding the Massachusetts Turnpike Authority[1] retained an independent engineering firm to inspect all Western Turnpike facilities from April through September, 2009. Their report concluded capital construction had not kept pace with the needs of the Western Turnpike, spending approximately $10 to $15 million annually versus their estimated annual need of approximately $47 million for proper repair, rehabilitation and replacement projects. This capital expenditure was deemed to be the minimum needed to fund necessary improvements and significantly reduce the rate of facility decline. The information listed below summarizes the findings of their inspection.

The Western Turnpike roadways were found to be in generally good condition. However, significant lengths of pavement were found to be in marginal condition. Programmed pavement resurfacing contracts were cited as the reason the pavement condition was rated good. It was emphasized this program needs to resurface a minimum of 10 to 12 miles per year to retain the current rating.

The report found the condition of 170 bridge structures on the Western Turnpike varied based upon when the bridge deck was last rehabilitated or reconstructed. Overall it was found most bridge elements have been adequately maintained and only a few require attention.

[1] Before the 2009 creation of MassDOT, the Massachusetts Turnpike Authority was the independent agency responsible for the construction, maintenance and operation of the Massachusetts Turnpike.

Interchanges including roadways, drainage systems and appurtenances along with the toll plazas were found to be in good condition overall. The report attributed this condition to ongoing maintenance and rehabilitation efforts by MassDOT's maintenance staff. In particular, a toll booth and canopy rehabilitation program lasting from 1996 to 2001 was cited as a reason for the favorable assessment, although plaza tunnel conditions at some locations must be watched for further water damage and deterioration. Long-term, if plazas were to be kept in operation after 2015, a next cycle of major building and tunnel and plaza rehabilitation would be warranted roughly 20 years after the last cycle.

Western Turnpike support facilities include motorist service areas, maintenance depots, communications and computer equipment, and police barracks. The maintenance depots were found to be in generally good condition overall, although a few of these facilities were rated to be in a range of marginal to fair. The State Police facilities located in Westfield, Charlton and Weston were found to be in generally good condition overall.

The Western Turnpike has at least some fixed facilities with data and power service between most interchanges, which could be used to support new mainline toll infrastructure.

1.3.2 Existing Traffic Conditions

Weekday daily volumes along the Western Turnpike mainline range from over 23,000 at the New York Stateline (Interchange 1) to over 130,000 between Natick and Weston (Interchange 13 & 14). The volumes show a consistent pattern of increasing traffic volumes from west to east.

Weekday AM and PM peak hour volumes by direction along the study corridor shows that in AM peak hour the predominant directions are westbound west of Interchange 9 in Sturbridge and eastbound east of Interchange 9. During the PM peak hour, eastbound and westbound traffic is balanced west of Interchange 9 and the predominant direction is westbound east of Interchange 9.

Weekday AM and PM peak hour toll plaza ramp traffic volumes were reviewed at each of the 17 interchanges. The highest hourly traffic volumes overall (over 3,000 vehicles) occur at Interchange 11A (I-495 in Westborough) for both entering and exiting vehicles in both peak hours. Other interchanges with high commuter hourly volumes include Interchanges 13 (AM exit) and 14 (PM enter). The lowest peak hour traffic volumes generally occur at Interchange 2 in Lee with volumes under 1,000 vehicles for both directions and peak hours.

Vehicle classification data from MassDOT was reviewed for years 2009 through 2011. The vehicle classification data shows that passenger vehicles (including 2-axle trailers) comprise approximately 91 percent of the total toll transactions for 2009, 2010, and 2011 through September 2011.[2]

Traffic operating conditions at the toll plazas were evaluated using existing toll plaza geometrics and volumes to calculate volume-to-capacity ratios for weekday peak hours. In addition, a micro-simulation model was developed for Interchanges 14, 15, and 55 in Weston including ramps to Route 128 and local roadways.

Most of the toll plazas have some level of queuing in at least one of the four peak periods analyzed (AM, PM, Off-Peak, and High Season). Only toll plazas 1 (West Stockbridge), 2 (Lee), 7 (Ludlow), and 11 (Millbury) were identified as not having vehicle queues in any of the study periods.

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[2] *Electronic & Manual Toll Collection Reports, Class Comparison – Western Turnpike, January-December 2009 VS January-December 2010, MassDOT Highway Division; Electronic & Manual Toll Collection Reports, Class Comparison – Western Turnpike,* January-September 2010 VS January-September 2011, MassDOT Highway Division.

Vehicle queues of 0.5 miles or more would occur during one or more peak periods at the following 10 Western Turnpike toll plazas:

- #4 (West Springfield)
- #5 (Chicopee)
- #6 (Chicopee)
- #10 (Auburn)
- #10A (Millbury)
- #11A (Westborough)
- #12 (Framingham)
- #13 (Natick)
- #14 (Weston)
- #15 (Weston)

It is noted that at many toll plazas vehicle throughput capacity is not the primary problem. Usually, the issue is that approach and departure geometry has ramp weaves, diverges and merges (often on curves) which are too close to the plaza aprons. This situation results in vehicle congestion and queuing which can be exacerbated by limited toll plaza throughput capacity. For example, at Weston the vehicle queues from Route 128 extend upstream, impacting operations at the Interchange 14 toll plaza. Vehicle queues also extend upstream from Interchange 16 in Newton to the Interchange 15 toll plaza.

1.3.3 Safety

To further examine the issue of safety, vehicle crash data at Interchanges 14 and 15 in Weston and the mainline segment of I-90 between Interchanges 13 and 14 were obtained and evaluated. Crash data between years 2007 and 2009 from MassDOT were obtained, reviewed and summarized.

The results show that while the Weston toll plaza area experienced fewer crashes than the adjacent longer mainline segment, the crash rate for the Weston toll plaza is about 60 percent higher than the adjacent mainline section. The higher number of crashes is due to a combination of higher traffic volumes in the toll plaza area combined with a shorter roadway length. Potential causes of the higher crash rates are the ramp weaving and merge areas at the approaches and departures to the toll plazas and speed differential between cash and FAST LANE vehicles.

1.4 Existing Operations Review

The owner's current cash handling and plaza staffing were reviewed. Toll collection staffing and costs over the past five years were also reviewed for developing a trend analysis of the existing system and an understanding of existing costs. The current customer service center operations were reviewed during the site visit of tolling operations. The review focused on:

- call center and account management,
- image processing,
- license plate lookups,
- mail processing,
- banking and credit card arrangements, and
- other major cost and activity centers.

1.4.1 Lane - Plaza Level, Host, and Back Office Operations

The tolling equipment at the plaza lanes is networked to, and supported by, hardware, software, and equipment installed in each toll plaza building and the MassDOT host computer. Each plaza building