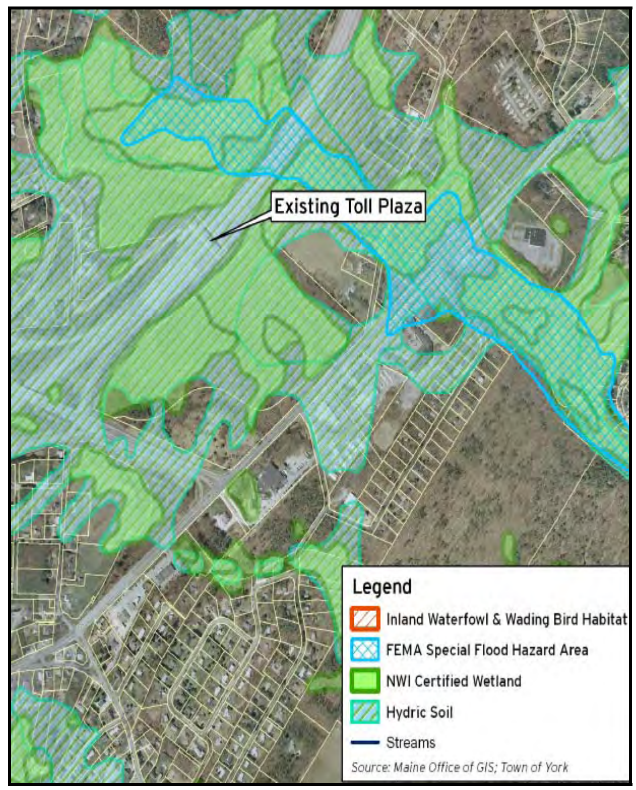
MAINE TURNPIKE
SOUTHERN TOLL PLAZA

EXISTING SITE EVALUATION



June 16, 2009

The Maine Turnpike Authority

Prepared by: HNTB Corporation

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

SECTION 1 – INTRODUCTION

The Maine Turnpike Authority's York Toll Plaza is situated seven miles north of the New Hampshire border and has served beyond its planned and structural life. It is processing more than three times the traffic it did when it first opened and is suffering from numerous operational and structural deficiencies and continues to be a safety concern. As a result of these factors, several years ago, the Maine Turnpike Authority (MTA) decided to curtail expending money on all non-critical repairs and to comprehensively evaluate the existing plaza issues and investigate how to most effectively move forward with a replacement that meets the Authority's goal of operating a safe, efficient and modern southern toll plaza.

The Maine Turnpike Authority has since engaged this study and has released a number of findings, including a report at the beginning of 2008 titled Technical Report in Response to Maine LD534. (LD534, Resolve, Directing the Maine Turnpike Authority To Study the Relocation of the York Toll Booth, is a Legislative Document generated by the Joint Standing Committee on Transportation) The response report was essentially a compendium of existing conditions, deficiencies and other safety related findings to date that supported the need for the York plaza replacement. In fact, it detailed the finding that a new plaza in a new location would better meet the safety, capacity, design criteria, and modern toll technology goals than numerous options at the existing site. Following the presentation of the response report to the Transportation committee, the MTA held several meetings with the public and local officials to discuss these and other findings. At the urging of the York Board of Selectpersons, the MTA Board agreed to request that it's Chief Consulting Engineering Firm, HNTB revisit the 'existing site evaluation'. As requested by the Selectpersons, the goal was to investigate out-of-the-box or 'what it would take' alternatives that would meet design criteria, minimize impact to right-of-way and avoid taking homes.

The purpose of this Report is to document the evaluation of options for rehabilitating/reconstructing the York Toll Plaza at its existing site or in close proximity and to recommend any option(s) that warrant being carried forward for further consideration. This report will become Part One of the full Site Identification and Screening Report. The Site Identification and Screening Report will then evaluate the most reasonable existing site option(s) along with screened new sites in the identified corridor and ultimately make a recommendation for the replacement of the York Toll Plaza. Existing site evaluation along with alternative site analysis are requirements of the environmental permitting agencies prior to them issuing necessary permits.

A complete and thorough evaluation must include such alternatives that meet purpose and need, create the least amount of environmental and community impact and are practicable. Recommendations from this report shall reflect the following goals that MTA has for rehabilitating/reconstructing the York Toll Plaza:

1. Impacts to property and the environment shall be minimized.
2. The design shall be fiscally responsible considering both initial construction and long term maintenance costs weighed against benefits realized over the life of the design.
3. The plaza shall have safer operations for both Turnpike patrons and staff.
4. The plaza shall have adequate capacity for current and future traffic demands.
5. The plaza design shall meet industry design standards for layout and operations.
6. The plaza shall have the ability to implement a more modern and efficient Open Road Tolling (previously referred to as Highway Speed Tolling) technology as decided by the MTA Board. The Maine Turnpike Authority has made a decision to implement Open Road Tolling.

SECTION 2 - DESIGN GUIDELINES FOR MAINLINE TOLL PLAZAS

While the construction and expansion of the mainline of the Maine Turnpike (The Widening) benefited from established and updated highway design guidelines, such national and uniform guidelines were not available for toll plazas when the York Plaza was built in 1969. However, in 2006, responding to the needs of many tolling operations across the country, the Federal Highway Administration issued a report that documented the most current best practices and established new guidelines for the design and construction of toll plazas. These guidelines and best practices are focused primarily on the design and construction of toll booths and toll lanes and how these structures interface with mainline traffic operation

Design guidelines are assembled to provide planners and engineers with a set of current "best practices" to provide safe and efficient facilities. These guidelines are developed nationally from experience in a wide variety of specific discipline areas and conditions. Guidelines have been developed for the highway and roadway practice area, which apply to turnpikes and toll plazas. Following is a list of the national design guideline publications being used for evaluation of the York Toll Plaza to provide users with a safe, efficient and environmentally conscious facility.

- A Policy on Geometric Design of Highways and Streets, AASHTO 2004
- Manual on Uniform Traffic Control Devices (MUTCD), FHWA 2003
- Roadside Design Guide, AASHTO 2006
- State of the Practice and Recommendations on Traffic Control Strategies at Toll Plazas, FHWA 2006

Further discussion of the details of these design guideline publications follows.

A. Purpose of National Design Guidelines

Excerpts from these various Guidelines, highlighting their purpose as well as the various basic design criteria mentioned, are contained in Appendix A.

1. A Policy on Geometric Design of Highways and Streets:

    Excerpt from page xliv: "These guidelines are intended to provide operational efficiency, comfort, safety and convenience for the motorist. The design concepts presented herein were also developed with consideration for environmental quality. The effects of the various environmental impacts can and should be mitigated by thoughtful design process. This principle, coupled with that of aesthetic consistency with the surrounding terrain and urban setting, is intended to produce highways that are safe and efficient for users, acceptable for non-users, and in harmony with the environment."

2. Manual on Uniform Traffic Control Devices (MUTCD):

    Excerpt from Section 1A.01 Purpose of Traffic Control Devices: 'The purpose of traffic control devices, as well as the principles for their use, is to promote highway safety and efficiency by providing for the orderly movement of all road users on streets and highways throughout the Nation."

    Excerpt from Section 1A.06: "Uniformity of devices simplifies the task of the road user because it aids in recognition and understanding, thereby reducing perception/reaction time. Uniformity assists road users, law enforcement officers, and traffic courts by giving everyone the same interpretation. Uniformity assists public officials through efficiency in manufacture, maintenance, and administration. Uniformity means treating similar situations in a similar way. The use of uniform traffic control devices does not, in itself, constitute uniformity. A standard device used where it is not appropriate is as objectionable as a nonstandard device; in fact, this might be worse, because such misuse might result in disrespect at those locations where the device is needed and appropriate."

3. Roadside Design Guide:

   Excerpt from Preface page vii: "The *Roadside Design Guide* is developed and maintained by AASHTO subcommittee on Design, Technical Committee for Roadside Safety. The guide presents a synthesis of current information and operating practices related to roadside safety ..."

   A second noteworthy point is that this document is a guide. It is not a standard, nor a design policy. It is intended for use as a resource document from which individual highway agencies can develop standards and policies. While much of the material in the guide can be considered universal in its application, there are several recommendations that are subjective in nature and may need modification to fit local conditions. However, it is important that significant deviations from the guide be based on operational experience and objective analysis."

4. State of the Practice and Recommendations on Traffic Control Strategies at Toll Plazas:

   Excerpt from page 1: "The goal is to achieve a consistent strategy for handling potential points of conflict, controlling flow of various vehicle types and conveying information at toll plazas so that safety and operations are enhanced, better efficiency and economy of design are achieved, and motorist recognition and comprehension are improved."

   Excerpt from page 2: "Further trends show toll roads facing greater commuter and recreational demands, resulting in cash paying and ETC users familiar with the toll road mixed with unfamiliar cash paying users. Without the use of good design practice, including effective deployment of various traffic control devices, this mix can result in unsafe and inefficient operations. ETC users now expect non-stop, high speed travel through toll plazas without incurring any delays. Development of national guidelines that address the implications of electronic toll collection on plaza operations has therefore become much more critical.

The common theme among these guidelines, as it relates to their purpose, is that uniformity of design practices and procedures is a key factor in the safety of travelers on our Nation's highways. In addition, operational efficiency of our roadway network can be improved through the use of these national guidelines and best practices. Another important result of applying these guidelines is the efficient use of resources while minimizing environmental impacts. Evaluation of the existing toll plaza will be based on these design manuals to develop a fair and reasonable summary of findings; setting the stage for rehabilitation strategies that are safe, efficient, economical, and environmentally sensitive.

HNTB will then utilize these national guidelines to develop, analyze and compare plaza alternatives resulting in final engineering recommendations that meet acceptable design practice. Ultimately, it is HNTB's goal to utilize these national guidelines, along with professional judgment, to maximize the safety of the traveling public and to the MTA toll staff while also providing the best value to the Maine Turnpike toll-payers. **The development of a toll plaza design that ignores industry standards, acceptable design practice, and nationally published design guidelines increases the safety risks to drivers and toll staff alike, is not supported by HNTB and should not be considered by the MTA.**

B. Basic Design Criteria for Toll Plazas

The next portion of the analysis is to detail the guidelines to be used for the design, location and implementation of traffic control strategies for toll plazas as well as to be used in the evaluation of an existing toll plaza. The following guideline criteria are documented in the Federal Highway Administration State of the Practice unless otherwise noted:

- *Provide one mile (5,280 ft) minimum separation between toll plaza and interchanges.* A one mile separation affords drivers with adequate time to interpret signs, maneuver accordingly and minimizes other decisions and distractions. A toll plaza placed near an interchange increases traffic weaving issues, signing difficulty, a wide range of vehicle speeds and general driver confusion.

- *Provide adequate decision sight distance (DSD) in advance of the toll plaza.* DSD, as defined by AASHTO, is the distance needed for a driver 1) to detect an unexpected or otherwise difficult to perceive information source or condition in the roadway environment that may be visually cluttered, 2) recognize the condition or its potential threat, 3) select an appropriate speed and path, and 4) initiate and complete the maneuver safely and efficiently. For open road (highway speed) tolling, the DSD requirement is composed of two sight distances: 1) 1,500 ft before the split point between open road and conventional cash lanes and 2) 1,800 ft between the split point and the plaza. At a point 3,300 ft prior to the plaza (total of these two values), the driver shall be able to see the split point as well as the plaza so that the driver can maneuver as necessary. This 1,500 ft DSD assumes vehicles are traveling at 70 mph and advance signing is provided in accordance with FHWA Guidelines. The second distance of 1,800 ft between the split and the plaza is based on the geometrics of the plaza. At the split point 1,800 ft prior to the plaza, the driver should also be able to clearly see the toll plaza.

- *Resulting from the above DSD recommendation - Provide 3,300 ft separation between toll plaza and overhead structures.* This distance is based on previously described DSD criteria. The driver should have unobstructed views of the split point and plaza, thereby improving facility safety. This requirement will also reduce or eliminate potential impacts to existing overhead structures. Overhead structures and bridges have two components that can restrict sight, one being the bridge itself and the other being the abutments and piers. These components can block view of signs, impact depth perception and in some cases require guardrail further blocking views of conditions existing on the far side of the bridge.

- *Locate toll plaza on a horizontal tangent (straight section) with no curves.* Locating a toll plaza on a tangent (straight section of roadway) improves sight distance, driver awareness, and facility safety when compared to a location on a horizontal curve. Placing a toll plaza on a curve: reduces driver sight distance, causes additional distractions to drivers thereby increasing potential for crashes, reduces plaza operational efficiency as some booth lanes will be over utilized and some underutilized, and may create engineering challenges relating to roadway cross slopes and super elevation needs.

- *Locate the toll plaza on a roadway high point.* Placing a toll plaza at the crest of a hill will provide sight distance advantages for all traffic and plaza operational benefits to cash patrons as the approach upgrade will aide in slowing vehicles down while the departure downgrade will aide in accelerating vehicles. This reduces the amount of engine braking and heavy acceleration noises often associated with the plaza. FHWA Studies have been done to determine acceptable levels of grade approaching and departing a toll plaza. Grades 3.0% and steeper have an adverse affect on the performance of commercial vehicles and grades less than 0.5% create drainage problems and possible icy conditions in the winter. Therefore, grades approaching and departing the toll plaza should be within the range of 0.5% to 2.0%.

The following table further describes key issues addressed by the above guidelines as well as describing their impact on safety, operations and the environment.

Figure 1 Design Guideline Summary Matrix
Maine Turnpike Southern Toll Plaza

Design Criteria	Safety			Operations			Environment			Summary
	Most Safe	Least Safe	Explanation	Best operationally	Worst Operationally	Explanation	Least Environmental Impacts	Most Environmental Impacts	Explanation	
1. Separation from interchange										
Weaving of Traffic	Toll plaza separated from interchange by at least 1 mile	Toll plaza and interchange located at same location	Interchanges - Mainline driver in the left and middle lanes planning to exit at an interchange move into the right lane prior to approaching an off ramp. Mainline drivers in the right lane not using the interchange, often move into the middle lane to avoid decelerating and accelerating vehicles in the right lane. Toll Plazas - Mainline drivers approaching a toll plaza typically change lanes in advance of a toll plaza. Providing a minimum of a 1 mile separation between an interchange and a toll plaza distributes the weaving vehicles (vehicles changing lanes) over a larger area thus reducing the concentration of weaving vehicles. A lower concentration of weaving vehicles typically equates to a lower number of collisions. Therefore, a 1 mile separation between an interchange and a toll plaza is likely to result in less collisions.	Toll plaza separated from interchange by at least 1 mile	Toll plaza and interchange located at same location	Interchanges - Mainline driver in the left and middle lanes planning to exit at an interchange move into the right lane prior to approaching an off ramp. Mainline drivers in the right lane not using the interchange, often move into the middle lane to avoid decelerating and accelerating vehicles in the right lane. Toll Plazas - Mainline drivers approaching a toll plaza typically change lanes in advance of a toll plaza. Providing a minimum of a 1 mile separation between an interchange and a toll plaza distributes the weaving vehicles (vehicles changing lanes) over a larger area thus reducing the concentration of weaving vehicles. A lower concentration of weaving vehicles typically equates to a higher capacity. Therefore, a 1 mile separation between an interchange and a toll plaza should is likely to result in higher capacity.	Toll plaza separated from interchange by at least 1 mile	Toll plaza and interchange located at same location or in close proximity	Additional mainline travel lanes could be constructed to decrease the concentration of weaving vehicles resulting in an increase in safety and capacity. Additional lanes would likely impact wetland and streams	Toll plazas and interchanges separated by at least 1 mile results in the highest safety, the best operations, and the least environmental impacts
Highway signing	Toll plaza separated from interchange by at least 1 mile	Toll plaza and interchange located at same location	Highway guide signs are suggested to guide motorist to their intended destination. National guidelines suggests that the same basic message be repeated multiple times starting 2 miles in advance. This allows adequate time for a driver to read, understand, and react to a message. (Note that vehicles traveling at the posted speed of 65 mph (95 feet/sec) will travel hundreds of feet while drivers see a sign, read and understand the message, decide on an action, and then implement the action.) Signs should be consistent and easily understood. Signing for both the toll plaza and the interchange within the 2 mile corridor requires multiple signs with separate and distinct messages which can create confusion for the driver. A confused driver is more likely to be involved in a collision than a non-confused driver.	Toll plaza separated from interchange by at least 1 mile	Toll plaza and interchange located at same location	Multiple signs create confusion and may lead to drivers not choosing their correct course of action (For example - May result in driver missing an exit). This condition results in substandard operations.				
2. Horizontal Alignment	Toll Plaza located on a straight section of roadway	Toll Plaza located on a curve	Toll plazas located on a straight section of road are more visible to the driver than a toll plaza located on a horizontal curve. This allows for adequate decision sight distance (DSD). DSD is the distance required for a vehicle traveling at 70 mph to detect an unexpected condition, recognize it's potential threat, select an action, and implement the action. High visibility leads to increased safety as a driver can see the toll plaza and start to make decision such as decreasing speed and changing lanes well in advance of the toll plaza. This provides for increased safety as the concentration of weaving vehicles is decreased.	Toll Plaza located on a straight section of roadway	Toll Plaza located on a curve	Drivers tend to stay on outside of curve. This results in the booths on the outside of the curve being heavily utilized while booths on the inside of the curve are underutilized. This condition decreases the overall capacity of the toll plaza which results in congestion when the demand exceeds the capacity. Congestion results in poor operations.	Not Applicable	Not applicable		Toll plazas located on a straight section of roadway results in the highest safety and the best operations
3. Vertical Alignment (profile)										
Grades	Up grade entering toll plaza and down grade leaving toll plaza	Down grade entering toll plaza and up grade leaving toll plaza	Gravity (downhill pull) positively influences vehicles ability to decelerate when vehicle is traveling uphill. A vehicle approaching a toll plaza climbing a steep hill will decelerate without the use of brakes. Therefore, steep upgrades to toll plaza minimizes the potential of serious collisions since gravity helps to decelerate vehicle which reduces the speed. Specific concerns include vehicles with faulty breaks and non attentive drivers.	Up grade entering toll plaza and down grade leaving toll plaza	Down grade entering toll plaza and up grade leaving toll plaza	Gravity (down hill pull) positively influences a vehicles ability to accelerate when traveling downhill. A vehicle leaviing a toll plaza on a down grade can move forward without the use of the engine. Upon leaving the toll plaza, a downgrade will facilitate the acceleration of the vehicle.	upgrade entering plaza and downgrade exiting toll plaza	down grade entering plaza and up grade exiting toll plaza	The use of gravity to assist with vehicle deceleration (entering plaza) and vehicle acceleration (departing plaza) minimizes fuel consumption, noise associated with braking, and excessive wear of	Toll plazas on a high point at the end of a long tangent with a 2% up grade entering the plaza and a 2% down grade leaving the plaza conform to the accepted national guidelines. This guideline reflects a balance of the safety, operational, and environmental concerns
Vertical Curves	Toll plaza located at end of long straight (tangent) section of roadway	Toll plaza located just beyond crest of hill	Toll plazas located at the end of a straight section of road are more visible to the driver than a toll plaza located just beyond the crest of a hill. This allows for adequate decision sight distance (DSD). DSD is the distance required for a vehicle traveling at 70 mph to detect an unexpected condition, recognize it's potential threat, select an action, and implement the action. High visibility leads to increased safety as a driver can see the toll plaza and start to make decision such as decreasing speed and changing lanes well in advance of the toll plaza. This provides for increased safety as the concentration of weaving vehicles is decreased.	Toll plaza located at end of long straight (tangent) section of roadway	Toll plaza located just beyond crest of hill	Toll plazas located at the end of a straight section of road are more visible to the driver than a toll plaza located just beyond the crest of a hill. High visibility allows the driver adequate time to see the toll plaza and start to make decision such as decreasing speed and changing lanes well in advance of the toll plaza. This decreases the concentration of the weaving and results in higher capacity	Not applicable	Not applicable	Not applicable	
4. Proximity to Bridges	Toll plaza located over 3500' feet from overhead bridge structure	Bridge structure located in close proximity to toll plaza	Toll plazas located at least 3500' from an overhead bridge are more visible to the driver than a toll plaza located just beyond an overhead bridge. This distance allows for adequate decision sight distance (DSD). DSD is the distance required for a vehicle traveling at 70 mph to detect an unexpected condition, recognize it's potential threat, select an action, and implement the action. High visibility leads to increased safety as a driver can see the toll plaza and start to make decision such as decreasing speed and changing lanes well in advance of the toll plaza. This provides for increased safety as the concentration of weaving vehicles is decreased. An overhead bridge within the plaza area may require intermediate piers. The piers, as well as their protection (Guardrail, impact attenuator, etc.) are a hazard and would likely results in more collisions.	Toll plaza located over 3500' feet from overhead bridge structure	Bridge structure located in close proximity to toll plaza	Toll plazas located at least 3500' from an overhead bridge are more visible to the driver than a toll plaza located just beyond the crest of a hill. High visibility allows the driver adequate time to see the toll plaza and start to make decision such as decreasing speed and changing lanes well in advance of the toll plaza. This decreases the concentration of the weaving and results in higher capacity	Not applicable	Not applicable	Not applicable	Toll plazas located at least 3500' from overhead bridges providee the highest safety and the best operations.
5. Toll Plaza Capacity	Toll plaza can process peak traffic without congestion in the mainline section. Delays are minimized	Toll plaza can not process average traffic and congestion extends into mainline section	Congestion on the mainline (3 lane section of roadway - outside of plaza area) has high potential for serious collision as mainline drivers traveling at 65 mph are not expecting stopped traffic on the mainline.	Toll plaza can process peak traffic without congestion in the mainline section. Delays are minimized	Toll plaza can not process average traffic and congestion extends into mainline section	Congestion in the mainline has high potential for vehicles to divert to alternate routes to avoid congestion	Minimal number of toll lanes	Large number of toll lanes	large number of toll lanes likely to have larger wetland and stream impact than minimal number of toll lanes	Toll Plaza should have adequate capacity to process traffic such that traffic does not become congested in the mainline section

Alternate Location (yellow)
Existing Location (orange)
Not applicable (light green)

SECTION 3 - PROJECT PURPOSE & NEED

A. Project Purpose

The purpose of the York Toll Plaza Replacement Study is to 1) identify structural, operational and safety deficiencies at the (York) toll plaza, and 2) propose a course of action that will ultimately result in a toll plaza that is considered safe, efficient, economical and satisfies the MTA's goal of incorporating open road tolling. HNTB's final project recommendation will take into consideration Turnpike operational parameters, engineering design criteria, capital and operational costs, and physical features including natural resources, cultural resources, and community resources. The final project recommendations should accommodate current and future traffic needs safely and efficiently, utilize nationally recognized design guidelines, provide the best value, and meet the requirements of the environmental permitting agencies. The basic project Purpose and Need, as proposed to the U.S. Army Corps of Engineers (USACOE) and subsequently approved/accepted by USACOE, is contained in Appendix B of this report. In addition, and to assist in understanding the various components of a toll plaza, please refer to Appendix C - What Is a Toll Plaza? The appendix contains a brief description of these components and an accompanying diagram.

B. Project Need

The need for the project can be separated into two areas, physical and operational. First, the physical needs are due to the poor and failing condition of the physical infrastructure itself including booths, canopy, access tunnel, the space limitations of the existing tollbooths, the absence of adequate toll staff protection, and the poor soil conditions. Second, the operational needs are demonstrated by the design deficiencies of the existing York Toll Plaza; a plaza and approach area that restricts operational efficiencies and meets none of the recently published FHWA design guidelines for toll plazas. Proximity to an interchange, poor or non-existent sight distance and poor alignment have led to a high number of crashes resulting in the plaza being classified as the 11^{th} highest crash rate location in the State out of over 900 such locations. Historically, near capacity operations along with unsafe vehicle weaving maneuvers further render the existing facility inadequate to perform safely into the future. Initial consideration of these issues, appeared to make upgrading the existing facility along with installation of open road tolling technology, infeasible. Details of these inadequacies and their consequences are described in greater detail later in the report.

C. Summary

As stated in the Maine Turnpike Authority's enabling legislation,38M.R.S.A. §1961, the Legislature made the following findings of fact: "The economic and social well-being of the citizens of the State requires that the transportation system be developed in a comprehensive manner and depends upon the safety, efficiency and modern functional state of the turnpike."

Based on the York Toll Plaza's crash rate history and operational performance, it is clear that the present day plaza can not deliver, today or in the future, a "safe, efficient and modern operation", as required of the Turnpike. The York Toll Plaza is not in conformance with current best practices and design guidelines and is in need of major rehabilitation or replacement to improve operations and overall safety. Current deficiencies impact the safety of both Turnpike staff and the traveling public and increase overall operation and maintenance costs. Capacity improvements are also needed to more efficiently and safely process the traffic volumes at a reasonable level of service today and in the future. While the addition of tolling lanes and ETC have improved the plaza's capacity, additional ETC toll lanes or open road toll lanes are needed to efficiently meet the future traffic volumes.

Similarly, infrastructure upgrades including maintenance paving, safety bumpers, island rehabilitation, signage improvements, etc., have improved the overall operation for both patrons and employees. However, these upgrades have only been considered short-term improvements and have met only a portion of the total need.

The MTA decided in 2001 that the future needs of the entire plaza should be addressed and further short to mid term fixes or improvements would be curtailed. A more comprehensive evaluation was deemed necessary to determine immediate and future needs, including what type of modifications would be required to bring the plaza layout up to current design standards and best practices, and to determine what structural or infrastructure improvements would be required to provide proper safety for staff and travelers at and near the plaza itself.

This report documents the guidelines and standards by which toll plazas should be designed and operated and compares and contrasts various levels of rehabilitation and reconstruction that address some or all of these deficiencies. As part of improving the plaza operations, the report also documents benefits and shortcomings of various tolling strategies including conventional toll booths, electronic toll collection and open road tolling.

SECTION 4 - TOLL COLLECTION STRATEGIES

Two types of toll collection systems are generally used in the industry today. One is the "ticket system" where motorists receive a ticket upon entering the system and then surrender the ticket and a cash toll upon exiting the system. The other is the "barrier system" where a set cash toll is charged based on a vehicle's number of axles. The Maine Turnpike currently operates a barrier toll system with electronic toll collection (ETC) capabilities in all toll lanes. The Maine Turnpike also recognized the benefits to the traveling public of standardizing its toll collection with neighboring States and other states in the Northeast U.S. and therefore has adopted the E-ZPass system.

At all Maine Turnpike plazas, electronic tolls can be collected in a traditional stop-and-go cash toll lane as well as through a dedicated slow speed ETC lane. ETC in both stop–and-go cash lanes and dedicated ETC lanes requires patrons to slow to a maximum speed of 10 mph while passing through the plaza to ensure the safety of Maine Turnpike staff as well as their own. With the development of more sophisticated transponders and receivers, another ETC method, Open Road Tolling (ORT) allows ETC patrons to travel at highway speeds (55-65 mph) while paying their toll. For safe operations, these ORT facilities physically separate the ETC patron from the cash paying patrons. ETC patrons remain on the mainline of the highway and cash paying patrons exit to the right to a conventional toll plaza.

A. Split Toll Plaza (Layout)

While not a tolling technology, split plazas are a tolling strategy and are frequently reviewed for potential benefits. Both a split toll plaza and a single toll plaza configuration have been considered as part of this study. A single plaza is a toll plaza where the northbound and southbound conventional plazas are built in the same location, whereas a split plaza has the northbound and southbound toll plazas in different locations. A split plaza could, in concept, reduce the mainline project footprint at any single location by dividing the total footprint between two locations, thus potentially reducing overall impact at any one location while creating plazas in two locations. However, a split toll plaza might result in greater overall project impacts and costs due to duplications of some facilities and additional earth disturbance required, e.g. from a second utility building, tunnel entrance, parking lot. A split plaza might have been appropriate if a single location, without major constraints, could not be found.

The existing location of the York Toll Plaza was reviewed to determine whether or not this site could be used in one direction or the other. Conceptual plaza layouts were developed and analyzed, and the following conclusions were reached:

1. Critical FHWA design guidelines would be violated. These include:
   - Criteria related to proximity of adjacent interchanges
   - Criteria related to horizontal geometry – decision sight distance
   - Criteria related to vertical geometry – decision sight distance
2. The support infrastructure, i.e. building, parking and access, already exists on the southbound side. The existing plaza would have to serve SB traffic to utilize this infrastructure. However, to do this, all SB traffic (cash and ETC) destined for Chases Pond Road would likely be separated from the thru traffic to address the merge and weave issue. The ramp traffic, both cash and ETC might then be routed through booths dedicated specifically to the ramp to again minimize weaving maneuvers. This could be confusing and potentially dangerous for the ramp traffic that is not expecting to exit so far ahead of, and out of sight of, the Chases Pond Road crossing. The NB plaza would be located elsewhere on the mainline.

3. The costs required to address the existing physical deficiencies of the existing plaza, including the adverse soil conditions and failing tunnel, would be substantial and would nearly approach costs of an entirely new two-way plaza. Expenditure of substantial funds to rehabilitate the existing deficiencies would not be prudent when considering the fact that the resulting design features would be substandard and another toll plaza would need to be built for the other direction of traffic.

Since it would not be feasible to provide one direction of a split plaza at the existing York Toll Plaza location, there is no operational advantage to a split plaza. In fact there are several operational disadvantages to a split plaza:

- A split plaza could double the required number of supervisors;
- A split plaza would increase the number of toll attendants because they would no longer be able to switch between the northbound and southbound directions to accommodate peak traffic flows;
- A split plaza would require two sets of utilities;
- A split plaza would require two fully equipped support buildings;
- A split plaza would require up to four turnarounds for winter maintenance, whereas a single plaza would require up to two; and
- In addition to the operations and maintenance disadvantages, construction of a split toll plaza at two locations would cost more than a single plaza.

Therefore, further consideration of a split plaza at the existing or a new location would only occur if there were no suitable locations that would accommodate a single plaza.

B. One Way Tolling

The Maine Turnpike Authority studied the concept of collecting tolls at York in only one direction in 2005. One-way tolling charges twice the one-way fare in one direction, while making the other direction toll-free. Typically, the concept of one-way tolling is used at bridges and tunnels to capture the high traffic volumes associated with peak commuting hours. The concept of one-way tolling in this area came to the forefront in August 2003, when New Hampshire's Governor authorized the New Hampshire DOT to conduct a one-way tolling experiment at the I-95 Hampton Toll Plaza. One-way tolling trials were conducted in the late summer/fall of 2003 and again during the summer of 2004. However, New Hampshire has discontinued these trials and has no plans to convert Hampton Toll Plaza to one-way tolling.

The complete One-Way Tolling Feasibility Study can be found in Appendix D. The Maine Turnpike Authority voted to cease further consideration of a one-way toll at the York Plaza based on the following findings.

- *Local Diversion/Traffic Impacts.* The average rate of diversion resulting from implementing one-way tolling is anticipated to be 11.7% or roughly 5,400 vehicles for an average day in 2007 shifting to local roads. (Present diversion rate is 2% - 3%, as documented in the recent 2007 York Toll Diversion Study.)
- *Loss in Revenue.* Implementation of one-way tolling is anticipated to result in a net revenue loss of approximately $2.0 million dollars per year.
- *Toll Opportunity.* Doubling the toll at York in one direction may limit the ability to effectively increase toll rates in the future. In addition to doubling the toll in one direction,

any future toll increase would also need to be doubled and added to that toll. For example, a 25¢ increase in each direction would be more acceptable than a 50¢ increase in one direction. Traffic diverting the plaza in one direction to avoid the 50¢ increase could be more appealing than diverting the plaza in both directions to avoid the 25¢ increase for each direction. Similarly, no tolls in one direction may cause an 'attraction' to some vehicles for that direction of travel. A downside to this is these vehicles are not paying for their share of the upkeep.

C. All Electronic Tolling

In 2006, the Maine Turnpike Authority voted and approved the concept that the replacement York Toll Plaza would be built incorporating highway speed toll lanes, also known as Open Road Tolling (ORT) for E-ZPass customers at the new plaza. ORT would allow E-ZPass users to pay their tolls electronically while traveling at normal highway speed (55-65 mph) by simply passing beneath sensors on the mainline of the highway. Cash paying customers would briefly exit the mainline of the highway to pay their tolls at a more traditional plaza. This decision was made after consideration of the potential benefits of ORT such as: improved safety, congestion relief, customer convenience, and capital cost savings, all weighed against some of the business costs associated with probable revenue leakage.

As part of the alternatives analysis related to the York Toll Plaza project, HNTB was commissioned to review the potential for All-Electronic Tolling (AET), also known as cashless and previously referred to as full Open Road Tolling. AET would eliminate all cash toll payments at the toll plaza. With AET, E-ZPass customers would continue to pay their tolls electronically, but at normal highway speeds. Tolls would be collected from non-E-ZPass users by capturing their license plates on video, using their license plate number to either match pre-paid license plate accounts or discover their mailing address and sending them a bill.

Since 2006, a small number of agencies have begun conversion or have set policies that state future installations will incorporate AET. A few more agencies have initiated extensive formal studies to evaluate the applicability of AET. Many other agencies are mainly waiting to see the results of these agencies' activities before conducting extensive assessments. It should be noted that although some agencies have committed to convert to AET, at the time of this review, no existing cash based agency has completed a total conversion to AET and therefore there is little to no available comparable information to assist other agencies with forecasting the applicability of AET for their own roadways. Furthermore, there is very little standardization of reporting of the business impacts of AET and much reluctance on the part of those agencies involved in AET to release documented and audited results of the business impacts. Considering the lack of information plus the broad range of local factors and the unique characteristics of each facility, a decision regarding use of AET cannot be based solely on what other agencies may be doing, but must consider the individual agency case in order to appropriately determine feasibility.

While the potential benefits of AET can be documented, the significant risk associated with the uncertainty behind the business costs of AET make the option of AET for the York Toll Plaza replacement unfeasible. The following points elaborate on this risk:

1. The traffic mix of the Maine Turnpike is such that a significant number of patrons are non E-ZPass users and from out of state or out of country. The extent to which these customers would not migrate to E-ZPass and/or pre-paid video products is uncertain and these factors greatly influence business costs such as operating costs and revenue losses. Current AET facilities

typically have a high percentage of E-ZPass or similar accounts and have a high percentage of commuters and frequent resident users.

2. The current lack of industry data for similar roadways already implementing AET limits the ability to compare potential MTA outcomes and makes forecasting difficult to calibrate.
3. The uncertainty relative to how customers will respond to the changes in payment methods and the uncertainty relative to revenue recovery potential for violations pose too broad a range of potential outcomes. These include potentially significant risks to net revenue required to operate the roadway.
4. Difficulties attributed to the duplicate license plate numbering system and the ability of video systems to recognize the myriad of different plate types present minor operational challenges.
5. The resulting toll and fee structure for an AET system could result in actual or perceived unfair distribution of payments between Maine and out of state customers. This results when out of state violators do not pay because there is no significant enforcement capability. The structure is then set up or perceived to be set up to offset these losses by in-state paying patrons further compelled to pay because of threat of vehicle registration hold.
6. The ability to recover toll revenue from as much as 26 percent of the total traffic at York due to the lack of interstate legislation that would compel payment from out of state patrons weighs significantly in this risk. While in-state collection is backed by laws and enforcement opportunity, out-of-state and out-of-country collection lacks this enforcement and has perplexed toll agencies for over 10 years; and we believe that this issue will not be cured in the next 20 years.
7. Revenue risk also may result in non-compliance with bond covenants and debt service requirements.
8. The MTA may be limited in its ability to allow for certain types of post payment options typical for AET systems. For example, post payments of video tolls by customers are considered an extension of credit and any restrictions on how the MTA operates under these situations would need to be considered.
9. The cost of producing and mailing a bill for say a $2 dollar toll will also need to be considered. Collection of this toll would include for example, computer processing of a license plate number, generation of license plate reports by State, request for registration name and address from State, generation of an invoice, envelope labeling, postage, mail opening, documentation of toll being paid, removal of open invoice from records, etc. This does not include any time or effort to respond to emails or phone calls explaining the invoice or any follow-up invoice.

Greater certainty around the potential impacts to toll operating costs and revenue impacts resulting from AET would be necessary to determine if the range of risks can potentially be mitigated to an acceptable level or if the risks are insurmountable. Based on the cost analyses conducted, the range of risk to the MTA resulting from uncertainties related to AET over 20 years could be as high as $400 million. Therefore, given the revenue risk associated with the stated uncertainties, HNTB does not recommend AET for the York Toll Plaza at this point in time.

The complete All Electronic Tolling Report can be seen in Appendix E.

D. Open Road Tolling

Following is a brief summary of highway speed tolling, now known as open road tolling. To keep this summary consistent with the full report contained as an appendix, the phrase highway speed tolling or highway speed dedicated ETC lanes will be used instead of the currently recognized term of open road tolling or open road lanes. Following this summary, the remainder of the report will utilize the term open road tolling. The Maine Turnpike Authority has studied various means of collecting tolls including two modes of electronic toll collection: (a) purely slow speed dedicated electronic toll collection (ETC) lanes, or (b) highway speed dedicated ETC lanes. The current York plaza, as well as many other MTA toll plazas, utilizes slow speed (10 mph) dedicated ETC lanes. The industry trend in the design of many new or replacement toll plazas incorporates highway speed (65 mph or similar) dedicated ETC lanes into the plaza design to take advantage of significant benefits associated with these designs. One factor in evaluating highway speed dedicated ETC lanes is the makeup of the vehicle stream. The southern portion of the Turnpike currently has a high enough percentage of E-ZPass customers, including a high percentage of heavy truck traffic, to be conducive to this tolling technology.

The benefits associated with the highway speed dedicated lanes specifically include:

- A highway speed toll plaza offers safety improvements due to the separation of non-stop from stopping traffic and reduction of the workers' exposure to fast moving traffic in the plaza area.
- Highway speed configurations can help to relieve congestion. Operational efficiencies from highway speed lanes present opportunity to more cost effectively manage traffic congestion at tolling points.
- Customer convenience increases with highway speed options. All ETC customers have the opportunity to travel at the posted highway speed through the plaza rather than the current 10 mph speed limit.
- Highway speed lanes have the potential to attract ETC customers through the expanded benefits offered by the new option. A high ETC customer base leads to a larger population of users making the most of the benefits of ETC and improves operations for the road operator.
- The benefits of highway speed lanes have the potential to attract cars from local roadways.
- Highway speed toll plaza configurations are potentially more cost effective. Preliminary cost estimates show that the cost of more complex toll equipment and infrastructure for a highway speed plaza is more than offset by the savings of not building additional manual toll lanes to handle the same throughput capacity as the highway speed toll lanes.
- The trend in the industry is to construct highway speed facilities. It is more cost effective and less disruptive to customers to build a new plaza with highway speed toll lanes than to renovate a plaza in the future to accommodate highway speed toll collection lanes.

However, in making the decision to incorporate highway speed lanes at future toll plazas, the Maine Turnpike Authority considered the following potential increases to business costs:

- Highway speed lanes will increase operational costs for back office and the customer service center due to initial and ongoing customer education, additional post processing of transactions and increased violation processing.
- Non-payment events at the plaza will likely increase due to patron unfamiliarity with the system and increased scofflaws. Other toll agencies who have installed highway speed lanes have experienced increases after conversion that lessens over time as a result of familiarization and enforcement.

In summary, the projected benefits outweigh the modest increase in business costs associated with highway speed tolling. The full Dedicated Electronic Toll Collection Lane Design Recommendations report can be found in Appendix F.

In light of these potential costs and benefits, and in comparison to other tolling technologies and strategies, the Maine Turnpike Authority made the decision to incorporate dedicated highway speed ETC lanes into the design of the future mainline toll plazas.

SECTION 5 - EXISTING YORK TOLL PLAZA SAFETY AND CAPACITY

This section documents the existing safety and capacity of the York Toll Plaza. This section also seeks to correlate the existing safety and capacity levels to overall plaza efficiency and operation and the fact that the existing York Toll Plaza does not meet several criteria relative to plaza design and layout. It is important to recognize that the existing York Toll Plaza was built with an expected life of 10-12 years. At thirty years beyond this intended life, the plaza faces major problems in terms of safety, efficiency and cost.

A. Safety

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 Link System. This system assigns a four-digit node number to each intersection, major bridge, railroad crossing, and crossing of town, county or urban compact lines. The segments of road that connect the nodes are referred to as links. As crash reports are received by MaineDOT, the information is assigned to the corresponding link or node at which they occurred. Appendix G provides crash data for the vicinity of the York Toll Plaza.

If a particular link or node meets certain criteria, then the MaineDOT classifies it as a High-Crash Location (HCL). These criteria are:

- The link or node must have eight or more reported crashes over the past three years <u>and</u> the link or node must have a "critical rate factor" (CRF) over 1.00. (The critical rate factor is a ratio of the crash rate at a particular link or node divided by the statewide crash rate average for a similar type of facility. The term "rate" is calculated by number of crashes divided by the number of millions of annual entering vehicles).

HNTB gathered recent MaineDOT crash data at and in proximity to the existing York Toll Plaza. Data was gathered for two, three-year time periods. The first was January 2003 through December 2005. The second was January 2004 through December 2006. Two sets of crash data were reviewed as the more recent crash data (04-06) became available during the course of preparing this report.

The following table provides a summary of MaineDOT crash data at the York Toll Plaza.

Table 1 Crash Data at York Toll Plaza

Direction	Years	Location	Critical Rate Factor (CRF)	High Crash Location (Y/N)	State Ranking
Northbound	2003-2005	Approach	4.45	**Yes**	**11**
		At Toll Plaza	<1.0	No	NA
		Departure	<1.0	No	NA
	2004-2006	Approach	3.53	**Yes**	**17**
		At Toll Plaza	<1.0	No	NA
		Departure	<1.0	No	NA
Southbound	2003-2005	Approach	<1.0	No	NA
		At Toll Plaza	<1.0	No	NA
		Departure	<1.0	No	NA
	2004-2006	Approach	<1.0	No	NA
		At Toll Plaza	<1.0	No	NA
		Departure	1.28	**Yes**	**320**

Summary of the crash data reveals that the northbound approach to the York Toll Plaza is currently a HCL. The close proximity of the NB on-ramp for Chases Pond Road to the plaza contributes to unsafe merging of two streams of traffic as they are approaching a toll plaza. In fact, MaineDOT has ranked this NB approach as the 11th and 17th highest locations for the periods 2003-2005 and 2004-2006 respectively out of over 900 locations Statewide. It is worth noting that the toll plaza is not equipped with safety bumpers on the departing side of the toll lanes. This is particularly concerning since the middle lanes can be used in either direction and there is no guardrail or other physical separation to prevent errant vehicles from crossing into the opposite toll lanes and striking a toll booth from this unprotected side. Additionally, a HCL exists at the southbound departure where weaving occurs for traffic either taking the SB off-ramp to Chases Pond Road or continuing on the mainline. The locations can be seen on the aerial photo in Figure 2.

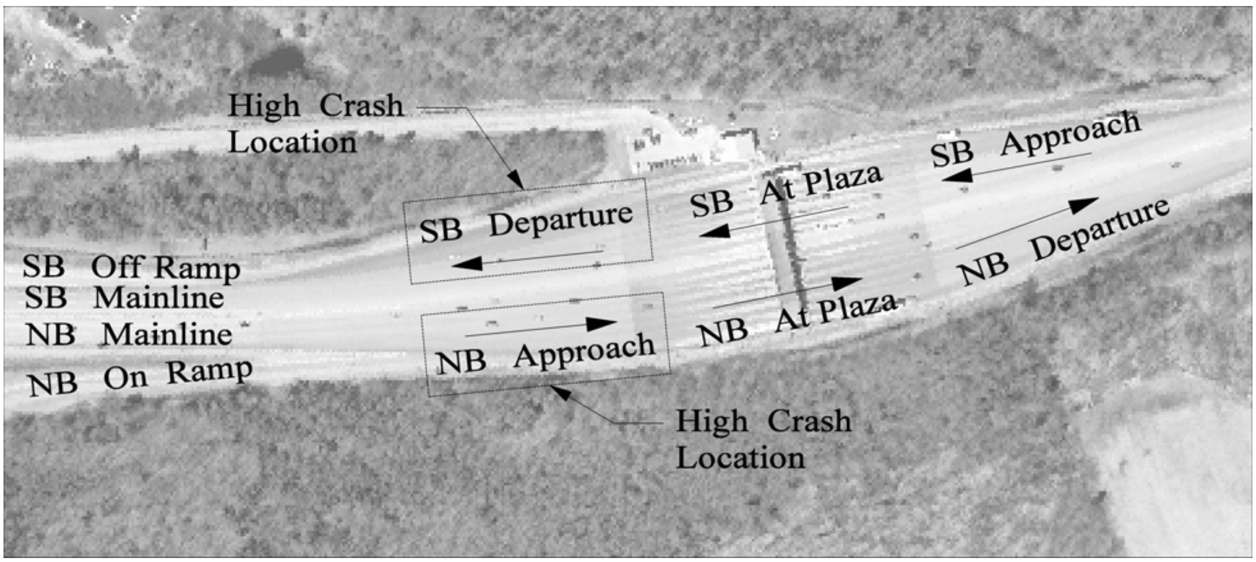


Figure 2 Map of High Crash Locations

A review of these HCL crash records reveals the majority of the crashes occurring were sideswipes/rear end. This is consistent with expectations given the close proximity of both the NB on and SB off-ramps to the York Toll Plaza and the inherent weaving and lane changing. Remedy for sideswipe type crashes would be to either separate ramp traffic from toll plaza/mainline traffic or to relocate the toll plaza farther away from the interchange. It is also worthy to note that as the E-ZPass customer base increases there will be an increase in the weaving and lane changes as these customers access the dedicated E-ZPass lanes. Along with this increase in weaving and lane change maneuvers comes an increased risk of additional and more serious crashes.

B. Capacity

The operations of the existing York toll plaza from 2009 to the design year of 2030 have been evaluated by comparing both the projected absolute peak hour and the projected 30th highest peak hour traffic volumes by direction with the capacity of the lane configuration. Capacity of the toll plaza varies based on number of lanes, mixture of cash and E-ZPass patrons, and processing rates during peak hour operations. The evaluation below uses an updated lane processing rate and cash/E-ZPass patron mix based on a review of 2008 lane data as compared to previous analyses[1] done using more historic data. See Section 6 for more details on the processing rates. Northbound and southbound were analyzed separately.

1. Northbound Analysis

Experience has shown that queuing can be significant when a plaza exceeds 90% of its capacity. Based on the updated analysis, the northbound plaza does not exceed the 90% capacity level throughout the design horizon of the plaza for both absolute peak and 30th highest peak hours. This is shown in Table 2 and Table 3. Therefore, the NB plaza as currently configured is not likely to experience significant design hour queuing. However, even moderate queuing may at times restrict access to certain lanes and impact overall toll plaza operation. This has been observed in E-ZPass lanes where cash lane queues may block access to these lanes during peak periods due to existing plaza approach geometry.

In order to remain below capacity thresholds, it is critical to periodically alter the configuration of the plaza to reflect increasing traffic volumes overall. Between 2009 and 2030, it is anticipated the volume of E-ZPass customers will more than double while the volume of cash-paying volumes will decline by about 30%. Therefore, over time, cash lanes need to be converted to E-ZPass lanes in order to adequately serve the growing volume of E-ZPass patrons. This conversion is noted in Table 2.

In reviewing the data in Table 2, it is important to understand the following assumptions about the manner in which the table was developed:

- The table assumes that 9 lanes are available to serve peak-hour traffic.
- All E-ZPass lanes are slow-speed lanes (posted speed of 10 mph) with a capacity of about 1,100 vehicles per hour (vph).
- Cash lanes, while allowing E-ZPass transactions, operate with the following average capacities:
  - Prior to 2013, while the cash toll is $2.00, the capacity is estimated at **388 vph**.
  - From 2013 onward (after an assumed toll increase), the capacity is reduced to approximately **320 vph**.
- The analysis does not identify times in which lanes could be eliminated. Rather, it identifies times in which lanes may be converted from cash to E-ZPass.
- A new lane is converted from cash to E-ZPass as soon as the existing E-ZPass lanes are filled to capacity. For example, once the E-ZPass volumes exceed 2,200 vph, a 3rd E-ZPass lane is added, since two dedicated E-ZPass lanes can handle a maximum of 2,200 vph (assuming a per-lane capacity of 1,100 vph). Similarly, a 4th E-ZPass lane is added (and a cash lane removed) once the E-ZPass volumes exceed 3,300 vph. One caveat: the lanes are only converted **if** the remaining number of cash lanes is sufficient to meet the demand for cash-paying patrons.
- The table illustrates how the capacity of the plaza varies, based on (a) total volumes, (b) the mix of traffic (i.e. cash vs. E-ZPass), and (c) the configuration of the plaza (i.e. number of cash and E-ZPass lanes). It does not necessarily reflect how the plaza was

[1] As compared to previous analyses conducted in the York Toll Replacement Technical Report In Response to Maine LD534 by HNTB, February 2008

operated in the past, and it is not necessarily a prescription for how the plaza should be operated in the future.

Table 2 Northbound Capacity of Existing Plaza, 2009-2030 – Absolute Peak Hour

Friday - Northbound						
Year	**Absolute Peak Volume**		Lane Configuration			% Capacity
	Cash	E-ZPass	Cash	Tandems	E-ZPass	Toll Plaza
2009	1,686	2,066	7	0	2	62.2%
2010	1,654	2,162	7	0	2	61.0%
2011	1,622	2,259	6	0	3	69.8%
2012	1,591	2,356	6	0	3	68.4%
2013	1,559	2,455	6	0	3	81.2%
2014	1,528	2,554	6	0	3	79.6%
2015	1,497	2,654	6	0	3	78.0%
2016	1,467	2,754	6	0	3	76.5%
2017	1,438	2,856	6	0	3	74.9%
2018	1,409	2,958	6	0	3	73.4%
2019	1,382	3,059	6	0	3	72.0%
2020	1,353	3,163	6	0	3	70.5%
2021	1,327	3,266	6	0	3	69.1%
2022	1,301	3,370	5	0	4	81.4%
2023	1,276	3,475	5	0	4	79.8%
2024	1,252	3,579	5	0	4	78.3%
2025	1,229	3,685	5	0	4	76.8%
2026	1,205	3,792	5	0	4	75.3%
2027	1,179	3,903	5	0	4	73.7%
2028	1,153	4,016	5	0	4	72.0%
2029	1,131	4,125	5	0	4	70.7%
2030	1,107	4,238	5	0	4	69.2%

Table 3 provides the same analysis at Table 2, but it is based on the volumes from the 30th highest hour. As the table indicates, in the NB direction, the plaza typically operates at 55-65% of its capacity during the 30th highest hour.

Table 3 Northbound Capacity of Existing Plaza - 30th Highest Peak Hour

Friday - Northbound						
Year	30th High Volume		Lane Configuration			% Capacity
	Cash	E-ZPass	Cash	Tandems	E-ZPass	Toll Plaza
2009	1,531	1,876	7	0	2	56.5%
2010	1,502	1,964	7	0	2	55.4%
2011	1,473	2,052	7	0	2	54.3%
2012	1,445	2,140	7	0	2	53.3%
2013	1,416	2,230	6	0	3	73.8%
2014	1,388	2,319	6	0	3	72.3%
2015	1,360	2,411	6	0	3	70.9%
2016	1,333	2,502	6	0	3	69.4%
2017	1,306	2,594	6	0	3	68.0%
2018	1,280	2,687	6	0	3	66.6%
2019	1,255	2,779	6	0	3	65.4%
2020	1,229	2,873	6	0	3	64.0%
2021	1,205	2,966	6	0	3	62.8%
2022	1,182	3,061	6	0	3	61.6%
2023	1,159	3,157	6	0	3	60.4%
2024	1,137	3,251	6	0	3	59.2%
2025	1,116	3,347	5	0	4	69.8%
2026	1,094	3,444	5	0	4	68.4%
2027	1,071	3,545	5	0	4	66.9%
2028	1,047	3,647	5	0	4	65.4%
2029	1,027	3,747	5	0	4	64.2%
2030	1,006	3,850	5	0	4	62.9%

2. Southbound Analysis

The updated analysis of the southbound plaza indicates that, during the absolute peak hour, the plaza will operate in excess of the 90% capacity level for every year from 2013 through 2030. As a result, significant queues are likely to occur in this direction during these hours. This is a critical point due to the existing geometry approaching the toll plaza. Queues from the manual lanes may block vehicles from accessing the right most lanes of the toll plaza and impact overall toll plaza operation.

During the 30th highest hour, the southbound plaza only occasionally reaches the 90% capacity level. At no point after 2009 does the capacity exceed 92%. Results of this analysis are shown in Table 4 and Table 5. The assumptions noted for Table 2 apply to these tables also.

In order to remain below capacity thresholds, it is critical to periodically alter the configuration of the plaza. Between 2007 and 2018, it is anticipated the E-ZPass volumes will increase by 125%, while cash-paying volumes decline by about 25%. Therefore, over time, cash lanes need to be converted to E-ZPass lanes in order to adequately serve the rapidly growing volume of E-ZPass patrons. This conversion is noted in the table below.

Table 4 Southbound Capacity of Existing Plaza - Absolute Peak Hour

Sunday - Southbound						
Year	**Absolute Peak Volume**		Lane Configuration			% Capacity
	Cash	E-ZPass	Cash	Tandems	E-ZPass	
2009	2,183	1,873	7	0	2	80.5%
2010	2,151	1,973	7	0	2	79.3%
2011	2,119	2,076	7	0	2	78.2%
2012	2,087	2,179	7	0	2	77.0%
2013	2,055	2,283	7	0	2	92.8%
2014	2,024	2,388	7	0	2	92.6%
2015	1,993	2,494	7	0	2	92.6%
2016	1,962	2,601	7	0	2	92.4%
2017	1,933	2,708	7	0	2	92.4%
2018	1,903	2,816	6	0	3	99.2%
2019	1,875	2,925	6	0	3	97.7%
2020	1,846	3,035	6	0	3	96.3%
2021	1,819	3,145	6	0	3	94.8%
2022	1,793	3,256	6	0	3	93.4%
2023	1,767	3,368	6	0	3	93.0%
2024	1,743	3,479	6	0	3	93.4%
2025	1,719	3,591	6	0	3	93.7%
2026	1,694	3,707	6	0	3	94.1%
2027	1,668	3,825	6	0	3	94.4%
2028	1,641	3,945	6	0	3	94.7%
2029	1,612	4,069	6	0	3	95.1%
2030	1,582	4,196	5	0	4	98.9%

Table 5 Southbound Capacity of Existing Plaza - 30th Highest Peak Hour

Sunday - Southbound						
Year	30th Highest Volume		Lane Configuration			% Capacity
	Cash	E-ZPass	Cash	Tandems	E-ZPass	
2009	1,922	1,649	7	0	2	94.7%
2010	1,894	1,738	7	0	2	91.2%
2011	1,866	1,828	7	0	2	88.1%
2012	1,838	1,919	7	0	2	85.3%
2013	1,810	2,010	7	0	2	82.7%
2014	1,782	2,102	7	0	2	80.3%
2015	1,755	2,196	7	0	2	78.4%
2016	1,728	2,290	6	0	3	90.0%
2017	1,702	2,384	6	0	3	88.7%
2018	1,676	2,480	6	0	3	87.3%
2019	1,651	2,576	6	0	3	86.1%
2020	1,626	2,673	6	0	3	84.7%
2021	1,602	2,770	6	0	3	83.5%
2022	1,579	2,867	6	0	3	82.2%
2023	1,556	2,966	6	0	3	81.1%
2024	1,535	3,063	6	0	3	80.0%
2025	1,514	3,162	6	0	3	78.8%
2026	1,492	3,264	6	0	3	77.7%
2027	1,469	3,368	5	0	4	91.8%
2028	1,445	3,475	5	0	4	90.4%
2029	1,419	3,583	5	0	4	88.7%
2030	1,393	3,695	5	0	4	87.1%

3. Evaluation of Existing Measures to Improve Operation and Increase Capacity

Given the historic capacity and operational constraints of the existing York Toll Plaza, changing directional demand, and varying processing rates due to adjusted toll rates, the three middle lanes have been made reversible; i.e., the lanes can be operated for either northbound or southbound traffic depending on need. (Note: these lanes are always on the left for approaching traffic.) This introduces safety concerns and creates a situation that is contrary to the industry standard of locating dedicated ETC lanes on the far left side of available toll lanes; e.g., on the Maine Turnpike, currently one or more (reversible) cash lanes may be to the left of a dedicated ETC lane. As a result, in certain reversible lane configurations, slow speed ETC patrons now must travel between stopped traffic on both sides of them.

In order to marginally increase the capacity of the plaza, the Authority (since 2001) has implemented tandem booths during peak periods in the summer. This was intended to be a temporary measure as this is confusing for the Turnpike patron due to their unfamiliarity with the practice and only results in an additional capacity of 30%, or approximately 100 vehicles per hour. The use of tandem booths requires a flagger to direct drivers into the lane and two toll collectors per lane. In addition, their use presents accountability concerns relative to toll collector audits as temporary booths do not contain standard lane computers for accounting and payment recording. Therefore, due to safety concerns of the flagger operating in the toll lanes, patron confusion, and accountability concerns, the extensive long-term use of tandem booths to address capacity needs is not desirable.

In summary; the need for reversible lanes and tandem booths, as presently utilized, will likely decrease over time due to the growth in E-ZPass usage and subsequent decrease in cash paying customers. Regardless, HNTB recommends the elimination of reversible lanes as they create safety concerns for both driver and toll staff. With respect to tandem booth, HNTB also recommends the elimination of their usage as they too create safety concerns for both driver and toll staff and provide little additional capacity.

SECTION 6 – PROPOSED TOLL PLAZA SIZING

Given the public interest in this study, the plaza sizing task has progressed well beyond the conceptual planning level of the rest of the report. As the York Toll Plaza Study has developed, there have been numerous conditions and sets of data that have shaped intermediate findings. Not the least of which is fluctuating and recently declining traffic volumes and a more critical look at toll plaza processing rates. Earlier planning level results of plaza sizing have therefore been updated to reflect these conditions. Following are details and a summary of the plaza sizing exercise.

A toll plaza should have adequate capacity to safely and effectively process the anticipated traffic without excessive queues and delays. However, unlike roadways and intersections which have national standards addressing capacity, no such standards exist for toll plazas. Each toll agency typically has its own goal as to adequate capacity. Historically, the Maine Turnpike Authority's goal has been to have a toll plaza meet two objectives throughout its design horizon of 20 years. One objective is to keep average delays during the absolute peak hours to approximately one minute or less. Another objective is to keep average queue lengths during the peak hours to 300 feet or less. These goals, which are intended to maximize patron convenience and safety, can also result in conservatively designed toll plazas, i.e. one with too long of a storage area or too many lanes.

HNTB recommends that the size of a proposed toll plaza, whether a conventional or open road design, be based on the 30th highest hour traffic volumes in each direction, i.e. the volume of traffic present in a single hour that is exceeded only 29 times in a typical year. This recommendation is based upon HNTB's experience with toll plaza design and sizing in other locations around the country and balancing the operational and safety requirements as expressed by the Maine Turnpike Authority. Any toll plaza should be adequately sized to provide a reasonable level of operation (moderate queues and delays) for patrons, but at the same time account for real-life circumstances such as lane equipment failures and vehicle incidents which may block or close toll lanes for an extended period of time. Toll plaza sizing and layout should also take into consideration absolute peak volume operating conditions such that vehicle queues do not impact mainline traffic and create an undesirable safety situation. By using the 30th highest hour traffic volumes by direction, an appropriately sized plaza that best balances the needs of both patron convenience and Maine Turnpike operation can be achieved. While using the 30th high hour as the standard, HNTB also recommends analyzing traffic conditions during the absolute peak in order to ensure that toll plaza backups do not create an unsafe condition (such as backing up to the mainline).

The process of developing an appropriately-sized toll plaza for the Maine Turnpike is described below:

Step 1 – Develop Design-Hour Volumes (DHV's). HNTB utilized the 30th highest hour traffic volumes by direction to determine the size of this mainline toll plaza. However, analysis was conducted for the absolute peak hour conditions to ensure that traffic will not back onto the mainline and create a safety issue or cause unreasonable delays.

Step 2 – Develop traffic projections. In order to evaluate toll plaza operations throughout the design horizon of the toll plaza, it is necessary to estimate the extent to which design-hour traffic will grow over time. At the York Toll Plaza, historical data suggests that design-hour traffic growth will average approximately **1.66**% per year over the design life of the facility. Over the past two years, peak-hour traffic at the York toll plaza has actually declined. However, over a design horizon of a project such as this, a 1.66% annual growth rate provides a reasonable estimate of long-term growth.

Step 3 – Identify payment types. In order to properly analyze a toll plaza, it is critical to understand the peak-hour split between cash-paying patrons and E-ZPass patrons. Generally speaking, the efficiency of a given toll plaza increases as the percentage of E-ZPass patrons increases. In 2008, during peak summer weekends, approximately 45% of the peak-hour patrons at the York Toll Plaza had an E-ZPass[2]. It is also necessary to project how the share of E-ZPass patrons will change over time. Historic data and current industry trends suggests that the share of E-ZPass patrons will grow by approximately 3% annually in the next few years and thereafter the growth will slow over time to about 1% per year. At the York Toll Plaza, peak-hour usage of electronic toll collection has grown from about 10% in 1997 to roughly 45% in 2008.

The end result of Steps 1 through 3 is an estimate of the number of peak-hour patrons (both cash and E-ZPass) passing through the toll plaza during each year of the toll plaza's design horizon. These volumes (for both 30th high hour and the absolute hour) were summarized earlier in Table 2 through Table 5.

Step 4 – Perform initial plaza sizing and configuration. Based on the volumes, projection and payment types developed in Steps 1, 2, 3 it is possible to develop an initial estimate of the appropriate toll plaza size. At the York Toll Plaza, the following operating standards were used to determine plaza size:

- Patrons with an E-ZPass proceed through a conventional toll lane at a rate of 1,100 vehicles per hour (vph).

- Patrons with an E-ZPass proceed through a open road toll lane at a rate of 1,800 vph.

- The processing rate for patrons paying cash depends on (a) the toll charge itself, and (b) whether the lane is operating as a conventional lane or a tandem lane.
    - **$2.00 Toll –** Conventional = 388 vph; Tandem = 500 vph
    - **Other Toll –** Conventional = 320 vph; Tandem = 415 vph[3].

The end result of this step is to identify the total number of lanes (both cash and dedicated E-ZPass) required to handle the peak-hour volumes

[2] The actual share of E-ZPass varied by day and by direction. Friday traffic in the NB direction exhibited the highest share of E-ZPass usage (52%). By comparison, Sunday traffic in the SB direction registered about 43% E-ZPass usage. In general, time periods that serve commuting patrons (such as Friday afternoons) have a higher share of E-ZPass usage.
[3] Previous analysis has indicated a conventional toll lane processing rate of 289 vph. The rates cited in the "Other Toll" category are derived from observations at the York Toll Plaza during the time in which a $1.75 toll was charged.

Step 5 – Test via simulation. After estimating the appropriate size of the toll plaza, the performance of the proposed size is simulated via use of the VISSIM computer model. VISSIM is a driver behavior-based simulation program that is used to simulate a wide variety of traffic operations, from urban arterials to freeway interchanges to complex toll facilities. The simulation serves two important purposes:

- Provides a visual illustration of the performance of the plaza, providing qualitative feedback concerning the performance of the plaza; and,

- Provides information on queues and delays at the plaza, providing quantitative feedback as well.

The following table summarizes the required lane configuration for plaza sizing for each of the nine (9) options that are considered in Section 7 Rehabilitate/Reconstruct Feasibility Analysis. A complete traffic forecast and model was developed for each option including optimizing the way each lane operates. Traffic forecasting and model creation was completed according to the above-described procedure. The exceptions are the No Build and Infrastructure Upgrade scenarios (Options 1 and 2) which both continue to operate with the same number of lanes as they do today. Each option was evaluated and optimized for existing, intermediate and design year conditions, including volumes, ETC usage and heavy vehicle parameters. The operational results of modeling are contained in Table 7 below. Expected queues and vehicle delays for the existing plaza configuration as well as for the various options being considered are listed for comparison.

It is important to understand what these values represent. Traffic queues reported for the existing condition are a result of all cash and E-ZPass customers mixed at a cash plaza that has only slow speed E-ZPass lanes which sometimes become blocked due to long cash lane queues. This queue occupies the approach area and the mainline. Traffic queues reported for open road alternatives are a result of essentially only cash customers in cash only lanes. Cash only lane operation is much more predictable than mixed cash and E-ZPass and so plaza sizing can be set more precisely. Alternatives with cash only lanes have been sized to minimize the number of lanes and resulting impacts, while accepting sometimes longer queues than a mixed cash and E-ZPass alternative. It is also important to note that a queue in a cash only lane will not be allowed to form back into mainline near free flowing traffic.

Table 6 – Toll Plaza Sizing

Opt#	Location	Description	Year	NB Conventional[2]	NB Ramp	NB ORT	Reversible[1]	SB Conventional[2]	SB Ramp	SB ORT	Total Lanes	Total Width (ft)[3]
1	Existing Site	No Build (Maintenance Only)	2013	7	0	0	3	7	0	0	17	295
			2030	*7*	*0*	*0*	*3*	*7*	*0*	*0*		
2	Existing Site	Infrastructure Upgrade Only	2013	7	0	0	3	7	0	0	17	295
			2030	*7*	*0*	*0*	*3*	*7*	*0*	*0*		
3	Existing Site	Upgrade w/ Conventional Tolling	2013	6	2	0	2	7	2	0	19	399
			2030	*6*	*2*	*0*	*2*	*7*	*2*	*0*		
4a	Existing Site	Upgrade w/ ORT and ramp tolls	2013	5	2	2	0	6	2	2	19	439
			2030	*4*	*2*	*3*	*0*	*5*	*2*	*3*		
4b	Existing Site	Upgrade w/ ORT (no ramp tolls)	2013	5	0	2	0	6	0	2	15	335
			2030	*4*	*0*	*3*	*0*	*5*	*0*	*3*		
6	Existing Site	Upgrade Existing Site w/ ORT, East Side Mainline Realignment, and Relocated Interchange	2013	5	0	2	0	6	0	2	15	335
			2030	*4*	*0*	*3*	*0*	*5*	*0*	*3*		
7	Existing Site	Relocate Plaza to West w/ ORT, West Side Mainline Realignment, and Relocated Interchange	2013	5	0	2	0	6	0	2	15	335
			2030	*4*	*0*	*3*	*0*	*5*	*0*	*3*		
8	Existing Site	Relocated Plaza to South w/ ORT and Reconfigured Interchange (with ramp tolls)	2013	5	2	2	0	6	2	2	19	382[4]
			2030	*4*	*2*	*3*	*0*	*5*	*2*	*3*		
9	Existing Site	Relocated Plaza to South w/ ORT and Relocated Interchange (with ramp tolls)	2013	5	2	2	0	6	2	2	19	435
			2030	*4*	*2*	*3*	*0*	*5*	*2*	*3*		
6, & 7 (alt)	Same as 6, & 7	Same config. as 6, & 7, except that conventional plaza has been reduced by 1 lane in each direction	2013	4[5]	0	2	0	5	0	2	13	297
			2030	*3*[5]	*0*	*3*	*0*	*4*	*0*	*3*		
8 & 9 (alt)	Same as 8 & 9	Same config. as 8 & 9, except that conventional plaza has been reduced by 1 lane in each direction	2013	4[5]	2	2	0	5	2	2	17	344-397
			2030	*3*[5]	*2*	*3*	*0*	*4*	*2*	*3*		

[1] Reversible lanes are capable of being operated as either northbound or southbound.
[2] Conventional lane allows cash and slow speed electronic toll collection (E-ZPass)
[3] Total width is pavement width at center of plaza.
[4] Does not include separate 58’ wide plaza for NB on ramp
[5] The reduction of one conventional lane is achieved by operating 3 tandem lanes

Table 7 – Traffic Queue and Delay Summary – 30th Highest Hour

		Opt 1&2		Opt 3		Opt 4a		Opt 4b		Opt 6-7		Opt 6-7 (alt)		Opt 8-9		Opt 8-9 (alt)	
		Existing Site - No-Build / Infrastructure Upgrade		Existing Site Upgrade with Conventional Tolling		Existing Site Upgrade with Highway Speed Tolling & Separate 2-In Ramp Plazas		Existing Site Upgrade with Highway Speed Tolling (no neparate ramp plazas)		Various Locations with ORT		Various Locations with ORT and Reduced Plaza Size		Various Locations with ORT and Ramp Toll Plazas		Various Locations with ORT, Ramp Toll Plazas, and Reduced Plaza Size	
	Year	**2013**	**2030**	**2013**	**2030**	**2013**	**2030**	**2013**	**2030**	**2013**	**2030**	**2013**	**2030**	**2013**	**2030**	**2013**	**2030**
NB 30th High Hour (Friday PM)	**NB Queue (ft)**																
	average	221	119	183	145	146	106	171	141	125	127	176	136	109	116	174	119
	max	563	333	373	334	202	144	237	251	187	174	254	217	155	163	244	175
	NB Delay (sec)																
	cash	35.3	36.2	35.5	27.9	32.1	21.8	33.4	33.4	29.3	25.9	26.6	15.8	25.2	30.9	26.4	14.0
	E-Zpass	17.5	15.1	12.8	17.9	5.0	8.5	4.3	8.0	3.2	6.3	3.7	8.4	2.8	6.6	3.0	3.5
SB 30th High Hour (Sunday PM)	**SB Queue (ft)**																
	average	130	189	72	102	208	172	**534**	**471**	239	**318**	**350**	**345**	150	163	**340**	127
	max	386	457	284	191	293	255	651	671	301	449	417	555	86	248	535	195
	SB Delay (sec)																
	cash	29.7	50.5	27.9	45.0	50.9	45.3	125.0	133.3	57.5	80.0	65.5	94.5	34.9	51.2	60.6	25.3
	E-Zpass	10.3	27.0	12.9	24.2	1.7	4.2	5.7	9.9	2.7	5.9	3.8	7.3	1.8	3.8	3.9	3.4
NB & SB Combined 30th High Hour (Saturday AM)	**NB Queue (ft)**																
	average	178	186	167	135	150	120	186	**358**	125	221	180	**370**	108	139	184	140
	max	301	277	362	196	205	185	259	620	181	353	272	662	170	202	265	213
	NB Delay (sec)																
	cash	37.3	46.5	34.7	33.0	34.2	27.2	46.4	104.5	31.1	62.5	29.0	73.0	25.7	36.0	28.8	19.9
	E-Zpass	11.4	11.5	9.6	8.7	3.8	6.4	4.1	8.8	2.5	6.4	2.8	9.0	2.3	5.4	2.7	2.9
	SB Queue (ft)																
	average	152	131	122	123	163	141	**455**	**325**	196	239	275	182	128	137	265	131
	max	255	338	253	305	203	179	550	420	268	311	342	283	156	204	347	203
	SB Delay (sec)																
	cash	36.0	36.4	33.2	42.6	40.3	33.6	112.8	83.8	45.5	64.9	49.5	35.0	27.1	34.1	47.8	20.8
	E-Zpass	11.1	11.4	8.5	10.3	1.3	2.4	5.3	6.1	2.2	3.7	3.0	3.2	1.3	2.2	2.9	2.2

The following points of explanation are critical to properly interpreting Table 7:

- While this table provides a comparison of vehicle queues and delays for the various options, it is of utmost importance to understand each option's physical characteristics and the differences between some of the options. As an example, for 2013 NB, Option 4a and 4b have very similar average queues, 146' and 171' respectively and cash delays, 32.1 sec 33.4 sec respectively. However, there physical layout is quite different, Option 4a has 19 lanes and occupies a footprint of 439'allowing for dedicated lanes to serve the York Interchange while Option 4b has 15 lanes and occupies 335' at the plaza and requires the E-ZPass users utilizing the York Interchange to utilize the cash lanes. As any operational comparison is made, the reader should also consider the physical characteristics of the options being compared.
- VISSIM traffic simulations were run for the years 2013 and 2030 to validate traffic operation projections. It is estimated that, at some point between 2025 and 2029, a cash lane in each direction will need to be converted into an Open Road Lane.
- All options are based on a cash processing rate of 320 vehicles per hour.
- Options with Open Road Tolling assume that 3% of E-ZPass patrons will use the conventional lanes and experience delays similar to the cash patrons. The 97% of E-ZPass patrons using the Open Road lanes will experience virtually no delay. The E-ZPass delay in the table presents a weighted average of the two E-ZPass streams of traffic.
- All options should be compared in light of the characteristics highlighted in Table 6. The primary differences between the options include the following:
    - **Plaza type.** Options 1 through 3 involve conventional toll plazas with reversible lanes. All other options involve ORT facilities with no reversible lanes.
    - **Ramp tolls.** Options 3, 4a, 8 and 9 each include two 2-lane ramp toll plazas. All other options have no ramp toll plazas.
    - **Tandem lanes.** Some options involve reducing the overall cross-section by two lanes. This is accomplished by operating with 3 tandem lanes in each direction during peak periods.
    - **Mix of Cash and ORT lanes.** For all ORT scenarios, the mix of cash and ORT lanes changes over time. In order to handle the projected surge in E-ZPass usage over time, one cash lane in each direction will need to be converted to an ORT lane.

The following conclusions may be drawn from the results in Table 7:

- Based on an analysis of traffic conditions during the 30th highest hour, all options are feasible. All options maintain a good level of service for E-ZPass patrons, preserve modest delays for cash patrons, and yield minimal queuing. Even Option 4b, which had the highest delays, maintained an average peak-hour queue of less than 500' (or less than 1/10th of a mile).
- The existing 17-lane plaza provides adequate peak-hour capacity throughout the study period. Therefore, the motivation for improving the toll plaza is not *primarily* operational.
- The foremost operational benefit of ORT is a significant reduction in delays for E-ZPass patrons. The near free-flow conditions afforded to E-ZPass patrons in an ORT environment represents a significant improvement in their level of service.
- The column labeled Opt8-9 (with a 15-lane cross-section) reflects similar queues and delays as the column labeled Opt8-9(alt) (with a 13-lane cross-section). This suggests that the use of tandem lanes during peak periods is a feasible means of maintaining service levels while reducing the footprint of the plaza. This benefit should be weighed against the safety- and accountability-related disadvantages of tandem lanes, as noted in Section 5.

- Option 4b is perhaps the least-desirable option of all. This option forces E-ZPass patrons traveling to or from Chases Pond Rd. to intermingle with cash patrons that are continuing on the mainline. As a result, the volumes at the "conventional" portion of the plaza in Option 4b are higher than all other options. This yields greater queuing and delays relative to all other options.

In light of the above-noted observations, HNTB draws the following conclusions:

1. Open Road Tolling does not necessarily provide an opportunity to reduce the cross-sectional area of the toll facility. However, it offers safety benefits by reducing the number of stops and starts and by separating slow-moving cash traffic from faster-moving E-ZPass traffic, and it significantly improves the level of service for E-ZPass patrons.
2. In the opening year, the facility will need to have 2 ORT lanes in each direction.
3. In addition to the ORT lanes, the Authority will need to construct conventional lanes to serve cash-paying patrons.
    a. If the Authority wishes to avoid the use of tandem lanes, then it should construct 5 conventional lanes in the NB direction and 6 conventional lanes in the SB direction.
    b. If the Authority wishes to minimize the footprint of the plaza, then it should construct 4 conventional lanes in the NB direction and 5 conventional lanes in the SB direction. During peak periods, 3 of the conventional lanes in each direction will need to be operated as tandem lanes.
    c. As noted earlier, all results in Table 7 are based on traffic conditions during the 30^{th} highest hour. Occasionally, actual traffic volumes will exceed this level. During those times, ORT options that do **not** include tandem lanes provide more flexibility to respond. In other words, options which do **not** include tandems could periodically incorporate tandems in order to respond to occasional surges. By contrast, options which already include tandems have little ability to augment their capacity in order to respond to surges which exceed the 30^{th} highest hour.
4. At some point prior to the end of the design life of the facility, one cash lane in each direction will need to be converted to an ORT lane.
5. If the plaza is separated from the interchange, then the Authority can avoid constructing ramp toll plazas. However, if the plaza is constructed in the immediate vicinity of the interchange, then separate ramp toll plazas may be needed to improve operations and enhance safety.
6. The analysis has been based on an assumption of fairly modest growth in the share of E-ZPass usage. From 2010 through 2030, it is assumed that the share of E-ZPass usage will grow by about 1.0-1.5% per year, reaching a share of approximately 75% in 2030. If E-ZPass usage grows faster than expected, then the operational forecasts will change as well. In general, greater E-ZPass usage will yield improved performance of the toll facility in any configuration but more so in the ORT configurations.

SECTION 7 – REHABILITATE/RECONSTRUCT FEASIBILITY ANALYSIS

The nine options investigated for the York Toll Plaza replacement have been developed based on infrastructure need, tolling strategies, and traffic demand. Mindful of developing a complete range of existing site alternatives, the following options vary from do-nothing or No-Build to a newly constructed plaza with the latest in tolling technology. Following are summaries of the analysis completed for each option, including some preliminary conclusions of each alternative's feasibility of meeting the project purpose and need. The goal of this existing site analysis is to identify those options that appear feasible and recommend them to be carried into the next phase of analysis. Further refinement of the recommended option(s) and their respective design will be necessary, however at the conceptual design stage the following considerations are used to compare and contrast the various options:

- safety;
- capacity;
- operational and physical conditions of the plaza;
- adherence to the previously stated basic engineering guidelines;
- property and natural resource impacts, and
- cost.

Presented below is a discussion of each option's construction elements, the deficiencies and adequacies of design and operations, property and natural resource impacts and costs reported in 2010 dollars. Layout graphics for each of the Options as well as a table that compares the various elements of the options follow the discussion; see Figure 3 to Figure 11 Option 9: Relocate Plaza to South with Open Road Tolling and Relocated Interchange
and Table 8 at the end of this section.

Option 1:	No-Build (Maintenance Only)
Option 2:	Infrastructure Upgrade
Option 3:	Upgrade Existing Site with Conventional Tolling and Separate Ramp Lanes
Option 4A:	Upgrade Existing Site with Open Road Tolling and Separate Ramp Lanes
Option 4B:	Upgrade Existing Site with Open Road Tolling without Separate Ramp Lanes
Option 5:	Relocate Plaza to Alternate Location with Open Road Tolling (not part of this evaluation but a placeholder for consistency with previously developed documents)
Option 6:	Upgrade Existing Site with Open Road Tolling, East Side Mainline Realignment, and Relocate Interchange
Option 7:	Relocate Plaza to West with Open Road Tolling, West Side Mainline Realignment, and Relocate Interchange
Option 8:	Relocate Plaza to South with Open Road Tolling and Reconfigure Interchange
Option 9:	Relocate Plaza to South with Open Road Tolling and Relocate Interchange

Option 1: No-Build (Maintenance Only)

For baseline and comparison purposes, and as required by environmental permitting agencies, a No-Build option is introduced and discussed. This option would not invest in a full scale replacement of the facility or mainline realignment; instead it consists of renovation of the failing components. As it exists, this plaza is not in conformance with the current engineering practices. According to recent crash records, this plaza is considered a High Crash Location. Section 5 summarizes this crash data. Deficiencies include the plaza is too close to an interchange, is located on a curve, is too close to an overhead bridge and is at the bottom of a hill. The Chases Pond Road Interchange (Exit 7) is within 1,000 ft of the plaza exacerbating crash potential especially for the Northbound on ramp and Toll Plaza merge area. The Southbound off ramp is also very close to the Plaza and requires unsafe weaving maneuvers to access the ramp. Sight distance criteria are not met for either direction of travel. Due to subsurface conditions, the bumpers that are supposed to protect staff in the toll booths by redirecting errant vehicles are sinking and creating additional safety concern.

The physical infrastructure, booths, tunnel, and canopy are all in urgent need of major rehabilitation. This alternative will only address the most serious of these issues as part of a long-term maintenance or renewal and replacement program. Identified deficiencies not addressed under Option 1 include the sinking roadway, deteriorating and undersized tunnel and proximity to the interchange.

From an operational perspective, there are currently vehicle queue (backup) problems during the busiest periods that would not be addressed by this option. Currently, during these peak periods the two dedicated ETC lanes in each direction have limited access due to inadequate visibility and the vehicle queues that extend back. Once able to maneuver into one of the two dedicated ETC lanes for each direction, patrons are limited to a 10 mph speed limit which slows processing time. Another concern with the ETC lanes is that this moving traffic is typically sandwiched between stop-and-go traffic of the single-direction cash lanes and the reversible cash lanes. This occurs due to the need of operating the three middle lanes as reversible depending on the direction of greatest demand. As the ETC traffic increases, the need for these reversible lanes may decrease allowing for a reassignment of these lanes to dedicated ETC lanes. See Sections 5 and 6 for details on the traffic analysis for this option.

Construction costs associated with this option are defined as the long term maintenance cost less the costs of maintaining a similar new toll plaza. The condition of the existing infrastructure, such as the leaking tunnel, sinking approach slabs and safety bumpers and deteriorating canopy require renewal costs above and beyond that of brand new components. These maintenance costs are categorized by either Annual Maintenance costs or Renewal and Replacement costs.

Annual maintenance costs consist of the following components:

- Toll equipment operation and replacement based on the current tolling structure
- Plaza maintenance based on the current physical layout and condition of the plaza
- Building maintenance based on the current building infrastructure in place at the plaza
- Seasonal tandem toll booth installation and removal

The Turnpike has developed a Renewal and Replacement (R&R) maintenance program for prolonging the life of the plaza another 20 years (2010–2030). It also shows where the Authority could anticipate and plan for the larger expenditures. Major elements of the anticipated R&R maintenance costs consist of the following components:

- Asphalt pavement
    - Pavement crack sealing
    - Mill and fill overlays to address the settlement of the roadway and accelerated pavement wear and tear due to poor soil subsurface conditions
- Sealing of the concrete slabs and other concrete surfaces
- Canopy painting and roof sealing

- Concrete bumper rehabilitation to maintain integrity and improve safety
- Tunnel rehabilitation

Other elements of toll plaza operation and maintenance such as staffing, guardrail, drainage, and other routine maintenance activities were not evaluated as these elements would be common to all other replacement design options considered to date.

There are no associated property or wetland impacts for this option.

This option, when compared to a purely no-build maintenance only option highlights the deficiencies at the existing site. When simply annualized over the 20 year period of 2010-2030, the Authority could expect to expend an average of $615,000 on a yearly basis for these extraordinary renewal and replacement activities. Given the condition of infrastructure there would need to be a substantial expenditure in the first few years. A total cost of more than $12.3 million would be expended above and beyond normal maintenance activities. Additional details can be found in Appendix H.

The No-Build option for the York Toll Plaza does not meet the Maine Turnpike Authority's objective of: having a southern toll plaza that is overall safe, efficient and economical, that is user-friendly and that implements open road tolling. This option does not address the current physical and safety deficiencies which will grow worse with time. The York Toll Plaza will continue to have capacity and operational issues. A total cost of approximately $12.3 million for this Option is not prudent.

Option 2: Infrastructure Upgrade

This option would build a new plaza 200 feet north of the existing toll plaza. The current number of lanes would be built along with maintaining the reversible lane capability. The proportion of cash versus dedicated slow speed ETC lanes would continue to be monitored and adjusted to maintain the best possible efficiency, i.e. as E-ZPass user numbers grow so too will the number of dedicated slow-speed E-ZPass lanes. The infrastructure to be replaced would include: toll booths and bumpers, canopy, tunnel, approach slabs and toll equipment. The upgrade would not include: altering the vertical or horizontal alignment, or improving access to Exit 7 On/Off ramps. The layout of this option can be seen in Figure 4.

Option 2 will continue to prolong the use of a plaza facility that does not meet basic engineering criteria. The plaza is too close to an interchange, is not on a tangent, is not far enough away from the overhead bridge and is not at the crest of a small hill. The Chases Pond Road Interchange (Exit 7) is within 1,000 feet of the existing toll plaza exacerbating two high crash locations due to the merge/weave area between the northbound on ramp and northbound plaza approach, and the merge/weave area from southbound plaza departure to the southbound off ramp. Sight distance design criteria are not met for either travel direction. This option assumes that the upgraded toll plaza would be located approximately 200 feet north of the existing facility. Moving the plaza 200 feet north allows for construction phasing and minimizes interruptions to toll plaza operations however it moves the plaza closer to a hill and further into a curve. Along with moving the plaza north, the approach and departure transition zones will be extended to meet the acceptable transition lengths of today's guidelines. Replacement of the tunnel and approach slabs would be done with consideration of poor soil conditions and projected settlement. However, the settlement of the roadway beyond the immediate plaza approaches would not be addressed here due to the poor soil conditions extending up to 1,000 feet in each direction.

From an operational perspective, there are currently vehicle queue (backup) problems during the busiest periods that would not be addressed under this option. Currently, during these peak periods, the dedicated ETC lanes have limited access due to inadequate visibility and the vehicle queues that extend back into the three-lane mainline section. Once able to maneuver into one of the two dedicated ETC lanes for each direction, patrons are limited to a 10 mph speed limit which slows processing time. Another concern with the ETC lanes is that this moving traffic is typically sandwiched between stop-and-go traffic of the single-direction cash lanes and the reversible cash lanes. This occurs due to the need of operating the three middle lanes as reversible depending on the direction of greatest demand. As the ETC traffic increases, the need for these reversible lanes may decrease allowing for a reassignment of these lanes to dedicated ETC lanes. See Sections 5 and 6 for details on the traffic analysis for this option.

The Infrastructure Upgrade option does not meet the Maine Turnpike Authority's objectives of open road tolling, the basic project purpose or the goals for safety, operation or maintenance. Furthermore, this option does not meet the basic engineering criteria. The majority of current infrastructure deficiencies will be addressed but many safety deficiencies will still exist since the basic engineering criteria are not met. The York Toll Plaza will continue to have operational issues that will worsen with time. The layout carries anticipated impacts of 0 home displacements, 1.5 acres of right-of-way, and 11 acres of wetlands and an approximate total cost of $23 million. A total cost of approximately $23 million for this Option is not prudent.

<u>Option 3: Upgrade Existing Site with Conventional Tolling and Separate Ramp Lanes</u>

This option would upgrade the infrastructure, as noted in Option 2, along with more efficient conventional tolling by separating the interchange ramps with their own toll booths. Several layouts were investigated during the design process altering the horizontal alignment to avoid the existing utility building and separating ramp traffic from mainline traffic. The chosen layout, seen in Figure 5, consists of 19 tolling lanes: six (6) Northbound, seven (7) Southbound, and two (2) reversible mainline toll lanes with two (2) dedicated ramp toll lanes for Exit 7 in each direction for a total of 19 lanes. A number of dedicated ETC lanes would be implemented in each direction on mainline. The proportion of cash versus dedicated slow speed ETC lanes would continue to be monitored and adjusted to maintain the best possible efficiency, as it is done today. This design minimizes the weaving conflicts of ramp and mainline traffic since ramp traffic is physically separated from mainline traffic. This layout assumes that the upgraded toll plaza would be located approximately 200 feet north of the existing facility. Replacement of the tunnel and approach slabs would be done with consideration of poor soil conditions and projected settlement. This layout can be seen in Figure 5.

Option 3 will continue to prolong the use of a facility that does not meet the objective of open road tolling, the basic engineering criteria and does little to address the major safety concerns. The plaza is not on a tangent, is not far enough away from the overhead bridge and is not at the crest of a small hill. While dedicated ramp booths and lanes minimize weaving conflicts by physically separating mainline traffic from ramp traffic at the plaza, the dedicated ramps only shift the decision point a short distance away from the plaza. The result is a plaza that is still too close to an interchange. Dedicated ramp lanes for Exit 7 will require advance signing that must be intermingled with the Cash vs. E-ZPass signing. It will likely be complicated and potentially confusing to the public. Sight distance design criteria are not met for either travel direction.

With this layout, vehicle processing time improves but ETC users are still limited to slow vehicle speeds. This plaza would accommodate the heaviest traffic volumes with minimal queuing. See Sections 5 and 6 for details on the traffic analysis for this option.

The layout carries anticipated impacts of 0 home displacements, 6.3 acres of right-of-way, and 17.6 acres of wetlands and an approximate total cost of $40.9 million. This Option does not meet the Maine Turnpike Authority's objective, the basic project purpose or all the goals for safety, operation and maintenance, including the implementation of open road tolling. Although traffic capacity will be improved, the total project cost of approximately $40.9 million for this Option is not prudent.

Option 4A: Upgrade Existing Site with Open Road Tolling and Separate Ramp Lanes

This option would upgrade the existing facility with open road tolling. Layouts investigated during the design process included altering the horizontal alignment to avoid the existing Administration Building, reconfiguring the Exit 7 Interchange, and separating ramp traffic from mainline traffic. The final layout accepted impacts to the Administration Building in exchange for an improved horizontal alignment and minimized environmental impacts. Given the continued increase in electronic toll collection, the decrease in cash toll collection and the fluctuation in overall traffic growth, two separate plaza layouts were developed to process this mix of traffic as efficiently as possible. For the opening year, layout consists of five NB and six SB cash toll lanes, two open road toll lanes in each direction and two dedicated ramp toll lanes in each direction. Growth in E-ZPass usage, and corresponding decline in cash tolls, will dictate that by 2019 one cash lane in each direction can be converted to an open road toll lane to maintain efficient use of both lane types and to minimize overall plaza sizing. The attached graphic shows the future layout, i.e. three (3) open road toll lanes in each direction, four (4) NB and five (5) SB cash toll lanes, and two (2) dedicated ramp toll lanes in each direction. Dedicated ramp booths were introduced to separate interchange traffic from toll traffic. This layout assumes that the upgraded toll plaza would be located approximately 200 ft north of the existing facility. This option assumes the replacement of the tunnel to facilitate safe access for the tolling staff. Replacement of the tunnel and approach slabs would be done with consideration of projected settlement and poor soil conditions. This layout can be seen in Figure 6.

Option 4A will continue to prolong the use of a facility that does not meet the full benefits of open road tolling, the basic engineering criteria and does little to address the major safety concerns. The plaza is not on a tangent, is not far enough away from the overhead bridge and is not at the crest of a small hill. While dedicated ramp booths and lanes minimize weaving conflicts by physically separating mainline traffic from ramp traffic at the plaza, the dedicated ramps only shift the decision point a short distance away from the plaza. The result is a plaza that only marginally meets the proximity to an interchange. Dedicated ramp lanes for Exit 7 will require advance signing that must be intermingled with the Cash vs. E-ZPass signing. It will likely be complicated and potentially confusing to the public. Sight distance design criteria are not met for either travel direction.

With this layout, vehicle processing time improves upon opening due to the physical separation of ETC and cash patrons, and will continue to improve as ETC usage increases. However, the geometrics of the mainline and ORT lanes and proximity to interchange will likely require lower mainline speed. Therefore, ETC patrons will not fully benefit from the implementation of open road tolling. This plaza would accommodate the heaviest traffic volumes with some queuing for cash patrons. Toll plaza personnel will benefit from interacting only with stop and go cash traffic and not with intermittent free flowing ETC traffic; resulting in improved safety at the toll plaza area. See Table 7 for details on the traffic analysis for this option.

This option carries anticipated impacts of 0 home displacements, 8.1 acres of right-of-way, and 28 acres of wetlands and an approximate total cost of $56.3 million. Although this option does not address all of the safety and geometric deficiencies, and does not realize the full benefit of open road tolling, this option does partially meet one of the more critical design criteria and has comparatively fewer impacts than other existing site alternatives.

Option 4B: Upgrade Existing Site with Open Road Tolling without Separate Ramp Lanes

This option would upgrade the existing facility with open road tolling. The layout for this option is essentially the same as Option 4A but does not have the dedicated ramp toll lanes. Reiterating from Option 4A, the final layout accepted impacts to the Administration Building in exchange for an improved horizontal alignment and minimized environmental impacts. Given the continued increase in electronic toll collection, the decrease in cash toll collection and the fluctuation in overall traffic growth, two separate plaza layouts were developed to process this mix of traffic as efficiently as possible. For the opening year, layout consists of five NB and six SB cash toll lanes and two open road toll lane in each direction without the use of dedicated ramp toll booths. Growth in E-ZPass usage, and corresponding decline in cash tolls, will dictate that by 2019 one cash lane in each direction can be converted to an open road toll lane to maintain efficient use of both lane types and to minimize overall plaza sizing. The attached graphic shows the future layout, i.e. three (3) open road toll lanes in each direction, four (4) NB and five (5) SB cash toll lanes. This layout assumes the upgraded toll plaza would be located approximately 200 ft north of the existing facility. This option includes the replacement of the tunnel to facilitate safe access for the tolling staff. Replacement of the tunnel and approach slabs would be done with consideration of projected settlement and poor soil conditions. This layout can be seen in Figure 7.

Option 4B will continue to prolong the use of a facility location that will not allow the MTA to meet basic engineering criteria and will not realize the full benefits of open road tolling. This layout will create a confusing traffic pattern by requiring all southbound Exit 7 traffic, cash and E-ZPass patrons, to travel through the cash only lanes. This results in a continued vehicle weave condition south of the plaza. For northbound patrons, Exit 7 on-ramp traffic will also continue with a weave situation approaching the plaza as E-ZPass patrons shift left and heavy trucks shift right to utilize the truck climbing lane following the plaza. Both of these confluence points have been recognized as High Crash Locations and this Option will not remove the root cause of this designation. This option provides a separation of slow or stopped cash patrons from open road patrons through the use of a physical barrier. Minimizing right-of-way and wetland impacts dictates this barrier be a minimum length which coincides with the deceleration length required for the cash lanes. The result for southbound traffic is 1) the end of this barrier and corresponding lane change does not become visible to the approaching driver until approximately 1650 feet away, only 200 feet more than the minimum required, 2) the barrier is on the inside of a curve requiring cash and Exit 7 traffic to steer across its location further to the inside of curve, and 3) is situated such that approach signing for Cash tolls and Exit 7 off ramp traffic must occupy the same space, creating multiple decisions to be made at the same time. For northbound traffic 1) the end of barrier and corresponding lane change will not be visible to the approaching driver until 1800 feet away, only 350 feet more than the minimum required, and 2) it requires traffic signage to be in very close proximity to Exit 7 off ramp signing. The combination of horizontal geometry, vertical geometry and complex signing make this layout a safety concern. In addition, the plaza is still too close to an interchange, is not on a tangent, is not far enough away from the overhead bridge and is not at the crest of a small hill. Sight distance design criteria are not met for either travel direction.

With this option, vehicle processing time improves at opening due to the separation of ETC and cash patrons, and will continue to improve as ETC usage increases. However, the geometrics of the mainline and ORT lanes and proximity to interchange will likely require lower mainline speed and therefore ETC patrons will not fully benefit from the implementation of open road tolling. Also, in the future year this option requires the use of tandem cash toll lanes during peak hour flow. This option would accommodate the heaviest traffic volumes with some queuing for cash patrons. Toll plaza personnel will not see the same benefit as in Option 4A from complete separation of Exit and mainline traffic, i.e. there will be E-ZPass patrons within the Exit 7 ramp traffic that will be required to utilize the cash lanes. See Table 7 for details on the traffic analysis for these options.

This option carries anticipated impacts of 0 home displacements, 3.3 acres of right-of-way, and 22.2 acres of wetlands with an approximate cost of $43 million. This option does not address the safety and geometric deficiencies; in fact it potentially increases safety concerns, and does not realize the full benefit of open road tolling. This option does have comparatively fewer impacts than other existing site alternatives.

Option 5: Relocate Plaza to Alternate Location with Open Road Tolling

Investigation of alternative locations was suspended in order to focus the comprehensive evaluation on the existing toll plaza area. Option 5 is being listed here only to maintain numerical consistency with previously developed documents.

Option 6: Upgrade Existing Site with Open Road Tolling, East Side Mainline Realignment, and Relocate Interchange

Option 6 was developed as one possibility to answer the question, "What would it take to replace the plaza in York?" While this option was thought to be, and ultimately deemed to be, impractical, it was researched and is being offered as part of a fully comprehensive response to the York Selectman. This option proposes upgrading the existing plaza with open road tolling and an eastern realignment of the mainline between the Turnpike and Route 1. The Exit 7 interchange at Chases Pond Road will be replaced with an interchange just south at Route 91. Local roadway work will include: 1) upgrading Route 91/Cider Hill Road between the Route 1 and Bog Road intersections, 2) rerouting a portion of Chases Pond Road north of the Turnpike to intersect Bog Road and 3) realigning Bog Road to accommodate the SB off ramp. Structural work will include the removal of the Chases Pond Road Bridge and lengthening of the Route 91 Bridge/Cider Hill Road Bridge. Given the continued increase in electronic toll collection, the decrease in cash toll collection and the fluctuation in overall traffic growth, two separate plaza layouts were developed to process this mix of traffic as efficiently as possible. For the opening year, layout was developed with five NB and six SB cash toll lanes and two open road lanes in each direction. Growth in E-ZPass usage, and corresponding decline in cash tolls, will dictate that by 2019 one cash lane in each direction can be converted to an open road toll lane to maintain efficient use of both lane types and to minimize overall plaza sizing. The attached graphic shows the future layout, i.e. three (3) open road toll lanes in each direction, four (4) NB and five (5) SB cash toll lanes. This can be seen in Figure 8 Option 6: Upgrade Existing Site with Open Road Tolling, East Side Mainline Realignment, and Relocate Interchange

.
This design generally meets basic engineering criteria identified in Section 3. The Turnpike is realigned so that the plaza is on a tangent segment of highway. The separation of the plaza and the interchange falls short of the 1 mile criteria by approximately 1,000 feet and is therefore categorized as marginally meeting standard. The advance signing for the new Route 91 Interchange, in concert with signing for open road tolling that must be incorporated with the toll plaza signing, will likely be complicated and potentially confusing for the public. The third criterion, proper separation from a bridge so sight distance is not jeopardized, is satisfied. Adjusting the profile to create a high point will satisfy the fourth criterion. The horizontal alignment north of the plaza contains s-curves that are one degree (5750' radius) so that the alignment can get back on track with the mainline. Though this alignment technically meet design standards, potential safety issues are likely to occur with high speed traffic making the s-curve maneuver. The soils at this location are poor and are likely to add to the overall cost and complexity of this option.

With this layout, vehicle processing time improves with the incorporation of open road lanes and will continue to operate well as ETC usage increases. This plaza would accommodate the heaviest traffic volumes with minimal queuing for cash patrons. Toll plaza personnel will benefit from interacting only with stop and go cash traffic and not with intermittent free flowing ETC traffic; resulting in improved safety at the toll plaza area. See Table 7 for details on the traffic analysis for this option.

This option marginally meets the basic design criteria; however falls short of the overall project purpose, in that it is not an environmentally conscious solution and is not cost effective. This option carries anticipated impacts of 89 home displacements, 202 acres of right-of-way, and 57 acres of wetlands and an approximate total cost of $155 million. Given the community and environmental impacts alone makes this Option not prudent; cost adds yet another reason to dismiss this option.

<u>Option 7: Relocate Plaza to West with Open Road Tolling, West Side Mainline Realignment, and Relocate Interchange</u>

Option 7 was developed as one possibility to answer the question, "What would it take to replace the plaza in York?" While this option was thought to be, and ultimately deemed to be, impractical, it was researched and is being offered as part of a fully comprehensive response to the York Selectman. This option proposes upgrading the existing plaza with open road tolling and a realignment of the mainline to the west between the Turnpike and Chases Pond Road. The Exit 7 interchange at Chases Pond Road will be replaced with an interchange to the south at Route 91. Local roadway work will include: 1) upgrading Route 91/Cider Hill Road between the Route 1 and Bog Road intersections, 2) rerouting a portion of Chases Pond Road north of the Turnpike to intersect Bog Road and 3) realigning Bog Road to accommodate the SB off ramp. Structural work will include the removal of the Chases Pond Road Bridge and lengthening of the Route 91/Cider Hill Road Bridge. Given the continued increase in electronic toll collection, the decrease in cash toll collection and the fluctuation in overall traffic growth, two separate plaza layouts were developed to process this mix of traffic as efficiently as possible. For the opening year, layout was developed with five NB and six SB cash toll lanes and two open road lanes in each direction. Growth in E-ZPass usage, and corresponding decline in cash tolls, will dictate that by 2019 one cash lane in each direction can be converted to an open road toll lane to maintain efficient use of both lane types and to minimize overall plaza sizing. The attached graphic shows the future layout, i.e. three (3) open road toll lanes in each direction, four (4) NB and five (5) SB cash toll lanes. This can be seen in Figure 9 Option 7: Relocate Plaza to West with Open Road Tolling, West Side Mainline Realignment, and Relocate Interchange

.

This design generally meets basic engineering criteria identified in Section 3. The Turnpike is realigned so that the plaza is on a tangent segment of highway. The plaza and the Exit 7 interchange meet the one mile separation criteria. The advance signing for the new Route 91 Interchange, in concert with signing for open road tolling that must be incorporated with the toll plaza signing, will likely be complicated and potentially confusing the public. The third criterion, proper separation from a bridge so sight distance is not jeopardized, is satisfied. Adjusting the profile to create a high point will satisfy the fourth criterion.

With this layout, vehicle processing time improves with the incorporation of open road lanes and will continue to operate well as ETC usage increases. This plaza would accommodate the heaviest traffic volumes with minimal queuing for ETC patrons. Toll plaza personnel will benefit from interacting only with stop and go cash traffic and not with intermittent free flowing ETC traffic; resulting in improved safety at the toll plaza area. See Section 8 for details on the traffic analysis for this option.

The existing site is surrounded by wetlands with approximately 61 acres of wetland to be impacted. Mitigation costs for these impacts are approximately $24.6 million assuming a 4:1 replacement ratio. The relocation of the Chases Pond Road interchange and the realignment of the Turnpike to the west would potentially displace 22 homes/buildings and an additional 106 acres of right-of way would be acquired.

This option essentially meets the basic design criteria; however, it falls short on the overall project purpose in that it does not offer a cost effective and environmentally conscious solution. This option, carrying anticipated impacts of up to 21 home displacements, 106 acres of right-of-way, and 62 acres of wetlands and an approximate total cost of $106 million, is simply not prudent.

Option 8: Relocate Plaza to South with Open Road Tolling and Reconfigure Interchange

Option 8 was developed as one possibility to answer the question, "What would it take to replace the plaza in York?" While this option was thought to be, and ultimately deemed to be, impractical, it was researched and is being offered as part of a fully comprehensive response to the York Selectman. Furthermore, Option 8 will likely require U.S. Congressional action before proceeding into any formal design due to the fact that the Maine Turnpike Authority does not have jurisdiction to toll the Interstate south of the existing plaza. However, for purposes of discussing all possibilities this option is detailed here. Option 8 would locate the plaza underneath a new Chases Pond Road Bridge with a combination of open road tolling and conventional cash tolls. To address the NB weigh station located south of Cider Hill Road and achieve the required one mile separation from an interchange, a collector – distributor road for NB traffic is developed to separate the weigh station along with the exiting ramp traffic from the mainline traffic. The collector – distributor road allows traffic to exit onto Chases Pond Road or continue to the toll plaza to go thru the cash toll lanes and merge with the mainline north of the toll plaza. Separate ramp toll plazas, each with 2 cash lanes, will be constructed for NB traffic entering the Turnpike and SB traffic exiting the Turnpike. The Exit 7 SB on ramps will be reconstructed and extended to meet appropriate spacing with the merging cash and open road tolling lanes. Local road work would be approximately 800' of realigning Chases Pond Road. Structural work would include reconstructing both Route 91/Cider Hill Road and Chases Pond Road bridges with longer spans. Given the continued increase in electronic toll collection, the decrease in cash toll collection and the fluctuation in overall traffic growth, two separate plaza layouts were developed to

process this mix of traffic as efficiently as possible. For the opening year, layout was developed with five NB and six SB cash toll lanes, two open road lanes in each direction, and two dedicated ramp toll lanes in each direction. Growth in E-ZPass usage, and corresponding decline in cash tolls, will dictate that by 2019 one cash lane in each direction can be converted to an open road toll lane to maintain efficient use of both lane types and to minimize overall plaza sizing. The attached graphic shows the future layout, i.e. three (3) open road toll lanes in each direction, four (4) NB and five (5) SB cash toll lanes, and two (2) dedicated ramp toll lanes in each direction. This can be seen in Figure 10 Option 8: Relocate Plaza to South with Open Road Tolling and Reconfigure Interchange
.

This design generally meets the four basic engineering criteria identified in Section 3. A one mile separation of the interchange ramps and the toll plaza is met along with standard spacing for merging and diverging traffic streams being satisfied due to longer than normal on/off ramps. However, with the interchange bridge at the plaza, traffic has to make a decision to exit the Turnpike a mile or more before the Chases Pond Road Interchange which is sooner than expected. The advance signing for the Exit 7 Interchange and dedicated ramp lanes, in concert with signing to direct open road and cash tolling traffic, will likely be complicated and potentially confusing to the public. Other basic design criteria of locating a plaza on a tangent and a high point will be met marginally. A horizontal curve begins on the mainline approximately 1,000 feet north of the plaza, however adequate sight distance is available, and a high point generated from a profile adjustment will be local considering the proximity to the existing hill north of Chases Pond Road. The fourth criterion of separation from a bridge is met.

With this layout, vehicle processing time improves with the incorporation of open road lanes and will continue to operate well as ETC usage increases. This plaza would accommodate the heaviest traffic volumes with minimal queuing for cash patrons. Toll plaza personnel will benefit from interacting only with stop and go cash traffic and not with intermittent free flowing ETC traffic; resulting in improved safety at the toll plaza area. See Table 7 for details on the traffic analysis for this option.

This option essentially meets the basic design criteria; however falls short on the overall project purpose in that it does not offer a cost effective and environmentally conscious solution. This option carrying anticipated impacts of up to 7 home displacements, 17.7 acres of right-of-way and 52 acres of wetlands and an approximate total cost of $118 million, while not completely addressing the safety and geometric deficiencies, is simply not prudent.

Option 9: Relocate Plaza to South with Open Road Tolling and Relocate Interchange

Option 9 was developed as one possibility to answer the question, “What would it take to replace the plaza in York?” While this option was thought to be, and ultimately deemed to be, impractical, it was researched and is being offered as part of a fully comprehensive response to the York Selectman. Furthermore, Option 9 will likely require U.S. Congressional action before proceeding into any formal design due to the fact that the Maine Turnpike Authority does not have jurisdiction to toll the Interstate south of the existing plaza. However, for purposes of discussing all possibilities this option is detailed here. Option 9 would locate the plaza directly below a new Chases Pond Road Bridge with a combination of open road tolling and conventional cash tolls. The Exit 7 interchange at Chases Pond Road will be replaced with an interchange to the south at Route 91. A collector – distributor road for NB approaching traffic will separate NB weigh station and NB exiting and entering ramp traffic from the mainline traffic. NB entering traffic and weigh station traffic will be required to go thru dedicated ramp cash toll lanes that are separated from the main plaza. After the plaza, all NB traffic passing

through the cash lanes will merge prior to merging with the ORT mainline traffic. SB motorists destined for Route 91 will exit prior to the exiting cash traffic and proceed through a longer than normal ramp and cash toll lanes that are separated from the main plaza. This traffic will then continue to Route 91. Local roadway work will include: 1) upgrading Route 91/Cider Hill Road between the Route 1 and Bog Road intersections, and 2) realigning Bog Road to accommodate the SB off ramp. Structural work would include reconstructing both Route 91/Cider Hill Road and Chases Pond Road bridges with longer spans. Given the continued increase in electronic toll collection, the decrease in cash toll collection and the fluctuation in overall traffic growth, two separate plaza layouts were developed to process this mix of traffic as efficiently as possible. For the opening year, layout was developed with five NB and six SB cash toll lanes, two open road lanes in each direction, and two dedicated ramp toll lanes in each direction. Growth in E-ZPass usage, and corresponding decline in cash tolls, will dictate that by 2019 one cash lane in each direction can be converted to an open road toll lane to maintain efficient use of both lane types and to minimize overall plaza sizing. The attached graphic shows the future layout, i.e. three (3) open road toll lanes in each direction, four (4) NB and five (5) SB cash toll lanes and two (2) dedicated ramp toll lanes in each direction. This can be seen in Figure 11 Option 9: Relocate Plaza to South with Open Road Tolling and Relocated Interchange
.

This design generally meets the four basic engineering criteria identified in Section 3. A one mile separation of the interchange ramps and the toll plaza along with standard spacing for merging and diverging traffic streams is satisfied. However, with the interchange bridge at the plaza, traffic has to make a decision to exit the Turnpike a mile or more before Chases Pond Road which could be sooner than expected. The advance signing for the Exit 7 Interchange and dedicated ramp lanes, in concert with signing for open road and cash tolling, will likely be complicated and potentially confusing to the public. Other basic design criteria, locating a plaza on a tangent segment of highway and on a high point, will be met marginally. A horizontal curve begins on the mainline approximately 1,000 feet north of the plaza, however adequate sight distance is available, and a high point generated from a profile adjustment will be local considering the proximity to the existing hill north of Chases Pond Road. The fourth criterion of separation from a bridge is met.

With this layout, vehicle processing time improves with the incorporation of open road lanes and will continue to operate well as ETC usage increases. This plaza would accommodate the heaviest traffic volumes with minimal queuing for cash patrons. Toll plaza personnel will benefit from interacting only with stop and go cash traffic and not with intermittent free flowing ETC traffic; resulting in improved safety at the toll plaza area. See Table 7 for details on the traffic analysis for this option.

This option essentially meets the basic design criteria; however falls short on the overall project purpose, which is to find a cost effective and environmentally conscious solution. This option, carrying anticipated impacts of up to 7 home displacements, 19.7 acres of right-of-way, and 43.7 acres of wetlands and an approximate total cost of $94.5 million, while not completely addressing the safety and geometric deficiencies, is simply not prudent.

DOES THIS MEET THE BASIC ENGINEERING CRITERIA?

ON A STRAIGHT STRETCH =	NO
ONE MILE FROM INTERCHANGE =	NO
SEPARATION FROM BRIDGE =	NO
ON CREST OF A SMALL HILL =	NO

WHAT WOULD IT TAKE

		17 CONVENTIONAL LANES
a.	POTENTIAL HOME IMPACTS =	0 HOMES
b.	POTENTIAL RIGHT-OF-WAY IMPACTS =	0 ACRES
c.	POTENTIAL WETLAND AND HYDRIC SOIL IMPACTS =	0 ACRES
d.	POTENTIAL STREAM IMPACTS =	0 LF
e.	LENGTH OF MAINLINE CONSTRUCTION =	400 LF MIN
f.	LENGTH OF LOCAL ROADWAY REALIGNMENT =	0 LF
g.	TOTAL COST =	$12,300,000

Scale: 150 0 150 300

No.	Revision	By	Date

Designed by: HNTB

	By	Date		By	Date
Designed	RWH	02/09	Checked	DAM	02/09
Drawn	RWH	02/09	In Charge of	RAL	02/09

HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

MAINE TURNPIKE

THE GOLD STAR MEMORIAL HIGHWAY

YORK TOLL PLAZA REPLACEMENT STUDY
FIGURE 3 – OPTION 1
NO BUILD
(MAINTENANCE ONLY)

SHEET NUMBER:

CONTRACT: DRAFT CONCEPT PLAN

Date:6/10/2009

Filename: Fig03_HighwayMM7-3_Option1.dgn

Date:6/10/2009

DOES THIS MEET THE BASIC ENGINEERING CRITERIA?

ON A STRAIGHT STRETCH =	NO
ONE MILE FROM INTERCHANGE =	NO
SEPARATION FROM BRIDGE =	NO
ON CREST OF A SMALL HILL =	NO

WHAT WOULD IT TAKE

		17 CONVENTIONAL LANES
a.	POTENTIAL HOME IMPACTS =	0 HOMES
b.	POTENTIAL RIGHT-OF-WAY IMPACTS =	1.5 ACRES
c.	POTENTIAL WETLAND AND HYDRIC SOIL IMPACTS =	11.0 ACRES
d.	POTENTIAL STREAM IMPACTS =	274 LF
e.	LENGTH OF MAINLINE CONSTRUCTION =	3600 LF MIN
f.	LENGTH OF LOCAL ROADWAY REALIGNMENT =	0 LF
g.	TOTAL COST =	$23,000,000

Scale: 150 0 150 300

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HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

MAINE TURNPIKE

THE GOLD STAR MEMORIAL HIGHWAY

YORK TOLL PLAZA REPLACEMENT STUDY

FIGURE 4 – OPTION 2
INFRASTRUCTURE UPGRADE

CONTRACT: DRAFT CONCEPT PLAN

SHEET NUMBER: 1 OF 1

Filename: Fig04_HighwayMM7-3_Option2.dgn

DOES THIS MEET THE BASIC ENGINEERING CRITERIA?

ON A STRAIGHT STRETCH =	NO
ONE MILE FROM INTERCHANGE =	MARGINAL
SEPARATION FROM BRIDGE =	NO
ON CREST OF A SMALL HILL =	NO

WHAT WOULD IT TAKE

15 CONVENTIONAL LANES
4 RAMP BOOTHS

a.	POTENTIAL HOME IMPACTS =	0 HOMES
b.	POTENTIAL RIGHT-OF-WAY IMPACTS =	6.3 ACRES
c.	POTENTIAL WETLAND AND HYDRIC SOIL IMPACTS =	17.6 ACRES
d.	POTENTIAL STREAM IMPACTS =	423 LF
e.	LENGTH OF MAINLINE CONSTRUCTION =	3,400 LF MIN
f.	LENGTH OF LOCAL ROADWAY REALIGNMENT =	0 LF
g.	LENGTH OF RAMP CONTRUCTION =	9050 LF MIN
h.	TOTAL COST =	$40,900,000

Scale: 150 0 150 300

No.	Revision	By	Date

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HNTB

	By	Date		By	Date
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HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

MAINE TURNPIKE

THE GOLD STAR MEMORIAL HIGHWAY

YORK TOLL PLAZA REPLACEMENT STUDY

FIGURE 5 – OPTION 3
UPGRADE EXISTING SITE WITH CONVENTIONAL TOLLING AND SEPARATE RAMP LANES

CONTRACT: DRAFT CONCEPT PLAN

SHEET NUMBER: 1 OF 2

Date:6/10/2009

Filename: Fig05-1_HighwayMM7-3_Option3_MINDesignFootprint.dgn

Scale: 150 0 150 300

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HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 772-7410

MAINE TURNPIKE

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YORK TOLL PLAZA REPLACEMENT STUDY

FIGURE 5 – OPTION 3

UPGRADE EXISTING SITE WITH CONVENTIONAL TOLLING AND SEPARATE RAMP LANES

CONTRACT: DRAFT CONCEPT PLAN

SHEET NUMBER: 2 OF 2

Filename: Fig05-2_HighwayMM7-3_Option3_MINDesignFootprint.dgn

Date:6/10/2009

BASIC ENGINEERING CRITERIA?

ON A STRAIGHT STRETCH =	NO
ONE MILE FROM INTERCHANGE =	MARGINAL
SEPARATION FROM BRIDGE =	NO
ON CREST OF A SMALL HILL =	NO

WHAT WOULD IT TAKE

		6 HIGHWAY SPEED LANES 9 CONVENTIONAL LANES 4 RAMP BOOTHS
a.	POTENTIAL HOME IMPACTS =	0 HOMES
b.	POTENTIAL RIGHT-OF-WAY IMPACTS =	8.1 ACRES
c.	POTENTIAL WETLAND AND HYDRIC SOIL IMPACTS =	28.0 ACRES
d.	POTENTIAL STREAM IMPACTS =	730 LF
e.	LENGTH OF MAINLINE CONSTRUCTION =	11,100 LF MIN
f.	LENGTH OF LOCAL ROADWAY REALIGNMENT =	0 LF
g.	LENGTH OF RAMP CONSTRUCTION =	9,250 LF MIN
h.	TOTAL COST =	$56,300,000

Filename: Fig06-1_HighwayMM7-3_Option4A_65DesignFootprint.dgn

Scale: 300 0 300 600

No.	Revision	By	Date

Designed by:

HNTB

	By	Date		By	Date
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HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

MAINE TURNPIKE

THE GOLD STAR MEMORIAL HIGHWAY

YORK TOLL PLAZA REPLACEMENT STUDY

FIGURE 6 – OPTION 4A

UPGRADE EXISTING SITE WITH OPEN ROAD TOLLING AND SEPARATE RAMP LANES

CONTRACT: DRAFT CONCEPT PLAN

SHEET NUMBER: 1 OF 2

Date:6/10/2009

Filename: Fig06-2_HighwayMM7-3_Option4A_65DesignFootprint.dgn

Scale: 300 0 300 600

No.	Revision	By	Date

Designed by:

HNTB

	By	Date		By	Date
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HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

MAINE TURNPIKE

THE GOLD STAR MEMORIAL HIGHWAY

YORK TOLL PLAZA REPLACEMENT STUDY
FIGURE 6 – OPTION 4A
UPGRADE EXISTING SITE WITH OPEN ROAD TOLLING AND SEPARATE RAMP LANES

CONTRACT: DRAFT CONCEPT PLAN

SHEET NUMBER: 2 OF 2

Date:6/10/2009

BASIC ENGINEERING CRITERIA?

ON A STRAIGHT STRETCH =	NO
ONE MILE FROM INTERCHANGE =	NO
SEPARATION FROM BRIDGE =	NO
ON CREST OF A SMALL HILL =	NO

POTENTIAL IMPACTS

6 HIGHWAY SPEED LANES
9 CONVENTIONAL LANES

a.	POTENTIAL HOME IMPACTS =	0 HOMES
b.	POTENTIAL RIGHT-OF-WAY IMPACTS =	3.3 ACRES
c.	POTENTIAL WETLAND AND HYDRIC SOIL IMPACTS =	22.2 ACRES
d.	POTENTIAL STREAM IMPACTS =	509 LF
e.	LENGTH OF MAINLINE CONSTRUCTION =	9,750 LF
f.	LENGTH OF LOCAL ROADWAY REALIGNMENT =	0 LF
g.	LENGTH OF RAMP CONSTRUCTION =	1350 LF
h.	TOTAL PROJECT COST =	$43,000,000

Scale: 300 0 300 600

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HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

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YORK TOLL PLAZA REPLACEMENT STUDY
FIGURE 7 – OPTION 4B
UPGRADE EXISTING SITE WITH OPEN ROAD TOLLING WITHOUT SEPARATE RAMP LANES

CONTRACT: DRAFT CONCEPT PLAN

SHEET NUMBER: 1 OF 2

Filename: Fig07-1_Option4-NORAMPBOOTHS.dgn

Date:6/10/2009

Filename: Fig07-2_Option4-NORAMPBOOTHS.dgn

Scale: 300 0 300 600

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HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

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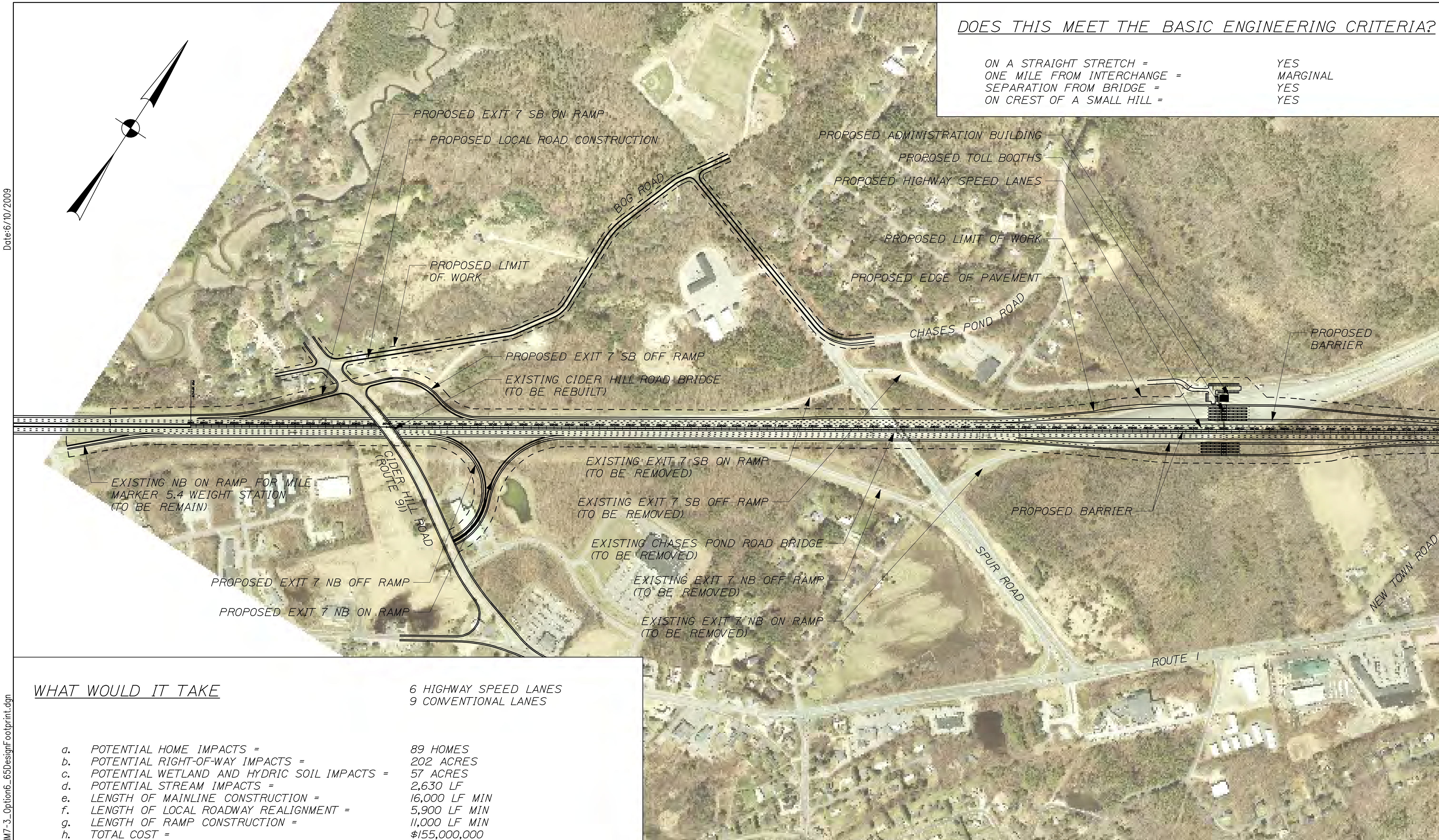
YORK TOLL PLAZA REPLACEMENT STUDY

FIGURE 7 – OPTION 4B

UPGRADE EXISTING SITE WITH OPEN ROAD TOLLING WITHOUT SEPARATE RAMP LANES

CONTRACT: DRAFT CONCEPT PLAN

SHEET NUMBER: 2 OF 2



DOES THIS MEET THE BASIC ENGINEERING CRITERIA?

ON A STRAIGHT STRETCH =	YES
ONE MILE FROM INTERCHANGE =	MARGINAL
SEPARATION FROM BRIDGE =	YES
ON CREST OF A SMALL HILL =	YES

WHAT WOULD IT TAKE

6 HIGHWAY SPEED LANES
9 CONVENTIONAL LANES

a.	POTENTIAL HOME IMPACTS =	89 HOMES
b.	POTENTIAL RIGHT-OF-WAY IMPACTS =	202 ACRES
c.	POTENTIAL WETLAND AND HYDRIC SOIL IMPACTS =	57 ACRES
d.	POTENTIAL STREAM IMPACTS =	2,630 LF
e.	LENGTH OF MAINLINE CONSTRUCTION =	16,000 LF MIN
f.	LENGTH OF LOCAL ROADWAY REALIGNMENT =	5,900 LF MIN
g.	LENGTH OF RAMP CONSTRUCTION =	11,000 LF MIN
h.	TOTAL COST =	$155,000,000

Scale: 300 0 300 600

No.	Revision	By	Date

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HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

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YORK TOLL PLAZA REPLACEMENT STUDY

FIGURE 8 – OPTION 6
UPGRADE EXISTING SITE WITH ORT, EAST SIDE MAINLINE REALIGNMENT AND RELOCATE INTERCHANGE

CONTRACT: DRAFT CONCEPT PLAN

SHEET NUMBER: 1 OF 3

Date:6/10/2009

Filename: ...\Fig08-1_HighwayMM7-3_Option6_65DesignFootprint.dgn

Scale: 300 0 300 600

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HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

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YORK TOLL PLAZA REPLACEMENT STUDY

FIGURE 8 – OPTION 6
UPGRADE EXISTING SITE WITH ORT, EAST SIDE
MAINLINE REALIGNMENT AND RELOCATE INTERCHANGE

CONTRACT: DRAFT CONCEPT PLAN

SHEET NUMBER: 2 OF 3

Date:6/10/2009

Filename: ...\Fig08-2_HighwayMM7-3_Option6_65DesignFootprint.dgn

Date:6/10/2009

Filename: ...\Fig08-3_HighwayMM7-3_Option6_65DesignFootprint.dgn

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HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

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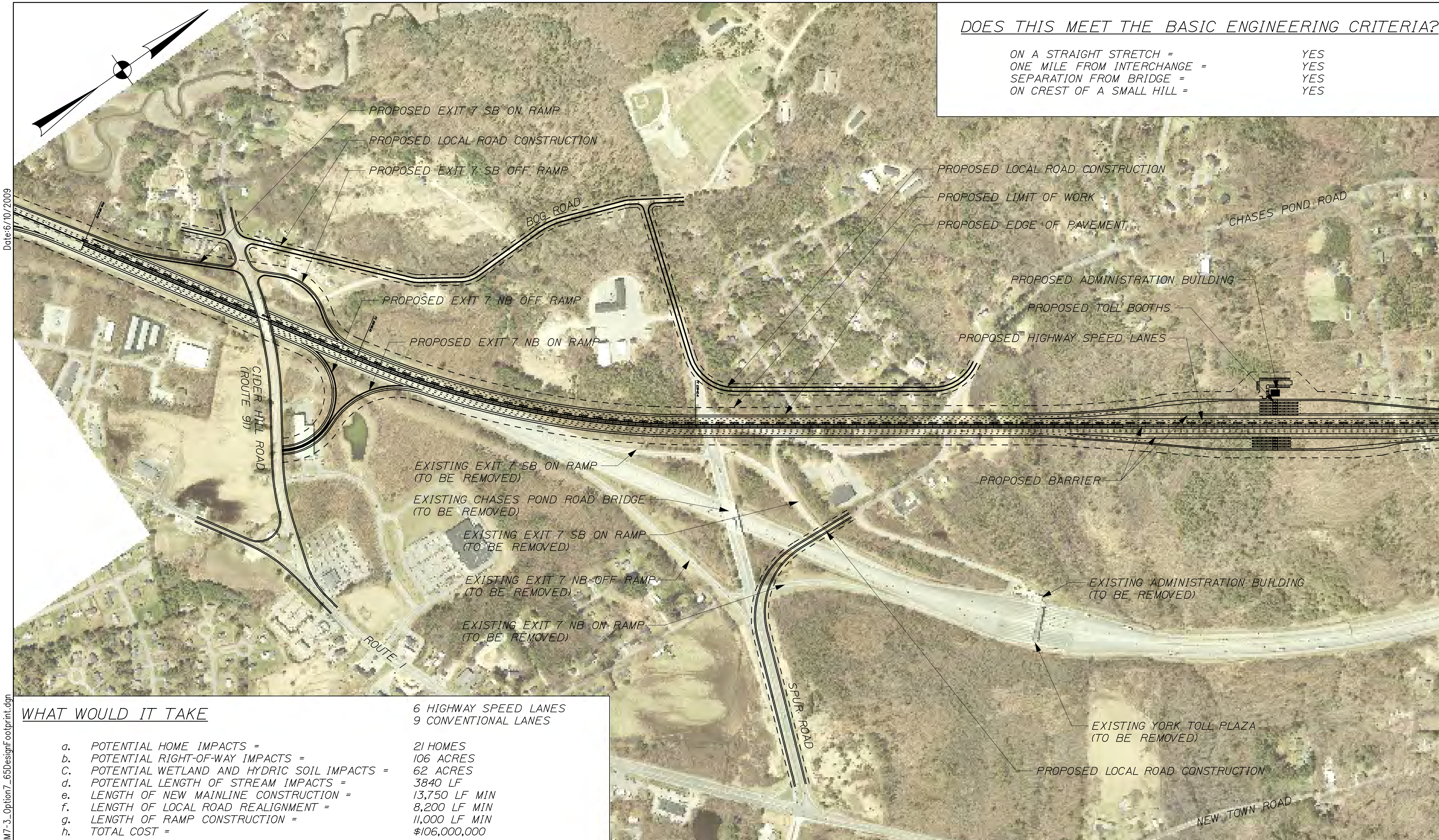
FIGURE 8 – OPTION 6
UPGRADE EXISTING SITE WITH ORT, EAST SIDE MAINLINE REALIGNMENT AND RELOCATE INTERCHANGE

CONTRACT: DRAFT CONCEPT PLAN

SHEET NUMBER: 3 OF 3



DOES THIS MEET THE BASIC ENGINEERING CRITERIA?

ON A STRAIGHT STRETCH =	YES
ONE MILE FROM INTERCHANGE =	YES
SEPARATION FROM BRIDGE =	YES
ON CREST OF A SMALL HILL =	YES

WHAT WOULD IT TAKE

6 HIGHWAY SPEED LANES
9 CONVENTIONAL LANES

a.	POTENTIAL HOME IMPACTS =	21 HOMES
b.	POTENTIAL RIGHT-OF-WAY IMPACTS =	106 ACRES
C.	POTENTIAL WETLAND AND HYDRIC SOIL IMPACTS =	62 ACRES
d.	POTENTIAL LENGTH OF STREAM IMPACTS =	3840 LF
e.	LENGTH OF NEW MAINLINE CONSTRUCTION =	13,750 LF MIN
f.	LENGTH OF LOCAL ROAD REALIGNMENT =	8,200 LF MIN
g.	LENGTH OF RAMP CONSTRUCTION =	11,000 LF MIN
h.	TOTAL COST =	$106,000,000

Date:6/10/2009

Filename: ...\Fig09-1_HighwayMM7-3_Option7_65DesignFootprint.dgn

Scale: 300 0 300 600

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HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

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YORK TOLL PLAZA REPLACEMENT STUDY

FIGURE 9 – OPTION 7
RELOCATE PLAZA TO WEST WITH ORT,
WEST SIDE MAINLINE REALIGNMENT
AND RELOCATE INTERCHANGE

CONTRACT: DRAFT CONCEPT PLAN

SHEET NUMBER: 1 OF 2

Date:6/10/2009

Scale: 300 0 300 600

No.	Revision	By	Date

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HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

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YORK TOLL PLAZA REPLACEMENT STUDY

FIGURE 9 – OPTION 7
RELOCATE PLAZA TO WEST WITH ORT,
WEST SIDE MAINLINE REALIGNMENT
AND RELOCATE INTERCHANGE

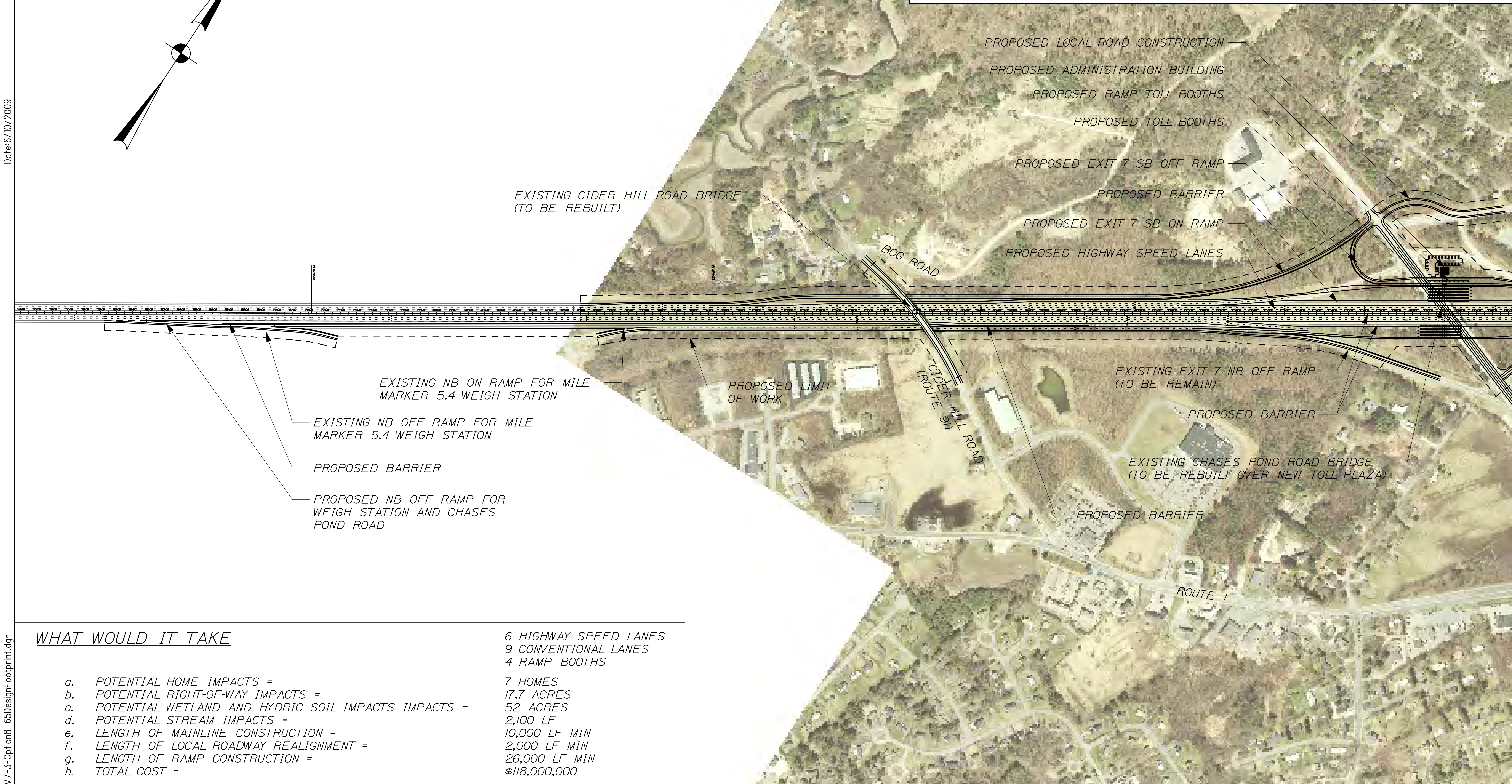
CONTRACT: DRAFT CONCEPT PLAN

SHEET NUMBER: 2 OF 2

Filename: ...\Fig09-2_HighwayMM7-3_Option7_65DesignFootprint.dgn

DOES THIS MEET THE BASIC ENGINEERING CRITERIA?

ON A STRAIGHT STRETCH =	MARGINAL
ONE MILE FROM INTERCHANGE =	YES
SEPARATION FROM BRIDGE =	YES
ON CREST OF A SMALL HILL =	MARGINAL



WHAT WOULD IT TAKE

6 HIGHWAY SPEED LANES
9 CONVENTIONAL LANES
4 RAMP BOOTHS

a.	POTENTIAL HOME IMPACTS =	7 HOMES
b.	POTENTIAL RIGHT-OF-WAY IMPACTS =	17.7 ACRES
c.	POTENTIAL WETLAND AND HYDRIC SOIL IMPACTS IMPACTS =	52 ACRES
d.	POTENTIAL STREAM IMPACTS =	2,100 LF
e.	LENGTH OF MAINLINE CONSTRUCTION =	10,000 LF MIN
f.	LENGTH OF LOCAL ROADWAY REALIGNMENT =	2,000 LF MIN
g.	LENGTH OF RAMP CONSTRUCTION =	26,000 LF MIN
h.	TOTAL COST =	$118,000,000

Date:6/10/2009

Filename: ...\Fig10-1_HighwayMM7-3-Option8_65DesignFootprint.dgn

Scale: 300 0 300 600

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HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

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YORK TOLL PLAZA REPLACEMENT STUDY

FIGURE 10 – OPTION 8
RELOCATE PLAZA TO SOUTH WITH ORT AND RECONFIGURE INTERCHANGE

CONTRACT: DRAFT CONCEPT PLAN

SHEET NUMBER: 1 OF 2

Date:6/10/2009

Filename: ...\Fig10-2_HighwayMM7-3-Option8_65DesignFootprint.dgn

Scale: 300 0 300 600

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HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

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YORK TOLL PLAZA REPLACEMENT STUDY

FIGURE 10 – OPTION 8
RELOCATE PLAZA TO SOUTH WITH ORT
AND RECONFIGURE INTERCHANGE

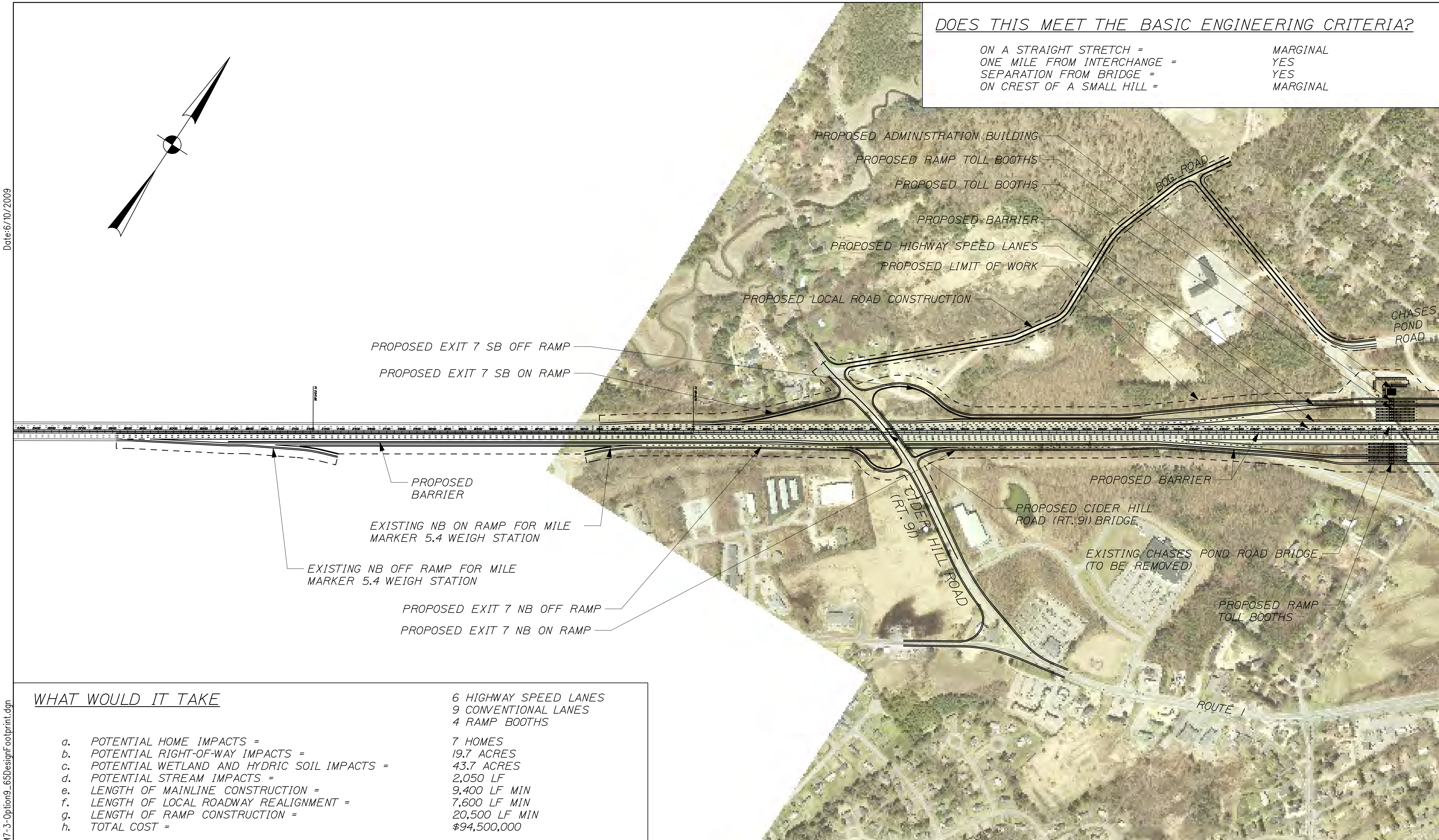
CONTRACT: DRAFT CONCEPT PLAN

SHEET NUMBER: 2 OF 2

Date:6/10/2009

DOES THIS MEET THE BASIC ENGINEERING CRITERIA?

ON A STRAIGHT STRETCH =	MARGINAL
ONE MILE FROM INTERCHANGE =	YES
SEPARATION FROM BRIDGE =	YES
ON CREST OF A SMALL HILL =	MARGINAL



WHAT WOULD IT TAKE

6 HIGHWAY SPEED LANES
9 CONVENTIONAL LANES
4 RAMP BOOTHS

a.	POTENTIAL HOME IMPACTS =	7 HOMES
b.	POTENTIAL RIGHT-OF-WAY IMPACTS =	19.7 ACRES
c.	POTENTIAL WETLAND AND HYDRIC SOIL IMPACTS =	43.7 ACRES
d.	POTENTIAL STREAM IMPACTS =	2,050 LF
e.	LENGTH OF MAINLINE CONSTRUCTION =	9,400 LF MIN
f.	LENGTH OF LOCAL ROADWAY REALIGNMENT =	7,600 LF MIN
g.	LENGTH OF RAMP CONSTRUCTION =	20,500 LF MIN
h.	TOTAL COST =	$94,500,000

Scale: 300 0 300 600

No.	Revision	By	Date

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HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

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YORK TOLL PLAZA REPLACEMENT STUDY

FIGURE 11 – OPTION 9
RELOCATE PLAZA TO SOUTH WITH ORT
AND RELOCATE INTERCHANGE

CONTRACT: DRAFT CONCEPT PLAN

SHEET NUMBER: 1 OF 2

Filename: ...\Fig11-1_HighwayMM7-3-Option9_65DesignFootprint.dgn

Date:6/10/2009

Filename: ...\Fig11-2_HighwayMM7-3-Option9_65DesignFootprint.dgn

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No.	Revision	By	Date

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HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

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THE GOLD STAR MEMORIAL HIGHWAY

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FIGURE 11 – OPTION 9
RELOCATE PLAZA TO SOUTH WITH ORT
AND RELOCATE INTERCHANGE

CONTRACT: DRAFT CONCEPT PLAN

SHEET NUMBER: 2 OF 2

Table 8 Comparison Matrix

	Option 1: Existing Site No Build (Maintenance Only)	Option 2: Existing Site Infrastructure Upgrade with No New Capacity	Option 3: Existing Site Upgrade with Conventional Tolling and Separate Ramp Booths	Option 4A: Upgrade Existing Site with Open Road Tolling and Separate Ramp Lanes	Option 4B: Upgrade Existing Site with Open Road Tolling without Separate Ramp Lanes	Option 6: Upgrade Existing Site with Open Road Tolling, East Side Mainline Realignment, and Relocate Interchange	Option 7: Relocate Plaza to West with Open Road Tolling, West Side Mainline Realignment, and Relocate Interchange	Option 8: Relocate Plaza to South with Open Road Tolling and Reconfigure Interchange	Option 9: Relocate Plaza to South with Open Road Tolling and Relocate Interchange
Plaza Capacity	Current capacity issues would escalate while the lane configuration of the plaza would have to be continually changed to optimize the available lanes.	Current capacity issues would escalate while the lane configuration of the plaza would have to be continually changed to optimize the available lanes.	Plaza would accommodate all but the heaviest traffic volumes with acceptable queuing.	Plaza would accommodate the heaviest traffic volumes with minimal queuing for cash patrons and free flow for ETC patrons.	Plaza would accommodate the heaviest traffic volumes with some queuing for cash patrons and free flow for ETC patrons.	Plaza would accommodate the heaviest traffic volumes with minimal queuing for cash patrons and free flow for ETC patrons.	Plaza would accommodate the heaviest traffic volumes with minimal queuing for cash patrons and free flow for ETC patrons.	Plaza would accommodate the heaviest traffic volumes with minimal queuing for cash patrons and free flow for ETC patrons.	Plaza would accommodate the heaviest traffic volumes with minimal queuing for cash patrons and free flow for ETC patrons.
Operations	Similar alignment to the toll plaza, reducing the need for patron decision making. There is familiarity with this traffic pattern.	Similar alignment to the toll plaza, reducing the need for patron decision making. There is familiarity with this traffic pattern.	Similar alignment to the toll plaza, reducing the need for patron decision making. There is familiarity with this traffic pattern.	Vehicles must decide to use highway speed lanes or exit to cash toll lanes. This will be a new traffic pattern for motorists.	Vehicles must decide to use highway speed lanes or exit to cash toll lanes while on a curve. Does not eliminate the weave potential between Cash and Exit vehicles. This will be a new traffic pattern for motorists.	Vehicles must decide to use highway speed lanes or exit to cash toll lanes. This will be a new traffic pattern for motorists.	Vehicles must decide to use highway speed lanes or exit to cash toll lanes. This will be a new traffic pattern for motorists.	Vehicles must decide to use highway speed lanes or exit to cash toll lanes. Decision point for exit will be in advance of expected exit point. This new traffic pattern will be confusing to motorists.	Vehicles must decide to use highway speed lanes or exit to cash toll lanes. Decision point for exit will be in advance of expected exit point. This new traffic pattern will be confusing to motorists.
	Electronic toll vehicles must slow as they enter the toll plaza area.	Electronic toll vehicles must slow as they enter the toll plaza area.	Electronic toll vehicles must slow as they enter the toll plaza area.	Provides ETC customers with dedicated highway speed lanes with minimal queuing or speed reduction. This provides the best possible level of service for ETC customers with the higher speeds leading to more efficient operation.	Provides ETC customers with dedicated highway speed lanes with minimal queuing or speed reduction. Level of service for ETC customers will not be highest due to curve and proximity to Exit and Cash/ETC separation. ETC patrons using Exit 7 will use Cash lanes.	Provides ETC customers with dedicated highway speed lanes with minimal queuing or speed reduction. This provides the best possible level of service for ETC customers with the higher speeds leading to more efficient operation.	Provides ETC customers with dedicated highway speed lanes with minimal queuing or speed reduction. This provides the best possible level of service for ETC customers with the higher speeds leading to more efficient operation.	Provides ETC customers with dedicated highway speed lanes with minimal queuing or speed reduction. This provides the best possible level of service for ETC customers with the higher speeds leading to more efficient operation.	Provides ETC customers with dedicated highway speed lanes with minimal queuing or speed reduction. This provides the best possible level of service for ETC customers with the higher speeds leading to more efficient operation.
	Processing of patrons remains the same.	Processing of patrons remains the same.	Processing of cash patrons improved with expanded plaza but processing of ETC patrons limited to same slow vehicle speed.	Increased efficiency of processing patrons - both ETC and cash paying.	Increased efficiency of processing patrons - both ETC and cash paying.	Increased efficiency of processing patrons - both ETC and cash paying.	Increased efficiency of processing patrons - both ETC and cash paying.	Increased efficiency of processing patrons - both ETC and cash paying.	Increased efficiency of processing patrons - both ETC and cash paying.
	Vehicles must access the dedicated toll lanes via the toll plaza approach area. Excessive vehicle queue in the approach area impacts access and efficiency of dedicated toll lanes.	Vehicles must access the dedicated toll lanes via the toll plaza approach area. Excessive vehicle queue in the approach area impacts access and efficiency of dedicated toll lanes.	Vehicles must access the dedicated toll lanes via the toll plaza approach area. Excessive vehicle queue in the approach area impacts access and efficiency of dedicated toll lanes.	ETC patrons are not effected by queuing at tolling lanes. Cash lane queues minimized by removal of ETC patrons from cash lanes.	Thru ETC patrons are not effected by queuing at tolling lanes. Exit 7 ETC patrons must utilize Cash lanes. Cash lane queues minimized by removal of ETC patrons from cash lanes.	ETC patrons are not effected by queuing at tolling lanes. Cash lane queues minimized by removal of ETC patrons from cash lanes.	ETC patrons are not effected by queuing at tolling lanes. Cash lane queues minimized by removal of ETC patrons from cash lanes.	ETC patrons are not effected by queuing at tolling lanes. Cash lane queues minimized by removal of ETC patrons from cash lanes.	ETC patrons are not effected by queuing at tolling lanes. Cash lane queues minimized by removal of ETC patrons from cash lanes.
Total Project Cost	12.3 Million	$23.0 Million	$40.9 Million	$56.3 Million	$43.0 Million	$155 Million	$106 Million	$118 Million	$94.5 Million
Potential wetland impacts (NWI Certified)	0 acres anticipated	Potential 3 acres impacted	Potential 7 acres impacted.	Potential 9 acres impacted.	Potential 5 acres impacted.	Potential 18 acres impacted	Potential 13 acres impacted	Potential 3 acres impacted	Potential 4 acres impacted
Potential wetland impacts (NRCS soils)	0 acres anticipated	Potential 11 acres impacted	Potential 17.6 acres impacted.	Potential 28 acres impacted.	Potential 22.2 acres impacted.	Potential 57 acres impacted	Potential 62 acres impacted	Potential 52 acres impacted	Potential 43.7 acres impacted
General Layout	Existing plaza remains	Replace plaza approximately 200 ft north of existing plaza.	Replace plaza approximately 200 ft north of existing plaza.	Replace plaza approximately 200 ft north of existing plaza.	Replace plaza approximately 200 ft north of existing plaza.	Relocate plaza in existing location	Relocate plaza west of existing site	Relocate below the Chases Pond Road Bridge	Relocate below the Chases Pond Road Bridge
	Exit 7 Ramp Traffic and Mainline Traffic remain mixed	Exit 7 Ramp Traffic and Mainline Traffic remain mixed	Exit 7 Ramp Traffic is separated to/from plaza.	Exit 7 Ramp Traffic is separated to/from plaza.	Exit 7 Ramp Traffic is not separated to/from plaza.	Exit 7 Ramp Traffic is separated to/from plaza.	Exit 7 Ramp Traffic is separated to/from plaza.	Exit 7 Ramp Traffic is separated to/from plaza.	Exit 7 Ramp Traffic is separated to/from plaza.
Horizontal Alignment	Plaza is not located on tangent.	Plaza is not located on tangent.	Plaza is not located on tangent.	Plaza is not located on tangent.	Plaza is not located on tangent.	Plaza Area would be located on a tangent.	Plaza Area would be located on a tangent.	Plaza Area would partially be located on a tangent.	Plaza Area would partially be located on a tangent.
Vertical Alignment	Existing Plaza is at a low point, not the recommended high point.	Existing Plaza is at a low point, not the recommended high point.	Vertical grade adjustment would be required to create localized high point. Plaza still at base of 5% hill to the North.	Vertical grade adjustment would be required to create localized high point. Plaza still at base of 5% hill to the North.	Vertical grade adjustment would be required to create localized high point. Plaza still at base of 5% hill to the North.	Plaza at high point, minor vertical grade adjustments possible.	Plaza at high point, minor vertical grade adjustments possible.	Vertical grade adjustment would be required to create localized high point. Plaza still at base of 5% hill to the North.	Vertical grade adjustment would be required to create localized high point. Plaza still at base of 5% hill to the North.
Sight Distance	Decision sight distance is not completely satisfied.	Decision sight distance is not completely satisfied.	Decision sight distance is not completely satisfied.	Decision sight distance is not completely satisfied.	Decision sight distance is not completely satisfied.	Decision sight distance is satisfied.	Decision sight distance is satisfied.	Decision sight distance is satisfied.	Decision sight distance is satisfied.
Proximity of plaza to interchanges / bridges	Recommended 1 mile separation from plaza and interchange is not met. Close proximity of Chase's Pond Rd Exit creates safety issues for vehicles. NB mainline lanes between entrance ramp and plaza is a high crash location.	Recommended 1 mile separation from plaza and interchange is not met. Close proximity of Chase's Pond Rd Exit creates safety issues for vehicles. NB mainline lanes between entrance ramp and plaza is a high crash location.	Recommended 1 mile separation from plaza and interchange is not met.	Recommended 1 mile separation from plaza and interchange is marginally met.	Recommended 1 mile separation from plaza and interchange is not met.	Recommended 1 mile separation from plaza and interchange is marginally met	Recommended 1 mile separation from plaza and interchange will be met.	Recommended 1 mile separation from plaza and interchange will be met.	Recommended 1 mile separation from plaza and interchange will be met.
Geotechnical conditions	Existing site has settlement issues. Approach slabs and bumpers at toll booths are settling. This creates hang-up points for vehicles with low ground clearance and safety issues for toll attendants.	Existing site has settlement issues. Approach slabs and bumpers at toll booths are settling. This creates hang-up points for vehicles with low ground clearance and safety issues for toll attendants.	Geotechnical issues at toll plaza may require use of light weight fill.	Geotechnical issues at toll plaza may require use of light weight fill.	Geotechnical issues at toll plaza may require use of light weight fill.	Geotechnical issues at toll plaza may require use of light weight fill.	Geotechnical issues are unknown.	Geotechnical issues are unknown.	Geotechnical issues are unknown.
Potential displacements	0 Displacements Possible	0 Displacements Possible	0 Displacements Possible	0 Displacements Possible	0 Displacements Possible	89 Displacements Possible	21 Displacements Possible	7 Displacements Possible	7 Displacements Possible
Potential Right-of-Way Impacts	0 Acres Impacted	1.5 Potential Acres Impacted	6.3 Potential Acres Impacted	8.1 Potential Acres Impacted	3.3 Potential Acres Impacted	202 Potential Acres Impacted	106 Potential Acres Impacted	17.7 Potential Acres Impacted	19.7 Potential Acres Impacted

Level of Acceptability: Best … Worst

*Note: Option 5 is purposely omitted from this table. This table, and this report, is meant to summarize and compare the existing site options only

SECTION 8 - REHABILITATE/RECONSTRUCT RECOMMENDATION

Considering all the factors detailed in this existing site evaluation including the plaza's crash history, operational inefficiency, structural deficiency, and its location such that these conditions compromise overall staff and patron safety, HNTB recommends replacement, and not repair of the York Toll Plaza. To determine the most effective course of action and meet the project purpose and need the following Option summaries are offered followed by a final recommendation. The Option(s) that warrant further consideration will be recommended to be carried forward into the full Site Identification and Screening process. As mentioned earlier, a full and thorough study will include options at alternative sites. The following is a summary of the nine options evaluated along with their respective recommendation.

Option 1: *No Build (Maintenance Only)*

Option 1 does not satisfy any of York Toll Plaza's safety or operational needs, present or future. This option leaves the Plaza requiring extensive and costly ongoing maintenance. However, standard procedure for permitting agencies is to use the No-Build option as a benchmark and compare it to other proposed possibilities. **This Option is required by the permitting agencies to be carried forward for further consideration.**

Option 2: Infrastructure Upgrade

Option 2 addresses only the structural deficiencies of the existing infrastructure. This option does not address the location related deficiencies, does not meet current industry design guidelines and will not address many safety or operational issues for Turnpike patrons and staff. In short, this option does not meet the Maine Turnpike Authority's objective of a safe and efficient modern toll plaza. The layout carries anticipated impacts of 0 home displacements, 1.5 acres of right-of-way, and 11 acres of wetlands and an approximate total cost of $23 million. The cost to provide this option would be lost without benefit as it would not remedy any of the truly needed safety improvements. **This Option is recommended to be dismissed from further consideration.**

Option 3: Upgrade Existing Site with Conventional Tolling and Separate Ramp Lanes

Option 3 upgrades the infrastructure, addresses some of the traffic flow inefficiency, but does not address the safety and operational concerns associated with the current plaza location. This option does not meet the current basic design guidelines. In short, this option does not meet the Maine Turnpike Authority's objective of a safe and efficient modern toll plaza. The layout carries anticipated impacts of 0 home displacements, 6.3 acres of right-of-way, and 17.6 acres of wetlands and an approximate total cost of $40.9 million. The cost of this option weighed against the marginal benefits is not prudent. In addition, there is no opportunity for implementing modern Open Road Lanes with this option. **This Option is recommended to be dismissed from further consideration.**

Option 4A: Upgrade Existing Site with Open Road Tolling and Separate Ramp Lanes

Option 4A implements open road tolling, improves traffic capacity and ETC processing time but fails to address some of the safety concerns associated with the current plaza location. The addition of dedicated ramp toll lanes does remove the merge and weave conditions between mainline and ramp traffic but creates potentially confusing traffic signage. This option addresses the proximity of the interchange in the most effective manner considering the constraints. It removes the weaves and merges by extending the interchange beyond the toll plaza location similar to the Hampton Toll Plaza (Hampton) in New Hampshire. Unlike Hampton, the interchange will not be in view at the decision point, due to the vertical and horizontal geometry, adding to possible confusion. This option does not meet three of the four current basic design guidelines. Full benefits of Open Road Tolling will not be realized due to the location on a curve and near a hill. Environmental impacts of this option, although significant, are less than some others in this evaluation. The layout carries anticipated impacts of 0 home displacements, 8.1 acres of right-of-way, and 28 acres of wetlands and an approximate total cost of $56.3 million. **Option 4A, while not meeting all the MTA goals; does address some of the major safety issues and has comparatively reasonable impacts and cost, and is therefore recommended to be carried forward for further consideration and comparison to other locations.**

Option 4B: Upgrade Existing Site with Open Road Tolling without Separate Ramp Lanes

Option 4B marginally improves traffic capacity and ETC processing time but fails to address all traffic safety concerns associated with the current plaza location. Separating open road toll patrons from the cash and ramp traffic improves the merge and weave issue similar to Option 4A along with the potential confusion. However requiring cash and ramp traffic to utilize the same lanes allows continued merge and weave situations for that traffic stream; thus not completely addressing the issue. This option does not meet the four basic design guidelines. In fact, minimizing the length of barrier separation has potentially created a new safety concern. The leading end of barrier only comes into view two seconds earlier than the minimum recommended of 14 seconds. Full benefits of Open Road Tolling will not be realized due to the location on a curve and near a hill requiring slower speeds. Environmental impacts for this option, are significant. The layout carries anticipated impacts of 0 home displacements, 3.3 acres of right-of-way, and 22.2 acres of wetlands and an approximate total cost of $43 million. Option 4B has comparable impacts and a marginally reduced cost when compared to that of Option 4A but provides far less benefit; in fact it introduces additional safety concerns over Option 4A. **However, given the magnitude of home, right-of-way and environmental impacts of the other existing site alternatives, Option 4B offers the next closest approach to Option 4A to meeting design guidelines, MTA goals and project purpose and need and reduced cost and impacts. Therefore Option 4B is recommended to be carried forward for further consideration and comparison to other locations.**

Option 5: *Relocate Plaza to Alternate Location with Open Road Tolling*

Investigation of alternative locations was suspended, in order to focus the comprehensive evaluation on the existing toll plaza area. It should be noted, as part of the next project phase alternative sites are recommended to be revisited with newly developed plaza sizing and other traffic statistics to continue their development.

Option 6: Upgrade Existing Site with Open Road Tolling, East Side Mainline Realignment, and Relocate Interchange

Option 6 will provide an Open Road Tolling facility that generally meets the basic engineering criteria and improves safety and plaza operations however, the s-curves in the horizontal alignment north of the plaza are not desirable. The layout carries anticipated impacts of 89 home displacements, 202 acres of right-of-way, and 57 acres of wetlands and an approximate total cost of $155 million. In short, this option is not economically feasible when weighed against other available options; the human and environmental impacts alone are staggering. **This Option is recommended to be dismissed from further consideration.**

Option 7: Relocate Plaza to West with Open Road Tolling, West Side Mainline Realignment, and Relocate Interchange

Option 7 will provide an Open Road Tolling facility that meets the basic engineering criteria and improves safety and plaza operations. However, the layout carries anticipated impacts of up to 21 home displacements, 106 acres of right-of-way, and 62 acres of wetlands and an approximate total cost of $106 million. In short, this option is not economically feasible when weighed against other available options; the human and environmental impacts alone are huge. **This Option is recommended to be dismissed from further consideration.**

Option 8: Relocate Plaza to South with Open Road Tolling and Reconfigure Interchange

Option 8 will provide an Open Road Tolling facility that generally meets the basic engineering criteria and improves safety and plaza operations. One of the more notable drawbacks to this option is the potentially confusing arrangement of interchange ramps and signing packages that would be required to direct motorists through unconventional traffic patterns. The layout carries anticipated impacts of up to 7 home displacements, 17.7 acres of right-of-way and 52 acres of wetlands and an approximate total cost of $118 million. In short, this option is not economically feasible when weighed against other available options; the environmental impacts alone are huge. **This Option is recommended to be dismissed from further consideration.**

Option 9: Relocate Plaza to South with Open Road Tolling and Relocate Interchange

Option 9 will provide an Open Road Tolling facility that generally meets the basic engineering criteria and improves safety and plaza operations. One of the more notable drawbacks to this option is the potentially confusing arrangement of interchange ramps, weigh station ramps and signing packages that would be required to direct motorists through unconventional traffic patterns. The layout carries anticipated impacts of up to 7 home displacements, 19.7 acres of right-of-way, and 43.7 acres of wetlands and an approximate total cost of $94.5 million. In short, this option is not economically feasible when weighed against other available options; the environmental impacts alone are huge. **This Option is recommended to be dismissed from further consideration.**

Recommendation

At the request of the Maine Turnpike Authority, HNTB has completed its 'existing site re-evaluation'. The goal of the re-evaluation, as described by the York Selectpersons, was to investigate 'out-of-the-box' or 'what it would take' alternatives that would meet design criteria, minimize impact to right-of-way and avoid taking homes. Based on additional investigation of the existing toll plaza area to identify these potential alternatives which meet basic engineering guidelines, meet MTA goals, and meet the purpose and need for the York Toll Plaza Replacement project, HNTB did not identify any alternative that fully met all parameters. However, two alternatives were identified that warrant further study.

Option 4A - Upgrade Existing Site with Open Road Tolling and Separate Ramp Booths, was an alternative that did meet some of the basic safety criteria, did implement open road tolling and kept home displacements to zero. Resulting right-of-way and environmental impacts, although significant were at the lower end of the existing site alternatives developed. While not meeting all of the MTA goals or the total project purpose and need, and considering all evaluation parameters, Option 4A provides the most improvements and is more reasonable than any of the other existing site alternatives. It should be noted that the cost of Option 4A is quite high especially when considering the few benefits realized and the numerous deficiencies remaining.

Similarly, HNTB recognizes Option 4B - Upgrade Existing Site with Open Road Tolling without Separate Ramp Booths, as an alternative that meets some of the basic safety criteria and does implement open road tolling. However, Option 4B still does not address all the MTA goals, all of the design guidelines, or the total project purpose and need. This option is marginally less expensive than Option 4A but leaves more deficiencies unaddressed. Option 4B is however, the alternative that has the least amount of right-of-way and environmental impacts while still implementing open road tolling. It should be reiterated here that Option 4B does introduce an additional safety concern due to only a partial separation of interchange traffic from mainline traffic.

HNTB recommends Option 4A and Option 4B, in addition to the No-Build Option 1, to be carried forward for further consideration. HNTB further recommends that these three options be included in a full Site Identification and Screening process where they will be more fully developed and compared to alternate site options. This further investigation of alternative sites and comparison to existing site options will be required by the environmental permitting agencies as part of a thorough permitting process.

Finally, based on our accumulated knowledge of this project and the advanced engineering that has resulted from this study of the existing site, including the significant reduction in the size of the plaza, HNTB believes that alternative locations exist that will enable the Authority to:

- Comply with national safety guidelines for toll plazas
- Avoid displacements of any homes
- Minimize wetland and other environmental impacts
- Minimize impacts to private property
- Integrate a more modern and efficient Open Road Tolling technology and
- Reduce the cost of the project.

APPENDIX A

DESIGN GUIDELINES

Foreword

As highway designers, highway engineers strive to provide for the needs of highway users while maintaining the integrity of the environment. Unique combinations of design requirements that are often conflicting result in unique solutions to the design problems. The guidance supplied by this text, *A Policy on Geometric Design of Highways and Streets*, is based on established practices and is supplemented by recent research. This text is also intended to form a comprehensive reference manual for assistance in administrative, planning, and educational efforts pertaining to design formulation.

Design values are presented in this document in both metric and U.S. customary units and were developed independently within each system. The relationship between the metric and U.S. customary values is neither an exact (soft) conversion nor a completely rationalized (hard) conversion. The metric values are those that would have been used had the policy been presented exclusively in metric units; the U.S. customary values are those that would have been used if the policy had been presented exclusively in U.S. customary units. Therefore, the user is advised to work entirely in one system and not attempt to convert directly between the two.

The fact that new design values are presented herein does not imply that existing streets and highways are unsafe, nor does it mandate the initiation of improvement projects. This publication is not intended as a policy for resurfacing, restoration, or rehabilitation (3R) projects. For projects of this type, where major revisions to horizontal or vertical curvature are not necessary or practical, existing design values may be retained. Specific site investigations and crash history analysis often indicate that the existing design features are performing in a satisfactory manner. The cost of full reconstruction for these facilities, particularly where major realignment is not needed, will often not be justified. Resurfacing, restoration, and rehabilitation projects enable highway agencies to improve highway safety by selectively upgrading existing highway and roadside features without the cost of full reconstruction. When designing 3R projects, the designer should refer to TRB Special Report 214, *Designing Safer Roads: Practices for Resurfacing, Restoration, and Rehabilitation* and related publications for guidance.

The intent of this policy is to provide guidance to the designer by referencing a recommended range of values for critical dimensions. It is not intended to be a detailed design manual that could supercede the need for the application of sound principles by the knowledgeable design professional. Sufficient flexibility is permitted to encourage independent designs tailored to particular situations. Minimum values are either given or implied by the lower value in a given range of values. The larger values within the ranges will normally be used where the social, economic, and environmental (S.E.E.) impacts are not critical.

The highway, vehicle, and individual users are all integral parts of transportation safety and efficiency. While this document primarily addresses geometric design issues, a properly equipped and maintained vehicle and reasonable and prudent performance by the user are also necessary for safe and efficient operation of the transportation facility.

Emphasis has been placed on the joint use of transportation corridors by pedestrians, cyclists, and public transit vehicles. Designers should recognize the implications of this sharing of the transportation corridors and are encouraged to consider not only vehicular movement, but also movement of people, distribution of goods, and provision of essential services. A more comprehensive transportation program is thereby emphasized.

Cost-effective design is also emphasized. The traditional procedure of comparing highway-user benefits with costs has been expanded to reflect the needs of non-users and the environment. Although adding complexity to the analysis, this broader approach also takes into account both the need for a given project and the relative priorities among various projects. The results of this approach may need to be modified to meet the needs-versus-funds problems that highway administrators face. The goal of cost-effective design is not merely to give priority to the most beneficial individual projects but to provide the most benefits to the highway system of which each project is a part.

Most of the technical material that follows is detailed or descriptive design information. Design guidelines are included for freeways, arterials, collectors, and local roads, in both urban and rural locations, paralleling the functional classification used in highway planning. The book is organized into functional chapters to stress the relationship between highway design and highway function. An explanation of functional classification is included in Chapter 1.

These guidelines are intended to provide operational efficiency, comfort, safety, and convenience for the motorist. The design concepts presented herein were also developed with consideration for environmental quality. The effects of the various environmental impacts can and should be mitigated by thoughtful design processes. This principle, coupled with that of aesthetic consistency with the surrounding terrain and urban setting, is intended to produce highways that are safe and efficient for users, acceptable to non-users, and in harmony with the environment.

This publication supersedes the 2001 AASHTO publication of the same name. Because the concepts presented could not be completely covered in one book, references to additional literature are given at the end of each chapter.

CHAPTER 1A. GENERAL

Section 1A.01 Purpose of Traffic Control Devices

Support:

The purpose of traffic control devices, as well as the principles for their use, is to promote highway safety and efficiency by providing for the orderly movement of all road users on streets and highways throughout the Nation.

Traffic control devices notify road users of regulations and provide warning and guidance needed for the reasonably safe, uniform, and efficient operation of all elements of the traffic stream.

Standard:

Traffic control devices or their supports shall not bear any advertising message or any other message that is not related to traffic control.

Support:

Tourist-oriented directional signs and Specific Service signs are not considered advertising; rather, they are classified as motorist service signs.

Section 1A.02 Principles of Traffic Control Devices

Support:

This Manual contains the basic principles that govern the design and use of traffic control devices for all streets and highways open to public travel regardless of type or class or the public agency having jurisdiction. This Manual's text specifies the restriction on the use of a device if it is intended for limited application or for a specific system. It is important that these principles be given primary consideration in the selection and application of each device.

Guidance:

To be effective, a traffic control device should meet five basic requirements:

A. Fulfill a need;
B. Command attention;
C. Convey a clear, simple meaning;
D. Command respect from road users; and
E. Give adequate time for proper response.

Design, placement, operation, maintenance, and uniformity are aspects that should be carefully considered in order to maximize the ability of a traffic control device to meet the five requirements listed in the previous paragraph. Vehicle speed should be carefully considered as an element that governs the design, operation, placement, and location of various traffic control devices.

Support:

The definition of the word "speed" varies depending on its use. The definitions of specific speed terms are contained in Section 1A.13.

Guidance:

The actions required of road users to obey regulatory devices should be specified by State statute, or in cases not covered by State statute, by local ordinance or resolution consistent with the "Uniform Vehicle Code."

The proper use of traffic control devices should provide the reasonable and prudent road user with the information necessary to reasonably safely and lawfully use the streets, highways, pedestrian facilities, and bikeways.

Support:

Uniformity of the meaning of traffic control devices is vital to their effectiveness. The meanings ascribed to devices in this Manual are in general accord with the publications mentioned in Section 1A.11.

Section 1A.03 Design of Traffic Control Devices

Guidance:

Devices should be designed so that features such as size, shape, color, composition, lighting or retroreflection, and contrast are combined to draw attention to the devices; that size, shape, color, and simplicity of message combine to produce a clear meaning; that legibility and size combine with placement to permit adequate time for response; and that uniformity, size, legibility, and reasonableness of the message combine to command respect.

Standard:

All symbols shall be unmistakably similar to or mirror images of the adopted symbol signs, all of which are shown in the "Standard Highway Signs" book (see Section 1A.11). Symbols and colors shall not be modified unless otherwise stated herein. All symbols and colors for signs not shown in the "Standard Highway Signs" book shall follow the procedures for experimentation and change described in Section 1A.10.

Guidance:

Aspects of a device's design should be modified only if there is a demonstrated need.

Support:

An example of modifying a device's design would be to modify the Side Road (W2-2) sign to show a second offset intersecting road.

Option:

Highway agencies may develop word message signs to notify road users of special regulations or to warn road users of a situation that might not be readily apparent. Unlike symbol signs and colors, new word message signs may be used without the need for experimentation. With the exception of symbols and colors, minor modifications in the specific design elements of a device may be made provided the essential appearance characteristics are preserved. Although the standard design of symbol signs cannot be modified, it may be appropriate to change the orientation of the symbol to better reflect the direction of travel.

Section 1A.04 Placement and Operation of Traffic Control Devices

Guidance:

Placement of a traffic control device should be within the road user's view so that adequate visibility is provided. To aid in conveying the proper meaning, the traffic control device should be appropriately positioned with respect to the location, object, or situation to which it applies. The location and legibility of the traffic control device should be such that a road user has adequate time to make the proper response in both day and night conditions.

Traffic control devices should be placed and operated in a uniform and consistent manner.

Unnecessary traffic control devices should be removed. The fact that a device is in good physical condition should not be a basis for deferring needed removal or change.

Section 1A.05 Maintenance of Traffic Control Devices

Guidance:

Functional maintenance of traffic control devices should be used to determine if certain devices need to be changed to meet current traffic conditions.

Physical maintenance of traffic control devices should be performed to retain the legibility and visibility of the device, and to retain the proper functioning of the device.

Support:

Clean, legible, properly mounted devices in good working condition command the respect of road users.

Section 1A.06 Uniformity of Traffic Control Devices

Support:

Uniformity of devices simplifies the task of the road user because it aids in recognition and understanding, thereby reducing perception/reaction time. Uniformity assists road users, law enforcement officers, and traffic courts by giving everyone the same interpretation. Uniformity assists public highway officials through efficiency in manufacture, installation, maintenance, and administration. Uniformity means treating similar situations in a similar way. The use of uniform traffic control devices does not, in itself, constitute uniformity. A standard device used where it is not appropriate is as objectionable as a nonstandard device; in fact, this might be worse, because such misuse might result in disrespect at those locations where the device is needed and appropriate.

Section 1A.07 Responsibility for Traffic Control Devices

Standard:

The responsibility for the design, placement, operation, maintenance, and uniformity of traffic control devices shall rest with the public agency or the official having jurisdiction. 23 CFR 655.603 adopts the Manual on Uniform Traffic Control Devices as the national standard for all traffic control devices installed on any street, highway, or bicycle trail open to public travel. When a State or other Federal agency

PREFACE

The *Roadside Design Guide* is developed and maintained by the AASHTO Subcommittee on Design, Technical Committee for Roadside Safety. The guide presents a synthesis of current information and operating practices related to roadside safety and is written in dual units—metric and U.S. Customary units. The 2006 edition of the guide supersedes the 1996 AASHTO publication of the same name and includes an update to Chapter 6, "Median Barriers," which replaces Chapter 6 of the 2002 edition.

In this guide, the roadside is defined as that area beyond the traveled way (driving lanes) and the shoulder (if any) of the roadway itself. Consequently, roadside delineation, shoulder surface treatments, and similar on-roadway safety features are not extensively discussed. While it is a readily accepted fact that safety can best be served by keeping motorists on the road, the focus of the guide is on safety treatments that minimize the likelihood of serious injuries when a driver runs off the road.

A second noteworthy point is that this document is a guide. It is not a standard, nor is it a design policy. It is intended for use as a resource document from which individual highway agencies can develop standards and policies. While much of the material in the guide can be considered universal in its application, there are several recommendations that are subjective in nature and may need modification to fit local conditions. However, it is important that significant deviations from the guide be based on operational experience and objective analysis.

To be consistent with AASHTO's *A Policy on Geometric Design of Highways and Streets,* design speed is as the basic speed parameter to be used in this guide. However, since the design speed is often selected based on the most restrictive physical features found on a specific project, there may be a significant percentage of a project length where that speed will be exceeded by a reasonable and prudent driver. Conversely, there will be other instances where roadway conditions will prevent most motorists from driving as fast as the design speed. Because roadside safety design is intended to minimize the consequences of a motorist leaving the roadway inadvertently, the designer should consider the speed at which encroachments are most likely to occur when selecting an appropriate roadside design standard or feature.

Design values are presented in this document in both metric and U.S. Customary units. The relationship between the metric and U.S. Customary values is neither an exact (soft) conversion nor a completely rationalized (hard) conversion. The metric values are those that would have been used had the guide been presented exclusively in metric units; the U.S. Customary values are those that would have been used if the guide had been presented exclusively in U.S. Customary units. Therefore, the user is advised to work entirely in one system and not to attempt to convert directly between the two.

The reader is cautioned that roadside safety is a rapidly changing field of study, and changes in policy, criteria, and technology are certain to occur after this document is published. Efforts should be made to incorporate the appropriate current design elements into the project development. Comments from users of this guide on suggested changes or modifications resulting from further developmental work or hands-on experience are appreciated. All such comments should be addressed to the American Association of State Highway and Transportation Officials, Engineering Program, 444 North Capitol Street NW, Suite 249, Washington, DC 20001.

CHAPTER 1

INTRODUCTION

This report has been prepared under a project initiative by the Federal Highway Administration (FHWA) to identify the 'state-of-the-practice' for traffic control strategies at toll plazas, and to develop recommended guidelines for agencies and departments that operate or plan to design and build such facilities.

The report contents begin with this introductory chapter. This chapter includes sections that outlines the purpose of this Project, provides a problem statement, articulating the focus of the project efforts, lists the study objectives, describes the methodology used to achieve the objectives, and concludes with the intended use of this report.

The introduction is followed by four chapters that include the state-of-the-practice and recommended guidelines for the following technical areas encompassing the development of traffic control strategies at toll plazas: 'Plaza Operations/Lane Configuration', 'Signing, Markings and Channelization', 'Geometric and Safety Design', and 'Toll Collection Equipment Technology'. The aggregation of these chapters provides useful historical information and a comprehensive analysis of when and where to apply various traffic control strategies.

The final chapter concludes this Report by identifying further research needs, which require more rigorous study including field verification of performance. This chapter also lists all of the recommended guidelines presented in the preceding chapters. A glossary of terms, definitions and diagrams to assist the reader's understanding of the topic material follows along with Appendix A Summary of Survey Results, Appendix B Expert Panel Workshop Summary, and Appendix C Literature Search.

1.1 PURPOSE

The purpose and focus of this report is to develop guidelines for designing and implementing traffic control strategies and devices at toll plazas that, for example, inform drivers which lanes to use for specific methods of payment, reduce speed variance, discourage lane changing and properly install equipment and devices. This was accomplished after researching related studies and reports, surveying current practices, and learning from the experience of experts within the toll collection industry. The goal is to achieve a consistent strategy for handling potential points of conflict, controlling flow of various vehicle types and conveying information at toll plazas so that safety and operations are enhanced, better efficiency and economy of design are achieved, and motorist recognition and comprehension are improved. This must be accomplished in consideration of the fact that each toll facility may desire its own unique identity.

approaches to bridges and tunnels. Different types of toll collection processes are addressed, including: automated cash/card/ticket, manual cash/card/ticket, and electronic toll collection (ETC). While this report covers plazas on roadway mainlines, interchange and access ramps, and approaches to bridges, and tunnels, the scope of the survey contained in Appendix A is limited to mainline plazas and approaches to bridges and tunnels. Therefore, design considerations and elements unique to ramp plazas may not be addressed in this report.

1.2 PROBLEM STATEMENT

Many decision points exist while approaching the plaza, at the plaza, and on departure from the plaza. The decision points can lead to vehicle merging, weaving, queuing, diverging and differential speeds. Diverging and weaving occurs on the approach to the plaza as electronic toll collection (ETC) users separate from cash paying customers, who then further diverge based on selected cash payment lane type, shortest traffic queue, and lane status (i.e., open or closed). Multiple collection methods can increase the potential for side swipe and rear-end collisions if the lane groupings are not clear to users who are making choices of which lane to use for payment. Potential safety hazards particularly exist when approaching and departing ETC dedicated lanes. When an driver unfamiliar with the toll plaza realizes their vehicle is in the wrong payment lane and suddenly stops, a following high-speed, ETC–equipped vehicle can easily collide with the stopped vehicle. Consequently, speed variance is another important factor to be considered at mixed use toll facilities. Similarly, merging and weaving occurs on the departure side of the plaza as the number of toll lanes tapers down to the width of the continuing mainline.

Various studies and reports have presented summaries of the state-of-the-practice within the industry, primarily related to specific design elements or practices of toll agencies. The present environment is seeing significant increases in new toll highway miles, resulting in more toll plazas, most of which include high speed express lanes for ETC users only. Further trends show toll roads facing greater commuter and recreational demands, resulting in cash paying and ETC users familiar with the toll road mixed with unfamiliar cash paying users. Without the use of good design practice, including effective deployment of various traffic control devices, this mix can result in unsafe and inefficient operations. ETC users now expect non-stop, high speed travel through toll plazas without incurring any delays. Development of national guidelines that address the implications of electronic toll collection on plaza operations has therefore become much more critical.

Toll plazas have been designed and constructed in the United States without the benefit of national toll plaza design guidelines and standards, often resulting in driver unfamiliarity and inefficient vehicle throughput. Without national guidelines and standards, designs have evolved placing undue focus on monetary constraints, deploying signs with too little or too much information, inefficiently configuring toll lanes and embodying design features with greater emphasis on establishing a unique identity than on plaza safety and operations. As a result, toll plaza design elements and practices vary from agency to agency, and are often dictated by either legacy toll plaza design practices or variations to historical designs that retains a distinctive appearance while incorporating enhancements to correct deficiencies. Plaza modifications made to add electronic toll collection (ETC) to existing plaza facilities operations, and relatively low commuter traffic volumes are forecasted.

The expectation based on recent toll facility projects is new mainline toll plaza requirements will include non-stop ETC express lanes, and new ramp plaza requirements will include non-stop ETC dedicated lanes. In these cases, the driver approaching a plaza will have to make a choice between the non-stop lanes and the conventional plaza lanes or adjacent cash lane(s).

Plaza Location Guidelines

Guideline	Plaza Locations Guideline 1
Title	Plaza and Interchange Intervals
Text	The 2001 AASHTO *A Policy on Geometric Design of Highways and Streets* (the "Green Book") recommends separation of 1 mile (urban sections) or 3 miles (rural sections) between interchanges. This criteria should be used as a guideline for selection of new mainline toll plaza sites (i.e., the interstate standards require 1 mile to the nearest interchange in urban areas and 3 miles in rural areas).
Commentary	Although it may not be possible to meet this design guideline at bridge and tunnel crossings, the interval spacing minimums should remain a goal.

Guideline	Plaza Locations Guideline 2
Title	Site Selection and Sight Distance
Text	New toll plazas should be sited such that motorists will be able to see the plaza, while driving at posted speeds with adequate stopping sight distance before the queue zone. The plaza site should be on a tangent pavement section.
Commentary	None.

Guideline	Plaza Locations Guideline 3
Title	Ramp Plaza Movements
Text	New toll plazas should not have merging or diverging movements within the plaza approach and departure zones. New plaza construction should not occur within trumpet interchange areas, if possible.
Commentary	Some existing toll plaza locations have merging and diverging movements within the plaza approach and departure zones. Other appropriate treatment options could be applied to improve their operations.

4.7 VERTICAL PROFILE GRADES

The vertical profile grade is the percent of elevation change along the centerline of the roadway. Vertical grades are necessary to assure drainage of storm water within the plaza to inlets and or outfall locations. Profile grades affectively reduce construction costs by more closely following the natural grade within the established right of way, balancing the quantity of excavation and embankment material and reducing the foundation and earthwork cost of bridges.

4.7.1 State-of-the-Practice

The survey did not request information on vertical profile grades.

4.7.2 Recommended Guidelines

Vertical Profile Grade Design Issue and Guideline Development

Construction of a toll plaza at the crest of a profile grade results in sight distance advantages and plaza operations benefit from gravitational forces in slowing vehicles approaching the toll lanes and accelerating vehicles departing the plaza. Consequently, some studies have recommended the use of a $\pm$ 3% grade for the plaza approach and departure area. Unfortunately, when the plaza's mixed flow traffic includes commercial vehicles, a 3% grade will adversely affect the performance of these vehicles, resulting in additional delays through the plaza. A vertical profile grade greater than or equal to $\pm$ 1% and less than or equal to $\pm$ 2% better accommodates the performance of commercial vehicles under the stop and go conditions normally encountered in plaza queue zones. For the toll lanes, the cross slope and the vertical profile grade should be designed concurrently to assure proper drainage. Under no circumstances should the vertical profile grade be less than $\pm$ 0.5% or exceed $\pm$ 2% in a toll lane. This avoids the undesirable need to install trench or slot drains across the toll lane entrance that may clog, causing the possible unsafe condition (to both attendant and user) of ice formation within the lane. The canopy and storm drainage system design must direct collected water away from the toll lanes.

Recommended Guidelines

Guideline	Vertical Profile Grade Guideline 1
Title	Plaza Approach and Departure Profile Grades
Text	In cases of fixed flow traffic, the vertical profile grade approaching and departing the toll plaza should be greater than or equal to ± 1% and less than or equal to ±2%.
Commentary	The upper limit on vertical profile grades may be increased to +3 when the percentage of commercial vehicles is low and the toll plaza is located at the crest of the profile grade.

Guideline	Vertical Profile Grade Guideline 2
Title	Toll Lane Profile Grades
Text	The vertical profile grade in a toll lane should be equal to or greater than ± 0.5% and less than or equal to ±2%.
Commentary	The cross slope and profile grade should be designed in conjunction to avoid storm drainage flows across the entrance to the toll lane. The canopy and storm drainage system design should direct collected water away from the toll lanes and help reduce precipitation within the toll lane.

Metric							US Customary						
Design speed (km/h)	Stopping sight distance (m)						Design speed (mph)	Stopping sight distance (ft)					
	Downgrades			Upgrades				Downgrades			Upgrades		
	3 %	6 %	9 %	3 %	6 %	9 %		3 %	6 %	9 %	3 %	6 %	9 %
20	20	20	20	19	18	18	15	80	82	85	75	74	73
30	32	35	35	31	30	29	20	116	120	126	109	107	104
40	50	50	53	45	44	43	25	158	165	173	147	143	140
50	66	70	74	61	59	58	30	205	215	227	200	184	179
60	87	92	97	80	77	75	35	257	271	287	237	229	222
70	110	116	124	100	97	93	40	315	333	354	289	278	269
80	136	144	154	123	118	114	45	378	400	427	344	331	320
90	164	174	187	148	141	136	50	446	474	507	405	388	375
100	194	207	223	174	167	160	55	520	553	593	469	450	433
110	227	243	262	203	194	186	60	598	638	686	538	515	495
120	263	281	304	234	223	214	65	682	728	785	612	584	561
130	302	323	350	267	254	243	70	771	825	891	690	658	631
							75	866	927	1003	772	736	704
							80	965	1035	1121	859	817	782

Exhibit 3-2. Stopping Sight Distance on Grades

Decision Sight Distance

Stopping sight distances are usually sufficient to allow reasonably competent and alert drivers to come to a hurried stop under ordinary circumstances. However, these distances are often inadequate when drivers must make complex or instantaneous decisions, when information is difficult to perceive, or when unexpected or unusual maneuvers are required. Limiting sight distances to those needed for stopping may preclude drivers from performing evasive maneuvers, which often involve less risk and are otherwise preferable to stopping. Even with an appropriate complement of standard traffic control devices in accordance with the MUTCD (**6**), stopping sight distances may not provide sufficient visibility distances for drivers to corroborate advance warning and to perform the appropriate maneuvers. It is evident that there are many locations where it would be prudent to provide longer sight distances. In these circumstances, decision sight distance provides the greater visibility distance that drivers need.

Decision sight distance is the distance needed for a driver to detect an unexpected or otherwise difficult-to-perceive information source or condition in a roadway environment that may be visually cluttered, recognize the condition or its potential threat, select an appropriate speed and path, and initiate and complete the maneuver safely and efficiently (**7**). Because decision sight distance offers drivers additional margin for error and affords them sufficient length to maneuver their vehicles at the same or reduced speed, rather than to just stop, its values are substantially greater than stopping sight distance.

Drivers need decision sight distances whenever there is a likelihood for error in either information reception, decision making, or control actions (**8**). Examples of critical locations where these kinds of errors are likely to occur, and where it is desirable to provide decision sight distance include interchange and intersection locations where unusual or unexpected maneuvers are required, changes in cross section such as toll plazas and lane drops, and areas of concentrated demand where there is apt to be "visual noise" from competing sources of information, such as roadway elements, traffic, traffic control devices, and advertising signs.

The decision sight distances in Exhibit 3-3 (1) provide values for sight distances that may be appropriate at critical locations, and (2) serve as criteria in evaluating the suitability of the available sight distances at these locations. Because of the additional safety and maneuvering space provided, it is recommended that decision sight distances be provided at critical locations or that critical decision points be moved to locations where sufficient decision sight distance is available. If it is not practical to provide decision sight distance because of horizontal or vertical curvature or if relocation of decision points is not practical, special attention should be given to the use of suitable traffic control devices for providing advance warning of the conditions that are likely to be encountered.

Metric					
Design speed (km/h)	Decision sight distance (m)				
	Avoidance maneuver				
	A	B	C	D	E
50	70	155	145	170	195
60	95	195	170	205	235
70	115	235	200	235	275
80	140	280	230	270	315
90	170	325	270	315	360
100	200	370	315	355	400
110	235	420	330	380	430
120	265	470	360	415	470
130	305	525	390	450	510

US Customary					
Design speed (mph)	Decision sight distance (ft)				
	Avoidance maneuver				
	A	B	C	D	E
30	220	490	450	535	620
35	275	590	525	625	720
40	330	690	600	715	825
45	395	800	675	800	930
50	465	910	750	890	1030
55	535	1030	865	980	1135
60	610	1150	990	1125	1280
65	695	1275	1050	1220	1365
70	780	1410	1105	1275	1445
75	875	1545	1180	1365	1545
80	970	1685	1260	1455	1650

Avoidance Maneuver A: Stop on rural road—t = 3.0 s
Avoidance Maneuver B: Stop on urban road—t = 9.1 s
Avoidance Maneuver C: Speed/path/direction change on rural road—t varies between 10.2 and 11.2 s
Avoidance Maneuver D: Speed/path/direction change on suburban road—t varies between 12.1 and 12.9 s
Avoidance Maneuver E: Speed/path/direction change on urban road—t varies between 14.0 and 14.5 s

Exhibit 3-3. Decision Sight Distance

Decision sight distance criteria that are applicable to most situations have been developed from empirical data. The decision sight distances vary depending on whether the location is on a rural or urban road and on the type of avoidance maneuver required to negotiate the location properly. Exhibit 3-3 shows decision sight distance values for various situations rounded for design. As can be seen in the exhibit, shorter distances are generally needed for rural roads and for locations where a stop is the appropriate maneuver.

For the avoidance maneuvers identified in Exhibit 3-3, the pre-maneuver time is increased above the brake reaction time for stopping sight distance to allow the driver additional time to detect and recognize the roadway or traffic situation, identify alternative maneuvers, and initiate a

APPENDIX B

BASIC PROJECT PURPOSE AND NEED

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
696 VIRGINIA ROAD
CONCORD, MASSACHUSETTS 01742-2751

REPLY TO
ATTENTION OF
Regulatory Division
CENAE-R-51

APR 0 9 2007

Joseph G. Grilli, PE
HNTB Corporation
75 State Street
Boston, MA 02109

Dear Mr. Grilli:

This is in reference to your client's proposal to replace the southern barrier toll plaza on the Maine Turnpike at York, Maine.

Based on presentations at several monthly interagency meetings with Federal and State regulatory and resource agencies, we have determined that the basic project purpose of the project is to replace/rehabilitate the existing barrier toll plaza on the Maine Turnpike at York, Maine, incorporating High Speed Tolling (HST) and addressing settling/subsidence and facilities deficiencies, safety deficiencies, and existing and projected traffic volumes. We will use this basic project purpose to analyze alternatives to avoid and minimize adverse impacts to waters and wetlands in order to comply with the Section 404(b)(1) Guidelines.

If you have any questions concerning this matter, please contact Jay Clement at 207-623-8367 at our Manchester, Maine Project Office.

Sincerely,

Jay L. Clement
For Christine Godfrey
Chief, Regulatory Division

Copies Furnished:
Trish Garrigan – EPA
Wende Mahaney – USFWS
Mark Hasselman – FHWA
Linda Kokemuller – Maine DEP

APR 1 2 2007

HNTB Corporation
The HNTB Companies
Engineers Architects Planners

75 State Street
Boston, MA 02109

Telephone (617) 542-6900
Facsimile (617) 428-6905
www.hntb.com

December 8, 2006

HNTB

Jay Clement, Senior Project Manager
Maine Project Office
New England District
US Army Corps of Engineers
675 Western Avenue #3
Manchester, Maine 04351

Re: Maine Turnpike Authority
Southern Toll Plaza Replacement
Request for Sign-off on Project Purpose and Need

Dear Mr. Clement:

On behalf of our client, the Maine Turnpike Authority, we are writing to provide information related to replacement of the southern barrier toll plaza at York and to request the Corps' sign-off on Project Purpose and Need. On October 10, 2006 the Maine Turnpike Authority introduced this project to you and other resource and regulatory agencies at the regularly scheduled MaineDOT interagency meeting. Additional information related to project Purpose and Need is provided herewith.

The purpose of the proposed project is to replace the obsolete barrier toll plaza at York with a new toll plaza, with Highway Speed Tolling (HST), at a suitable location determined with consideration of Turnpike operational parameters, engineering design criteria, physical features including regulated natural resources, cultural resources, community resources, and capital and operational costs.

The need for the project is demonstrated by four areas of deficiencies:

Settlement and facility deficiencies;
Safety;
Congestion; and
Customer service (highway speed tolling).

The attached Project Needs Briefing Paper provides more detail on these deficiencies.

HNTB is currently conducting a site identification and screening study of potential locations for the replacement toll plaza. We will be submitting to you a report on this study on or about the end of the year.

Should you have any questions or comments about this project, please feel free to contact us. We look forward to your review and Project Purpose and Need Sign-off.

Regards,

Joseph G. Grilli, PE
Study Manager

encl. Project Needs Briefing Paper

cc: C. Welzel, MTA, w/encl.

Maine Turnpike
Southern Toll Plaza Replacement Study
Project Needs Briefing Paper

December 4, 2006

Prepared for: The Maine Turnpike Authority

MAINE TURNPIKE

Prepared by: HNTB Corporation

HNTB

Maine Turnpike
Southern Toll Plaza Replacement Study
Project Needs Briefing Paper

Background

The existing York Toll Plaza was constructed in 1969. Due to the age of the facility, numerous maintenance and rehabilitation projects have been required to improve the capacity of the plaza, to maintain aging components and to alleviate the adverse conditions resulting from the poor soils in the area. The initial 11-lane plaza was expanded by four lanes as traffic grew in southern Maine. The plaza was modified in 1997 to incorporate electronic toll collection and in 1999, two dedicated electronic toll lanes were added to the plaza to form the current configuration of 17 lanes. The canopy over the original lanes was extended in 2001 to cover all but the exterior dedicated toll lanes. In 2005, the plaza was included in the conversion to E-ZPass.

Today, as the gateway to Maine, the York Toll Plaza sees 15 million transactions per year. $34 million in revenue is collected here yearly, which is 39 percent of total Maine Turnpike revenue.
Truck traffic accounts for 15 to 20 percent of the plaza's use. Forty percent of total traffic at York utilizes Electronic Toll Collection.

In July 2007, the Maine Turnpike Authority authorized implementation of Highway Speed Tolling (HST) at the new Southern Toll Plaza. This feature allows EZ-Pass customers to maintain highway speeds along the mainline highway lanes, while non-EZ-Pass customers must exit the mainline to pay their toll at a conventional toll plaza. This feature improves customer service, aids in congestion relief, provides operational benefits, and provides environmental benefits in terms of air quality and noise.

Need

The need for the project is demonstrated by the deficiencies of the York Toll Plaza, a plaza and plaza approach design that does not meet recently published FHWA guidelines.

The age of the toll plaza, the outmoded conditions of the existing tollbooths, canopy, and tunnel, and poor soil conditions make upgrade of the existing facility, including installation of HST technology, infeasible. Proximity to interchanges, inadequate geometry, and exceeded capacity render the existing facility inadequate. Details of these inadequacies are:

<u>Toll Booths</u>
The original tollbooth structures were designed in the 1960s and are considered deficient by today's standards from a space, layout, climate control, protection, and systems perspective. The original design did not anticipate the need for additional equipment required for modern technology such as Electronic Toll Collection systems. The current booths have limited space for collector activities. The booths are heated in winter but do not include positive ventilation or air conditioning for warm weather operations. Larger modern booths as installed at other locations on the Maine Turnpike will not fit on the existing toll islands. Also, the newer booths have an additional layer of concrete protection on the upstream and downstream ends of the booths providing improved safety for toll collectors.

Canopy & Tunnel
The canopy and tunnel infrastructure at the plaza are in poor condition and in need of replacement. The portions of the tunnel directly under the toll lanes have been repaired, but the tunnel sections under the tollbooths haven't been repaired and remain in poor condition. The extensive costs associated with repairing the tunnel sections under the booths rival the costs for a new tunnel. Similarly, the structural supports for the canopy have reached a point of capacity given the additional roofing, equipment, and signage that have been placed on the canopy structure over time.

Soil Conditions
The original toll plaza was built in an area with poor subsurface soil conditions, mainly consisting of compressible clay. With this site condition recognized in the design, the plaza tunnel, booths, and canopy were constructed on H-piles to prevent settlement of the entire structure due to consolidation of the clay soils. However, the roadway approaches to the plaza were not pile supported. As a result, the approaches have and continue to settle as the clay soil consolidates. In an effort to mitigate the ongoing settlement of the roadway approaches, routine shimming of the pavement has been necessary. Even with the shimming work, the plaza has a noticeable slope approaching and leaving the plaza, with the roadways settling away from the pile-supported plaza. This approach settlement has created a range of adverse conditions, from low bed trailer hang-ups at the plaza to excessive settlement of the protective concrete bumpers in front of the booths, both resulting in safety concerns. Vehicles that become hung up on the plaza high point increase potential for vehicle accidents, and settlement of the concrete bumpers reduces the ability of the bumpers to absorb vehicle collisions increasing risk to toll plaza staff and patrons.

Proximity to Interchange
The proximity of the Chase's Pond Road interchange (Exit 7) located immediately south of the plaza presents undesirable safety and operational conditions for the plaza from both a traffic weaving and sight distance perspective. The Federal Highway Administration's (FHWA) recently published "State of the Practice and Recommendations on Traffic Control Strategies at Toll Plazas," recommends a one (1) mile separation between toll plaza and interchanges. The interchange southbound off ramp is less than 1,000 feet from the plaza and the northbound on ramp is less than 500 feet from the plaza. The proximity of these interchange ramps to the plaza creates traffic weaving issues, signing difficulty and driver confusion. MaineDOT has classified the York Toll Plaza in the northbound direction as a high crash location (2003-2005 crash data).

Vertical Geometry
The FHWA guidelines recommend toll plazas be located on a crest vertical curve. Locating the plaza on a high point will increase sight distance and provide operational benefits as the approach up-grade will aide in slowing vehicles and the departure down-grade will aide in accelerating vehicles.

The existing York Toll Plaza is located at the low point of a hill that begins just north of the plaza. This vertical geometry presents undesirable conditions with traffic departing northbound and approaching southbound. The northbound impact is primarily operational in nature, since the roadway north of the plaza includes a significant grade that impacts acceleration for departing vehicles, especially trucks. There is currently a truck climbing lane in this area to mitigate this condition. The southbound approach represents a concern from the safety perspective since it is on a downgrade. This creates a condition where vehicles (especially trucks) must brake sooner to compensate for the downgrade in addition to the significant speed reduction required in the plaza area.

Horizontal Geometry
Recently published FHWA Guidelines recommend plazas be constructed on horizontal tangents instead of curves. Placement of plazas on tangents results in improved driver sight distance, awareness, and ultimately safety.

The York Toll Plaza was built on a horizontal curve. In addition to driver sight distance concerns, the curved roadway has an operational impact on the plaza, specifically in the southbound direction. Vehicles approaching southbound make a sweeping right turn approaching the plaza. This movement creates a tendency for southbound vehicles to travel through toll lanes on the outside of the curve (interior of the plaza) and reduces utilization of the tollbooths on the inside of the curve. Traffic that is not uniformly distributed in the plaza reduces operational efficiency, with some lanes over utilized and some underutilized. While a certain amount of non-uniform usage is common at plazas, the existing roadway curve exacerbates the skewed distribution.

Plaza Capacity
The original York Toll Plaza, along with past expansions, does not accommodate today's peak traffic loads. With the plaza constrained laterally by wetlands the only opportunities for expanding through-put are through the use of Electronic Toll Collection, installation of pass-thru satellite booths and/or tandem booths. While a number of efforts have been employed to increase capacity of the plaza, the current location is severely constrained from an expansion perspective.

One option for increasing capacity through the toll plaza is the use of Highway Speed Tolling. Utilization of this technology in a new Southern Toll Plaza is viable and will prove constructive by providing improved customer service, congestion relief, operational ease, and environmental benefits. However, due to the deficiencies described above, this technology cannot be installed at the existing York Toll Plaza.

Summary
In summary, the existing southern toll plaza at York is deficient in many areas and rehabilitation and expansion to accommodate current and future needs is not feasible. Therefore, a replacement southern toll plaza is required.

APPENDIX C
WHAT IS A TOLL PLAZA

Components of a Typical Conventional Toll Plaza

A conventional toll plaza consists of several main components: a toll booth on a concrete island, toll lanes, a canopy, and a tunnel. These are described below and shown in the following figure. Within these descriptions there are a number of additional items mentioned along with their purpose.

1. Toll Lane – The toll lane allows the patron to drive through to pay their toll either with cash or E-ZPass. The lane is typically a minimum of 11' wide. There are different types of lanes at a conventional plaza including staffed, coin collection, and dedicated slow speed E-ZPass.

    - Staffed Lanes – A staffed lane is attended with Turnpike personnel that collect money and make change.

    - Coin Collection Lanes – This lane is not attended. There is a coin machine with a basket that drivers toss correct coin combinations into.

    - Dedicated E-ZPass Lanes – This lane is not attended. Only drivers with an E-ZPass transponder are allowed to pass through at speed of 10 mph. Their transponder is read, allowing for proper toll payment, and a signal gives them an indication of acceptance. Drivers are not to stop in these lanes.

    To maximize the efficiency of processing patrons, some lanes on the Turnpike have changeable signing that allows for lanes to switch between types. Regardless of lane types, all Turnpike toll plazas have a 10 mph speed limit for the immediate area before and after the plaza.

2. Concrete Island with Toll Booth – A concrete island with curbing is provided to separate the toll booths from the toll lanes. The island functions much the same as a curb and sidewalk does to separate pedestrians from vehicles. The island also provides an area to house 'bumpers' and/or attenuators along with various tolling equipment.

    - Sloping Concrete and the First Bumper – The concrete island is shaped to slope up to the first bumper and is intended to redirect the vehicle away from the toll booth back into the toll lane. The first concrete "block" is intended to stop a vehicle that hasn't been redirected, essentially protecting the toll attendant from errant vehicles approaching the toll plaza.

    - Second Bumper - The second massive concrete "block" is the second line of defense from errant vehicles and is after the first bumper. This also surrounds the toll booth. If the errant vehicle gets past the first bumper, this bumper is intended to stop the vehicle.

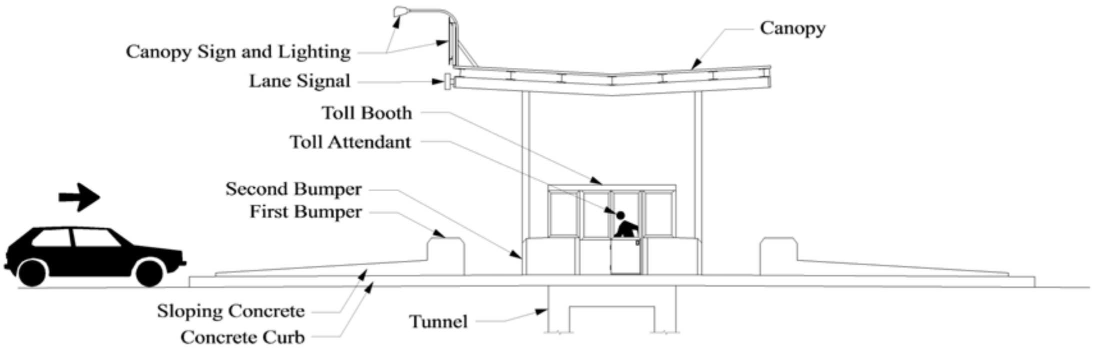
    - Attenuator and Guardrail - Installing impact attenuators followed by guardrail before the toll booth is an alternative to a system of bumpers and sloping concrete that some agencies have adopted. The purpose of the impact attenuator is to slow down an errant vehicle or make it come to a complete stop by absorbing the vehicle's energy. The guardrail is meant to redirect the vehicle back into the lane.

- Toll Booth – The toll booth is a weatherproof structure located on the island behind the system of bumpers. Toll collection equipment and heating / ventilation systems are housed in the toll booths. A toll attendant collects cash tolls from inside toll booths serving staffed lanes. Toll booths for coin collection lanes have coin machines for patrons to pay their tolls into.

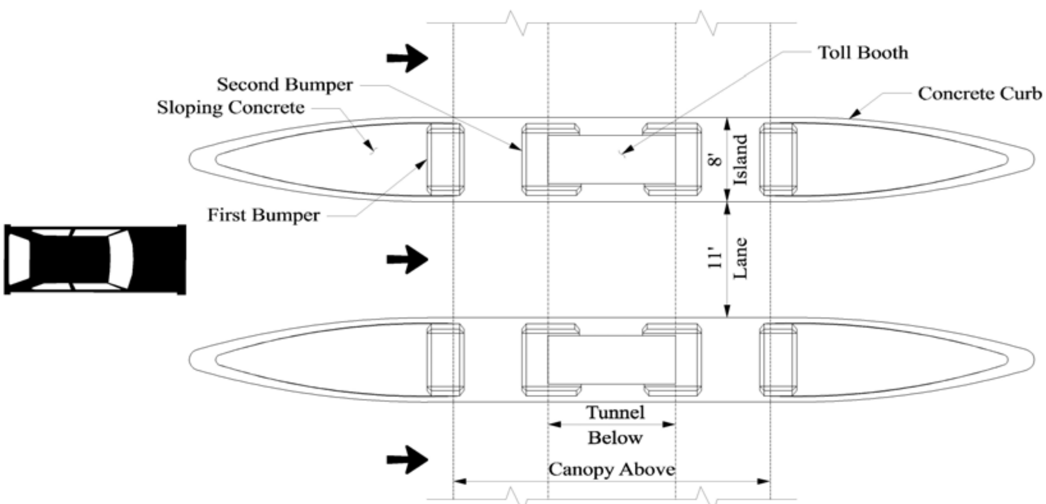
- Toll Attendant – The attendant is the Turnpike employee collecting cash tolls and making change for patrons as needed.

3. Canopy – The canopy or "roof" covering the toll booths and toll lanes provides protection from the weather. The canopy must be able to support a snow load as well as signing, lighting, lane signals and tolling equipment that is mounted above and below the canopy.

4. Tunnel – The weatherproof tunnel under the toll booths and travel lanes allows safe passage for Turnpike employees to access the booths and lanes. Tunnel access is provided on certain islands to minimize the number of toll lanes that personnel will have to cross. Personnel also use the tunnel to move the money collected to the toll plaza auxiliary building. Also located in the tunnel are electrical and communication lines along with heating / ventilation system components. Location of these utilities in the tunnel allows for easier access for repair and maintenance.



ELEVATION VIEW



PLAN VIEW

APPENDIX D

ONE-WAY TOLLING FEASIBILITY STUDY

One-Way Tolling Feasibility Study

Prepared for the:

Maine Turnpike Authority

EXECUTIVE SUMMARY

HNTB

July 2005

Executive Summary

PURPOSE

The purpose of this report is to identify and assess the various impacts associated with the conversion of the York Toll Plaza to one-way tolling. The report will also identify the critical issues that the Maine Turnpike Authority (MTA) will need to address both in order to implement one-way tolling on the Maine Turnpike and to construct a new toll facility to replace the existing York Toll Plaza.

BACKGROUND

The MTA has considered one-way tolling at York toll plaza since the conversion to a closed barrier toll system in September 1997. One-way tolling essentially involves charging twice the fare in one direction, while making the other direction toll-free.

The concept of one-way tolling in this area came to the forefront in August 2003, when New Hampshire's Governor authorized the New Hampshire DOT to conduct a one-way tolling experiment at the Hampton toll plaza. One-way tolling trials were conducted at the Hampton Toll plaza in the late summer/fall of 2003 and again during the summer of 2004. However, New Hampshire plans no additional trials, nor has it identified permanent plans to convert Hampton Toll Plaza to one-way tolling.

Evaluation of one-way tolling at the York Toll plaza began in 2003 as a result of the Hampton Toll Plaza one-way tolling trials. This current evaluation incorporates the toll rate changes and conversion to the E-ZPass electronic toll collection system that became effective on February 1, 2005.

The MTA is currently planning to replace the existing York Toll Plaza in 2008. This study and its findings will be included in the overall evaluation of locating and constructing a new toll facility.

STUDY ASSUMPTIONS

The following are key assumptions used in the one-way tolling feasibility study:

- Vehicles at the York toll plaza are tolled in the NB direction only
- February 1, 2005 toll rates are the basis for calculating toll rates
- Cash fares at York toll are doubled in the NB direction
- Northbound ETC fares are nearly doubled, but continue to be less than or equal to the cash fares
- Commuter rates remain unchanged

RESULTS OF HAMPTON ONE-WAY TOLLING TRIAL

The New Hampshire DOT – Division of Turnpikes launched its first trial in one-way tolling in August 2003. On this date, the NHT doubled its northbound toll to $2.00 while making southbound travel toll-free. The NHDOT continued its one-way tolling policy for 10 weeks, ending the trial in October 2003. A second trial was run in the summer of 2004 for approximately 15 weeks. The key results are as follows:

- Diversion around the northbound toll averaged **4.7%**.
- Attraction to the Turnpike in the southbound (toll-free) direction averaged **2.3%**.

ESTIMATED TRAFFIC IMPACTS

Traffic impacts, both at York Toll Plaza and on local roadways, were estimated for a one-way tolling condition. Traffic impacts included both diversion and attraction. Diversion is an important concern for two reasons. First, diverting vehicles represent lost revenue to the Authority. And second, diverting vehicles may create problems for local roadways, since they impose additional demands on a network that already experiences peak-hour congestion. Attraction is a measure of the extent to which non-Turnpike users are drawn to the Turnpike when tolls are lowered. By drawing vehicles away from parallel routes and onto the Turnpike, attraction can provide relief to congested local roadways and intersections. Understanding attraction is important, because the benefits of attraction may help to offset the disbenefits associated with diversion.

The key findings of this analysis are summarized in the following bullets:

- HNTB estimates that the rates of diversion and attraction at York toll would be higher than the diversion at Hampton Toll Plaza. Over the course of a year, the average rate of diversion would be approximately **11.7%**, while the rate of attraction would be approximately **10.0%**. This equates to 5400 vehicles per day of diversion and 4600 vehicles per day of attraction.
- A conversion to one-way tolling could potentially improve operations at the York toll plaza. Currently, the plaza is at (or above) capacity during peak summer periods. If one-way tolling were implemented, then more lanes could be devoted to servicing northbound traffic, while southbound traffic could flow freely without having to stop. In short, one-way tolling would enable the existing plaza to meet the growing demand while avoiding summer backups. However, a new toll plaza is currently planned for 2008, which will alleviate these backups.
- A conversion to one-way tolling would also enable the Authority to construct a smaller, less costly plaza when the existing facility is replaced.
- HNTB estimates that the volume of traffic diverting around one-way tolling would be modest, and would be relatively consistent throughout the year.
- The combined impact of diversion and attraction will have a nearly negligible impact on key roadways and intersections along Routes 1 and 236.

ESTIMATED REVENUE IMPACTS

The foremost concern to the Authority is the impact one-way tolling would have on net revenue. It is estimated that an average of **11.7%** of all northbound patrons would divert to an alternative route. These diverting patrons represent lost revenue. This raises a fundamental question: Can savings in capital and operating expenses offset this lost revenue? If not, the financial feasibility of one-way tolling will be in jeopardy.

HNTB has developed a revenue model for the Maine Turnpike to assess one-way tolling. This model incorporates current traffic volumes and historical trends as a means of forecasting how changes in rates could affect Turnpike revenue. The model accounts for all classes of vehicles, as well as all of the various payment programs (e.g. commuter, debit, and cash) that the MTA offers to its patrons. As part of this effort, a new set of one-way tolling rate tables were developed for all vehicle types and payment programs. These rates were then input into the revenue model, based on traffic volumes for 2004 the first part of 2005.

In 2005, the York toll plaza is projected to account for approximately **$34.1 million** in toll revenue. A diversion rate of 11.7% would yield a revenue loss of **$4.0 million**. This equates to an overall drop in revenue of **4.6%**.

ESTIMATED COST SAVINGS AT YORK

Conversion to one-way tolling would likely provide a cost savings that such a conversion might yield. These savings will come in three forms—labor, operations, and capital.

- **Labor Savings**. One significant opportunity for cost savings brought about by one-way tolling is the reduction of toll collection staff. By collecting tolls in one direction only, the number of toll collection staff can be reduced by approximately 30%.
- **Operation and Maintenance Cost Savings**. In addition to reducing the toll collection staff, a conversion to one-way tolling would also reduce operation and maintenance (O&M) costs at York toll plaza. These O&M costs include ETC Maintenance Costs, Toll Lane Equipment Replacement Costs, and Toll Plaza Maintenance (Canopy, lighting, signing, etc)
- **Toll Plaza Construction Savings**. Currently, the Maine Turnpike Authority 20-year plan calls for the replacement of the York Toll Plaza in 2008. The estimated cost to replace the York Toll Plaza as a two-way toll plaza is currently $33 million. A new one-way toll plaza will cost significantly less, primarily due to its smaller size.

A summary of the estimate costs savings by converting to one-way tolling at York is identified in the table below.

Yearly Cost Savings Summary (2005$)

Labor Savings:	$	800
Operations & Maintenance Savings:	$	166
Capital Savings:	$	1,050
Reduction in Costs ($k)	**$**	**2,016**

NET REVENUE

Based on these figures above, net revenue would decrease by about **$2.0 million** if the MTA were to adopt one-way tolling. In other words, the savings in capital, operating, and maintenance costs would likely cover only about half of the projected loss in revenue.

SAFETY IMPACTS

Currently, the York Toll Plaza is a two-directional barrier toll plaza collecting tolls in both the northbound and southbound directions. All traffic, with the exception of ETC traffic, must stop and pay a toll. Toll collectors can access their booths either by walking across live lanes of traffic, or by using the tunnel that runs from the utility building under the entire toll plaza. Crossing lanes is the foremost safety concern of toll collectors. Visibility is limited, and ETC patrons—sometimes passing through the plaza in excess of 25 miles per hour—can use any lane. Other safety concerns include current crash rates at York toll plaza. York toll plaza is a high crash location (HCL) in both the northbound and southbound directions based on 2001-2003 MaineDOT crash data. An assessment of toll collector and vehicular safety impacts by converting to one-way toll collection concludes that:

- Conversion to one-way tolling at York is likely to have a greater positive effect on toll collector and vehicular safety.
- The existing high crash location at York toll plaza SB will be greatly improved. The majority of crashes occurring at York toll plaza are rear end/driver inattention crashes resulting from vehicles queuing to pay toll.
- Toll collectors will no longer cross non-stopping traffic to access toll lanes. However, the Authority should review this operational issue to ensure that all collectors can use the tunnel from the utility building to the toll lanes.

It should be noted that the construction of the new York Toll facility in 2008 is also anticipated to improve toll collector and vehicle safety through improved facility design, roadway geometrics, and ETC lane location.

Other Potential Impacts

Other relevant impacts that should be carefully evaluated as part of the one-way tolling feasibility assessment include:

- **Toll Equity**. One-way tolling at York would create a more uneven directional toll than exists in the current toll system. For example, a northbound Class 1 vehicle cash toll would be $3.50 while southbound would be free. Directional toll differential has been a previous issue identified under other toll studies.
- **Toll Opportunity**. Doubling the toll at York in one direction may limit the ability to increase toll rates in the future. For example, where a $0.25 increase previously may have generated sufficient additional revenue as part of a toll increase package, the required increase under one-way tolling would be $0.50 to generate approximately the same level of revenue.
- **Toll Elasticity.** The recent toll increase, coupled with the flat growth at the York toll plaza, may suggest that the limit of the current toll elasticity is being reached. A $3.50 Class 1 toll rate at a single toll location is similar in the northeast only at bridge or tunnel locations (Tobin Bridge, Tappan Zee Bridge, Holland Tunnel, etc.)
- **Off-Site Improvement Costs**. Specific off-site improvements are not identified as part of this study. Impacts of one-way tolling (due to diversion around the toll) may require costly local roadway enhancements such as intersection improvements (turn lanes, signalization).
- **System Anomaly**. A one-way toll plaza would create an anomaly in the existing toll structure where tolls have been historically charged in both directions at mainline plazas.
- **Air Quality**. Construction of a one-way tolling facility will reduce the number of stops by approximately ½. This is a small but quantifiable air quality benefit and a real public perception benefit.

Findings and Recommendations

Based on the findings in this one-way toll feasibility study, HNTB recommends that the Maine Turnpike Authority cease further consideration of a one-way toll at the York Plaza. This recommendation is based on the following findings:

- **Loss in Revenue**. Implementation of one-way tolling is anticipated to result in a net revenue loss of approximately $2.0 million dollars per year.
- **Local Diversion/Traffic Impacts**. The average rate of diversion by implementing one-way tolling is anticipated to be 11.7%. This equates to roughly 5400 vehicles per day shifting to local roads.
- **Improved Safety from a new toll facility**. One-way tolling would improve both vehicle and toll collector safety, but many of these safety benefits are also anticipated to be realized through the construction of a new toll facility in 2008.
- **Toll Equity/Elasticity**. One-way tolling at York would create a more uneven directional toll than exists in the current toll system and may reach the limit of toll elasticity at York.
- **Toll Opportunity**. Doubling the toll at York in one direction may limit the ability to increase toll rates in the future.

APPENDIX E
ALL ELECTRONIC TOLLING REPORT

Maine Turnpike Southern Toll Plaza Initial All-Electronic Tolling Feasibility Review

Prepared for

Maine Turnpike Authority

Prepared by:

HNTB

February 20, 2009

Table of Contents

EXECUTIVE SUMMARY

The York Toll Plaza was constructed in 1969 and was expected to be removed with the defeasance of the bonds in 1981. Since its construction it has undergone two expansions and has experienced four toll collection systems. The York toll Plaza processes 15.7 million vehicle transactions per year. A total of $33 million or 41 % of the Turnpike's revenue was collected at York in 2008. Of the 15.7 million vehicles processed at York in 2008, roughly 12% were trucks, approximately half were from out of state and over 57% used E-ZPass.

In 2006, the Maine Turnpike Authority voted and approved the concept that the replacement York Toll Plaza would be built incorporating highway speed tolling for E-ZPass customers at the new plaza. Highway speed tolling (HST) would allow E-ZPass users to pay their tolls electronically while traveling at normal highway speed (55-65 mph). Cash paying customers would exit the mainline to pay their tolls. This decision was made after consideration of the potential benefits of HST such as: improved safety, congestion relief, customer service, and capital cost savings, all weighed against some of the business costs associated with probable revenue leakage.

As part of the alternatives analysis related to the York Toll Plaza project, HNTB was commissioned to review the potential for All-Electronic Tolling (AET), also known as cashless or full open road tolling. AET would eliminate all cash toll payments potentially using two methods. First, E-ZPass users would pay their toll as they would under HST as well as any former cash customers who would convert to E-ZPass as a result of the implementation of AET. Tolls would be collected from non-E-ZPass users through video tolling.

Since 2006, a few agencies in the US have either begun implementing or have set policy that future replacement facilities will be AET. A handful of agencies have begun conversion or have set policies that future installations will incorporate AET. A few more agencies have initiated extensive formal studies to evaluate the applicability of AET. Many agencies are mainly waiting to see the results of these agencies activities before conducting extensive assessments. It should be noted that although some agencies have committed to convert to AET, at the time of this review, no existing cash based agency has completed a total conversion to AET. Furthermore, there is very little standardization of reporting of the business impacts of AET and much reluctance on the part of those agencies involved in AET to release documented and audited results of the business impacts.

While the potential benefits of AET can be documented, the significant risk associated with the uncertainty behind the business costs of AET make the option of AET for the York Toll Plaza replacement not feasible. The following points elaborate on this risk:

- The ability to recover toll revenue from as much as 26 percent of the total traffic at York due to the lack of legislation that would compel payment from out of state patrons weighs significantly in this risk. This inability has perplexed toll agencies for over 10 years and we believe that this issue will not be cured in the next 20 years.
- The traffic mix of the Maine Turnpike is such that a significant number of patrons are non E-ZPass users and from out of state. The extent to which these customers would not migrate to E-ZPass and pre-paid video products is uncertain and these factors greatly influence business costs such as operating costs and revenue losses.
- The resulting toll and fee structure for an AET system could result in actual or perceived unfair distribution of payments between Maine and out of state customers. This results when out of state violators do not pay because there is no significant enforcement capability and the structure is set up or perceived to be set up to offset these losses by paying in-state patrons further compelled to pay because of threat of registration hold.
- Difficulties attributed to the duplicate license plate numbering system and the ability of video systems to recognize the myriad of different plate types present minor operational challenges.
- The current lack of industry data for similar roadways already implementing AET limits the ability to compare potential MTA outcomes makes forecasting difficult to calibrate.
- The uncertainty relative to how customers will respond to the changes in payment methods and the uncertainty relative to revenue recovery potential for violations pose too broad a range of potential outcomes. These include potentially significant risks to net revenue required to operate the roadway.
- The MTA may be limited in its ability to allow for certain types of post payment options typical for AET systems. For example, post payments of video tolls by customers are considered an extension of credit and any restrictions on how the MTA operates under these situations would need to be considered.

Greater certainty around the potential impacts to toll operating costs and revenue impacts resulting from AET would be necessary to determine if the range of risks can potentially be mitigated to an acceptable level or if the risks are insurmountable. Based on the cost analyses conducted, the range of risk to the MTA resulting from uncertainties related to AET over 20 years could be as high as $400 million. Therefore, given the revenue risk associated with the stated uncertainties, HNTB does not recommend AET for the York Toll Plaza at this point in time, nor do we anticipate, given the significant concerns described herein, that AET would be prudent for York Toll within the next 20 years.

INTRODUCTION

In 2006, the Maine Turnpike Authority voted and approved the concept that the replacement York Toll Plaza would incorporate highway speed tolling for E-ZPass customers at the new plaza. Highway speed tolling (HST) would allow E-ZPass users to pay their tolls electronically while traveling at normal highway speed (55-65 mph) by simply passing beneath sensors on the mainline of the highway. Cash paying customers would briefly exit the mainline of the highway to pay their tolls at a more traditional plaza. This decision was made after consideration of the potential benefits such as improved safety, congestion relief, customer service, and capital cost savings, all weighed against potential business costs associated with probable revenue leakage.

As part of the alternatives analysis related to the project, HNTB was commissioned to review the potential for All-Electronic Tolling (AET), also known as cashless or full open road tolling, as an alternative to the currently planned highway speed and cash collection plaza. An AET option would eliminate all cash toll payments at the toll plaza. Turnpike customers originally with E-ZPass would continue to pay as they would under HST as well as any former cash customers who would convert to E-ZPass as a result of the implementation of AET. Tolls would be collected from non-E-ZPass users by capturing an image of their license plate, using their license plate number to either match pre-paid license plate accounts or identify the registered owner's address to send them a bill.

Since 2006, a few agencies in the US have either begun implementing or have set policy that future replacement facilities will be AET. Some of these agencies are start-up or "greenfield" toll roads while others are existing "brownfield facilities with established toll roads and customers. A handful of agencies have begun conversion or have set policies that future installations will incorporate AET. A few more agencies have initiated extensive formal studies to evaluate the applicability of AET. Many agencies are mainly waiting to see the results of these agencies activities before conducting extensive assessments. It should be noted that although some agencies have committed to convert to AET, at the time of this review, no existing cash based agency has completed a total conversion to AET and therefore there is little to no available information to assist other agencies with forecasting the applicability of AET for their own roadways. Furthermore, there is very little standardization of reporting of the business impacts of AET and much reluctance on the part of those agencies involved in AET to release documented and audited results of the business impacts. Considering the lack of information plus the broad range of local factors and the unique characteristics of each facility, a decision regarding AET cannot be based solely on what other agencies may be doing, but must consider the individual agency case in order to appropriately determine feasibility.

TOLL TECHNOLOGY BACKGROUND

Electronic toll collection (ETC) technology has been in use on major toll roads since 1988 and has grown significantly due to its convenience for the consumer/customer. Nearly every toll agency that has implemented ETC has shown positive impacts on vehicular throughput and customer service for toll collection. The development and public acceptance of ETC technologies have allowed toll agencies to rely less on cash collection and more on non-stop electronic toll collection. Initially in the 1990's there were some predictions of an eventual national interoperability standard that would unite ETC systems across the country by the turn of the century. In practice, there are several regional groups within the United States that have adopted interoperability requirements so that a single transponder can be used on any of the facilities that are part of that group but there is no national interoperability at this stage. The Federal Highway Administration along with several other coalitions and industry groups continue to pursue the development of a national standard that would tie into an overall vehicle to vehicle and vehicle to infrastructure communication system, but this schedule continues to be uncertain. Instead, regional interoperability has grown and the result has encouraged ETC use to continue to grow steadily while cash payments have declined.

The Maine Turnpike has used electronic toll collection since 1997, when Transpass, the first system in New England, was put into operation. In 2005, the Authority converted their electronic toll collection system to ***E-ZPass***, allowing Maine and any customer of the 11 state Inter-Agency Group (IAG) to pay tolls electronically on the Maine Turnpike. This system provides the Maine Turnpike with a far-reaching ***E-ZPass*** user base and provides interoperability and a regional transponder distribution network that extends throughout the Northeast. The IAG has issued over 17.5 million active ***E-ZPass*** transponders throughout the northeast.

In addition to transponder based electronic toll collection, several agencies (such as agencies in Texas, Florida and North Carolina) have or are planning to implement some form of "video tolling" as an additional payment option for patrons. Video tolling represents the option for a customer to pay for the toll based on the capture of their license plate by a roadside camera at the toll plaza rather than purchasing a transponder. Video toll accounts are typically designed for less frequent customers who cannot justify the cost of a transponder based on the frequency of their trips to benefit from the lower cost per toll for ETC.

The variety of video toll accounts types typically fall into two categories, "pre-paid" and "post-paid". In the "pre-paid" account option, the customer would sign up for an account, much like an E-ZPass account, but instead of a transponder assigned, the customer provides a license plate number for the account. Pre-paid accounts could include the same options as the current ETC accounts, including debit or commuter plans, but they can also include features such as period passes that allow unlimited travel within a window of time. However the account is set up, the cost of tolls (or fees associated with the toll) for pre-paid video accounts is typically higher than ETC rates to first cover the cost to review the images and any other appropriated operational costs (such as a percentage of unreadable image costs). Second, some agencies consider pricing the video toll transaction to encourage ETC participation to improve operating efficiencies, weighing frequency of travel with operating costs. "Post-paid" accounts can take on different forms also, including those similar to the pre-paid options, only handled after the travel occurs. For example, the customer could contact the MTA post-travel to pay the toll, set up a debit and/or commuter account, or purchase a period pass covering the timeframe. The primary consideration is "when" the post payment occurs. Options for post payment within a time window (such as 72 hours or one week) after travel via a phone call or website would present one option. The next would be post-payment upon receipt of an invoice for travel. Toll rates or associated fees are typically set to cover costs for each scenario, similar to the pre-paid cost structures.

Most toll plazas designed and constructed within the last 10 years in the United States have incorporated dedicated ETC lanes as part of the toll plazas. These lanes are dedicated solely to ETC patrons and are designed as either slow speed or highway-speed dedicated electronic toll collection. A detailed description of slow speed and highway speed dedicated ETC technology is presented in the HNTB report entitled, "*Maine Turnpike Southern Toll Plaza Dedicated Electronic Toll Collection Lane Design Recommendations*" dated July 27, 2006. As noted, the MTA is currently planning to incorporate highway speed tolling at the replacement York plaza. This decision was in part based on the referenced report.

All-Electronic Tolling (AET)

It is possible that All-Electronic-Toll collection (AET) will be employed on a number of toll highways in the future. The concept of AET, also termed "Full Open Road Tolling", "Full ORT" or "cashless" tolling has been incorporated in the long range plans of a number of toll agencies. AET is a concept where 100% of all tolls are collected electronically without the need for a conventional toll plaza. While the technology to implement cashless, AET toll collection currently exists, the conversion from a cash or cash/ETC-based toll collection system to AET requires the resolution of many difficult issues, most of which are non-technical.

Since the 2006 report, the number of toll agencies studying AET and in the process of opening, planning to open or converting existing systems to AET has increased. The common characteristics among the majority of these installations remains that the facilities are:

- Primarily commuter roadways

- Primarily in-state user based
- Primarily ETC driven or ETC will be required of all users
- Heavily congested toll plazas

In addition to the above characteristics, another important factor is whether or not the project is part of an existing toll road ("brownfield" project), or part of a completely new toll road ("greenfield" project). For example, the conversion of existing toll roads in Texas and Florida to AET are all considered brownfield projects. New toll roads such as projects in North Carolina and Virginia are greenfield projects. Brownfield projects are faced with the additional challenges such as established cash payment options, driver expectations, and existing labor agreements and employees. Greenfield projects have the benefit of being designed from the beginning to incorporate AET based on understanding of the customer market, planning for operations and infrastructure, and setting local expectations early. For example, if the Maine Turnpike were considering a new roadway as part of their network and this roadway met the appropriate characteristics, this would likely represent a better candidate for AET than a brownfield portion of the existing system.

The Maine Turnpike currently does not share any of the characteristics common to agencies considering AET . By comparison, the Maine Turnpike is not a commuter roadway and approximately 50% of the vehicles entering the York Toll plaza and the Turnpike are from out of state. ETC penetration on the Maine Turnpike is only 50%. While this value is expected to grow towards the 80% range in the next 20 years full AET applications are expected to be higher still. Congestion levels are not significant with the exception of peak summer weekends in York and isolated ramp plaza locations during certain commuter hours.

The reason behind these common characteristics is risk. AET presents far greater risk in the collection of revenue. This is due to the fact that AET presents no restriction regarding who may use the roadway. As a result, the system is reliant upon video capture of sufficient information to assess the toll. The risks of this system include: correct video capture, availability of information regarding the vehicle and the legal ability to assess the toll and penalties in the instances of non payment. Three of the common characteristics listed above serve to significantly reduce this risk because of the consistent and /or known identity of the users. Even in the instance of the facility being a high commuter roadway with high ETC tag penetration the system can fail. The 407 ETR in Canada was the first full AET roadway. The 407 ETR meets the first two conditions listed with the roadway being the commuter roadway into Toronto and having in excess of 80% toll tag (ETC) utilization and 98.5% of the users being in province with no duplicate plate numbers between plate types. 407 ETR requires "heavy vehicles" (large commercial trucks) to use a transponder while passenger cars and light commercial vehicles have the option to pay by video tolling. Video represents about 20% of the transactions on 407 ETR. Currently, there is a significant issue regarding toll collection of non toll tag users such that there is a severe revenue shortfall.

With regards to agency efforts to increase ETC percentages, a number of approaches have been tested or implemented by other agencies. In some cases, agencies (by direct action or through required construction) have limited the available cash payment lanes, resulting in delays to cash customers to encourage ETC participation. This approach must be carefully calculated as the resulting backups must be considered for potential safety conflicts with other traffic patterns, such as blocking through traffic on ramps or ramp access onto a facility. These methods of increasing ETC participation have not shown success.

The following page summarizes the toll agencies that have or will likely be utilizing AET. Note that the information available produces mainly high level characterizations of these facilities. In practice, the details behind certain types of data, such as net violations and recovery, are not readily available. Where applicable, HNTB is able to apply some experience with other agencies but only indirectly as an industry observation.

		Open Road Deployments										
		Existing Full ORT Facilities					Proposed Full ORT Facilities				ORT/Managed Lane Configuration	
	Facility	407 ETR	Westpark Tollway	Crosstown Expressway Elevated Reversible	Central Texas Turnpike SH 183A & SH 130	NTTA DNT, PGBT, AATT, MCLB	Miami Dade Expressway SRs 924, 878, 874, 836, & 112	E470 NWP, CTE, E-470	Inter County Connector	North Carolina Turnpike Authority	SR-91	SANDAG I-15
	Location	Toronto, Canada	Houston, TX	Tampa, FL	Austin, TX	Dallas, TX	Miami, FL	Denver, CO	Montgomery County, MD		Orange County, CA	San Diego, CA
Item	Characteristic											
1	Roadway											
	Competing Routes	Rt 401 & QEW	US 59, Beltway, SH 6	I-4 and FL 60	I-35	Local commuter routes	Local commuter routes	I-25, I-70	MD 198 MD 28	Multiple projects	SR-91 GP Lanes	I-5
	Type (urban rural et)	Urban 4 lane	Urban 4 lane	Urban 3 lane reversible	Urban 4 lane	Urban 6 lane	Urban 3-5 lane	Urban	Urban 6 lane		Urban 4 lanes	Urban 4 lane
	Open-Closed System	Closed	Open	Closed	Open	Open	Open	Open - Mixed	TBD	Open - Mixed	Closed	Open - mixed
	Toll Movements (all - partial)	All	Partial	All	Partial	Partial (have tolled and untolled ramps onto and off of tolled main lanes)	Partial	All	TBD	Partial or All	All	Reversible section (all) and variable access (partial)
	Infrastructure	Double Gantry at every Entrance and Exit		Double Gantry at Toll Zone		Double (old) and Single Gantry (new)	Single Gantry		Under Construction TBD	TBD	One Double Toll Gantry (6 lanes at toll point)	Single Gantry
2	Traffic											
	Total Transactions (Revenue)			$550K/mo	$9M (5 months May 07)	383,453,978 ($223,894,096.65)			T&R Study in Progress			
	ETC %			100%	85%	79		Approx 70%		Projected 80%	100%	100% on reversible section
	Video Toll %			1%	15%	11				Projected 20%		
	Violation Rates		16% initially, then 2% (reported 2005)	unavailable (FTE)								Approx 14%
3	Patrons											
	Commuter - casual	Mostly commuter & Light Truck	Commuter	Commuter	Primarily Commuter	Commuter primarily	Commuter and tourist	Commuter and Tourist	Primarily Commuter	Depends on project - mostly commuter	Primarily Commuter	Primarily Commuter
	Instate - Out of state	Both, incl light, heavy single truck and heavy multiple trailer		Instate	Instate	Instate	Instate	Instate	Yes - Metro DC Area and Tourist	Depends on project - mostly in-state	Instate	Instate
4	Products											
	Type of Transponders	MK IV - TDMA (ASTM v6)	TransCore eGo, ATA Transponders; TxTag, TollTag, EZ Tag	TransCore SunPass Transponder Allegro, ATA, eGo+	TransCore eGo, ATA Transponders; TxTag, TollTag, EZ Tag	TransCore eGo, ATA Transponders; TxTag, TollTag, EZ Tag	TransCore SunPass Transponder Allegro, ATA, eGo+	CA Title 21, TC and SIRIT	IAG	TBD	CA Title 21, TC and SIRIT	CA Title 21, TC and SIRIT
	Rental Cars - Accounts etc	Fleet MGT Capability - specifically silent on Rental Car Accounts	Unk	(future)	Unk	Have agreement with Rent A Toll; working with Enterprise directly; working through statewide Interoperability for future PlatePass.	FTE SunPass accounts by some rental cars in place)	Unk	TBD	TBD	Unk	Unk
	LPN Lists	Yes	Yes	Yes	Yes	Yes	Yes	Yes	TBD	Yes		
	Rate structures	Light, Heavy single, Heavy multiple	Axle Based 2-6 axles	Axle Based 2-10 axles	2 Axle only	Axle Based 2 to 6+ axles	Axle Based 2 to 9 axles	Axle Based 2 to 9 axles	TBD		2-axle, HOV 3+, dynamic	2 axle, HOV 2+
	Discount Plans	ETR Program provides Free Toll mileage and Gas Discounts; Heavy Vehicle Savings Program		none		Video toll have premiums above the transponder toll rate		Express Toll Reward Program - provides discounts and deals from local companies	TBD			
5	Enforcement											
	Equipment	Video with ALPR		Video		Video with ALPR and manual review			TBD		Manual CHP and Video ALPR	Manual CHP and Video ALPR
	Out of State Pursured?	Yes including in US		yes		Some					Yes	
	Revenue Recovered	Yes - % or Amount Unk		unavailable (FTE)							Yes - % or Amount Unk	
	Fee/Fines Recovered	Yes - % or Amount Unk		unavailable (FTE)							Yes - % or Amount Unk	
	Instate Pursued?	Yes				Yes, once meet business rules					Yes	
	Revenue Recovered	Yes - % or Amount Unk		unavailable (FTE)							Yes - % or Amount Unk	
	Fee/Fines Recovered	Yes - % or Amount Unk		unavailable (FTE)							Yes - % or Amount Unk	
	Legal Restrictions etc					2 years from txn date to pursue through citation in JP courts, no limit on collection process						
6	What Led to ORT Decision?											
	(capital cost, O&M costs, customer service, congestion relief)	Congestion relief in city center	Improve mobility in region	Relieve congestion (during peak periods - directional)	Improve mobility and Congestion relief	Improve mobility and Congestion relief; reduce operation and capital costs	Eliminate Cash Operations and reduce congestion	Improve mobility and Congestion relief	Improved mobility and Congestion relief	Overall and capital cost savings	SR 91 congestion relief between Orange County and Riverside County	Congestion relief in region
7	Master Plan and/or Decision paper available?											
				Available		Conversion plan to be completed in June/July 2008	Available					

The toll lane level technology involved for AET is very similar if not the same as toll technology used for highway speed dedicated ETC lanes already approved for the replacement York Toll Plaza. The system would include overhead structures to support the placement of antennas and cameras to identify vehicles passing through the toll point. Other sensors would detect and classify vehicles to assign the appropriate toll point and these could be a combination of overhead mounted and pavement surface sensors.

While the benefits and cost considerations for AET are very similar to the decision to incorporate the option of HST, one fundamental difference exists. HST maintains an option for non-ETC customers preferring to use a stop condition form of payment, such as cash. AET is entirely electronic and eliminates the option to stop and pay by cash at the plaza. This distinction provides both benefits and costs worthy of careful consideration:

In conjunction with a decision to incorporate AET at future toll plazas, the Maine Turnpike Authority must also consider the following negative impacts:

1. AET will measurably increase operational costs for back office and the customer service center due to initial and ongoing customer education, additional post processing of transactions and increased violation image and notice processing.

2. Non-payment events at an AET plaza will likely increase due to patron confusion, technology limitations and increased scofflaws. Other toll agencies who have installed highway speed lanes or AET have typically experienced increases after conversion that lessens over time as a result of familiarization and enforcement. The issue of revenue collection has been discussed previously regarding scofflaws. The issue of collecting from patrons who infrequently use the roadway must also be considered as the cost to collect for one or two trips must be weighed against the available tolls and fees that could be charged.

3. Current limitations or lack of interstate agreements to enforce out of state toll violators limit the options for penalizing these violators. Without these agreements or laws, the Turnpike has few options to try to compel these violators to pay.

4. Improperly structured AET programs could result in a real or perceived subsidization of revenue by certain customers (for example, in-state patrons paying for out of state violators who do not pay). An AET program would need to be structured to minimize subsidization of tolls by certain groups of paying patrons at different points in the payment stream. For example, rates/fees/penalties associated with violations would need to be appropriately assigned to cover losses in that category due to lost revenue rather than having ETC or video rates set to offset a portion of losses due to violations. Global inefficiencies such as unreadable images would need to be distributed given an appropriate traffic assumptions.

5. Privacy concerns may emerge given that AET reduces the anonymous options for driver payments. Currently cash is exchanged with no record of the driver. An AET system may require anonymous account options to satisfy a portion of this concern. However, patrons who do not prepay with an account would be subject to identification via license plate lookup. The actual level of this concern is unknown and would need to be the subject of further understanding of patrons.

6. Regardless of the result of capital, operating maintenance and revenue impact costs and savings comparisons, consideration must be given for the potential equity or ethical concerns that could arise from the initial or sustained increases in non-payments expected under AET. The business case of cost savings would have to be weighed against the policy decision to accept that the potential that fewer patrons will ultimately pay the toll. More specifically, a system that allows higher revenue leakage but results in a net positive revenue over previous tolling regimes could still be viewed as inequitable or unethical since a larger portion of patrons are not actually paying the toll.

7. The capacity of local judicial processes is a potential concern if the judicial system is not set up to handle the additional cases resulting from AET. Advanced planning and coordination with the appropriate agencies would be necessary to determine costs and considerations needed as part of AET planning and implementation.

8. Unbanked customers (those without bank or credit card accounts) that prefer to pay cash at the point of tolling will find the cash option of pre or post paying with cash offsite as a burden.

9. AET may result in revenue decreases from increased diversion to local roads (some of which are already congested) as some patrons who perceive a lack of options to pay the toll that suits their preferences, seek alternate routes.

10. AET will require additional costs to increase transponder use, develop, market and implement new tolling products, as well as implement a significant public relations campaign to inform the public of the changes initially and ongoing education of future customers. The introduction of video tolling products and the removal of cash payment on the roadway will require significant public communication. Other products may include anonymous accounts to satisfy privacy concerns by some patrons.

11. Weather impacts to equipment are magnified with increasing reliance on video technologies. Significant snow or similar conditions may reduce the quality of images resulting in higher volumes of image rejections resulting in direct revenue losses.

12. AET may violate restrictions associated with existing bond covenants, trust indentures or similar agreements associated with the financing of the Maine Turnpike. For example, where bonds require toll revenues to meet certain thresholds, a higher amount of revenue loss under AET may require higher toll rates either initially or over a sustained period.

13. Consideration for labor agreements and the impact regarding AET implementation.

14. In some cases, the location for the construction of an AET plaza may not be conducive for the construction of a cash plus highway speed toll plaza given the different site requirements. If for some reason the plaza needed to be converted to add cash collection in the future, some AET plaza sites may restrict this option.

15. The conversion of only one location on the Maine Turnpike to AET while maintaining cash options at others may present confusion among patrons with regards to where payments options are available. Since cash lanes on the Maine Turnpike do not have enforcement cameras, if patrons assuming AET payment options pass through these lanes without stopping to pay, the Maine Turnpike would not realize this revenue.

16. Without fare collection staff at toll plazas, the Maine Turnpike will need to consider alternatives to handling wide load permits, which are currently a function served by fare collection staff.

With the challenges understood, the following beneficial impacts associated with AET include:

1. An AET toll plaza has the potential for greater safety due to the removal of any decisions required of the patron at the toll point. The goal of AET is a transparent roadway that reduces or eliminates any change to the driver's environment than what is typically encountered on other parts of the facility.

2. Under AET, all customers of the facility benefit from the convenience of not having to stop to pay the toll. Customers can either sign up for a transponder or opt

for other products such as pre-paid or post-paid video tolling options that could be offered by the agency.

3. AET toll plaza configurations minimize plaza construction capital cost by eliminating the need for toll booths that may require wider right of way and additional infrastructure. .

4. AET toll plazas typically require less long term maintenance, since an AET plaza includes significantly less infrastructure.

5. AET eliminates the cost of fare collection staffing and support at the toll plaza.

6. Additional environmental benefits are possible with an AET plaza. By increasing the average speed of vehicles passing through the plaza, the average fuel economy of vehicles will increase. This quantifiable reduction in the use of fuel will not only provide financial benefits to the patrons, but reduce the consumption of non-renewable resources.

An AET plaza would require patrons to either sign up for an E-ZPass account or pay via a pre-paid or post-paid video toll account. The MTA would need to consider pricing of such options would be matched to the frequency of the trip by the customer and cover administrative costs for each product. Pricing considerations can also go further to influence patrons to utilize more cost efficient products. Infrequent users who cannot justify the cost of a transponder would have the option to pay a video toll at a higher rate than the transponder rate but less than the cost of a transponder. Depending on the magnitude of the rate adjustment, larger portions of infrequent users would find the transponder option more financially practical. It may be expected that this adjustment may be as high three or more times the existing transponder rate in cases where patrons delay payment until an invoice or notice is received. While having the positive impact of driving patrons towards more cost efficient pre-payment options, this would likely have significant negative public acceptance issues.

DETAILED COST FACTOR DISCUSSION FOR ALL-ELECTRONIC TOLLING

As noted, the current direction of both industry technology and agency decision-making is to allow for the possibility of migration to AET under the right conditions. Some agencies are implementing AET on current projects or as in the case of the Maine Turnpike, considering this a future possibility in strategic planning activities. In addition to planning for the York Toll Plaza, other barrier toll plaza projects are under consideration in long range planning that will also consider HST and AET options. Each agency is faced with unique user and traffic features which will impact the consideration and viability of AET. The following discussion presents the benefits and costs in the context of the decision process for planning for AET.

Capital Cost Considerations

Plazas that incorporate staffed and/or cash collection along with considerations for ETC customers either through dedicated or highway speed lanes require greater infrastructure than those plazas that do not. The plazas require a larger right of way for pavement to support the widening for toll booths and traffic splits, as well as utilities, access and buildings to support the plaza staff. By comparison, an AET facility requires basically the same infrastructure as the highway speed tolling lanes of an HST toll plaza. At the center of the proposed HST plaza would contain a set of toll gantries over a section of roadway continuous with the mainline alignment. These gantries and equipment would be very similar to an AET toll point. The overhead structures, pavement footprint and toll equipment are basically the same. The state of the practice in the industry is to construct the highway speed lanes to match the approaching mainline configuration, allowing simpler transition to AET in the future although this may be modified dependent upon ETC utilization.

Based on the condition of the existing plaza, a capital cost estimate has also been performed to determine the amount of investment needed to refurbish the existing toll plaza. The following provides an initial estimate and comparison of the capital costs for each option. Both represent an average estimated cost for a new plaza location.

Capital Construction Cost Estimates for Plaza Options

	Existing	Highway Speed	AET
Existing Plaza Demo	n/a	$ 2,500,000	$ 2,500,000
New Construction	$ 14,300,000	$ 28,900,000	$ 4,400,000
	$ 14,300,000	$ 31,400,000	$ 6,900,000

While the toll equipment and system for transponder users is essentially the same between the AET and highway speed systems, the development of and related system upgrades in order to support any new products such as pre-paid or post-paid video tolling would be an additional cost to the AET system for the back office. These additional costs are not captured here.

Maintenance Cost Considerations

Because the highway speed plaza involves cash collection lanes as well as the dedicated ETC lanes, the annual maintenance costs will likely be higher. The life cycle costs require significant review as over time part of the cash collection infrastructure may morph into part of the ETC system. Annual maintenance includes additional building, plaza and roadway maintenance. Building maintenance would include items such as custodial, lighting, HVAC and other regular maintenances. Roadway maintenance would include snow and ice control for the additional plaza area as well as annual routine maintenance of pavements, plaza structures and plaza grounds.

In addition to routine maintenance, the non-routine (also known as reserve maintenance or renewal and replacement costs) items such as pavement rehabilitation, plaza area concrete maintenance and booth maintenance require budgeting in the later years of the facility. By contrast, the AET plaza does not require these additional costs because it does not include the cash plaza infrastructure. Both options require maintenance of the toll equipment. The highway speed option contains a larger amount of toll equipment because of the additional cash equipment, where as the AET system would require more maintenance of the backhouse operation, potentially involving more technical staff or expansion of contracted maintenance services.

The following estimates the maintenance requirements for both options. The cost of toll equipment maintenance for AET assumes a highest cost option, which would involve a separate vendor with full time on-site support. In practice, the use of the same vendor as the rest of the system or limited on-site availability could yield lower costs.

Estimated Annual Routine Maintenance Costs for York Plaza Options

	Current Plaza	Highway Speed	AET
Cash Plaza Maintenance	$ 345,000	$ 345,000	$ -
Toll Equipment Maintenance	$ 204,000	$ 180,000	$ 187,000
	$ 549,000	$ 525,000	$ 187,000

Non-routine Maintenance Cost for Plazas with Cash Collection Infrastructure

Activity	Cost	Frequency
Concrete islands, slab and other surface sealing	$106,000	Every 5 years
Approach pavement crack sealing	$12,300	Every 8 years
Canopy roof sealing	$53,000	Every 15 years
Complete approach pavement overlay	$2.8 million	Every 15 years
Tunnel and slab rehabilitation	$740,000	Every 20 years

Operations Cost Considerations

The cost to operate toll plazas for the purposes of this report includes the cost to staff the plaza and the cost of customer service and violations processing related to the plaza. Since the highway speed plaza sizing and staffing has not been finalized and ultimate impacts to overall MTA staff costs will be an MTA policy decision, this study starts by assuming a percentage reduction in staffing costs based on the most recent reduced number of cash lanes in the highway speed plaza compared to the current plaza. Since the AET plaza requires no on-site cash collection, the AET option is assumed have no on-site fare collection staffing costs. Depending on the capacity of current MTA back office staff, additional technical staff associated with the new toll system may be required offsite. It must be noted that the functions of toll collection are primarily transferred to the customer service and violations processing centers.

Both highway speed tolling and an AET option will increase the load on the customer service and violations processing costs to the MTA. Highway speed tolling is projected to have far less of an effect since a cash option will remain. The challenge with estimating the impact under the AET scenario is projecting the migration of the cash customers. Without any similar industry examples to compare to and without quantifiable information about the attitudes and willingness of MTA cash customers to migrate to certain products, the projection of operating costs carries the potential for significant variation and therefore risk. The risk in the case of the MTA is much higher since the characteristics of the roadways are so different. The other agencies share the benefits of high commuter usage, high ETC penetration rates and high instate constituency. The largest agency contemplating this change is the Port Authority of New York and New Jersey (PANYNJ). The risk for this agency is likely smaller than may be contemplated. The facilities of PANYNJ fit the common characteristics previously discussed with one other benefit. For example, the PANYNJ enjoys up to 80% market share (peak), and over 85% of plates are within jurisdiction. Being a duel state agency, PANYNJ has jurisdiction in both New York and New Jersey. This means they can assess fines for the largest amount of their users, all of the two states mentioned.

In order to estimate the range of this risk for the MTA given the limited information, two scenarios were considered. The first involves using limited MTA traffic pattern information (origin and destination studies or O&D) to estimate how cash patrons might migrate to certain products based on their frequency of use. This first "optimistic" scenario assumes that a significant portion of the transactions (but not patrons) will be handled as E-ZPass or video transactions under an all AET configuration. The second scenario presents a significantly more negative scenario in which all of the cash customers at the plaza migrate to the violation category. In other words, under this "pessimistic" scenario, none of the cash customers at the York plaza choose to sign up for E-ZPass or video tolling (pre-paid or post-payment before invoicing). This presents somewhat of a worst case and places a high end on the risk assessment.

The following represents the four categories of customers likely under AET:

1. E-ZPass customer (lowest risk of not collecting)
2. Registered video account (mild risk)
3. Unregistered video (more risk)
4. Violation (maximum risk)

Under the "optimistic" scenario, cash customer migration to ETC or video is based on trip frequency estimated from O&D study information. Current cash customers who use the Turnpike with greater frequency are assumed to migrate to one of these products for cost benefit reasons. The result of an evaluation of O&D data and estimates of patron trip frequency suggests that approximately 600,000-700,000 unique patrons use the Maine Turnpike. Based on trip frequencies of different patrons and based on payment type, it is estimated that approximately 225,000 unique patrons pay using E-ZPass, 350,000 pay with cash, and depending on the frequency of violations, 20,000-80,000 unique patrons violate. The cash users are further broken down in two groups, frequent and infrequent users. Based on the O&D data, it is estimated that roughly two out of three unique patrons travel less than once per week but at most six times per year. Because of their infrequent use, these individuals would represent approximately 10% of the cash transactions on the Turnpike. So for the purposes of estimating the increased volume of violation transactions to be processed by the violations processing center, this study conservatively assumes that 10% of the cash transactions at York (or 2 out of 3 current cash customers, not transactions, but unique customers of the Turnpike, based on estimated frequency of travel) will become violations. So the "optimistic" scenario assumes that 2 out of 3 unique cash customers on the Turnpike would choose to not pay the toll before receiving a violation notice. This would represent an approximate 150% increase in total non-payments at the toll plaza and an overall gross violation rate of 6.4%. This translates into additional staff required for the violations processing center to handle the additional volume of images from the system and process notices.

It is assumed that the majority of the rest of patrons (diversions are addressed later in the report), based on their estimated trip frequencies, will join E-ZPass, prepaid video tolling or post paid video tolling either via paying by phone or website within a certain window of time after traveling or by paying an invoice. These would include the one out of three unique cash patrons noted in the O&D observations above. These represent 90% of the cash transactions at York. Based on estimated trips per account, this additional volume would require additional customer service staff to manage the higher volume of E-ZPass or video accounts.

Under the "pessimistic" scenario, all cash customers (and their corresponding transactions) are assumed to migrate to the violation category. This results in a more straightforward calculation of the operating and revenue cost impacts, because the larger volume is simply applied to the current cost and recovery rates for the Maine Turnpike violations processing center. What is not assessed is the potential for increased violations due to the "their not paying why so I" scenario.

The following summarizes the additional staff estimated for each option to cover the additional costs of ETC, video tolling and violation processing followed by the additional costs for these increases in staffing.

Estimated Additional CSC/VPC Staff

	Highway Speed	AET Optimistic	AET Pessimistic
Customer Service Reps	1	12	2
Image Reviewers	1	3	25
Notice Processors	1	4	48
Clerical Staff	1	2	24
Total Additional Staff	4	21	99

The following summarizes the estimated total annual operating costs for the York plaza under each configuration. This includes the additional staff costs as well as direct costs. Direct costs include costs such as rent, utilities, postage, printing and credit card fees.

York Plaza Annual Operating Costs by Plaza Type

	Current	Highway Speed Option	AET "Optimistic"	AET "Pessimistic"
Fare Collection	$ 3,750,000	$ 3,150,000	$ -	$ -
Base CSC Cost	$ 507,000	$ 507,000	$ 507,000	$ 507,000
Additional CSC Costs	$ -	$ 84,000	$ 1,210,000	$ 165,000

Base VPC Costs	$ 137,000	$ 137,000	$ 137,000	$ 137,000
Additional VPC Costs	$ -	$ 255,000	$ 762,000	$ 8,378,000
Total Annual Costs	$ 4,394,000	$ 4,133,000	$ 2,616,000	$ 9,187,000

Revenue Impacts

In order to estimate the revenue impacts of AET at the York plaza, an analysis of the current system-wide and York plaza leakage was developed. The current estimate was then used as a baseline for estimating the revenue impacts of highway speed tolling at York and AET (optimistic and pessimistic) at York. Since the analysis is based on the system-wide observations to develop the York portion, an estimate of the total system leakage for a system-wide AET deployment also results.

With the E-ZPass system-wide conversion in 2005 and with recent augmentations to the VPC process, the MTA has a robustly capable enforcement system with revenue recovery methods for the ETC lanes at the York Toll Plaza, in addition to the rest of the ETC and coin lanes throughout the MTA system for both in-state and out of state violators. Additionally, roughly half of the images captured are used to collect revenue from E-ZPass customers who, for a variety of reasons that are mostly due to patron behavior, are not captured via valid transponder transaction. The MTA is also currently pursuing in and out of state violations that meet MTA policy and thresholds.

Revenue leakage is defined for this effort by the transactions that ultimately do not result in a collected toll. A variety of factors can be attributed to revenue leakage and this effort focuses on where the leakage is occurring in the system and what impact the new toll collection methods will have.

Potential sources of revenue leakage on the Maine Turnpike

Lane Type	Leakage	Notes
ETC lane	Unreadable image – system	Cannot pursue vehicles that cannot be identified due to equipment error
	Unreadable image – patron	Cannot pursue vehicles that cannot be identified due to patron action
	Rejected image	Some images are rejected based on non-revenue vehicles such as state police cars
	Non-pursued transactions	The MTA does not pursue certain transactions based on cost effectiveness thresholds or policies.
	In-state suspended or waived violation	In-state violators who do not pay violation notices are moved to suspension and are not

		collected from. In practice, most of this category is recaptured but due to data limitations, this category is conservative included as loss.
	Out of state suspended or waived violation	Out of state violators who do not pay violation notices are moved to suspension and are not collected from. This means the driver's right to operate in Maine is suspended however, this is not enforceable in other states and therefore provides minimal leverage.
	Select out of state and out of country violators	Due to limitations in some direct DMV access, the MTA has limited options to cost effectively pursue some violators. In some of these cases, MTA utilizes access to data via State Police for these violators. For the purposes of this analysis, these are considered losses due to the lack of data history. In practice, the MTA is actively seeking the majority of this revenue with some initial returns.
Manual Lane	Non-payments	Revenue not realized in manual lanes.

The current system leakage is estimated at the following based on MTA data and applied average toll rates. Note these are only approximate initial estimates based on average toll rates. Some variation could be expected due to higher volumes of trucks in one category or another, but this does provide an order of magnitude estimate at a minimum.

Current Estimated System-wide and York Plaza Revenue Leakage

	System-wide		York Plaza
Total net leakage as % of transactions	**1.7%**	**$1,500,000**	**$560,000**
Manual lane non-payments	1.1%	$1,000,000	$328,000
Non-pursued transactions	0.4%	$330,000	$138,000
Unreadable or reject images	0.1%	$110,000	$89,000
New Hampshire	<0.01%	<$10,000	<$5,000
Pennsylvania	<0.01%	<$1000	<$1000
New Brunswick	<0.01%	<$5,000	<$1000
In-state suspended or waived	<0.01%	<$1000	<$1000
Out of state suspended or waived	<0.01%	<$1000	<$1000

As the patrons shift as discussed in the Operations costs section, this also impacts the revenue leakage estimates. The following presents revenue leakage for the highway speed and AET options. Note that system-wide highway speed is not applicable at this stage given not all locations would facilitate highway speed tolling and therefore the leakage factors would not apply to all locations.

Highway Speed York Plaza Revenue Leakage for York Plaza

	York Plaza
Total net leakage	**$850,000**
Manual lane non-payments	$312,000
Non-pursued transactions	$429,000
Unreadable or reject images	$89,000
New Hampshire	<$10,000
Pennsylvania	<$1000
New Brunswick	<$5,000
In-state suspended or waived	<$1000
Out of state suspended or waived	<$5000

Estimated System-wide and York Plaza Revenue Leakage
Under "Optimistic" AET Scenario

	System-wide		York Plaza
Total net leakage as % of transactions	**4.2%**	**$3,300,000**	**$1,500,000**
Manual lane non-payments	0%	$0	$0
Non-pursued transactions	3.5%	$2,700,000	$1,000,000
Unreadable or reject images	0.6%	$500,000	$400,000
New Hampshire	0.04%	$46,000	$25,000
Pennsylvania	<0.01%	<$5000	<$5000
New Brunswick	<0.02%	$18,000	$10,000
In-state suspended or waived	<0.01%	<$5000	<$5000
Out of state suspended or waived	0.05%	$55,000	$23,000

Estimated System-wide and York Plaza Revenue Leakage
Under "Pessimistic" AET Scenario

	System-wide		York Plaza
Total net leakage as % of transactions	**45.6%**	**$36,000,000**	**$17,100,000**
Manual lane non-payments	0%	$0	$0
Non-pursued transactions	38.8%	$30,200,000	$13,000,000
Unreadable or reject images	5.6%	$4,300,000	$3,400,000
New Hampshire	0.4%	$520,000	$277,000
Pennsylvania	0.04%	$43,000	$21,000
New Brunswick	0.17%	$202,000	$105,000
In-state suspended or waived	0.1%	$61,000	$19,000
Out of state suspended or waived	0. 5%	$620,000	$254,000

Comparison of York Plaza Total Revenue Leakage under Each Scenario

	Current	Highway Speed	AET "Optimistic"	AET "Pessimistic"
Total Leakage	**$560,000**	**$850,000**	**$1,500,000**	**$17,100,000**

In addition to the revenue impacts due to leakage, the estimates should also recognize a level of diversion from the toll plaza under the AET scenario. There were no significant estimates of diversion for this scenario, but as a point of reference, if 2.5% of the current cash customers at the York plaza choose to divert under AET, this would represent about $400,000 in lost revenue. In addition, privacy concerns, technology aversion, and preference to pay cash are factors that must be considered as they will impact the outcome of diversion.

While leakage and diversion negatively impact revenue, the collection of tolls, fees and penalties under the violation process are also recognized. The following estimates the revenue recovery by the violations processing center.

York Plaza Total Annual VPC Revenue Recovery

	Current	Highway Speed	AET "Optimistic"	AET "Pessimistic"
Annual Recovery	**$12,000**	**$38,000**	**$200,000**	**$2,300,000**

An AET plaza would require these patrons to either sign up for an E-ZPass account or pay via a pre-paid or post-paid video toll account. From an operating cost recovery perspective, the MTA would need to consider pricing of such options would be matched to the frequency of the trip by the customer and cover operating costs for each product. Pricing considerations can also go further to influence patrons to utilize more cost efficient products. So infrequent users who cannot justify the cost of a transponder would have the option to pay a video toll at a higher rate than the transponder rate but less than the cost of a transponder based on the infrequency of use. Depending on the magnitude of the rate adjustment, larger portions of infrequent users would find the transponder option more financially practical.

Note that specific toll revenue projections or revised rate structures are not part of the scope of this report. This report does assume, as a starting point of reference, that there will be some balance of cost recovery with the increased cost to process the customer options above. In other words (and subject to further discussion), pre and post paid video billing is assumed (for initial estimates) to be structured such that the net operating cost to the MTA is the same as processing ETC customers. So for the one in three cash customers identified as "frequent" users, the net cost to handle them will require the same staffing and direct costs as handling current ETC accounts. This introduces further discussions that will be needed relative to overall pricing of toll products, how each recovers costs to operate and how the pricing structure might be set to direct customers towards more cost efficient products (namely transponder based accounts).

The following summarizes the entire cost analysis for the options at the York plaza.

Total 20-Year Cost Summary for York Plaza ($2008)*

Current	$ 132 million
Highway Speed	$ 152 million
AET "Optimistic"	$ 94 million
AET "Pessimistic"	$ 494 million

*Capital costs assume 20-year bonds at 4.75%. O&M costs factored in on annual or scheduled as needed basis. No cost inflation, changes in traffic volume, ETC penetration, violation rates assumed as this stage.

<u>*Other Considerations*</u>

In addition to the business costs, the Authority will also need to consider the other less tangible impacts that would result from the implementation of AET:

1. Regardless of business case, consideration may be needed for the potential equity or ethical concerns that could arise from the initial or sustained increases in non-payments anticipated under AET. For example, the current toll plaza does not collect approximately $0.6 million due to revenue leakage. Under the "optimistic" AET scenario, this would potentially increase to $1.5 million in uncollected tolls. The Maine Turnpike would be accepting an additional loss of approximately $1 million annually to realize the one time savings of at least $20 million in capital costs and maintenance and operating cost savings of up to $2.1 million annually. Under the "pessimistic" AET scenario a substantial amount of the MTA revenue would be at risk. The business case of cost savings would have to be weighed against the policy decision to accept that fewer patrons will initially and ultimately pay the toll regardless of recovery efforts.
2. Consideration for any restrictions associated with existing bond covenants, trust indentures or similar agreements associated with the financing of the Maine Turnpike.
3. Consideration for current labor agreements and the impact to the timing of an AET implementation
4. Possible environmental credits for reducing emissions at toll plazas.
5. Safety benefits due to reduce conflict potential on the roadway.

CONCLUSION AND RECOMMENDATIONS

The reality of the circumstance is that it is very unlikely that the optimistic or the pessimistic scenario will occur. It is more likely that revenue leakage will be somewhere in the middle. This value however is significant and poses a grave threat to the Maine Turnpike.

While there may be theoretical benefits of converting a cash & ETC facility to AET, the significant uncertainty behind the business costs associated with AET coupled with the unique and quantified characteristics of the Maine Turnpike make the consideration of AET for the York Toll Plaza replacement not a feasible option at this point in time or in the 20 year planning horizon. The lack of industry data for similar roadways, the uncertainty relative to how customers will respond to the changes in payment methods and the uncertainty relative to revenue recovery potential for violations pose too broad a range of potential outcomes. These include significant risks to net revenue required to operate the roadway. Greater certainty around the potential impacts to toll operating costs and revenue impacts would be necessary to reduce the range of risks to an acceptable level for the further consideration of AET. Therefore, given the lack of comparable industry information to date and the revenue risk associated with uncertainties with patron behavior, HNTB does not recommend AET for the York Toll Plaza at this time, nor do we anticipate, given the significant risk described herein, that AET would not be prudent for York Toll within the next 20 years.

APPENDIX F

DEDICATED ELECTRONIC TOLL COLLECTION LANE DESIGN RECOMMENDATIONS

Maine Turnpike Southern Toll Plaza Dedicated Electronic Toll Collection Lane Design Recommendations

Prepared for

Maine Turnpike Authority

Prepared by:

HNTB

July 27, 2006

Table of Contents

EXECUTIVE SUMMARY

The Maine Turnpike Authority (MTA) is examining the options for resolving the need to address an aging existing York toll plaza. The current toll plaza was constructed in the 1970s and is well beyond the design life of the type of facility that was constructed. The current location not only suffers from aging and outdated facilities, the plaza also has deficiencies relative to layout and site conditions that need to be addressed. Technology has advanced significantly since the initial construction and efforts to retrofit the plaza have only provided temporary solutions to date. The York toll plaza is the busiest plaza on the Maine Turnpike, annually serving around 15 million transactions and collecting approximately $34 million. These numbers represent 19% of all Maine Turnpike transactions but more importantly, over 39% of the total Maine Turnpike revenue. Initial estimates of the replacement cost of the plaza range from $30-35 million (2005 dollars) with a design life of over 40 years. In short, the York Toll Plaza is a critical and valuable component of the Maine Turnpike and careful consideration must be made for any adjustments to how traffic and revenue is handled at this southern terminus of the toll collection system.

A fundamental decision prior to the detailed design of the project is the decision to incorporate either: (a) purely slow speed dedicated electronic toll collection (ETC) lanes, or (b) highway speed dedicated ETC lanes. The current York plaza, as well as many other MTA toll plazas, utilizes slow speed (10 mph) dedicated ETC lanes. The industry trend in the design of many new or replacement toll plazas incorporate highway speed (65 mph or similar) dedicated ETC lanes into the plaza design to take advantage of significant benefits associated with these designs.

The benefits associated with the highway speed dedicated lanes specifically include:

- A highway speed toll plaza has the potential for **safety improvements** due to the separation of non-stop from stopping traffic and reduction of exposure for workers in the plaza area.

- Highway speed configurations can help to **relieve congestion**. Operational efficiencies from highway speed lanes present opportunity to more cost effectively manage traffic congestion at tolling points.

- **Customer convenience increases** with highway speed options. All ETC customers have the opportunity to travel at the posted highway speed through the plaza rather than the current 10 mph speed limit.

- Highway speed lanes have the potential to **attract ETC customers** through the expanded benefits offered by the new option. A high ETC customer base leads to a larger population of users making the most of the benefits of ETC and improves operations for the road operator.

- The benefits of highway speed lanes have the potential to **divert cars from local roadways**.

- Highway speed toll plaza configurations are potentially **more cost effective**. Preliminary cost estimates show that the cost of more complex toll equipment and infrastructure for a highway speed plaza is more than offset by the savings of not building additional manual toll lanes to handle the same throughput capacity as the highway speed toll lanes.

- The **trend in the industry** is to construct highway speed facilities. It is more cost effective and less disruptive to customers to build a new plaza with highway speed toll lanes than to renovate a plaza in the future to accommodate highway speed toll collection lanes.

- A highway speed toll plaza has the potential to provide **benefits to the environment** due to increased fuel efficiency associated with maintaining a constant speed, reduced noise impacts and reduced emissions.

However, in conjunction with a decision to incorporate highway speed lanes at future toll plazas, the Maine Turnpike Authority must also consider the following potential increases to business costs:

- Highway speed lanes will potentially increase operational costs for back office and the customer service center due to initial and ongoing customer education, additional post processing of transactions and increased violation processing.

- Non-payment events at the plaza will likely increase due to patron confusion, technology limitations and increased scofflaws. Other toll agencies who have installed highway speed lanes have typically experienced increases after conversion that lessens over time as a result of familiarization and enforcement.

In light of these potential costs and benefits, HNTB recommends that the Maine Turnpike Authority incorporate highway speed dedicated ETC lanes into the design of the future mainline toll plazas. The projected benefits outweigh the modest increase in business costs associated with highway speed tolling.

In order to mitigate the potential increase in business costs related to highway speed toll collection, the following are recommended:

- Upon the introduction of highway speed toll lanes, the Authority should consider the required capacity to handle increased demands on back office operations related to highway speed operations.

- The Maine Turnpike Authority should conduct a specific review of the current violation enforcement practices and continue to evaluate potential options to further maximize revenue recovery.

- Future plaza design should include development and implementation of a clear and comprehensive signing plan and geometric layout to minimize patron confusion.

- Highway speed system specifications for future plazas should be comprehensive to insure the highest available accuracies of equipment.

- The Maine Turnpike Authority should consider a specific public awareness campaign relative to the use of highway speed lanes as designs are developed.

INTRODUCTION

The Maine Turnpike Authority (MTA) is examining the options for resolving the need to address an aging existing York toll plaza. The current toll plaza was constructed in the 1970s and is well beyond the typical design life for this type of facility. The current location not only suffers from aging and outdated facilities, the plaza also has deficiencies relative to layout and site conditions that need to be addressed. Technology has advanced significantly since the initial construction and efforts to retrofit the plaza have only provided temporary solutions to date. The York toll plaza is the busiest plaza on the Maine Turnpike, serving almost 15 million transactions annually and collecting almost $34 million. These numbers represent 19% of all transactions but more importantly, over 39% of the total Maine Turnpike revenue. Initial estimates of the replacement cost of the plaza range from $30-35 million (2005 dollars) with a design life of over 40 years. In short, the York Toll Plaza is a critical component of the Maine Turnpike and careful consideration must be made for any adjustments to how traffic and revenue is handled at the southern terminus of the toll collection system.

A fundamental decision prior to the detailed design of a solution is the decision to incorporate either: (a) purely slow speed dedicated electronic toll collection (ETC) lanes, or (b) highway speed dedicated ETC lanes. The current York plaza, as well as many other MTA toll plazas, utilizes slow speed (10 mph) dedicated ETC lanes. The industry trend in the design of many new or replacement toll plazas incorporate highway speed (65 mph or similar) dedicated ETC lanes into the plaza design to take advantages such as safety improvements, customer benefits, and operational efficiencies. This report will present these factors and provide a recommendation on the use of highway speed dedicated lanes. This document is only part of the beginning of the comprehensive process to evaluate options and recommendations. Further detailed evaluations and related activities as required will follow; including, but not limited to: location and need analyses, environmental permitting, and public involvement, as well as detailed design and cost estimates.

TOLL TECHNOLOGY BACKGROUND

Attended toll lanes are labor intensive and inconvenient for customers. Consequently, electronic toll collection (ETC) technology has been in use on major toll roads since 1988. Nearly every toll agency that has implemented ETC has shown positive impacts on vehicular throughput and customer service for toll collection. The development and public acceptance of ETC technologies have allowed toll agencies to rely less on cash collection and rely more on non-stop electronic toll collection. There are several regional groups within the United States that have adopted interoperability requirements so that a single transponder can be used on any of the facilities that are part of that group. Interoperability has encouraged ETC use to continue to grow steadily while cash payments have declined. Some facilities are now completely ETC.

The Maine Turnpike has used electronic toll collection since 1997, when Transpass was put into operation. 1n 2005, the Authority converted their electronic toll collection system to ***E-ZPass***, allowing Maine and any customer of the 11 state Inter-Agency Group (IAG) to pay tolls electronically on the Maine Turnpike. This system provides the Maine Turnpike with a far-reaching ***E-ZPass*** user base and provides interoperability and a regional transponder distribution network that extends throughout the Northeast. The IAG has issued over 16 million ***E-ZPass*** transponders throughout the northeast.

Most toll plazas designed and constructed within the last 10 years in the United States have incorporated dedicated ETC lanes as part of the toll plaza. These lanes are dedicated solely to ETC patrons and are designed as either slow speed or highway-speed dedicated electronic toll collection. The following is a brief description of both methods:

Slow Speed Dedicated Electronic Toll Collection (10 mph)

The Maine Turnpike currently uses slow speed dedicated ETC lanes at numerous plazas, including the York toll plaza. Typically at toll facilities across the country, vehicles speeds within a plaza area are limited to 5 to 15 mph for safety reasons and depending on local laws. Toll lanes dedicated solely to electronic toll transactions are located within the plaza, and users of these lanes are expected to also decelerate to the posted speed. These vehicles then must accelerate while merging with the other attended toll lanes back to the typical roadway section. These lanes provide the advantage of being reserved for electronic toll ONLY thereby improving throughput.

Highway Speed Electronic Toll Collection (65 mph)

Highway speed electronic toll collection allows a vehicle to operate at the posted highway speed through the toll plaza area. This not only increases customer convenience, but it also provides for more efficient operation of the toll plaza. This method of toll collection requires physical separation from the attended lanes since the operating speeds of the attended lanes and the highway speed electronic toll collection are dramatically different. The separation should extend an adequate distance from the plaza area to allow the users of the attended lanes to accelerate close to the posted speed of the highway prior to merging with the highway speed lanes.

Many toll agencies have implemented highway-speed ETC lanes. These implementations have involved reconfiguring existing toll plazas, reconstructing existing plazas, or designing and constructing new facilities.

The following list summarizes the facilities that have incorporated highway speed ETC lanes over the past 10 years.

- San Joaquin Hills Transportation Corridor (Southern California)
- Eastern Transportation Corridor (Southern California)
- Foothill Corridor (Southern California)
- Pennsylvania Turnpike
- Oklahoma Turnpike
- Dallas North Tollway (Dallas)
- Sam Houston Toll Road (Houston)
- Hardy Toll Road (Houston)
- US 183A (Austin, TX)
- Port Authority New York and New Jersey
- President George Bush Turnpike (Dallas)
- Orlando Orange County Expressway Facilities
- Delaware DOT Facilities
- Atlantic City Expressway
- New Jersey Turnpike
- Garden State Parkway
- Georgia 400
- Florida Turnpike Facilities
- Illinois Tollway Facilities

These facilities did not necessarily have significant ETC participation rates to justify the selection of highway speed ETC lanes. Several of the facilities had ETC participation rates of less than 50%, but the customer service benefits outweighed the perceived need for high ETC usage. The customer response has been overwhelmingly positive on all facilities that have implemented highway speed ETC lanes. According to New Jersey Turnpike Authority data, about 95% of users prefer highway speed lanes to slow speed dedicated lanes. In addition, the capacity increase and (in some cases) the resulting reduced size of the toll plaza provided additional benefits to the agencies.

Many toll agencies have incorporated full Open Road Tolling (ORT) into their long-range plans. ORT is a concept where tolls are collected 100% electronically without the need for a conventional toll plaza. Technology exists today to implement cashless, ORT toll collection; however, the conversion from a cash or cash/ETC-based toll collection system to full ORT requires the resolution of many difficult issues, most of which are non-technical. Only 2 ORT facilities operate in North America: WestPark in Houston and 407ETR in Toronto. These are commuter-based toll facilities and were designed and opened as ORT toll roads.

DEDICATED LANE COMPARISON

The following is a summary of the two types of options reviewed for the design of dedicated lanes at a new toll plaza as well as a discussion of the advantages and disadvantages of each. From a cost perspective, initial review of conceptual costs estimates that the overall plaza construction costs would be similar. Slow speed plazas may require more staffed booths to achieve the same throughput as highway speed facilities. The additional cost of booths is generally roughly equivalent to the cost of additional equipment and pavement required for a highway speed facility.

Slow Speed Dedicated ETC Lanes

This toll system is currently utilized at the York Toll Plaza. Dedicated lanes on the outside of the toll plazas are separated from the adjacent toll lane by a curbed concrete island. In addition, two interior toll lanes can be signed as dedicated electronic toll lanes as conditions warrant.

Benefits:

- All vehicles approaching the toll plaza maintain the same alignment until reaching the toll plaza approach zone, reducing the need for patron decision making.
- Requires similar footprint per lane as existing toll plaza configuration.
- Limited merge distance required since all vehicles operate at similar speeds
- Similarity to existing conventional toll plazas leads to patron familiarity

Limitations and Considerations:

- Electronic toll vehicles must slow as they enter the toll plaza area. While this is an improvement over the stop condition, slowing down to 10 mph is less ideal from a customer and operations perspective when compared to a highway speed lane.

- Insufficient deceleration by low speed dedicated lane toll users can create an unsafe situation in which the ETC vehicles approaching the toll plaza area at a relatively high rate of speed while all other vehicles are stopping

- Vehicles must access the dedicated toll lanes via the toll plaza approach area. Excessive vehicle queue in the approach area impacts access and efficiency of dedicated toll lanes.

- Current state of the leading industry technology allows highway speed tolling.

Highway Speed Dedicated ETC Lanes

Highway speed dedicated toll lanes are currently not used on the Maine Turnpike. Highway speed dedicated lanes would be designed to physically separate the majority of ETC traffic from the cash customers, resulting in operational, safety and customer satisfaction improvements. Given the higher speeds of a portion of the traffic passing through, considerations for plaza layout and approach roadways are required to safely transition the vehicles between these significantly different transaction conditions.

Regardless of configuration, highway speed dedicated lanes provide the following advantages and disadvantages:

Benefits:

- Separation of non-stop and stopped vehicles reduces potential conflicts within the plaza booth area

- Significantly reduces the number of non-stop vehicles in the cash collection area where toll collectors and other employees may be crossing

- Safe higher speeds lead to more efficient operation and reduced congestion.

- Increases throughput capacity of the plaza, potentially reducing the number of booths required

- Provides ETC customers with specific at-speed lanes with no queuing or speed reduction. This provides the best possible level of service for ETC customers.

- Provides increased incentive to participate in ETC program through the added convenience of the highway speed tolling.

- Potentially diverts additional users to the roadway from local roads as compared to conventional plazas due to increased customer convenience.

- Reduces fuel consumption, vehicle emissions and noise due to higher average speeds through the plaza and reduced braking and acceleration.

Limitations and Considerations:

- Will likely increase the non-payment rate through the plaza

- Less communication with the patron regarding tag status

- Increased cost of toll and violation detection equipment

- May eliminate the ability to implement reversible lanes

BENEFIT AND COST DISCUSSION OF HIGHWAY SPEED DEDICATED LANES

As noted, the current direction of both technology and agency decision-making is towards the use of highway speed tolling. While each facility presents unique user and traffic features, the overriding commonalities of increased customer service, improved operational efficiencies, and enhanced safety have generally compelled agencies to implement highway speed tolling. The following discussion develops the benefits and costs in the context of the decision for the layout of the future southern toll plaza.

Benefits of Highway Speed Tolling

The current York toll plaza serves as a gateway to the State of Maine for travelers on Interstate 95. These travelers include a combination of commuters, local trips and out of state visitors. The plaza clearly shows peak traffic volumes in the traditional recreation and vacation periods, further demonstrating the emphasis on use of the plaza as an entry point for tourism. Improvements to the operation of the York toll plaza will ensure that it does not function as a barrier to tourism. Any efforts to improve the quality of service to customers traveling through the plaza therefore have the potential to enhance a key component of the State's economy. Highway speed tolling clearly reduces or eliminates the need for ETC patrons to adjust their driving behavior when passing through a plaza. The customer is allowed to continue through at highway speeds rather than the conventional plaza speed of say 10 mph. Patrons are not required to slow down or negotiate slowing or stopped traffic. The more "transparent" the system, the less impact is to the patron and the quality of service increases.

In addition to the added convenience for ETC customers, cash paying customers will also see benefits of the new configuration. Since a large portion of traffic will have the option to utilize the highway speed lanes, fewer vehicles will enter the slow speed portion of the plaza. Customers who continue to choose to pay cash or use slow speed lanes for ETC will still encounter fewer vehicles in the payment area. This provides fewer conflicts as noted in relation to the safety benefits, but also reduces the number of decisions required of the driver. Also, the slow speed area of the plaza will have fewer lanes with ETC only modes, reducing the potential that a cash customer mistakenly enters a slow speed dedicated lane. Signage and lane types will be similar to previous plaza designs, adding consistency and familiarity to the plaza that will additionally benefit cash customers.

While often difficult to forecast and quantify, the potential also exists for increased incentive to participate in an ETC program given the higher level of service to customers. Also, the increased convenience may also persuade drivers to use the Maine Turnpike as opposed to alternative local routes.

The cost of toll equipment that allows the identification of vehicles at high speed and the capture of images of violating vehicles is higher than the cost of conventional slow speed lane equipment. This is primarily due to the more complex sensors, computer and camera equipment required. Furthermore, the cost of additional pavement and other physical infrastructure to separate highway speed traffic from slow or stopped traffic also presents additional capital costs. However, operational efficiencies can be realized given the increased throughput capacities of highway speed lanes that reduce the overall number of slow speed lanes required. An initial analysis of the mix of Maine Turnpike traffic as it relates to the projected sizing of both highway speed and conventional toll plazas shows that a conventional plaza will require more slow speed lanes than a plaza incorporating highway speed lanes. Cost estimates of the various options shows that the additional costs of highway speed toll equipment and infrastructure is more than offset by the cost of the additional toll structures for a conventional plaza. Current cost estimates show that regardless of configuration, the new plaza would cost between $30-35 million (2005 dollars), with conventional plazas typically on the higher end of the range. Moreover, as overall traffic continues to migrate towards the use of ETC, the efficiency of the highway speed plaza increases over time, further presenting opportunity for operational savings in the long term.

One clear advantage of the highway speed toll plaza configuration over the conventional slow speed condition are the environmental benefits realized from highway speed tolling.. By increasing the average speed of overall vehicles passing through the plaza (since a greater number of vehicles will be able to continue at highway speeds) the average fuel economy of vehicles will increase. This quantifiable reduction in the use of fuel will not only provide financial benefits to the patrons, but reduce the consumption of non-renewable resources. Fewer vehicles decelerating and accelerating has the potential to reduce overall noise impacts at the plaza and reduces the emissions in the area due to lower residence times of vehicles in the plazas (since many will pass through quicker). Reducing air emissions has the potential to improve the air quality for plaza workers, passing vehicle cabin air intakes, surrounding communities and environments over a conventional plaza.

Finally, while specific safety studies and toll plaza design configuration standards have been limited, there is an overall trend in the industry to consider the potential safety implications of toll plaza design. High profile accidents at toll plazas have created renewed industry emphasis focusing on aspects of toll plazas that contribute to or reduce conflicts. Similar to the separation of local road traffic from highway speed through traffic in roadway networks in general (such as interstate bypasses around developed areas), there is increasing emphasis on the physical separation of toll plaza traffic that can continue at speed via electronic toll collection from the vehicles who are required to stop and pay cash. This concept of separation also moves traffic away from plaza areas with pedestrian activities (toll collectors and workers) in the lanes. Fewer vehicles in these lanes result in fewer potential conflicts, reducing worker exposure. These potential safety benefits are key factors when considering basic toll plaza configurations.

Business Cost Considerations of Highway Speed Tolling

A potential cost of the incorporation of highway speed lanes in the center of a toll plaza relates to the inability of the plaza to incorporate reversible toll collection lanes in the center of the plaza. For facilities that experience significant differences in peak flow volumes by direction, the use of reversible lanes provides operational efficiencies with fewer booths. Recent trends in the peak flows at the current York toll plaza have shown directional peak flows approaching equalization in both directions. Initial analysis has shown that in peak conditions the future plaza would benefit from having at most a single lane, if any at all, that would be reversible. In short, the reversible lane option does not provide significant operational efficiencies, particularly when compared to the improved throughput of a highway speed lane.

Toll agencies who have incorporated highway speed lanes have realized varying levels of increases in non-payment events at these newly configured toll plazas. These increases have a variety of reasons, mainly centered on the lack of patron recognition of the new plaza configuration, limitations of the toll tag reading technology and increases in scofflaws. Regardless of the reason for the increase of non-payment events at these types of plazas, the technology for capturing images of vehicles who do not register a payment is sound and proven to accurately capture license plates of vehicles in the highway speed tolling environment. Regardless of whether the patron mistakenly entered the highway speed lane, the patron's toll tag was not read or the patron was emboldened by the opportunity to violate at highway speeds, the Maine Turnpike can specify a new system which will reasonably identify the license plates of vehicles involved in non-payment events to maximize revenue recovery potential.

While the current industry trend has been towards the use of highway speed lanes at new or renovated toll plazas, if incorporated in Maine, the concept would be new to many patrons. As other agencies have experienced, the addition of a new toll plaza configuration will require additional design considerations to mitigate confusion; including, but not limited to specific signing and geometric layout considerations. The introduction of a new toll plaza configuration is also typically accompanied by significant public relations campaigns to educate patrons.

Since highway speed lanes typically do not provide feedback to individual patrons passing through the toll zone, accommodations for those who wish to receive feedback from a patron fare display (as currently used in Maine Turnpike plazas) or similar device could still be achieved by allowing those patrons to use their tags in the slow speed lanes. While this population of users tends to be very low, agencies have recognized that this is a factor that is easily considered by accepting ETC in all lanes.

For those ETC customers who forget to mount their toll tag or have a tag the system fails to read for some reason, the MTA will be able to continue to use its automated processes to accurately charge these existing customers. For those additional actual violation events, the MTA will need to continue to be diligent in the pursuit of violators as the current laws allow and continue to evaluate options for violation recovery through continuous improvement of the current violation enforcement system and policy as appropriate and available. Through the optimization of the violation enforcement process and the maximization of opportunities for revenue recovery, the Maine Turnpike has the potential to reduce the impact of these additional violations to levels to lowest possible level.

As part of the initial broad assessment and one of the many design options under consideration, one compromise between the desire to incorporate highway speed lanes and the need to minimize preliminary revenue impacts would be to design a 'convertible' plaza. The design would be initially constructed as a conventional plaza with consideration for conversion to highway speed lanes in the future at a time when the revenue impacts would be further reduced. Initial estimates of the cost of a convertible plaza from a capital perspective alone would result in an additional approximate $4 million (2005 dollars) in conversion costs in the future, not to mention additional disruptions to traffic due to additional construction activity in a relatively short period of time following the initial construction of the plaza. In the spirit of improving the gateway to Maine and given the magnitude of the additional capital costs, this concept, while worth noting, was not deemed appropriate.

RECOMMENDATIONS

HNTB therefore makes the following recommendations:

- **The Maine Turnpike Authority should incorporate highway speed dedicated ETC lanes into the design of future mainline toll plazas. The projected benefits outweigh the modest increase in business costs associated with highway speed tolling.**

- In order to mitigate the potential revenue impacts related to highway speed toll collection, the following is recommended:

  - *Operational considerations.* Upon the introduction of highway speed toll lanes, the Authority will need to consider the required capacity to handle increased demands on back office operations related highway speed operations.

- *Enforcement process evaluation.* In order to offset potential increases in revenue loss due to increased violations associated with the introduction of highway speed lanes, the Authority should conduct further assessment of the current violation enforcement practice and policy to determine if any modifications would be warranted based on the operational costs, public response and potential legislative requirements that may accompany such modifications.

- *Signing.* Development and implementation of a clear and comprehensive signing plan to guide patrons in advance of the toll plaza will help reduce confusion.

- *Geometrics.* Design the entrance to the highway speed portion of the toll plaza as a "split" rather than an "exit", with an identical division for both the highway speed lanes and the conventional toll plaza. This should reduce confusion among patrons.

- *Comprehensive specification and system testing.* Limiting the errors introduced by technology can be in part mitigated by comprehensive specification of the highway speed system and rigorous testing to ensure the requirements are met. While no technology delivers a 100% accurate system, these efforts have the potential to minimize loss due to technology.

- *Public awareness.* Inform the public of the conversion through a proactive public relations campaign. This will not only further reduce confusion, but it can help build public support for the improved facility as well.

APPENDIX G

CRASH DATA

Crash Summary Report

Report Selections and Input Parameters

REPORT SELECTIONS

☑ **Crash Summary I** ☑ **Section Detail** ☑ **Crash Summary II**

REPORT PARAMETERS

Study Period: Year 2004, Start Month 1 through Year 2006 End Month: 12

Input Data: Route 0095S First Node: 58357 Last Node: 58356

Exclude First Node: No; Exclude Last Node: No

Start Offset: 0; End Offset: 0

REPORT DESCRIPTION

I-95 SB York

Maine Department Of Transportation - Traffic Engineering, Crash Records Section

Crash Summary I

Nodes

Node	Route - MP	Node Description	U/R	Total Crashes	Injury Crashes K	A	B	C	PD	Percent Injury	Annual M Ent-Veh	Crash Rate	Critical Rate	CRF
58357	0095S - 293.72	Non-Int I 95 SB	1	0	0	0	0	0	0	0.0	8.439	0.00	0.10	0.00
										Statewide Crash Rate:		0.03		
57693	0095S - 295.23	Non-Int I 95 SB	1	1	0	0	0	0	1	0.0	0.000	0.00	0.00	0.00
										Statewide Crash Rate:		0.03		
58871	0095S - 295.48	Int of I 95 SB, RAMP B OFF TO YORK CONNECTOR	1	0	0	0	0	0	0	0.0	8.439	0.00	0.10	0.00
										Statewide Crash Rate:		0.03		
58869	0095S - 295.89	Int of I 95 SB, RAMP A FROM YORK CONNECTOR	1	1	0	0	0	0	1	0.0	10.541	0.03	0.09	0.00
										Statewide Crash Rate:		0.03		
58356	0095S - 296.30	BRG 6228, I 95 SB under ST RTE 91	2	0	0	0	0	0	0	0.0	10.541	0.00	0.26	0.00
										Statewide Crash Rate:		0.12		
Study Years: 3.00		**NODE TOTALS:**		2	0	0	0	0	2	0.0	37.960	0.02	0.11	0.16

Maine Department Of Transportation - Traffic Engineering, Crash Records Section

Crash Summary I

Sections

Start Node	End Node	Element	Offset Begin - End	Route - MP	Section Length	U/R	Total Crashes	K	A	B	C	PD	Percent Injury	Annual HMVM	Crash Rate	Critical Rate	CRF
57693	58357	239222	0 - 1.51	0095S - 293.72	1.51	1	27	0	0	4	2	21	22.2	0.12743	70.63	95.48	0.00
Non-Int I 95 SB				INT 95 SB										Statewide Crash Rate:	63.57		
57693	58871	239223	0 - 0.25	0095S - 295.23	0.25	1	11	0	0	0	1	10	9.1	0.02110	173.80	137.31	1.27
Non-Int I 95 SB				INT 95 SB										Statewide Crash Rate:	63.57		
58356	58869	239734	0 - 0.41	0095S - 295.48	0.41	1	8	0	0	2	1	5	37.5	0.04322	61.70	116.75	0.00
BRG 6228, I 95 SB under ST RTE 91				INT 95 SB										Statewide Crash Rate:	63.57		
58869	58871	240305	0 - 0.41	0095S - 295.48	0.41	1	1	0	1	0	0	0	100.0	0.03208	10.39	124.58	0.00
Int of I 95 SB, RAMP A FROM YORK CONNECTOR				INT 95 SB										Statewide Crash Rate:	63.57		
Study Years:	3.00			**Section Totals:**	2.58		47	0	1	6	4	36	23.4	0.22383	69.99	87.89	0.80
				Grand Totals:	2.58		49	0	1	6	4	38	22.4	0.22383	72.97	92.75	0.79

Crash Summary

Section Details

Start Node	End Node	Element	Offset Begin - End	Route - MP	Total Crashes	K	A	B	C	PD	Crash Report	Crash Date	Crash Mile Point	Injury Degree
57693	58357	239222	0 - 1.51	0095S - 293.72	27	0	0	4	2	21	2004-24842	09/06/2004	293.93	B
											2005-20265	07/20/2005	294.23	B
											2004-21958	08/12/2004	294.23	PD
											2005-24540	08/28/2005	294.53	PD
											2004-23420	08/22/2004	294.53	PD
											2005-16743	06/11/2005	294.73	B
											2005-24044	08/28/2005	294.73	PD
											2005-4101	02/10/2005	294.93	PD
											2004-8351	02/06/2004	294.98	C
											2006-12693	05/25/2006	295.03	B
											2004-23734	08/30/2004	295.03	PD
											2006-16830	06/29/2006	295.03	PD
											2004-6629	02/20/2004	295.13	C
											2004-24837	07/06/2004	295.13	PD
											2004-31963	11/01/2004	295.13	PD
											2004-37138	12/26/2004	295.13	PD
											2004-37140	12/26/2004	295.13	PD
											2004-37141	12/26/2004	295.13	PD
											2006-100	01/01/2006	295.13	PD
											2004-18321	07/05/2004	295.13	PD
											2005-26918	09/23/2005	295.13	PD
											2005-40692	12/09/2005	295.13	PD
											2006-22352	09/13/2006	295.23	PD
											2006-16565	07/08/2006	295.23	PD
											2006-6139	03/07/2006	295.23	PD
											2006-2867	02/02/2006	295.23	PD
											2006-1590	01/23/2006	295.23	PD

Crash Summary

Section Details

Start Node	End Node	Element	Offset Begin - End	Route - MP	Total Crashes	K	A	B	C	PD	Crash Report	Crash Date	Crash Mile Point	Injury Degree
57693	58871	239223	0 - 0.25	0095S - 295.23	11	0	0	0	1	10	2005-34027	12/04/2005	295.33	C
											2005-868	01/07/2005	295.33	PD
											2005-19028	06/28/2005	295.33	PD
											2005-26383	09/17/2005	295.33	PD
											2006-354	01/11/2006	295.33	PD
											2005-1859	01/23/2005	295.33	PD
											2004-30304	10/25/2004	295.33	PD
											2006-14254	06/15/2006	295.33	PD
											2004-36553	12/20/2004	295.33	PD
											2006-18246	07/26/2006	295.33	PD
											2006-19418	08/04/2006	295.33	PD
58869	58871	240305	0 - 0.41	0095S - 295.48	1	0	1	0	0	0	2006-32072	12/15/2006	295.59	A
58356	58869	239734	0 - 0.41	0095S - 295.89	8	0	0	2	1	5	2005-26200	09/18/2005	296	B
											2004-31589	11/13/2004	296	PD
											2004-26504	09/22/2004	296.20	B
											2004-34743	12/07/2004	296.20	C
											2004-18523	07/07/2004	296.20	PD
											2004-18470	07/07/2004	296.20	PD
											2004-15669	05/30/2004	296.20	PD
											2004-37770	12/26/2004	296.20	PD
				Totals:	47	0	1	6	4	36				

Crash Summary II - Characteristics

Crashes by Day and Hour

	AM												Hour of Day / PM													
Day Of Week	**12**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Un**	**Tot**
SUNDAY	0	0	0	0	2	0	1	1	0	1	0	0	2	2	1	1	0	0	0	1	0	0	0	0	0	12
MONDAY	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	2	2	0	0	0	0	0	0	0	0	7
TUESDAY	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	2	0	0	0	0	0	0	0	0	5
WEDNESDAY	0	0	0	0	0	0	0	0	1	0	1	1	0	0	1	1	2	0	0	0	0	0	0	0	0	7
THURSDAY	0	0	0	0	0	0	1	1	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0	1	0	7
FRIDAY	0	0	0	0	0	1	0	0	0	1	0	0	0	2	1	1	0	0	0	0	1	0	0	0	0	7
SATURDAY	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	4
Totals	0	0	0	0	2	1	3	3	2	2	1	3	3	5	4	9	7	0	1	1	1	0	0	1	0	**49**

Crashes by Year and Month

Month	2004	2005	2006	Total
JANUARY	0	2	3	5
FEBRUARY	2	1	1	4
MARCH	0	0	1	1
APRIL	0	1	0	1
MAY	1	0	1	2
JUNE	0	2	2	4
JULY	4	1	2	7
AUGUST	4	2	1	7
SEPTEMBER	2	3	1	6
OCTOBER	1	0	0	1
NOVEMBER	2	0	0	2
DECEMBER	6	2	1	9
Total	**22**	**14**	**13**	**49**

Vehicle Counts by Type

Unit Type	Total
1-2 Door	9
2-4 Door	33
3-Convertible	0
4-Station Wagon	3
5-Van	8
6-Pickup Truck	6
7-SUV	13
10-Truck Tractor Only (Bobtail)	0
12-School Bus	0
13-Motor Home	0
14-Motorcycle	0
15-Moped	0
16-Motor Bike	0
17-Bicycle	0
18-Snowmobile	0
20-2 Axle Single Unit with Dual Tires	1
21-2 Axle Tractor with Single Axle Semi	0
22-2 Axle Tractor with Tandem Axle Semi	0
25-2 Axle Tractor with Single Axle Semi & 2 Axle Trailer	0
30-3 Axle Single Unit	1
31-3 Axle Tractor with Single Axle Semi	0

Unit Type	Total
32-3 Axle Tractor with Tandem Axle Semi	9
33-3 Axle Tractor with Tridem Axle Semi	2
35-3 Axle Tractor with Single Axle Semi & 2 Axle Trailer	0
36-3 Axle Tractor with Tandem Axle Semi & 2 Axle Trailer	0
37-5 Axle Semi; Split Trailer Tandem	0
38-6 Axle Semi; Split Trailer Tandem with Center Axle	0
39-6 Axle; Standard Trailer Tandem with Center Axle	0
40-4 Axle Single Unit	0
42-4 Axle Tractor with Tandem Axle Semi	0
50-Any Other Axle Configuration	0
60-Other Unit	0
70-ATV	0
81-2 Axle Bus	0
82-3 Axle Bus	0
98-Farm Vehicles / Tractors	0
99-Unknown	0
Total	**85**

Crash Summary II - Characteristics

Crashes by Apparent Contributing Factor And Driver

Apparent Contributing Factor	Dr 1	Dr 2	Dr 3	Dr 4	Dr 5	Other	Total
No Improper Action	14	16	3	1	0	0	34
Failure to Yield Right of Way	5	2	0	0	0	0	7
Illegal Unsafe Speed	14	3	0	0	0	0	17
Following Too Close	1	3	0	0	0	0	4
Disregard Traffic Control Device	0	0	0	0	0	0	0
Driving Left of Center Not Passing	0	0	0	0	0	0	0
Improper Passing, Overtaking	1	1	0	0	0	0	2
Improper Unsafe Lane Change	4	1	0	0	0	0	5
Improper Parking Start, Stop	0	0	0	0	0	0	0
Improper Turn	0	0	0	0	0	0	0
Unsafe Backing	0	0	0	0	0	0	0
No Signal or Improper Signal	0	0	0	0	0	0	0
Impeding Traffic	0	0	0	0	0	0	0
Driver Inattention, Distraction	8	6	0	0	0	0	14
Driver Inexperience	0	0	0	0	0	0	0
Pedestrian Violation Error	0	0	0	0	0	0	0
Physical Impairment	0	0	0	0	0	0	0
Vision Obscured, Windshield Glass	0	0	0	0	0	0	0
Vision Obscured, Sun, Headlights	0	0	0	0	0	0	0
Other Vision Obscurement	0	0	0	0	0	0	0
Other Human Violation Factor	0	0	0	0	0	0	0
Hit and Run	0	0	0	0	0	0	0
Defective Brakes	0	0	0	0	0	0	0
Defective Tire, Tire Failure	0	0	0	0	0	0	0
Defective Lights	0	0	0	0	0	0	0
Defective Suspension	0	0	0	0	0	0	0
Defective Steering	0	0	0	0	0	0	0
Other Vehicle Defect or Factor	2	0	0	0	0	0	2
Unknown	0	0	0	0	0	0	0
Total	**49**	**32**	**3**	**1**	**0**	**0**	**85**

Crashes by Apparent Physical Condition And Driver

Apparent Physical Condition	Dr 1	Dr 2	Dr 3	Dr 4	Dr 5	Other	Total
Normal	47	31	3	1	0	0	82
Under the Influence	0	1	0	0	0	0	1
Had Been Drinking	1	0	0	0	0	0	1
Had Been Using Drugs	0	0	0	0	0	0	0
Asleep	1	0	0	0	0	0	1
Fatigued	0	0	0	0	0	0	0
ill	0	0	0	0	0	0	0
Handicapped	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0
Total	**49**	**32**	**3**	**1**	**0**	**0**	**85**

Driver Age by Unit Type

Age	Driver	Bicycle	SnowMobile	Pedestrian	ATV	Total
09-Under	0	0	0	0	0	0
10-14	0	0	0	0	0	0
15-19	4	0	0	0	0	4
20-24	11	0	0	0	0	11
25-29	12	0	0	0	0	12
30-39	20	0	0	0	0	20
40-49	15	0	0	0	0	15
50-59	17	0	0	0	0	17
60-69	3	0	0	0	0	3
70-79	1	0	0	0	0	1
80-Over	2	0	0	0	0	2
Unknown	0	0	0	0	0	0
Total	**85**	**0**	**0**	**0**	**0**	**85**

Maine Department Of Transportation - Traffic Engineering, Crash Records Section

Crash Summary II - Characteristics

Fixed Object Struck

Fixed Object Struck	Total
1-Construction, Barricades Equipment, etc.	0
2-Traffic Signal	0
3-R.R. Crossing Device	0
4-Light Pole	0
5-Utility Pole (Tel. Electrical)	0
6-Sign Structure Post	0
7-Mail Boxes or Posts	0
8-Other Poles, posts or supports	1
9-Fire Hydrant/Parking Meter	0
10-Tree or Shrubbery	0
11-Crash Cushion	2
12-Median Safety Barrier	6
13-Bridge Piers (including protective guard rails)	1
14-Other Guardrails	3
15-Fencing (not median barrier)	0
16-Culvert Headwall	0
17-Embankment, Ditch, Curb	3
18-Building, Wall	1
19-Rock Outcrops or Ledge	0
20-Other	5
Total	**22**

Traffic Control Devices

Traffic Control Device	Total
1-Traffic Signals (Stop & Go)	0
2-Traffic Flashing	0
3-Overhead Flashers	4
4-Stop Signs - All Approaches	0
5-Stop Signs - Other	0
6-Yield Sign	1
7-Curve Warning Sign	0
8-Officer, Flagman, School Patrol	0
9-School Bus Stop Arm	0
10-School Zone Sign	0
11-R.R. Crossing Device	0
12-No Passing Zone	0
13-None	34
14-Other	10
Total	**49**

Road Character

Road Character	Total
1-Level Straight	26
2-Level Curved	0
3-On Grade Straight	18
4-On Grade Curved	4
5-Top of Hill Straight	1
6-Top of Hill Curved	0
7-Bottom of Hill Straight	0
8-Bottom of Hill Curved	0
9-Other	0
Total	**49**

Injury Data

Severity Code	Injury Crashes	Number Of Injuries
K	0	0
A	1	1
B	6	6
C	4	7
PD	38	0
Total	**49**	**14**

Light

Light	Total
1-Dawn (Morning)	3
2-Daylight	38
3-Dusk (Evening)	3
4-Dark (Street Lights On)	2
5-Dark (No Street Lights)	3
6-Dark (Street Lights Off)	0
7-Other	0
Total	**49**

Maine Department Of Transportation - Traffic Engineering, Crash Records Section

Crash Summary II - Characteristics

Crashes by Crash Type and Type of Location

Crash Type	Straight Road	Curved Road	Three Leg Intersection	Four Leg Intersection	Five Leg Intersection	Driveways	Bridges	Interchanges	Other	Total
Object in Road	4	0	0	0	0	0	0	1	0	5
Rear End / Sideswipe	20	4	0	0	0	0	0	2	3	29
Head-on / Sideswipe	0	0	0	0	0	0	0	0	0	0
Intersection Movement	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0
Train	0	0	0	0	0	0	0	0	0	0
Ran Off Road	8	0	0	0	0	0	0	0	0	8
All Other Animal	0	0	0	0	0	0	0	0	0	0
Bike	0	0	0	0	0	0	0	0	0	0
Other	5	0	0	0	0	0	0	0	0	5
Jackknife	0	0	0	0	0	0	0	0	0	0
Rollover	0	0	0	0	0	0	0	0	0	0
Fire	0	0	0	0	0	0	0	0	0	0
Submersion	0	0	0	0	0	0	0	0	0	0
Rock Thrown	0	0	0	0	0	0	0	0	0	0
Bear	0	0	0	0	0	0	0	0	0	0
Deer	0	0	0	0	0	0	0	0	0	0
Moose	2	0	0	0	0	0	0	0	0	2
Total	**39**	**4**	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**49**

Crash Summary II - Characteristics

Crashes by Weather, Light Condition and Road Surface

Weather Light	Debris	Dry	Ice, Packed Snow, Not Sanded	Ice, Packed Snow, Sanded	Muddy	Oily	Other	Snow Slush, Not Sanded	Snow, Slush, Sanded	Wet	Total
Blowing Sand or Dust											
Dark (No Street Lights)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights Off)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights On)	0	0	0	0	0	0	0	0	0	0	0
Dawn (Morning)	0	0	0	0	0	0	0	0	0	0	0
Daylight	0	0	0	0	0	0	0	0	0	0	0
Dusk (Evening)	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0
Clear											
Dark (No Street Lights)	0	1	0	0	0	0	0	0	0	0	1
Dark (Street Lights Off)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights On)	0	0	0	0	0	0	0	0	0	0	0
Dawn (Morning)	0	0	0	0	0	0	0	0	0	0	0
Daylight	0	24	0	0	0	0	0	0	0	0	24
Dusk (Evening)	0	2	0	0	0	0	0	0	0	0	2
Other	0	0	0	0	0	0	0	0	0	0	0
Cloudy											
Dark (No Street Lights)	0	2	0	0	0	0	0	0	0	0	2
Dark (Street Lights Off)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights On)	0	0	0	0	0	0	0	0	0	0	0
Dawn (Morning)	0	1	0	0	0	0	0	0	0	0	1
Daylight	0	3	0	0	0	0	0	0	0	0	3
Dusk (Evening)	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0
Fog, Smog, Smoke											
Dark (No Street Lights)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights Off)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights On)	0	0	0	0	0	0	0	0	0	0	0
Dawn (Morning)	0	0	0	0	0	0	0	0	0	0	0
Daylight	0	0	0	0	0	0	0	0	0	0	0
Dusk (Evening)	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0

Crash Summary II - Characteristics

Crashes by Weather, Light Condition and Road Surface

Weather Light	Debris	Dry	Ice, Packed Snow, Not Sanded	Ice, Packed Snow, Sanded	Muddy	Oily	Other	Snow Slush, Not Sanded	Snow, Slush, Sanded	Wet	Total
Other											
Dark (No Street Lights)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights Off)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights On)	0	0	0	0	0	0	0	0	0	0	0
Dawn (Morning)	0	0	0	0	0	0	0	0	0	0	0
Daylight	0	0	0	0	0	0	0	0	0	0	0
Dusk (Evening)	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0
Rain											
Dark (No Street Lights)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights Off)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights On)	0	0	0	0	0	0	0	0	0	0	0
Dawn (Morning)	0	0	0	0	0	0	0	0	0	0	0
Daylight	0	0	0	0	0	0	0	0	0	2	2
Dusk (Evening)	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0
Severe Cross Winds											
Dark (No Street Lights)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights Off)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights On)	0	0	0	0	0	0	0	0	0	0	0
Dawn (Morning)	0	0	0	0	0	0	0	0	0	0	0
Daylight	0	0	0	0	0	0	0	0	0	0	0
Dusk (Evening)	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0
Sleet, Hail, Freezing Rain											
Dark (No Street Lights)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights Off)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights On)	0	0	0	0	0	0	0	0	0	0	0
Dawn (Morning)	0	0	0	0	0	0	0	0	0	0	0
Daylight	0	0	0	0	0	0	0	0	1	0	1
Dusk (Evening)	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0

Crash Summary II - Characteristics

Crashes by Weather, Light Condition and Road Surface

Weather / Light	Debris	Dry	Ice, Packed Snow, Not Sanded	Ice, Packed Snow, Sanded	Muddy	Oily	Other	Snow Slush, Not Sanded	Snow, Slush, Sanded	Wet	Total
Snow											
Dark (No Street Lights)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights Off)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights On)	0	0	0	0	0	0	0	1	1	0	2
Dawn (Morning)	0	0	0	0	0	0	0	0	2	0	2
Daylight	0	0	1	1	0	0	0	4	2	0	8
Dusk (Evening)	0	0	0	0	0	0	0	0	1	0	1
Other	0	0	0	0	0	0	0	0	0	0	0
TOTAL	**0**	**33**	**1**	**1**	**0**	**0**	**0**	**5**	**7**	**2**	**49**

Crash Summary Report

Report Selections and Input Parameters

REPORT SELECTIONS

☑ Crash Summary I ☑ Section Detail ☑ Crash Summary II

REPORT PARAMETERS

Study Period: Year 2004, Start Month 1 through Year 2006 End Month: 12

Input Data: Route 0095X First Node: 58311 Last Node: 58312

Exclude First Node: No; Exclude Last Node: No

Start Offset: 0; End Offset: 0

REPORT DESCRIPTION

I-95 NB

Crash Summary I

Nodes

Node	Route - MP	Node Description	U/R	Total Crashes	K	A	B	C	PD	Percent Injury	Annual M Ent-Veh	Crash Rate	Critical Rate	CRF
58311	0095X - 6.18	BRG 6228, I 95 NB under BERWICK RD	2	0	0	0	0	0	0	0.0	10.337	0.00	0.26	0.00
											Statewide Crash Rate:	0.12		
58866	0095X - 6.44	Int of I 95 NB, RAMP OFF TO YORK CONNECTOR	1	2	0	0	0	1	1	50.0	10.337	0.06	0.09	0.00
											Statewide Crash Rate:	0.03		
58868	0095X - 7.10	Int of I 95 NB, RAMP ON FROM YORK CONNECTOR	1	0	0	0	0	0	0	0.0	8.315	0.00	0.10	0.00
											Statewide Crash Rate:	0.03		
57692	0095X - 7.19	Non-Int I 95 NB	1	2	0	0	0	0	2	0.0	8.315	0.08	0.10	0.00
											Statewide Crash Rate:	0.03		
58312	0095X - 9.43	BRG 1311, I 95 NB over CAPE NEDDICK RIVER	1	0	0	0	0	0	0	0.0	0.000	0.00	0.00	0.00
											Statewide Crash Rate:	0.03		
Study Years: 3.00		NODE TOTALS:		4	0	0	0	1	3	25.0	37.304	0.04	0.11	0.33

Crash Summary I

Sections

Start Node	End Node	Element	Offset Begin - End	Route - MP	Section Length	U/R	Total Crashes	K	A	B	C	PD	Percent Injury	Annual HMVM	Crash Rate	Critical Rate	CRF
57692	58312	239220	0 - 2.24	0095X - 4.95	2.24	1	17	1	1	0	1	14	17.6	0.18625	30.43	90.15	0.00
Non-Int I 95 NB				INT 95 NB										Statewide Crash Rate:	63.57		
58311	58866	239686	0 - 0.26	0095X - 6.18	0.26	1	13	0	0	1	2	10	23.1	0.02688	161.24	129.70	1.24
BRG 6228, I 95 NB under BERWICK RD				INT 95 NB										Statewide Crash Rate:	63.57		
58866	58868	240301	0 - 0.66	0095X - 6.44	0.66	1	13	0	0	1	0	12	7.7	0.05083	85.25	112.89	0.00
Int of I 95 NB, RAMP OFF TO YORK CONNECTOR				INT 95 NB										Statewide Crash Rate:	63.57		
57692	58868	239221	0 - 0.09	0095X - 7.10	0.09	1	14	0	0	1	3	10	28.6	0.00748	623.62	178.38	3.50
Non-Int I 95 NB				INT 95 NB										Statewide Crash Rate:	63.57		
Study Years: 3.00				Section Totals:	3.25		57	1	1	3	6	46	19.3	0.27144	70.00	85.72	0.82
				Grand Totals:	3.25		61	1	1	3	7	49	19.7	0.27144	74.91	90.50	0.83

Crash Summary

Section Details

Start Node	End Node	Element	Offset Begin - End	Route - MP	Total Crashes	K	A	B	C	PD	Crash Report	Crash Date	Crash Mile Point	Injury Degree
58311	58866	239686	0 - 0.26	0095X - 6.18	13	0	0	1	2	10	2004-11873	04/25/2004	6.28	B
											2004-35997	12/15/2004	6.28	C
											2004-13592	05/16/2004	6.28	PD
											2006-7531	03/10/2006	6.28	PD
											2005-32949	11/19/2005	6.28	PD
											2005-32193	11/21/2005	6.28	PD
											2004-7641	02/06/2004	6.28	PD
											2006-22933	09/20/2006	6.28	PD
											2005-7127	03/04/2005	6.28	PD
											2004-21899	07/02/2004	6.28	PD
											2006-11814	05/20/2006	6.28	PD
											2006-22931	09/19/2006	6.38	C
											2004-12449	05/03/2004	6.38	PD
58866	58868	240301	0 - 0.66	0095X - 6.44	13	0	0	1	0	12	2006-21747	09/04/2006	6.44	PD
											2006-21169	09/02/2006	6.44	PD
											2004-26928	06/23/2004	6.54	B
											2004-15701	05/29/2004	6.54	PD
											2006-6133	03/03/2006	6.54	PD
											2006-10538	04/24/2006	6.54	PD
											2006-28986	11/12/2006	6.54	PD
											2006-32074	12/20/2006	6.54	PD
											2004-21431	08/01/2004	6.54	PD
											2006-11168	05/15/2006	6.64	PD
											2006-12582	05/28/2006	6.74	PD
											2005-22723	08/13/2005	6.74	PD
											2004-24901	08/07/2004	6.94	PD

Crash Summary

Section Details

Start Node	End Node	Element	Offset Begin - End	Route - MP	Total Crashes	K	A	B	C	PD	Crash Report	Crash Date	Crash Mile Point	Injury Degree
57692	58868	239221	0 - 0.09	0095X - 7.10	14	0	0	1	3	10	2004-35994	12/07/2004	7.10	B
											2004-37768	12/30/2004	7.10	C
											2004-24110	08/27/2004	7.10	C
											2005-12590	04/25/2005	7.10	C
											2006-22932	09/19/2006	7.10	PD
											2006-25856	10/20/2006	7.10	PD
											2005-10262	03/31/2005	7.10	PD
											2005-14065	04/15/2005	7.10	PD
											2004-35115	12/11/2004	7.10	PD
											2004-13828	05/21/2004	7.10	PD
											2004-22472	08/17/2004	7.10	PD
											2004-24986	08/21/2004	7.10	PD
											2004-24902	08/06/2004	7.10	PD
											2006-28174	11/11/2006	7.19	PD
57692	58312	239220	0 - 2.24	0095X - 7.19	17	1	1	0	1	14	2006-24012	10/01/2006	7.29	C
											2004-18319	06/24/2004	7.29	PD
											2006-21601	08/27/2006	7.39	PD
											2006-8591	04/06/2006	7.39	PD
											2006-20626	08/27/2006	7.49	PD
											2005-9502	03/17/2005	7.59	PD
											2006-170	01/05/2006	7.69	PD
											2006-32903	12/30/2006	8.19	PD
											2006-12960	06/03/2006	8.19	PD
											2006-15195	06/25/2006	8.19	PD
											2004-17015	06/16/2004	8.29	A
											2005-1123	01/08/2005	8.29	PD
											2006-2651	01/30/2006	8.39	PD
											2005-1892	01/24/2005	8.69	PD
											2004-828	01/07/2004	8.89	PD
											2005-27852	10/09/2005	9.19	K
											2004-15702	06/10/2004	9.29	PD
				Totals:	57	1	1	3	6	46				

Crash Summary II - Characteristics

Crashes by Day and Hour

Day Of Week	AM 12	1	2	3	4	5	6	7	8	9	10	11	PM 12	1	2	3	4	5	6	7	8	9	10	11	Un	Tot
SUNDAY	1	0	2	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0	2	1	0	0	0	0	0	10
MONDAY	0	1	0	0	0	1	1	0	0	0	0	0	2	1	0	1	0	0	0	0	1	0	0	0	0	8
TUESDAY	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	4
WEDNESDAY	0	0	0	0	0	0	2	0	1	1	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	7
THURSDAY	0	0	1	0	0	2	0	0	0	0	0	0	1	1	0	0	1	0	1	1	0	0	0	0	0	8
FRIDAY	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	5	2	1	0	0	0	0	0	1	0	12
SATURDAY	0	0	1	1	0	0	0	0	0	0	0	1	2	0	3	0	0	2	0	1	0	0	0	1	0	12
Totals	1	1	4	2	0	4	3	1	1	1	1	2	6	4	4	8	5	3	4	3	1	0	0	2	0	61

Crashes by Year and Month

Month	2004	2005	2006	Total
JANUARY	1	2	2	5
FEBRUARY	1	0	0	1
MARCH	0	3	2	5
APRIL	1	2	2	5
MAY	5	0	3	8
JUNE	4	0	3	7
JULY	1	0	0	1
AUGUST	6	2	2	10
SEPTEMBER	0	1	5	6
OCTOBER	0	1	2	3
NOVEMBER	0	2	2	4
DECEMBER	4	0	2	6
Total	23	13	25	61

Vehicle Counts by Type

Unit Type	Total
1-2 Door	10
2-4 Door	31
3-Convertible	0
4-Station Wagon	5
5-Van	12
6-Pickup Truck	12
7-SUV	12
10-Truck Tractor Only (Bobtail)	0
12-School Bus	0
13-Motor Home	0
14-Motorcycle	0
15-Moped	0
16-Motor Bike	0
17-Bicycle	0
18-Snowmobile	0
20-2 Axle Single Unit with Dual Tires	7
21-2 Axle Tractor with Single Axle Semi	0
22-2 Axle Tractor with Tandem Axle Semi	1
25-2 Axle Tractor with Single Axle Semi & 2 Axle Trailer	1
30-3 Axle Single Unit	1
31-3 Axle Tractor with Single Axle Semi	0

Unit Type	Total
32-3 Axle Tractor with Tandem Axle Semi	9
33-3 Axle Tractor with Tridem Axle Semi	1
35-3 Axle Tractor with Single Axle Semi & 2 Axle Trailer	0
36-3 Axle Tractor with Tandem Axle Semi & 2 Axle Trailer	0
37-5 Axle Semi; Split Trailer Tandem	0
38-6 Axle Semi; Split Trailer Tandem with Center Axle	0
39-6 Axle; Standard Trailer Tandem with Center Axle	0
40-4 Axle Single Unit	0
42-4 Axle Tractor with Tandem Axle Semi	0
50-Any Other Axle Configuration	0
60-Other Unit	1
70-ATV	0
81-2 Axle Bus	0
82-3 Axle Bus	0
98-Farm Vehicles / Tractors	0
99-Unknown	0
Total	103

Maine Department Of Transportation - Traffic Engineering, Crash Records Section

Crash Summary II - Characteristics

Crashes by Apparent Contributing Factor And Driver

Apparent Contributing Factor	Dr 1	Dr 2	Dr 3	Dr 4	Dr 5	Other	Total
No Improper Action	31	18	1	0	0	0	50
Failure to Yield Right of Way	3	5	0	0	0	0	8
Illegal Unsafe Speed	12	1	0	0	0	0	13
Following Too Close	0	5	0	0	0	0	5
Disregard Traffic Control Device	0	0	0	0	0	0	0
Driving Left of Center Not Passing	0	0	0	0	0	0	0
Improper Passing, Overtaking	0	1	0	0	0	0	1
Improper Unsafe Lane Change	5	1	0	0	0	0	6
Improper Parking Start, Stop	0	0	0	0	0	0	0
Improper Turn	0	0	0	0	0	0	0
Unsafe Backing	1	0	0	0	0	0	1
No Signal or Improper Signal	0	0	0	0	0	0	0
Impeding Traffic	0	0	0	0	0	0	0
Driver Inattention, Distraction	3	8	0	0	0	0	11
Driver Inexperience	1	0	0	0	0	0	1
Pedestrian Violation Error	0	0	0	0	0	0	0
Physical Impairment	1	0	0	0	0	0	1
Vision Obscured, Windshield Glass	0	0	0	0	0	0	0
Vision Obscured, Sun, Headlights	0	0	0	0	0	0	0
Other Vision Obscurement	0	1	0	0	0	0	1
Other Human Violation Factor	1	0	0	0	0	0	1
Hit and Run	0	0	0	0	0	0	0
Defective Brakes	0	0	0	0	0	0	0
Defective Tire, Tire Failure	2	0	0	0	0	0	2
Defective Lights	0	0	0	0	0	0	0
Defective Suspension	0	0	0	0	0	0	0
Defective Steering	0	0	0	0	0	0	0
Other Vehicle Defect or Factor	0	1	0	0	0	0	1
Unknown	1	0	0	0	0	0	1
Total	61	41	1	0	0	0	103

Crashes by Apparent Physical Condition And Driver

Apparent Physical Condition	Dr 1	Dr 2	Dr 3	Dr 4	Dr 5	Other	Total
Normal	58	40	1	0	0	0	99
Under the Influence	1	1	0	0	0	0	2
Had Been Drinking	0	0	0	0	0	0	0
Had Been Using Drugs	0	0	0	0	0	0	0
Asleep	1	0	0	0	0	0	1
Fatigued	0	0	0	0	0	0	0
ill	0	0	0	0	0	0	0
Handicapped	0	0	0	0	0	0	0
Other	1	0	0	0	0	0	1
Total	61	41	1	0	0	0	103

Driver Age by Unit Type

Age	Driver	Bicycle	SnowMobile	Pedestrian	ATV	Total
09-Under	0	0	0	0	0	0
10-14	0	0	0	0	0	0
15-19	8	0	0	0	0	8
20-24	13	0	0	0	0	13
25-29	8	0	0	0	0	8
30-39	22	0	0	0	0	22
40-49	24	0	0	0	0	24
50-59	16	0	0	0	0	16
60-69	8	0	0	0	0	8
70-79	3	0	0	0	0	3
80-Over	0	0	0	0	0	0
Unknown	1	0	0	0	0	1
Total	103	0	0	0	0	103

Crash Summary II - Characteristics

Fixed Object Struck

Fixed Object Struck	Total
1-Construction, Barricades Equipment, etc.	0
2-Traffic Signal	0
3-R.R. Crossing Device	0
4-Light Pole	0
5-Utility Pole (Tel. Electrical)	0
6-Sign Structure Post	0
7-Mail Boxes or Posts	0
8-Other Poles, posts or supports	1
9-Fire Hydrant/Parking Meter	0
10-Tree or Shrubbery	3
11-Crash Cushion	0
12-Median Safety Barrier	8
13-Bridge Piers (including protective guard rails)	0
14-Other Guardrails	0
15-Fencing (not median barrier)	0
16-Culvert Headwall	0
17-Embankment, Ditch, Curb	0
18-Building, Wall	0
19-Rock Outcrops or Ledge	0
20-Other	2
Total	14

Traffic Control Devices

Traffic Control Device	Total
1-Traffic Signals (Stop & Go)	2
2-Traffic Flashing	0
3-Overhead Flashers	3
4-Stop Signs - All Approaches	0
5-Stop Signs - Other	2
6-Yield Sign	3
7-Curve Warning Sign	0
8-Officer, Flagman, School Patrol	0
9-School Bus Stop Arm	0
10-School Zone Sign	0
11-R.R. Crossing Device	0
12-No Passing Zone	0
13-None	38
14-Other	13
Total	61

Road Character

Road Character	Total
1-Level Straight	41
2-Level Curved	1
3-On Grade Straight	14
4-On Grade Curved	5
5-Top of Hill Straight	0
6-Top of Hill Curved	0
7-Bottom of Hill Straight	0
8-Bottom of Hill Curved	0
9-Other	0
Total	61

Injury Data

Severity Code	Injury Crashes	Number Of Injuries
K	1	1
A	1	1
B	3	11
C	7	7
PD	49	0
Total	61	20

Light

Light	Total
1-Dawn (Morning)	4
2-Daylight	36
3-Dusk (Evening)	2
4-Dark (Street Lights On)	9
5-Dark (No Street Lights)	10
6-Dark (Street Lights Off)	0
7-Other	0
Total	61

Crash Summary II - Characteristics

Crashes by Crash Type and Type of Location

Crash Type	Straight Road	Curved Road	Three Leg Intersection	Four Leg Intersection	Five Leg Intersection	Driveways	Bridges	Interchanges	Other	Total
Object in Road	8	0	0	0	0	0	0	0	0	8
Rear End / Sideswipe	30	3	2	0	0	0	0	1	1	37
Head-on / Sideswipe	0	0	0	0	0	0	0	0	0	0
Intersection Movement	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0
Train	0	0	0	0	0	0	0	0	0	0
Ran Off Road	4	2	0	0	0	0	0	0	0	6
All Other Animal	0	0	0	0	0	0	0	0	0	0
Bike	0	0	0	0	0	0	0	0	0	0
Other	3	0	0	0	0	0	0	0	0	3
Jackknife	0	0	0	0	0	0	0	0	0	0
Rollover	0	0	0	0	0	0	0	0	0	0
Fire	0	0	0	0	0	0	0	0	0	0
Submersion	0	0	0	0	0	0	0	0	0	0
Rock Thrown	0	0	0	0	0	0	0	0	0	0
Bear	0	0	0	0	0	0	0	0	0	0
Deer	5	0	0	0	0	0	0	0	0	5
Moose	2	0	0	0	0	0	0	0	0	2
Total	52	5	2	0	0	0	0	1	1	61

Crash Summary II - Characteristics

Crashes by Weather, Light Condition and Road Surface

Weather / Light	Debris	Dry	Ice, Packed Snow, Not Sanded	Ice, Packed Snow, Sanded	Muddy	Oily	Other	Snow Slush, Not Sanded	Snow, Slush, Sanded	Wet	Total
Blowing Sand or Dust											
Dark (No Street Lights)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights Off)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights On)	0	0	0	0	0	0	0	0	0	0	0
Dawn (Morning)	0	0	0	0	0	0	0	0	0	0	0
Daylight	0	0	0	0	0	0	0	0	0	0	0
Dusk (Evening)	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0
Clear											
Dark (No Street Lights)	0	2	0	0	0	0	0	0	0	0	2
Dark (Street Lights Off)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights On)	0	6	0	0	0	0	0	0	0	0	6
Dawn (Morning)	0	2	0	0	0	0	0	0	0	1	3
Daylight	0	21	0	0	0	0	0	0	0	0	21
Dusk (Evening)	0	2	0	0	0	0	0	0	0	0	2
Other	0	0	0	0	0	0	0	0	0	0	0
Cloudy											
Dark (No Street Lights)	0	2	0	0	0	0	0	0	0	0	2
Dark (Street Lights Off)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights On)	0	0	0	0	0	0	0	0	0	0	0
Dawn (Morning)	0	1	0	0	0	0	0	0	0	0	1
Daylight	0	6	0	0	0	0	0	0	0	1	7
Dusk (Evening)	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0
Fog, Smog, Smoke											
Dark (No Street Lights)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights Off)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights On)	0	0	0	0	0	0	0	0	0	0	0
Dawn (Morning)	0	0	0	0	0	0	0	0	0	0	0
Daylight	0	0	0	0	0	0	0	0	0	0	0
Dusk (Evening)	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0

Crash Summary II - Characteristics

Crashes by Weather, Light Condition and Road Surface

Weather / Light	Debris	Dry	Ice, Packed Snow, Not Sanded	Ice, Packed Snow, Sanded	Muddy	Oily	Other	Snow Slush, Not Sanded	Snow, Slush, Sanded	Wet	Total
Other											
Dark (No Street Lights)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights Off)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights On)	0	0	0	0	0	0	0	0	0	0	0
Dawn (Morning)	0	0	0	0	0	0	0	0	0	0	0
Daylight	0	0	0	0	0	0	0	0	0	0	0
Dusk (Evening)	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0
Rain											
Dark (No Street Lights)	0	0	0	0	0	0	0	0	0	4	4
Dark (Street Lights Off)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights On)	0	0	0	0	0	0	0	0	0	3	3
Dawn (Morning)	0	0	0	0	0	0	0	0	0	0	0
Daylight	0	0	0	0	0	0	0	0	0	4	4
Dusk (Evening)	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0
Severe Cross Winds											
Dark (No Street Lights)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights Off)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights On)	0	0	0	0	0	0	0	0	0	0	0
Dawn (Morning)	0	0	0	0	0	0	0	0	0	0	0
Daylight	0	0	0	0	0	0	0	0	0	0	0
Dusk (Evening)	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0
Sleet, Hail, Freezing Rain											
Dark (No Street Lights)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights Off)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights On)	0	0	0	0	0	0	0	0	0	0	0
Dawn (Morning)	0	0	0	0	0	0	0	0	0	0	0
Daylight	0	0	1	0	0	0	0	0	0	0	1
Dusk (Evening)	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0

Crash Summary II - Characteristics

Crashes by Weather, Light Condition and Road Surface

Weather Light	Debris	Dry	Ice, Packed Snow, Not Sanded	Ice, Packed Snow, Sanded	Muddy	Oily	Other	Snow Slush, Not Sanded	Snow, Slush, Sanded	Wet	Total
Snow											
Dark (No Street Lights)	0	0	0	2	0	0	0	0	0	0	2
Dark (Street Lights Off)	0	0	0	0	0	0	0	0	0	0	0
Dark (Street Lights On)	0	0	0	0	0	0	0	0	0	0	0
Dawn (Morning)	0	0	0	0	0	0	0	0	0	0	0
Daylight	0	0	0	1	0	0	0	1	0	1	3
Dusk (Evening)	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	42	1	3	0	0	0	1	0	14	61

APPENDIX H

RENEWAL & REPLACEMENT – MAINTENANCE PROGRAM

YORK TOLL PLAZA (MM7.3) MAINTENANCE DATA COMPARISON

Detailed Renewal and Replacement Program Estimate for the Existing Plaza

	Major Plaza Rehabilitation (3)						Asphalt Pavement (8)			Toll System (9)		Roadway (10)	Buildings (10)	Miscellaneous (11,12)			Total
	Tunnel Rehab. Program (2)	Profile Reconstruction & Final Overlay (4)		Concrete Bumper Reconstruction (5)	Replace Booths, Island & Lane Slabs, Canopy (17 Lanes) (6)	EZ-Pass Remove & Reset (7)	Mill and Fill Overlay 11/2" (100%)	Mill and Fill Overlay 11/2" (50%)	Pavement Crack Sealing	Equipment Routine/Annual Maintenance	Equipment Replacement (17 Lanes)	Routine Plaza Maintenance	Routine Maintenance	Tandem Booth Operations	Plaza Paint and Surface Sealing	Canopy Roof Sealing	Annual and R&R Expenditures (2010$)
Unit Price (1)	$61,171	$520,478	$2,326,129	$79,939	$7,426,300	$541,059	$2,754,096	$1,377,048	$12,301	$216,424	$106,090	$74,263	$21,218	$5,305	$106,090	$53,045	
Quantity	6	6	1	6	1	1	1	1	1	1	17	1	1	1	1	1	
Unit	Lane	Phase	LS	Phase	LS	LS	LS	LS	LS	LS	Lane	LS	LS	LS	LS	LS	
Interval	1	1	16	1	1	1	16	8	4	1	10	1	1	1	5	10	
Year 2010	$185,000	$520,000		$80,000	$1,240,000	$90,000	Included in Profile Adjustment & Final Overlay Operation		$12,300	$216,400		$74,200	$21,200	$5,300	$106,000		$2,550,400
2011	$185,000	$520,000		$80,000	$1,240,000	$90,000				$216,400		$74,200	$21,200	$5,300		$53,000	$2,485,100
2012		$520,000		$80,000	$1,240,000	$90,000				$216,400		$74,200	$21,200	$5,300			$2,247,100
2013		$520,000		$80,000	$1,240,000	$90,000				$216,400		$74,200	$21,200	$5,300			$2,247,100
2014		$520,000		$80,000	$1,240,000	$90,000				$216,400		$74,200	$21,200	$5,300			$2,247,100
2015		$520,000	$2,330,000	$80,000	$1,240,000	$90,000			$10,500	$216,400	$1,800,000	$74,200	$21,200	$5,300	$106,000		$6,493,600
2016										$216,400		$74,200	$21,200	$5,300			$317,100
2017										$216,400		$74,200	$21,200	$5,300			$317,100
2018										$216,400		$74,200	$21,200	$5,300			$317,100
2019									$12,300	$216,400		$74,200	$21,200	$5,300			$329,400
2020										$216,400		$74,200	$21,200	$5,300	$106,000		$423,100
2021										$216,400		$74,200	$21,200	$5,300		$53,000	$370,100
2022										$216,400		$74,200	$21,200	$5,300			$317,100
2023								$1,380,000	$6,150	$216,400		$74,200	$21,200	$5,300			$1,703,250
2024										$216,400		$74,200	$21,200	$5,300			$317,100
2025										$216,400	$1,800,000	$74,200	$21,200	$5,300	$106,000		$2,223,100
2026										$216,400		$74,200	$21,200	$5,300			$317,100
2027	$185,000								$12,300	$216,400		$74,200	$21,200	$5,300			$514,400
2028	$185,000									$216,400		$74,200	$21,200	$5,300			$502,100
2029	$185,000									$216,400		$74,200	$21,200	$5,300			$502,100
2030	$185,000									$216,400		$74,200	$21,200	$5,300	$106,000		$608,100
Total	$1,110,000	$3,120,000	$2,330,000	$480,000	$7,440,000	$540,000	$0	$1,380,000	$53,550	$4,544,400	$3,600,000	$1,558,200	$445,200	$111,300	$530,000	$106,000	$27,348,650
																Annual (14)	**$1,367,433**

Detailed Renewal and Replacement Program Estimate for a New Plaza at Existing Location

	Major Plaza Rehabilitation (3)						Asphalt Pavement (8)			Toll System (9)		Roadway (10)	Buildings (10)	Miscellaneous (11,12)			Total
	Tunnel Rehab. Program (2)	Profile Reconstruction & Final Overlay (4)		Concrete Bumper Reconstruction (5)	Replace Booths, Island & Lane Slabs, Canopy (17 Lanes) (6)	EZ-Pass Remove & Reset (7)	Mill and Fill Overlay 11/2" (100%)	Mill and Fill Overlay 11/2" (50%)	Pavement Crack Sealing	Equipment Routine/Annual Maintenance	Equipment Replacement (17 Lanes)	Routine Plaza Maintenance	Routine Maintenance	Tandem Booth Operations	Plaza Paint and Surface Sealing	Canopy Roof Sealing	Annual and R&R Expenditures (2010$)
Unit Price (1)	$61,171	$520,478	$2,326,129	$79,939	$7,426,300	$541,059	$2,754,096	$1,377,048	$12,301	$216,424	$106,090	$74,263	$21,218	$5,305	$106,090	$53,045	
Quantity	6	6	1	6	1	1	1	1	1	1	17	1	1	1	1	1	
Unit	Lane	Phase	LS	Phase	LS	LS	LS	LS	LS	LS	Lane	LS	LS	LS	LS	LS	
Interval	1	1	16	1	1	1	16	8	4	1	10	1	1	1	5	10	
Year 2010										$216,400		$74,200	$21,200				$311,800
2011										$216,400		$74,200	$21,200				$311,800
2012										$216,400		$74,200	$21,200				$311,800
2013										$216,400		$74,200	$21,200				$311,800
2014									$12,300	$216,400		$74,200	$21,200				$324,100
2015										$216,400		$74,200	$21,200		$106,000		$417,800
2016										$216,400		$74,200	$21,200				$311,800
2017										$216,400		$74,200	$21,200				$311,800
2018								$1,380,000	$6,150	$216,400		$74,200	$21,200				$1,697,950
2019										$216,400		$74,200	$21,200				$311,800
2020										$216,400	$1,800,000	$74,200	$21,200		$106,000	$53,000	$2,270,800
2021										$216,400		$74,200	$21,200				$311,800
2022									$12,300	$216,400		$74,200	$21,200				$324,100
2023										$216,400		$74,200	$21,200				$311,800
2024										$216,400		$74,200	$21,200				$311,800
2025										$216,400		$74,200	$21,200		$106,000		$417,800
2026							$2,750,000		$12,300	$216,400		$74,200	$21,200				$3,074,100
2027										$216,400		$74,200	$21,200				$311,800
2028										$216,400		$74,200	$21,200				$311,800
2029										$216,400		$74,200	$21,200				$311,800
2030	$185,000								$12,300	$216,400	$1,800,000	$74,200	$21,200		$106,000	$53,000	$2,468,100
Total	$185,000	$0	$0	$0	$0	$0	$2,750,000	$1,380,000	$55,350	$4,544,400	$3,600,000	$1,558,200	$445,200	$0	$424,000	$106,000	$15,048,150
																Annual (14)	**$752,408**

Differential (13)	$925,000	$3,120,000	$2,330,000	$480,000	$7,440,000	$540,000	-$2,750,000	$0	-$1,800	$0	$0	$0	$0	$111,300	$106,000	$0	$12,300,500
																Annual (14)	**$615,025**

Footnotes

1. Construction prices are in 2010 dollars, as derived from MTA, MDOT, and recent industry unit pricing for materials and work of similar or like nature.
2. Tunnel rehab. program consists of work similarly performed on 9 lanes at the York Plaza to date, and for which 6 lanes remain to be rehabilitated. The work includes rehabilitation of concrete slabs; replacement of PVC conduits with galvanized rigid metal conduit; replacement of electrical wires, wire ways, and conduits; replacement of AVI/AVC/LC wire ways; replacement of loop detectors; pressure injection of concrete cracks and construction joints; sealing and caulking of rehabilitated concrete slabs; and signing and maintenance of traffic. Similar to other work described below, this would be phased 3 lanes at a time (see note 3, profile discussion).
3. Phased construction work is based on the assumption that this work would most expeditiously occur by utilizing the whole lane, and that a maximum of 3 lanes can be taken out of service at one time, in order that the Plaza remain at an acceptable level of service. Based on established plaza volumes and previous field experience, this has been approximated at 3 lanes per phase. Therefore to cross the 17 lane plaza would require 5.6 (say 6) phases.
4. Profile reconstruction is based on a profile developed to specifically address and correct the incoming 200' of approach either side of the plaza where excessive sag results in low-bed hangups, concrete slab/tunnel impact, and poor drainage. Reconstruction consists of exist. pavement removal, fill gravel to subbase grade, then 12" of new pavement to profile grade.
5. Concrete bumper reconstruction consists of wrecking out the old bumpers, prep. and place new concrete slab, and mount 35 mph crash cushion with safety lighting. This would be done in conjunction with the profile phasing.
6. Replacement of the booths, island and lane slabs, and canopy, is work considered programmatic in nature. This work would need to occur every 20 years in order to maintain the tunnel top, approach slabs, booths, bumpers, and the canopy in sound condition, in good working order, and to address advances in technology, changes in the worker's environment, and future demands of the automotive/transportation industry. The most recent work of this nature at York occurred in 1996 with the advent of Transpass. Having this work simultaneous with the reminder of plaza work minimizes overal lane closures. It is assumed to occur on a similar 6-year phased construction cycle in order for the plaza to operate acceptably during construction.
7. E-Z Pass Remove and reset is that work associated with booth replacement in order to remove and reinstall up-to-date ETC equipment. Based on industry standards, this is estimated at $30,000 per lane, and would occur at the same time as the booth and island work.
8. Mill and fill overlay consists of the periodic (20 yr) milling of existing pavement, recapping with 1 1/2" of new pavement, and striping for 1800 lf of approach either side of the plaza. The 50% mill and fill operation assumes that every 10 years, that approximately 1/2 of the entire plaza would need this type of repair, on an as-needed basis (some lanes receive more wear than others). Note: the amount is different when the mill & fill is combined with the profile reconstruction due to the interior 200' either side of the plaza having just been paved. This mill & fill would be timed to occur along with the final phase of profile work so to result in a uniform "like new" total plaza area. Pavement crack sealing is assumed to occur on a periodic basis (every 4 years) to help maintain the pavement surface, and also occurs with every mill and fill operation.
9. Toll System maintenance consists of two components; the routine/annual maintenance of ETC equipment (as currently contracted with Transcore), and the industry expected life cycle of plaza equipment, which has been estimated at $106,000 per lane every 10 years.
10. Roadway and building maintenance are those annual costs associated with the standard maintenance of the plaza area and the buildings (snowplowing, mowing, boiler maintenance, etc.).
11. Tandem booth operations is the annual cost associated with the seasonal set-up and take-down of the tandem toll booths. These are currently needed to help process the seasonally high summer traffic volumes.
12. Plaza paint, surface sealing, and canopy roof sealing are those periodic applications of paint, concrete sealer, and asphaltic roof sealer that are assumed to be needed to keep these plaza components in sound condition, good appearance, and to protect the steel and concrete beneath.
13. Differential consists of the cost of the existing plaza maintenance minus the cost of a new plaza at existing location maintenance costs.
14. Annual is the overall cost of the 20 year program, divided by 20 years to reflect an annualized cost. Costs are not reflective of inflation over that 20 year period and are reported in constant 2010 dollars.

APPENDIX I

GLOSSARY

GLOSSARY

- **30th Highest Hour traffic**: The volume of traffic present in a single hour that is exceeded only 29 times in a typical year.
- **AASHTO**: American Association of State Highway and Transportation Officials
- **Absolute Peak Hour traffic**: The volume of traffic present in a single hour that is never exceeded in a typical year.
- **All Electronic Tolling (AET)**: A type of tolling where tolls are collected either by an electronic transponder or by video tolling; there is no cash collection option.
- **Capacity**: The amount of vehicles in a given time frame (e.g. vehicles per hour) that a roadway or facility can accommodate; typically reported for a stated level of service, e.g. length of backup or average delay per vehicle.
- **Cash Tolling (Conventional Tolling)**: The method of toll collection in which a patron is required to stop at a toll booth, pay cash for the toll and then resume highway speed.
- **Design Guidelines**: A set of recommended rules or criteria that have been developed over time based on experience and that are to be applied to in similar situations. Typically design guidelines are developed by a national organization with responsibilities to protect the safety of a large group or population, e.g. traffic light operation is contained in Manual of Uniform Traffic Control Devices published by the Federal Highway Administration to be used across the Nation.
- **Electronic Toll Collection (ETC)**: The method of toll collection in which tolls are collected without cash via the use of electronic means.
- **Existing Site Evaluation**: The title of (this) report developed by HNTB at the request of the MTA that documents the re-evaluation of options for rehabilitating/reconstructing the York Toll Plaza at its existing site or in close proximity and which recommends option(s) that warrant being carried forward for further consideration
- **E-ZPass**: A brand of electronic toll collection system utilized on the Maine Turnpike and other Northeast states.
- **FHWA:** Federal Highway Administration
- **Footprint**: The outer boundary or approximate limit of work for the proposed toll plaza design.
- **High Crash Location (HCL)**: A link or node that has eight or more reported crashes over the past three years and the link or node must have a "critical rate factor" (CRF) over 1.00. (The critical rate factor is a ratio of the crash rate at a particular link or node divided by the statewide crash rate average for a similar type of facility. The term "rate" is calculated by number of crashes divided by the number of millions of annual entering vehicles).
- **Highway Speed Tolling**: A toll collection technique in which users pay a toll through some form of electronic means at highway speeds (55-65mph), e.g. E-ZPass. Similar to the dedicated E-ZPass toll lanes now in use on the Maine Turnpike with the difference being traveling at normal highway speeds versus the 10 miles per hour as posted currently. Same as Open Road Tolling.

- **HNTB Corporation**: General Engineering Consultant to the Maine Turnpike Authority.
- **LD534**: A Resolve directing the Maine Turnpike Authority to Study the Relocation of the York Toll Booth enacted by the Maine Legislature in 2007.
- **Location Study Report**: The title given to a report that, as currently planned, will be given to the U.S. Army Corps of Engineers for purposes of documenting the study of the York Toll Plaza. The report will contain information on conditions, deficiencies, options explored to rehabilitate and reconstruct, existing site options, alternative site options and recommendations for proceeding further with the York Toll Plaza Replacement.
- **Maine Turnpike Authority**: a quasi-state agency created by the Maine Legislature in 1941 to construct, manage and operate the 109 mile, toll highway from Kittery to Augusta.
- **Mainline**: The thru travel portion of the highway; as opposed to entrance and exit ramps, service plazas etc..
- **Merge**: The driving maneuver in which an entering vehicle from an on-ramp makes to move onto the mainline with other mainline traffic.
- **MUTCD**: Manual on Uniform Traffic Control Devices
- **Node and Link System**: A system established by the Maine Department of Transportation to catalog traffic statistics. A four-digit number is assigned to each node (intersection, major bridge, railroad crossing, and crossing of town, county or urban compact lines etc.). The segment of road that connects the nodes is referred to as a link. Data can now be compiled based on these node and/or link numbers.
- **Open Road Tolling**: A toll collection technique in which users pay a toll through some form of electronic means at highway speeds (55-65mph), e.g. E-ZPass. Similar to the dedicated E-ZPass toll lanes now in use on the Maine Turnpike with the difference being traveling at normal highway speeds versus the 10 miles per hour as posted currently. Same as Highway Speed Tolling.
- **Pre-paid video products**: Various types of accounts that can be set up to allow toll payment based on a video camera capturing a license plate number at one or more toll plazas.
- **Processing Rate**: The average rate at which tolls can be collected during a specific period of time and for a specific number of lanes, often reported as per lane per hour, e.g. 320 vehicles per lane per hour can pay their toll.
- **Profile grade**: The slope of the roadway measured along mainline.
- **Queue**: Traffic backup.
- **Ramp**: Portion of roadway where vehicles enter or exit the mainline.
- **Reversible Lane**: A toll lane that can be operated in either direction, e.g. Northbound and Southbound directions.
- **Slow-speed dedicated ETC lanes**: A toll lane that only accepts Electronic Toll Collection and only at a slow speed; currently 10 mph on the Maine Turnpike.
- **State of the Practice**: State of the Practice and Recommendations on Traffic Control Strategies at Toll Plazas; a report under a project initiative by the Federal Highway Administration to identify the 'state of the practice' for traffic control strategies at toll

plazas. The document summarizes recommended guidelines for agencies and departments that operate or plan to design and build such facilities.

- **Tandem Booth (Tandem Lane Operation)**: A toll collection method that expands the capacity of cash collection by adding a tolling booth inline and immediately downstream of an existing booth. Tolls can be collected by two toll attendants simultaneously for groups of 3 or 4 vehicles. Typical increase in capacity is approximately 30%.
- **Tangent**: A straight portion of highway.
- **Transponder and Receiver**: Two pieces of equipment necessary to have Electronic Toll Collection. A transponder sends a signal identifying an account number and a receiver collects the transponders signal to assess a specific toll for that location.
- **Tunnel**: For many toll plazas the best way to provide toll attendants with safe access to the toll booths is by a tunnel built beneath the toll plaza. In addition, the tunnel can serve as housing for electrical and data infrastructure necessary for toll collection.
- **Utility Building**: The building used to house communication, mechanical and electrical systems, toll staff offices and amenities and for other infrastructure necessary to operate a toll plaza.
- **VISSIM**: A driver behavior-based simulation program that is used to simulate a wide variety of traffic operations, from urban arterials to freeway interchanges to complex toll facilities.
- **Weave**: A driving maneuver in which two or more traffic streams must cross the path of the other, i.e. the right hand lane traffic moves into the left hand lane and the left hand lane traffic moves into the right hand lane. An example is an on-ramp followed closely by an off ramp; the on-ramp traffic must cross the path of a mainline vehicle needing to exit mainline.