

Executive Summary

Maine Turnpike ORT/AET Impact Analysis

This report summarizes the results of CDM Smith's independent impact assessment for possible conversion to Open Road Tolling (ORT) or All Electronic Tolling (AET) at two toll plazas on the Maine Turnpike. The Turnpike is faced with a number of challenges in the future regarding many of its existing toll collection facilities. Perhaps most urgent among these is the need for possible reconstruction of the York Toll Plaza, the southernmost barrier on the Maine Turnpike. That facility is decades old, and was constructed in a location in which subsurface conditions may preclude reconstruction. Consideration is being given to reconstruction of the plaza at an alternative location, but at a significant additional capital cost.

The Turnpike also anticipates the need to replace its northernmost toll plaza, at the I-295 connection in Gardiner. That facility, which was constructed immediately below the roadway overpass, which is no longer in use, must be slightly relocated and reconstructed in the future.

The toll industry is moving toward automating the toll collection process, using either ORT or AET. ORT would allow for high-speed, non-stop, collection of tolls from vehicles equipped with E-ZPass transponders, while retaining a limited number of cash collection lanes in each direction. AET would feature the elimination of cash collection altogether, and require only the construction of high-speed gantries across the mainline roadway, significantly reducing capital cost but requiring new methods and costs to handle vehicles without electronic transponders. Under AET, a license plate image is taken of customers without E-ZPass; those video transactions are sent to the customer by mail. This introduces considerable collection risk due to some video transactions being unbillable and others uncollectable.

Model Overview

CDM Smith developed a model to analyze the potential net revenue impacts of both AET and ORT. The model takes into account diversion to alternative routes (due to video toll surcharges or for those not comfortable with the technological aspects of AET), unreadable video images, lack of Department of Motor Vehicle (DMV) address information, and out of date DVM information. All of these result in unbillable video transactions. The model also takes into account payment billing collection rates and assumed uncollectable transactions. Both unbillable and uncollectable transactions result in toll revenue leakage.

A key component of the analysis was to track potential toll revenue leakage under both AET and ORT. ORT operates most similarly to the existing condition in that both E-ZPass and cash are still accepted. Under this scenario there is relatively little opportunity for revenue leakage compared to how the system currently operates. Experience on other facilities that have converted to ORT has confirmed that there is very little impact on net revenue collection. Under AET, however, all non-E-ZPass transactions must be invoiced. The need to invoice video transactions is where both the increased risk of revenue leakage and the higher costs of toll collection occur.

In addition, the model also takes into account the maintenance and operating (M&O) costs associated with collecting tolls under both AET and ORT scenarios. Thus, costs associated with video image

review, DMV look up, invoice mailing, and fare collection/administration are all tracked in the model. In the end, M&O costs are subtracted from gross toll revenue impacts to develop the net toll revenue associated with AET and ORT. These are then compared to estimated existing condition net toll revenue at York and Gardiner. Annual net toll revenue impacts were developed over the forecast period from 2015 through 2030.

A final component of the analysis incorporated the capital costs of converting York and Gardiner to either AET or ORT. All capital cost estimates were provided by HNTB Corporation. A final measure of comparison was developed by taking into account both the 10-year net present value of the net toll revenue impacts and the estimated capital cost impacts associated with AET and ORT.

The following summarizes CDM Smith's net revenue impact analysis of converting the York and Gardiner toll facilities to either AET or ORT.

York Toll Plaza

E-ZPass currently accounts for about 64 percent of York transactions. Of the remaining 36 percent of cash paying customers, only about 37 percent are Maine residents. Under AET, the majority of cash customers become video customers. As a result of this cash/E-ZPass mix and the relatively low percent of in-state cash paying customers, estimates of potential toll revenue leakage amount to almost 10 percent of total toll transactions at York. This amounts to about 42 percent of the potential video transaction component. This toll revenue leakage necessitated the need for revenue enhancements in the form of video toll surcharges (even after taking into account the estimated AET impacts on M&O costs) in order to maintain net revenue neutrality with the existing condition.

A range of AET unregistered video surcharges was tested ranging from \$0.00 to \$4.00 for a passenger car. Both 5 and 10-year cumulative net revenue impacts were developed for each surcharge level tested. The model assumed that video customers could choose between two video options: registered and unregistered. Registered video customers would pre-register their plates and set up an account with a minimum balance required. Tolls would be automatically deducted from their account once successfully identified in the image review process. Due to the lower costs associated with this type of transaction, their surcharge level was assumed to be half that for unregistered video customers. Experience on other AET facilities shows that, when offered, registered video participation is very low, generally ranging between 0 and 5 percent. For purposes of this study, CDM Smith assumed 5 percent of video transactions would be registered.

The analysis indicated that an unregistered video surcharge of about \$3.00 (passenger car) would be required to maintain net revenue neutrality under AET at York over a 10-year time horizon. This is in addition to the current \$3.00 cash toll at this location. The most recent toll increase at York took place on November 1, 2012 (from \$2.00 to \$3.00) and the Authority foresees that, under the existing condition, no further increases would be needed for 15-20 years. The imposition of the \$3.00 video surcharge is also estimated to result in diversion to US Route 1 ranging from 3,400 to 5,500 per day.

Because ORT operations are very similar to current operations, no net revenue leakage is estimated to occur at the York Toll Plaza. Under this scenario, therefore, the current cash and E-ZPass rates would be maintained (i.e., no cash surcharge would be required).

A 10-year net present value comparison was conducted for both AET and ORT. HNTB estimates the capital costs to maintain the existing York Toll Plaza to be about \$22.1 million. Costs for ORT conversion amount to \$36.0 million, or about \$13.9 million greater than the existing condition costs.

AET capital costs are estimated at about \$4.8 million or about \$17.3 million less than the existing condition.

When the capital cost impacts are taken into consideration along with the 10-year net present value of the estimated AET toll revenue impacts, a net positive \$18.7 million is generated. However, it must be remembered that this is assuming a \$3.00 unregistered video surcharge and the accompanying toll diversion to US Route 1. Under ORT, the resulting combination of capital cost impacts and 10-year net present toll revenue impact is negative \$5.3 million.

Gardiner Toll Plaza

E-ZPass currently accounts for about 55 percent of Gardiner transactions. Of the remaining 45 percent of cash paying customers, about 75 percent are Maine residents. Under AET, the majority of cash customers become video customers. As a result of this cash/E-ZPass mix and the mix of in-state/out-of-state cash paying customers, estimates of potential toll revenue leakage amount to about 12 percent of total toll transactions at Gardiner. This amounts to about 36 percent of the potential video transaction component. This toll revenue leakage necessitated the need for revenue enhancements in the form of video toll surcharges (even after taking into account the estimated AET impacts on M&O costs) in order to maintain net revenue neutrality with the existing condition.

A range of AET unregistered video surcharges was tested ranging from \$0.00 to \$1.00 for a passenger car. Both 5 and 10-year cumulative net revenue impacts were developed for each surcharge level tested. Just as for the York analysis, the model assumed that video customers could choose between two video options: registered and unregistered. For purposes of this study, CDM Smith assumed 5 percent of video transactions would be registered at Gardiner.

The analysis indicated that an unregistered video surcharge of about \$0.75 would be required to maintain net revenue neutrality under AET at Gardiner over a 10-year time horizon. This is in addition to the current \$1.00 cash toll at this location. The Authority foresees that, under the existing condition, no further increases would be needed for 15-20 years. The imposition of the \$0.75 video surcharge is also estimated to result in diversion to alternative routes ranging from 800 to 1,400 per day.

As with York Toll Plaza, because ORT operations are very similar to current operations, no net revenue leakage is estimated to occur at the Gardiner Toll Plaza. Under this scenario, therefore, the current cash and E-ZPass rates would be maintained (i.e., no cash surcharge would be required).

A 10-year net present value comparison was conducted for both AET and ORT. HNTB estimates the capital costs to maintain the existing Gardiner Toll Plaza to be about \$7.0 million. Costs for ORT conversion amount to \$14.4 million, or about \$7.4 million greater than the existing condition costs. AET capital costs are estimated at about \$3.8 million or about \$3.2 million less than the existing condition.

When the capital cost impacts are taken into consideration along with the 10-year net present value of the estimated AET toll revenue impacts, a net positive \$6.7 million is generated. However, it must be remembered that this is assuming a \$0.75 unregistered video surcharge and the accompanying toll diversion to local roads. Under ORT, the resulting combination of capital cost impacts and 10-year net present toll revenue impact is negative \$4.5 million.

Summary

Various impacts and implications of implementing either ORT or AET at the York and Gardiner Toll Plazas have been presented in this report. The study compared traffic, toll rates, operating costs, net revenue over a 10-year period, and capital costs to a hypothetical continuation of the current cash collection of tolls. The analysis was conducted over a 10-year interval for each condition.

Both AET and ORT can be financially feasible options at York and Gardiner. AET offers free flow travel for all motorists with lower overall capital costs, but requires substantial video surcharges and results in traffic diversion to alternative routes. Because AET requires license plate image capture and mailed invoices for non-E-ZPass motorists, it also involves substantially more risk associated with being able to bill and collect on a substantial portion of transactions.

Conversion to ORT preserves cash collection at a lower operating cost, creates less risk to the Turnpike and requires no change to present toll rates. Cash paying motorists, however, would still be required to stop and pay their toll. And while the 10-year net toll revenue impact is positive, ORT capital costs are substantially higher than those for either the existing condition or for AET.

Technical Memorandum

Maine Turnpike ORT/AET Impact Analysis

This report summarizes the results of CDM Smith's independent impact assessment for possible conversion to Open Road Tolling (ORT) or All Electronic Tolling (AET) at one or more toll plazas on the Maine Turnpike. The Turnpike is faced with a number of challenges in the future regarding many of its existing toll collection facilities. Perhaps most urgent among these is the need for possible reconstruction of the York Toll Plaza, the southernmost barrier on the Maine Turnpike. That facility is decades old, and was constructed in a location in which subsurface conditions may preclude reconstruction. Consideration is being given to reconstruction of the plaza at an alternative location, but at a significant additional capital cost.

The Turnpike also anticipates the need to replace its northernmost toll plaza, at the I-295 connection in Gardiner. That facility, which was constructed immediately below the roadway overpass which is no longer in use, must be slightly relocated and reconstructed in the future.

The toll industry is moving toward automating the toll collection process, using either ORT or AET. While described in more detail below, ORT would allow for high-speed, non-stop collection of tolls from vehicles equipped with E-ZPass transponders, while retaining a limited number of cash collection lanes in each direction. All electronic tolls would feature the elimination of cash collection altogether, and require only the construction of high-speed gantries across the mainline roadway, significantly reducing capital cost but requiring new methods and costs to handle vehicles without electronic transponders. In order to account for estimated toll revenue leakage resulting from AET implementation, some level of toll surcharge on non-E-ZPass transactions would also be required. With ORT, such surcharges would not be needed for current cash customers.

As the Turnpike Authority finalizes plans for replacement of these two critical plazas, it engaged the services of CDM Smith to provide an independent assessment of potential traffic, revenue and operating cost impacts associated with the ORT and/or AET options at each location. Our firm was initially contracted to perform the assessment at the York Plaza only; the Gardiner Plaza was added to the study subsequently. The Maine Turnpike Authority may ultimately consider all electronic tolling on the full system in the future, but this analysis only addressed the potential pilot implementation of AET or ORT at the York and/or Gardiner facilities.

Project Background

Preliminary estimates of capital cost to replace the York Toll Plaza range from \$26-\$45 million, for an open road tolling configuration, as compared to about \$5 million for all electronic tolling. However, the York Toll Plaza accounts for over 38 percent of Turnpike revenue; and a sizable portion of non-ETC traffic at that location is from out of state. All electronic tolling generally relies on video identification of vehicle license plates and a "pay by mail" system. Not only does this significantly increase collection complexity for previous cash-paying vehicles; it also increases collection risk, especially from out-of-state motorists.

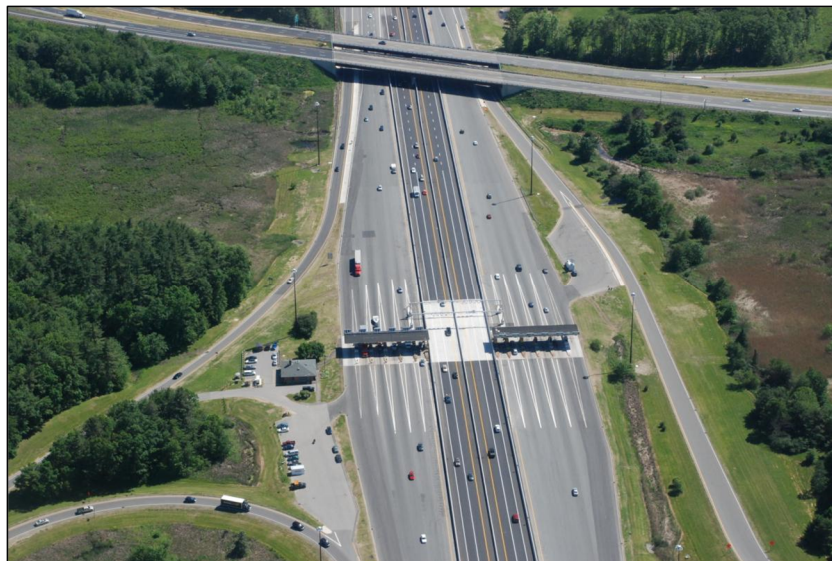
In essence, AET offers the promise of significant capital cost savings, as compared to plaza reconstruction in an ORT configuration, but at the likely cost of increased tolls for non-E-Zpass customers. In addition, AET also presents considerable additional uncertainty regarding future operating costs and collection risk for motorists without electronic tolls. Clearly a detailed evaluation of the revenue and cost implications needs to be considered, in addition to the significant capital cost differential when making final decisions on how to proceed with a new toll collection solution at two critical toll plazas.

Open Road Tolling

Open road tolling involves the provision of high-speed, non-stop toll collection for vehicles equipped with electronic toll transponders, while retaining cash booths for collection from non-ETC traffic. An example of this is shown in Figure 1, an overhead photo depicting the relatively new ORT plaza at the Hampton tolling point on the New Hampshire Turnpike. In this case, two high-speed lanes are provided for ETC vehicles in each travel direction while six cash lanes are retained to the outside. Because electronic toll traffic continues to operate at full highway speeds, the cash and ETC express lanes are physically barrier separated, with the roadways rejoining north and south of the toll plaza.

From a collection standpoint, conversion to open road tolling is relatively low risk, and has been in successful operation for several years at dozens of mainline plazas throughout the U.S. The primary risk associated with the use of ORT express lanes is typically a small increase in violations through the ETC lanes; some intentional and some unintentional by motorists who may enter the express lanes in error. Even at high speeds, today's video imaging technology provides a reliable violation enforcement system and, in general, a relatively high percentage of revenue is retained. As importantly, motorists without ETC may continue to pay tolls by using cash as they do today, regardless of state of vehicle registration. It should be noted that no increase in violations has been observed at the New Gloucester toll plaza since ORT operation began April 1, 2013. To the contrary, implementation of violations enforcement systems (VES) on the cash lanes is bringing enforcement to "run-through" violations.

Figure 1
Typical ORT Mainline Plaza
Hampton Plaza, New Hampshire Turnpike



All Electronic Tolling

Examples of all electronic toll collection system gantries are shown in Figure 2. In this case, single (or in some cases twin) consecutive gantries are constructed across the roadway. The gantries are mounted with antennas and readers for identifying vehicles equipped with E-ZPass. Motorists not so equipped are charged a toll by high resolution cameras which capture images of license plates.

Figure 2
Typical AET Toll Zones

SH 121 Tollway (Dallas) and Melbourne Citylink (Australia)



Cash is no longer collected at AET plazas, and therefore the plaza reconstruction cost is greatly reduced. As importantly, there is essentially no additional right-of-way typically required, since the gantries are constructed across existing roadways only. AET also has the benefit of virtually eliminating accident risk at toll plaza locations; toll plazas typically represent high accident locations on toll roads across the country.

The biggest challenge, of course, with conversion to AET, is how vehicles without transponders are handled. Video tolling, while not new, contains inherent risks associated with various steps in the toll collection process. For example, it is possible that some plates may not be properly read, or vehicle owner address information with DMV records is incomplete. There are some limitations on the ability to obtain vehicle owner information from some states, and particular uncertainties regarding the ability to obtain address information from vehicles registered in Canada, who represent a notable proportion of traffic on the Maine Turnpike.

Under a pay-by-mail system, there is also an inherent collection risk itself; motorists who simply don't "pay the bill". There is a fairly complex process of multiple statements, and fees for non-payment which may be included. However, overall, the video tolling approach typically results in raw uncollectable tolls to the range of 10-20 percent or more.

Typically, agencies converting to all electronic tolling establish a "surcharge" for video users. This increase in the toll charge has three objectives:

- To encourage motorists to enroll in the ETC program which results in lower costs and higher collection to the toll agency;

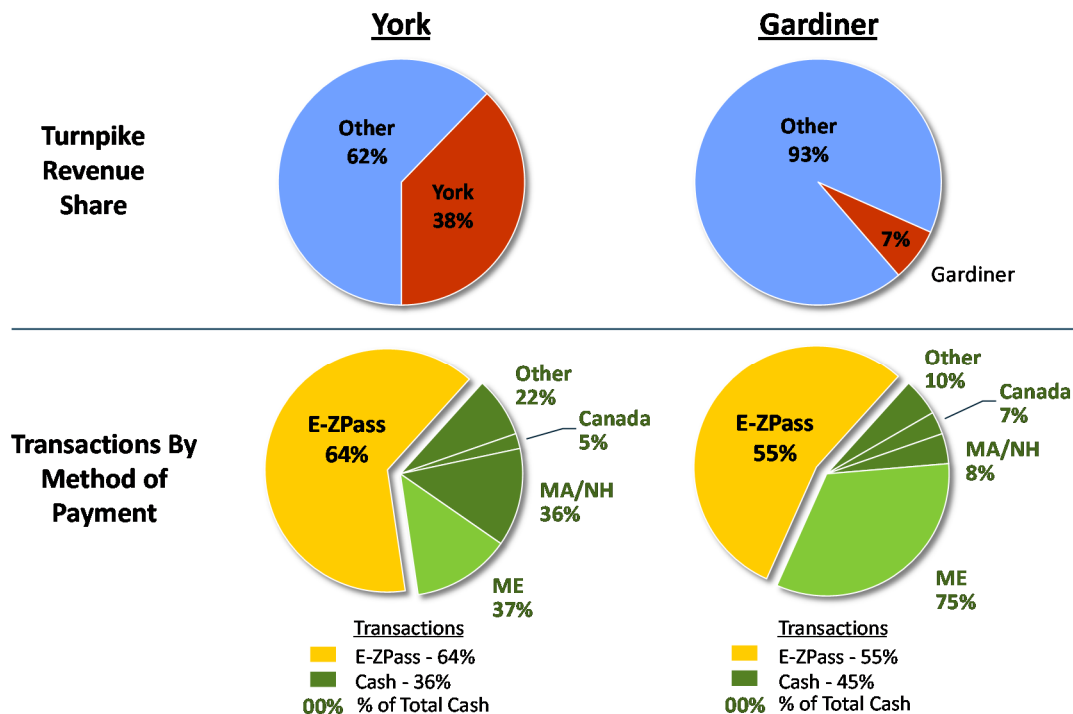
- To cover the additional operating cost associated with collection (as compared with ETC) for image recognition, mailing and follow-ups; and
- To cover the inherent “leakage” (from uncollected tolls) from the prior cash population.

Our study tested a number of alternative surcharge levels at both toll plazas evaluated. Any surcharge represents an increase in cost to the driving public, and therefore has the potential to result in traffic diversions off the Turnpike to alternative routes.

Plazas Evaluated

As noted above, this analysis was undertaken with respect to both the York Toll Plaza and the Gardiner Toll Plaza, generally at opposite ends of the Maine Turnpike. Both locations are in need of plaza replacement, but each location represents a significantly different traffic profile and level of risk. Existing conditions at the two toll plazas are summarized in Figure 3. The York Plaza accounts for 38 percent of total Turnpike revenue, while the Gardiner toll Plaza accounts for just 7 percent of Turnpike revenue, even though it covers traffic on the northern end of I-295. By contrast, the York Plaza currently has 64 percent of its traffic using one form or another of the E-ZPass electronic toll system. This component of traffic represents a very low risk under ORT or AET. E-ZPass at the Gardiner Plaza represents only 55 percent of transactions. On the other hand, at Gardiner, 75 percent of the cash traffic is typically represented by vehicles registered in the state of Maine. These represent the lowest collection risk for video tolling. At the York Plaza, which is near the New Hampshire state line, Maine-registered vehicles represent just 37 percent of current cash traffic.

Figure 3
Current York and Gardiner Characteristics



The states of Maine, New Hampshire and Massachusetts are the only three states in the U.S. to enter into reciprocity agreements for electronic toll enforcement. Under this program, subject to certain limitations, any of the states may deny registration renewal if a minimum threshold of violations (or presumably valid video toll transactions) remain unpaid in any of the three states. This is considerably important in terms of reducing collection risk. Hence, as noted later in this report, current cash vehicles with registrations in Massachusetts and New Hampshire are treated separately from all other states and Canada. Massachusetts/New Hampshire cash traffic represents 36 percent total at York but just 8 percent at Gardiner.

Study Objectives

The primary objectives of this study are to estimate the net revenue impact associated with converting to either open road tolling or all electronic tolling at the York and/or Gardiner Toll Plazas. This impact assessment was conducted in comparison to the base current system configurations at each location. The net revenue impact was determined by estimating:

- Impacts on toll revenue collections;
- Impacts on operating cost; and
- Potential revenue from administrative fees associated with possible non-payments under AET.

The net revenue impacts were evaluated at each location, under various scenarios, over a 10-year forecast period, generally extending from 2015-2024. The net present value of the 10-year net revenue potential for each scenario was then related to the hypothetical continuation of current toll operations. The discounted net impacts could then be related to alternative capital costs associated with the ORT vs. AET options at each location by the Authority.

Finally, recognizing the inherent uncertainties associated with the video tolling portion of the AET option, a risk analysis was undertaken. This involved testing a range of assumptions regarding customer payments, image recognition and various other factors, with a goal of establishing a net revenue forecast at 90 and 95 percent confidence levels. While this is most critical with respect to AET, a nominal risk assessment was also undertaken for ORT.

Overview of Study Approach

A detailed assessment of existing conditions at each toll plaza was made at the outset of the study. Historical data regarding the traffic mix at each location was obtained, and seasonal observations were made of the state distribution of cash traffic at each location for various times of year. CDM Smith also evaluated historical trends, such as the increasing share of E-ZPass traffic over time. It was also important to identify the distribution of ETC traffic itself; since a differential mechanism and rates are used for motorists who enroll in E-ZPass through the Maine Turnpike as opposed to other interoperable states.

The CDM Smith team also identified alternative routes for vehicles that might choose to divert off the Turnpike in the event of video surcharges (primarily under the AET option). In addition, data from

the Turnpike and HNTB was used to estimate the proportion of traffic at the York Plaza which entered/exited at each of the next several ramp locations; critical in the traffic diversion assessment.

The potential behavioral options for drivers under each alternative were then established. For example, under ORT, motorists can choose to remain in their current mode of collection, using either E-ZPass or cash. However, the implementation of high-speed, non-stop collection for E-ZPass provides an appealing incentive for some cash motorists to switch to ETC. It was ultimately determined that no ORT cash surcharge would be needed between cash and non-Maine issued E-ZPass vehicles; hence, there was little or no motivation for traffic to leave the Turnpike for alternative routes under the ORT option.

The options under AET were considerably more numerous. The elimination of the ability to pay cash would encourage some current customers to shift to ETC. However, it may also cause a small proportion to simply leave the Turnpike due to a technology aversion or privacy concerns. More importantly, since AET would inevitably require establishment of a video toll surcharge to overcome leakage and increased operating cost, a portion of cash traffic would be expected to shift to alternative routes. This diversion to US Route 1 could be significant if sufficiently high surcharges were required; and is an important factor to be taken into consideration.

Those motorists choosing to continue to use the Turnpike without a transponder would ultimately be billed for their trip. This would trigger a complex set of possibilities regarding the ultimate collection of the toll, as described in more detail below.

While estimates of traffic diversions under AET were calculated using well tested diversion techniques, the proportions of traffic that would actually be billable and collectable were based on reasonable assumptions based on experience at other AET facilities across the nation. While several facilities have converted to AET, there are still limitations on detailed performance information at several of these agencies; agencies are often reluctant to provide detailed data due to security considerations. However, reasonable expectations for collection rates and other factors were used. Since these assumptions are critical to the analysis, the risk analysis tested a wide range of “percentages” to help identify minimum levels of net revenue potential at strategic confidence intervals.

Finally, the study provides a “bottom line” cost-effectiveness assessment for each plaza, comparing performance for ORT and AET, under various scenarios, with the current base condition. The net impacts, over a 10-year horizon, are then related to the net differences in capital investment costs, as provided by HNTB.

ORT Analytical Methodology

The ORT impact assessments were relatively straightforward. No changes were assumed for current E-ZPass traffic, be they Maine-issued E-ZPass or accounts issued in other states. Toll rates were assumed to be the same.

The analysis estimated a small proportion of cash vehicles which would choose to shift to E-ZPass based on the more convenient, uncongested toll collection opportunities provided by the new express lanes. The study also looked at actual experience on other ORT facilities, and estimated an increase in

the violation portion for vehicles passing through the express lanes without transponders. As previously discussed, no increase in violations has been observed at the New Gloucester toll plaza since ORT operation began April 1, 2013. While this provides some indication that the increase in violations may not occur at the York and Gardiner toll plazas under ORT operation, the potential risk remains and the experience at New Gloucester was not factored into the estimated slight increase in ORT lane violations at York and Gardiner. No diversions to alternative routes were estimated under the ORT configuration.

Operating cost impacts were estimated for ORT, based on the reduced number of cash collection facilities which will be required. Increased violation enforcement costs, as well as violation enforcement fees, were also prepared. Ten-year net revenue estimates were developed for each plaza under the ORT configuration, and ultimately formatted for direct comparison of capital cost.

A detailed spreadsheet model was developed for estimating traffic, revenue and operating cost impacts. A simplified version of this was used in the ORT analysis itself. A much more complex version, referred to as the CDM Smith Waterfall model, was used for the AET analysis, as described below.

AET Analytical Methodology

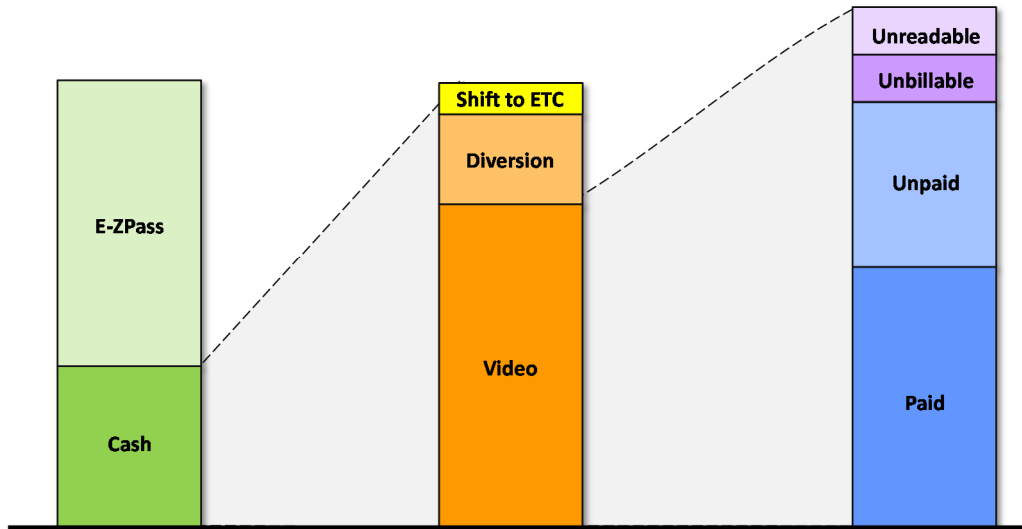
The AET impact assessments were much more complex. This involved assessing the redistribution of current cash traffic, assessing payment cost implications and bringing these together in development of ten-year net revenue estimates. A range of scenarios were tested at each location, including a range of surcharge levels to offset possible revenue leakage and higher cost of collection.

Assessing Redistribution of Current Cash Traffic

Figure 4 graphically summarizes the analysis used in assessing the redistribution of current cash traffic, and potential collection risks. At each location, traffic is currently made up of E-ZPass and cash. The E-ZPass traffic represents 55 percent of the total at Gardiner and 64 percent at York.

Since cash would no longer be available under the AET option, the first step in the process was to estimate the redistribution of current cash vehicles into ETC, video or “off the road”. A relatively small proportion was assumed to shift to ETC, based in part on the magnitude of surcharge applied to video cost transactions. The portion of the traffic estimated to divert to alternative routes is also directly related to the surcharge level, and involves a review of the best alternative routes for most typical movements, travel time differential and distance differences and the net increase in toll associated with the surcharge. Former cash traffic diverted off the Turnpike was no longer available to pay tolls and was all treated as lost revenue. The remaining portion of former cash vehicles, shown in orange in the center bar of Figure 4, was assumed to remain on the Turnpike. Their tolls, under AET, would be collected by means of captured license plate information. This data would then be subjected to a DMV lookup for owner name and address.

**Figure 4
Redistribution of Former Cash Traffic Under AET**



Of the total vehicles without transponders passing under the toll gantry (the “video” traffic), a certain portion was assumed to be unreadable based upon weather, license plate physical limitations, trailer hitch blockages and more. Another portion of the traffic was assumed to be “unbillable”; primarily cases where information on vehicle owner address could not be obtained or proved to be faulty. Both of these conditions exist under current AET operations throughout the U.S. and Canada. The light blue and dark blue portions of the right bar represent motorists who are actually billed for the trip(s) made within a billing period. A percentage of those are assumed to be paid, while another percentage remains unpaid, sometimes after multiple invoices.

Assessing Payment and Cost Implications

The distribution of video transactions into unreadable, unbillable and billable transactions was handled in this step using the Waterfall model described below. In addition, the proportion of invoices paid on the first invoice, second invoice or later was also an important input into the modeling process. This is somewhat uncertain and was heavily tested in the risk analysis.

Cost implications were also estimated in the detailed model, based on unit costs provided primarily by Maine Turnpike orations staff based, in turn, on the Agency’s historical experience with violation processing. In practice, this resulted in a fairly conservative estimate of back office operating costs associated with video collection; since under AET there would be a significant increase in the number of billings and amount of collections, it is not unlikely that certain cost efficiencies could be introduced into the process. However, for purposes of this analysis, the same conservative unit costs for each step of the process was coded into the study model.

The CDM Smith AET Waterfall Model is a spreadsheet-based series of calculations that closely mimics the processes through which AET transactions would be handled. In the absence of a formal MTA AET business rules document, assumptions regarding AET business rules for use in the model were

developed in close cooperation with the MTA. Figure 5 depicts how transactions and revenues flow through the system and end up as either lost revenue or collected toll revenue.

This model begins with existing condition gross transactions and toll revenue and applies a series of parameters and decision points that collectively determine whether revenue is collected for each transaction, the method under which that revenue is collected, and at what rate. The model processes transactions and revenue for passenger vehicles separately from commercial vehicles. The model also distinguishes between vehicles registered in Maine, Massachusetts/New Hampshire, all other states and Canada.

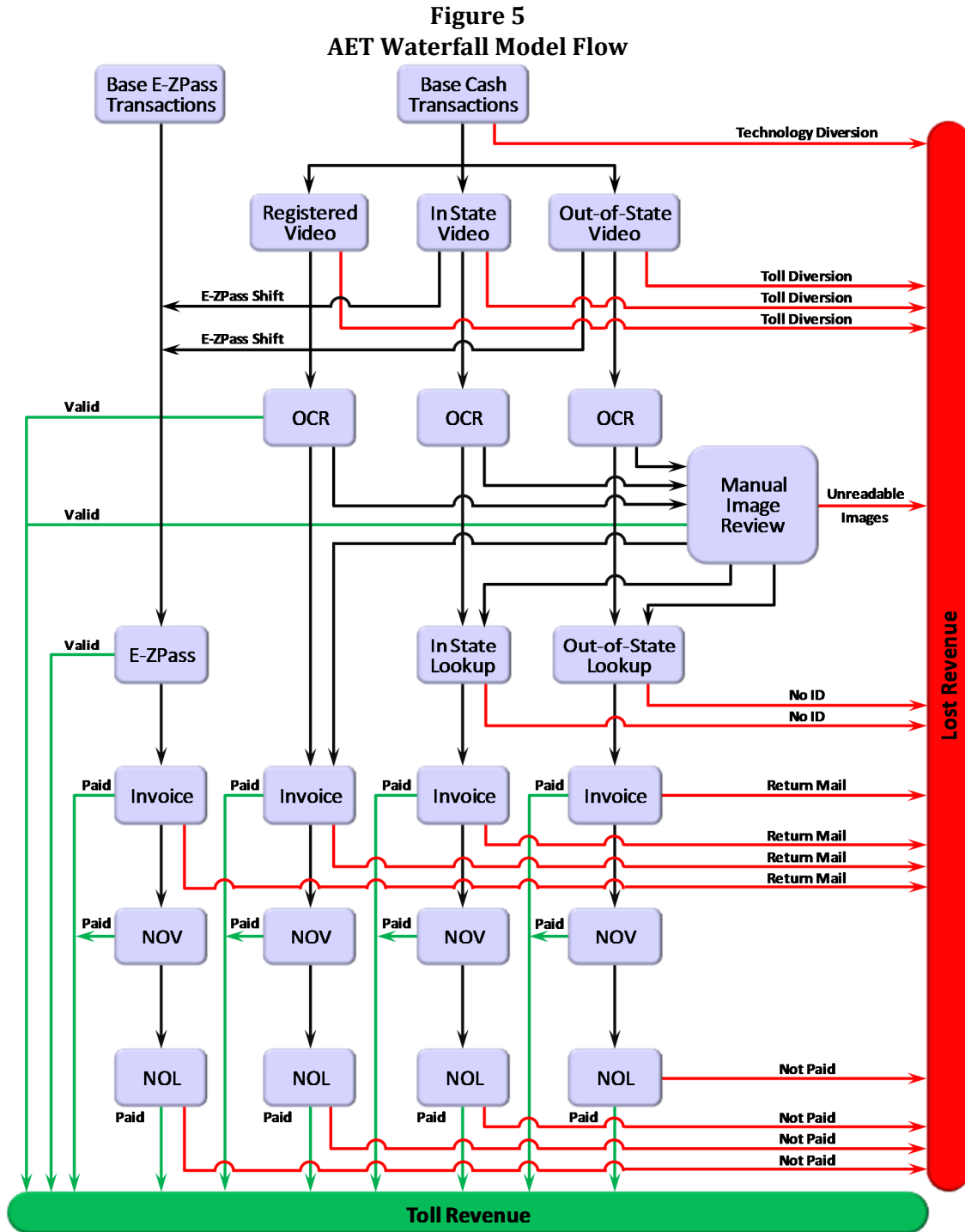
Additionally, a simplified version of the AET Waterfall Model was developed to simulate ORT operation. While ORT utilizes similar toll collection procedures as currently seen on the Maine Turnpike, the Waterfall Model is needed to estimate the traffic and revenue impacts of the implementation of high-speed E-ZPass lanes, a cash toll collection surcharge, and improved violations enforcement within cash lanes.

AET Waterfall Model Overview

The following list provides descriptions for key elements and decision points presented in Figure 5:

1. Existing condition transactions are composed of two groups: E-ZPass and cash transactions.
2. E-ZPass users with valid accounts pass through the AET model with no further consideration. Revenue is added directly to the final revenue calculations.
3. E-ZPass users with an invalid account (e.g. expired or declined credit card associated with the account) go through an invoicing/violations process... An assumed payment rate is applied to the initial invoice. Additional payment rates are then applied to the portion of each subsequent attempt at collecting the toll and associated fees assumed to remain unpaid. This process includes a Notice of Violation (NOV) and Notice of Liability (NOL). The portion of violations remaining unpaid after the entire process is considered lost revenue.
4. A technology diversion percent is applied to those existing cash customers unwilling to either join E-ZPass or become a video customer. They choose to not use the facility under AET for various reasons, including the desire not to be tracked, the belief that this technology will be used to catch speeders, they simply do not understand how it works, etc.
5. Following the application of technology diversion, a calculation is applied to account for the portion of current cash customers that will obtain an E-ZPass account due to implementation of AET. These new E-ZPass account holders are then added to the total E-ZPass population.
6. The remaining cash customers (i.e., after toll technology shift and shift to E-Z Pass), become potential video customers. Some small proportion (5 percent in the base case AET model) are assumed to become registered video customers. The remaining become potential unregistered video customers and the model is set up to deal with in-state and out-of-state motorists separately.
7. Once the registered and unregistered video customer mix has been identified, toll diversion is estimated based on the amount of the video surcharge amounts. These are effectively toll increases for these customers. For purposes of this analysis, it was assumed that registered

video toll surcharges would be 50 percent of the unregistered surcharge amount. As shown in Figure 5, all toll diversion revenue flows to the right side of the figure as lost revenue.



8. The same first steps of OCR and manual image review take place for unregistered video transactions as they do for registered video transactions. As shown in Figure 5, unreadable images represent lost revenue, while readable images then go through the in-state and out-of-state department of motor vehicle look-up process.
9. Registered video transactions would be identified upon being successfully read by an optical character reader (OCR). Their license plate would match that set up by the account holder and the appropriate toll would be deducted from their account. In the event the plate is not successfully read, it would go through a manual image review process. If successfully identified there, the appropriate amount would be deducted from their account. If readable after the manual review process, the toll amount would be considered lost revenue. In the event that license is identified, but the account is found to be invalid (e.g. expired or declined credit card associated with the account), the same invoice/violation process would be followed as for E-ZPass accounts. All DMV lookup success rates are then applied to in-state and out-of-state video transactions. Invoices are then mailed to the addresses returned from the DMV lookup process. Some of these will be undeliverable, resulting in return mail. These are considered lost revenue. Historically, MTA has not been able to obtain plate data from the eastern provinces of Canada. Although recent overtures to Quebec and New Brunswick may yield some plate data recovery, for present purposes no recovery is assumed.
10. Payment rates are then applied to the video toll invoices successfully mailed to patrons. Additional payment rates are then applied to the portion of each subsequent attempt at collecting the toll and associated fees assumed to remain unpaid. Any remaining unpaid notices are considered losses.
11. Any remaining unpaid notices for in-state video transactions are subject to suspension of vehicle registration (notice of suspension or NOS). Only the remaining unpaid notices for out-of-state video transactions are subject to the NOS action, as the model assumes MTA will lack the authority to suspend out-of-state registrations. For purposes of this model, the mailing costs associated with NOS is assumed, but due to the very low assumed collection level at this stage, no toll revenue collection is assumed.

Key Model Variables

The following section presents descriptions of those variables that have the greatest influence on the AET modeling process. The values used for these variables in the Waterfall Model were developed in close cooperation with the MTA. Wherever possible, the values used in the Waterfall Model are based on data provided by MTA based on current Turnpike experience. Where existing MTA data did not provide sufficient basis for model inputs, values were developed based on data collected through interviews with toll agencies that have implemented AET. Facility characteristics such as location, user profile, tolling policy, and enforcement measures were taken into account when considering whether agency interview data was applicable to the Turnpike for the purposes of this study. This section includes only those variables that CDM Smith believes to be critical to the understanding of the AET model and not all variables are presented here.

Technology Diversion

Upon implementation of AET, a certain percentage of Turnpike patrons who currently pay cash will neither enroll in E-ZPass, nor will they participate in video tolling. The only remaining option for these

patrons is to leave the facility entirely. Based on the experience of CDM Smith, having observed several US facilities that have converted to AET, it is expected that only a small percentage of customers would actually divert from the road for this reason. CDM Smith estimates technology diversion at 3.0 percent for both passenger vehicles and commercial vehicles. Technology diversion is not applicable to ORT as customers continue to have the option to pay tolls using cash.

Video/Cash Surcharge

In addition to the technology diversion, diversion will occur due to the de-facto rate increase for video toll users under AET and for cash users under ORT. Under AET or ORT operation customers without an E-ZPass account may pay more than E-ZPass users for the same trip. Surcharge rates being evaluated in this study will cause some current Turnpike cash customers to divert to an alternate route. Surcharges ranging from \$0.00 to \$5.00 were tested for the York toll Plaza. Surcharges ranging from \$0.00 to \$2.00 were tested for the Gardiner toll Plaza.

Shift from Cash to E-ZPass

This input represents the assumed percentage of cash customers—remaining following Technology Diversion—that would shift to E-ZPass as a result of AET or ORT implementation. The volume of this potential shift is largely based on the perceived and actual benefits of obtaining an E-ZPass account. The primary benefit of E-ZPass under AET is the cost savings related to not being subject to the video surcharge. As the surcharge increases in relation to the existing toll, the number of patrons willing to obtain an E-ZPass account is also expected to increase. Within the AET and ORT models, the percentage of cash customers estimated to shift to E-ZPass ranged from 3 percent to 23 percent. The standard discount afforded to motorists using a Maine issued E-ZPass was accounted for in the toll differential when calculating the percentage of cash customers who are expected to shift to E-ZPass. Because cash customers are predominantly infrequent users, the Maine E-ZPass frequent-user discount program was assumed to have a minimal impact and was not factored into the toll differential when estimating shift.

Under ORT, it is expected that a smaller percentage of Turnpike customers will shift to E-ZPass based solely on the convenience and perceived time savings of the high-speed E-ZPass lanes.

Registered Video Accounts

Registered video accounts represent an additional option for current Turnpike cash customers to avoid the full AET video surcharge. A Registered Video user is someone who has contacted the Turnpike and has guaranteed payment of the toll, in some manner such as a credit card, pre-paid cash balance, or post-pay agreement. This agreement minimizes the risk of leakage due to non-payment. It has the added benefits of minimizing costs associated with identification and mailing. Increased payment rates and decreased costs associated with registered video accounts allow agencies to reduce video surcharges for registered video users. In turn, the lower video surcharge incentivizes video customers to register. Where offered, participation in registered video discount programs on existing AET facilities has been demonstrated to be low. Thus, in the AET model, 5 percent of potential video transactions are assumed to shift into registered video accounts.

Normal E-ZPass Growth

This is the growth in E-ZPass penetration that would occur independently of AET conversion. It is based on historical growth and has been incorporated into this analysis. The “shift from cash to E-

ZPass” discussed above, would reflect the impact of AET and would be added to the normal E-ZPass growth that would occur over time.

Identifiable License Plate Images

This input represents the assumed percentage of successful license plate images identification, either through the OCR or manual identification process. This is an important metric for AET as unidentifiable images result in unbillable toll transactions. Image review success rates can be influenced by tolling equipment, inclement weather, obscured plates, and vehicle mix among others. For the purposes of this study, successful image identification rates used in the model were assumed to be the same as current MTA violation enforcement experience. Values used in the model for this variable can be seen in Tables 1 and 2.

Successful DMV Lookup

As previously discussed, once the license plate of a non-E-ZPass patron is recorded, it must be matched to a name and address for billing purposes. The rate at which MTA is able to obtain matching billing information is a critically important variable. For every plate that goes unmatched, MTA loses a would-be source of revenue.

The figures used in the model for this input were based on current MTA successful DMV look-up rates for in-state and out-of-state vehicles. DMV look-ups are currently conducted through the Maine DMV for in-state vehicles, the New Hampshire DMV for New Hampshire Vehicles, and through Duncan Solutions for all other out-of-state vehicles. Values used in the model for this variable can be seen in Tables 1 and 2. Since it is currently difficult for MTA to obtain Canadian DMV plate data, all unregistered Canadian video transactions are considered losses from a toll revenue standpoint.

Returned Mail

A portion of invoices mailed to MTA video toll patrons are expected to be returned as invalid addresses. In these cases, MTA has little recourse to correct this, as methods of obtaining a correct address would not be cost effective. The figures used in the model for this input were based on current MTA return mail rates. Values used in the model for this variable can be seen in Tables 1 and 2.

Payment on Video Invoice and Notices

One of the most critical variables in the AET analysis is the proportion of patrons who will pay at the various levels of invoicing. When customers fail to pay the 1st invoice, the cost to mail subsequent notices increases and offsets portions of the toll revenue being collected. It is expected that payment rates decrease with each successive mailing resulting in a percentage of video toll transactions that go unpaid. This results in a negative impact on net revenue as a high collection cost is incurred in conjunction with no toll revenue being collected.

AET Model assumptions relating to video tolling at the York and Gardiner toll plazas are presented in Tables 1 (York) and 2 (Gardiner). Included are percentages for unsuccessful image capture, invalid DMV data, return mail and video billing payments for ME, MA/NH and other out-of-state cash customers. The percentages are applied to each group of cash customers in succession to estimate the percentage of potential video transactions that go unpaid. At the York plaza, cash customers are split fairly evenly between Maine, Massachusetts and New Hampshire, and other out of state roadway users. As shown, the “Other” category, which represents 27.4 percent of all video transactions, has the

highest uncollected rate (64.2 percent). This is largely due to the very low assumed invoice payment rates for these motorists. Under the current assumptions for identification and payment rates, this results in approximately 42 percent of total video transactions being uncollected. This represents about 9.6 percent of total transactions (E-ZPass and video) at York.

Table 1
York Toll Plaza AET Video Toll Payment Assumptions

<u>Item</u>	<u>Maine</u>	<u>MA/NH</u>	<u>Other</u>	<u>Weighted Average</u>
Percent Cash Distribution	37.0%	35.6%	27.4%	100.0%
Percent No Image Capture	1.5%	15.0%	15.0%	10.0%
Percent No DMV Record/Returned Mail	17.2%	5.1%	8.5%	10.9%
Billable Video Transactions				
% Pay 1st Invoice	55.0%	50.0%	25.0%	45.0%
% Pay NOV	55.0%	40.0%	20.0%	40.1%
% Pay NOL	35.0%	20.0%	10.0%	22.8%
Total % Pay Invoice	86.8%	76.0%	46.0%	72.1%
Total % Unpaid Invoice	13.2%	24.0%	54.0%	27.9%
Total Percent Video Uncollected	29.2%	38.7%	64.2%	42.2%
Total Percent Uncollected (ETC + Video)				9.6%

Table 2 shows the same information for Gardiner. In this case, because Maine registered vehicles make up a very large (75 percent) proportion of video transactions, the overall amount of uncollected video transactions amounts to 35.9 percent. But, because video transactions make up a larger share of total transactions at Gardiner, the number of uncollected video transactions represents about 12 percent of total transactions (E-ZPass and video).

Table 2
Gardiner Toll Plaza AET Video Toll Payment Assumptions

<u>Item</u>	<u>Maine</u>	<u>MA/NH</u>	<u>Other</u>	<u>Weighted Average</u>
Percent Cash Distribution	75.0%	8.2%	16.8%	100.0%
Percent No Image Capture	1.5%	15.0%	15.0%	4.9%
Percent No DMV Record/Returned Mail	17.2%	5.1%	8.5%	15.0%
Billable Video Transactions				
% Pay 1st Invoice	55.0%	50.0%	25.0%	49.6%
% Pay NOV	55.0%	40.0%	20.0%	47.9%
% Pay NOL	35.0%	20.0%	10.0%	29.6%
Total % Pay Invoice	86.8%	76.0%	46.0%	79.3%
Total % Unpaid Invoice	13.2%	24.0%	54.0%	20.7%
Total Percent Video Uncollected	29.2%	38.7%	64.2%	35.9%
Total Percent Uncollected (ETC + Video)				12.0%

Cost Assumptions

Operations and maintenance costs are very important to the AET analysis. It is known that a certain percentage of present toll transactions will be lost under AET. As described above, this will be due to technology and surcharge diversion, unreadable license plate images, unsuccessful DMV lookups, returned mail and uncollectable tolls. Generally, the costs of operations and maintenance of an AET system are expected to be less than the costs associated with a conventional cash and ETC system. There will be fewer personnel needed. This will result in a reduction in cost for labor, benefits, insurance and administration. The costs of operating and maintaining the toll plazas will be eliminated. There will be no costs for handling and securing large amounts of cash. On the other side, under AET, there will be increased back office costs, mailing costs, maintenance of expensive camera equipment, costs for image reviews and DMV lookups. Reduced costs of operations and maintenance under AET may offset some of the loss of toll revenue associated with traffic diversion and uncollectable tolls.

The AET model utilizes a series of cost-related components to determine the costs associated with AET operations. These were developed in close cooperation with MTA. The assumptions developed were based upon current toll collection cost data provided by MTA, when available. Assumptions were also influenced by CDM Smith experience in previous projects and staff participation in industry surveys supporting other AET conversions. Table 3 presents some of the key per-unit costs used in the AET and ORT models.

**Table 3
Per Unit Cost Summary
2013-2030**

Cost Component	2013 AET/ORT Model Value	Annual Rate of Inflation				
		2014	2015	2016	2017	2018-2030
Per Unit Cost						
Base CSC Per Transaction Cost	\$0.04	3.5%	2.5%	2.5%	2.5%	2.5%
Cost Per Manual Image Review	\$0.16	3.5%	2.5%	2.5%	2.5%	2.5%
Notices Stuffed & Mailed	\$0.54	3.5%	2.5%	2.5%	2.5%	2.5%
1st Notice (30 days)	\$1.71	3.5%	2.5%	2.5%	2.5%	2.5%
Mailing NOV	\$1.71	3.5%	2.5%	2.5%	2.5%	2.5%
Mailing NOL	\$2.00	3.5%	2.5%	2.5%	2.5%	2.5%
Mailing NOS	\$1.94	3.5%	2.5%	2.5%	2.5%	2.5%
In-State Lookup	\$0.13	3.5%	2.5%	2.5%	2.5%	2.5%
Out-of-State DMV lookup	\$1.87	3.5%	2.5%	2.5%	2.5%	2.5%

Findings

This section summarizes the study team’s use of the AET and ORT models to estimate AET traffic, toll revenue, and M&O costs for a range of surcharge levels over the forecast period from 2015 to 2030. With this information, total net AET and ORT toll revenue is developed and compared to the estimated net revenue values for the existing condition. The result of this comparison is then used to identify the optimum AET video toll and ORT cash toll surcharge levels. The optimal surcharge level is identified

as the lowest surcharge at which a given scenario becomes net revenue neutral. This is the point at which surcharge revenue is sufficient to offset changes in toll collection costs and revenue leakage due to the implementation of AET or ORT. Once the selected surcharge value is determined and the net revenue values estimated, a further analysis is conducted taking into account the estimated capital costs associated with both AET and ORT. As will be discussed in more detail below, toll surcharges were only deemed necessary under AET; ORT implementation was financially feasible without an additional cash toll surcharge.

As described in the AET model description, the existing condition traffic and revenue estimates form the starting point for the AET analysis. All of the assumed AET shifts and diversions shown in Figure 5 are applied to existing condition traffic and revenue estimates.

As it relates to the current study, the most important analysis is the estimated net revenue impact of converting to AET or ORT (compared to the existing condition) and not overall net revenue figures. Thus, if a certain AET or ORT scenario has a net positive impact compared to the existing condition, it will continue to have a similar net positive impact in the event new existing condition forecasts are developed.

Please note that CDM Smith has chosen to report toll revenue and fee revenue separately. The fee revenues should not necessarily be considered in whole as this revenue is not always collected. Very often agencies will wave outstanding fees if the base toll debt is paid or will engage in other programs designed to incentivize patrons to pay past-due balances. Thus, for purposes of this study, it was decided that only 30 percent of total potential fee revenue would be collected.

York Toll Plaza

The following section presents estimated traffic and revenue for the York Toll Plaza under AET and ORT conditions. The results of surcharge sensitivity tests are discussed, including the estimated annual net revenue forecasts associated with various surcharge levels. Estimated annual traffic and toll revenue impacts are presented assuming the optimal surcharge level.

York Toll Plaza Assuming AET

The results of the AET surcharge sensitivity tests are presented in Table 4. These were conducted at estimated 2015 levels, the assumed opening year. Surcharge rates were tested at \$0.00, \$1.00, \$2.00, \$3.00 and \$4.00. These are the assumed passenger-car video toll surcharges that would be assessed to unregistered video transactions in addition to the \$3.00 cash toll. Registered video transaction surcharges were assessed at 50 percent of the unregistered video surcharge. Data shown in Table 4 includes estimated toll transactions, no contact/uncollectable transactions, gross toll and fee revenue, M&O costs, and net revenue impacts associated with each surcharge levels.

Estimated annual transactions are provided for the existing condition for both cash and E-ZPass (including violations). These existing condition transactions do not change across the various surcharge levels since this assumes no AET. In total, an estimated 13,965,000 transactions are anticipated to occur in 2015 under existing conditions. If AET is implemented, total toll transactions are expected to decrease compared to the existing condition. At \$0.00 surcharge, a reduction of 1,756,000 transactions is anticipated, an approximately 12.6 percent reduction compared to the existing condition. The “lost” 1,756,000 transactions are identified in the table under the header No

Table 4
Estimated 2015 York Toll Plaza AET Surcharge Sensitivity Summary (1)
All Values in Thousands

Toll Transactions	Unregistered Video Surcharge (2)				
	\$0.00	\$1.00	\$2.00	\$3.00	\$4.00
Existing Condition Toll Transactions: Cash	4,213	4,213	4,213	4,213	4,213
Existing Condition Toll Transactions: E-ZPass	9,752	9,752	9,752	9,752	9,752
Total Existing Condition Toll Transactions+Violations	13,965	13,965	13,965	13,965	13,965
AET Toll Transactions: Video	2,359	2,096	1,785	1,414	995
AET Toll Transactions: E-ZPass	9,850	10,013	10,176	10,341	10,507
Total AET Toll Transactions	12,209	12,109	11,961	11,755	11,501
AET Transaction Impacts	-1,756	-1,856	-2,003	-2,209	-2,463
No Contact/Uncollectable Transactions					
Toll and Technology Diversion	119	410	783	1,259	1,818
Unreadable Plates and DMV No Hits	374	331	279	217	147
Unsuccessful Collection	1,344	1,196	1,022	815	580
Total AET No Contact/Uncollectable	1,837	1,937	2,084	2,290	2,545
Existing Condition Violations	81	81	81	81	81
AET Transaction Loss Impact	1,756	1,856	2,003	2,209	2,463
Gross Toll and Fee Revenue					
Existing Condition Gross Toll Revenue: Cash	\$14,776	\$14,776	\$14,776	\$14,776	\$14,776
Existing Condition Gross Toll Revenue: E-ZPass	40,710	40,710	40,710	40,710	40,710
Existing Condition Fee Revenue	189	189	189	189	189
Total Existing Condition Gross Toll+Fee Revenue	\$55,675	\$55,675	\$55,675	\$55,675	\$55,675
AET Gross Toll Revenue: Video	\$8,359	\$10,074	\$10,965	\$10,792	\$9,413
AET Gross Toll Revenue: E-ZPass	40,970	41,455	41,942	42,432	42,926
AET Collected Fee Revenue (30% of Maximum)	1,794	1,589	1,344	1,051	718
Total AET Gross Toll+Discounted Fee Revenue	\$51,123	\$53,118	\$54,251	\$54,275	\$53,057
Total AET Gross Toll Revenue Impact	-\$4,552	-\$2,557	-\$1,424	-\$1,400	-\$2,619
Summary of Existing Condition M&O Costs					
Image Review	\$159	\$159	\$159	\$159	\$159
DMV Lookup	16	16	16	16	16
Mailing	59	59	59	59	59
Fare Collection/Administration	5,832	5,832	5,832	5,832	5,832
Total Annual Existing Condition M&O Costs	\$6,067	\$6,067	\$6,067	\$6,067	\$6,067
Summary of AET M&O Costs					
Image Review	\$682	\$607	\$518	\$411	\$290
DMV Lookup	1,652	1,461	1,233	959	647
Mailing	3,303	2,923	2,472	1,929	1,313
Fare Collection/Administration	2,415	2,428	2,431	2,419	2,394
Total Annual AET M&O Cost	\$8,052	\$7,420	\$6,653	\$5,719	\$4,644
AET Cost Savings	-\$1,985	-\$1,352	-\$586	\$348	\$1,423
Net Revenue Impacts (3)					
Total Net Existing Condition Toll+Fee Revenue	\$49,608	\$49,608	\$49,608	\$49,608	\$49,608
Total Net AET Toll Revenue	43,071	45,698	47,598	48,556	48,412
Total Net AET Toll Revenue Impact	-\$6,537	-\$3,910	-\$2,010	-\$1,052	-\$1,196
5-yr Cumulative AET Net Revenue Impact	-\$27,350	-\$15,312	-\$6,609	-\$2,150	-\$2,591
10-yr Cumulative AET Net Revenue Impact	-\$42,993	-\$21,109	-\$5,305	\$2,910	\$2,521

(1) Per MTA, it is assumed that no billing information can be obtained for vehicles with Canadian license plates.

(2) These are the assumed passenger car video toll surcharge amounts that would be assessed to unregistered video transactions in addition to the \$3.00 cash toll. Registered video transaction surcharges were assessed at 50 percent of the unregistered video surcharge.

(3) Net revenue is calculated by subtracting maintenance and operations costs from gross toll+fee revenue.

Contact/Uncollectable Transactions. At the \$0.00 level surcharge, it is estimated that a total of 1,837,000 transactions would be lost in 2015 due to:

- 119,000 transactions lost due to diversion (both toll diversion and technology diversion);
- 374,000 transactions lost due to unreadable plates or no DMV match; and
- 1,344,000 transactions lost due to unsuccessful collection.

The estimated leakage of toll transactions increases as the unregistered video surcharge increases from \$0.00 to \$4.00 (again, registered video rates are increasing at 50 percent of these rates). The increase is primarily due to increasing levels of diversion associated with the increased video toll rate. Negative impacts on the other two categories actually decrease since the pool of video customers decreases (due to diversion and greater assumed shifts to E-ZPass) at increasingly higher video surcharge levels. But, the overall net impact is increasing losses as surcharge levels increase.

Estimates of toll and fee revenue are provided for the existing condition and for the various surcharge levels under AET. The total estimated AET gross toll revenue impact is negative in 2015 at all tested surcharge levels. The impact is smallest at the \$3.00 surcharge, totaling a negative impact of \$1,400,000 compared to the existing condition. The toll revenue impact includes the video and E-ZPass gross toll revenue and the anticipated fee revenue. Beyond that, the video surcharge levels are so great that the negative effects of toll diversion outweigh the positive impacts of the toll increase.

Maintenance and operation costs, both existing and under AET are shown for the surcharge levels. The existing M&O does not change, and the estimated annual AET M&O costs decrease continuously from the \$0.00 to the \$4.00 surcharge. The decreasing AET M&O costs are largely due to the diminishing number of video toll transactions thus reducing transaction related processing costs such as image review, DMV lookup and mailings. The total AET cost savings turns positive at the \$3.00 surcharge level. At lower surcharge levels, the combination of high license plate look-up costs (especially for out-of-state motorists) and mailing costs more than offset the other personnel and administrative savings afforded by AET.

Total AET M&O costs are greater at the \$0.00 through \$2.00 surcharge levels compared to those for the existing condition. Beginning at the \$3.00 rate, total AET M&O costs are estimated to be lower than those for the existing condition. It is interesting to note, however, that at all surcharge levels, the Fare Collection/Administration cost component under AET is always less than half those for the existing condition. This is largely due to the elimination of toll collector costs. What drives the total AET M&O costs up are the additional costs incurred by the other three cost components: Image Review, DMV Lookup, and Mailing. These three components increase dramatically over the existing condition as cash customers become video customers, each of whom needs to be identified and sent an invoice (or multiple invoices).

The net revenue impacts (gross toll and fee revenue minus M&O costs) are shown for AET compared to the existing condition. In 2015, the net toll revenue impact is always negative for all surcharge levels, although it is minimized at the \$3.00 surcharge. At the \$4.00 surcharge, gross toll revenue starts to decrease due to the levels of toll diversion and conversion to E-ZPass. In 2015 it is estimated that the net toll revenue impact of AET is negative \$1,052,000 at the \$3.00 surcharge level. The five-

year cumulative AET net revenue impact with a \$3.00 surcharge totals a negative \$2,150,000. The ten-year cumulative impact at the \$3.00 level turns positive, totaling an estimated \$2,910,000 in 2015.

A graphical summary of the estimated annual net toll revenue from 2015 through 2030 at the various unregistered video surcharge levels and for the existing condition (Base Case) is shown in Figure 6. The net revenue curve for the \$3.00 and \$4.00 curve are so similar at this scale that they appear as one line. All the AET estimated net toll revenues fall short of the Base Case in 2015. The estimated AET toll revenue streams associated with the \$2.00, \$3.00 and \$4.00 video surcharges exceed the Base Case toll revenue in future years while the estimated annual toll revenue associated with the \$0.00 and \$1.00 surcharge never equals or exceeds the Base Case forecast. The \$3.00 and \$4.00 surcharges result in annual gross toll revenues that exceed the Base Condition by about 2019. The annual gross toll revenue at the \$2.00 surcharge exceeds the Base Condition toll revenue in about 2021.

Figure 6
Estimated York Toll Plaza AET Annual Net Revenue Forecasts

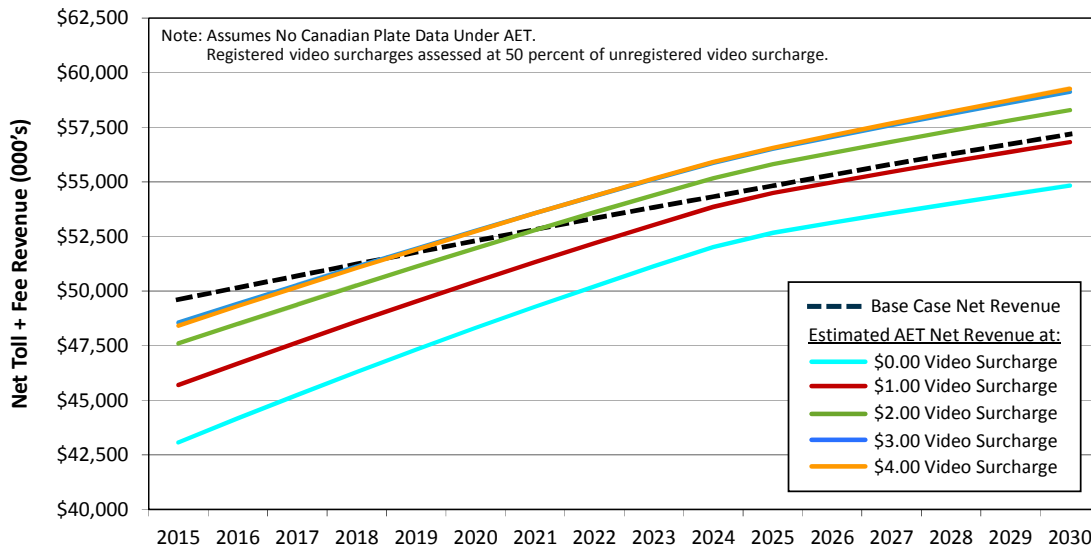


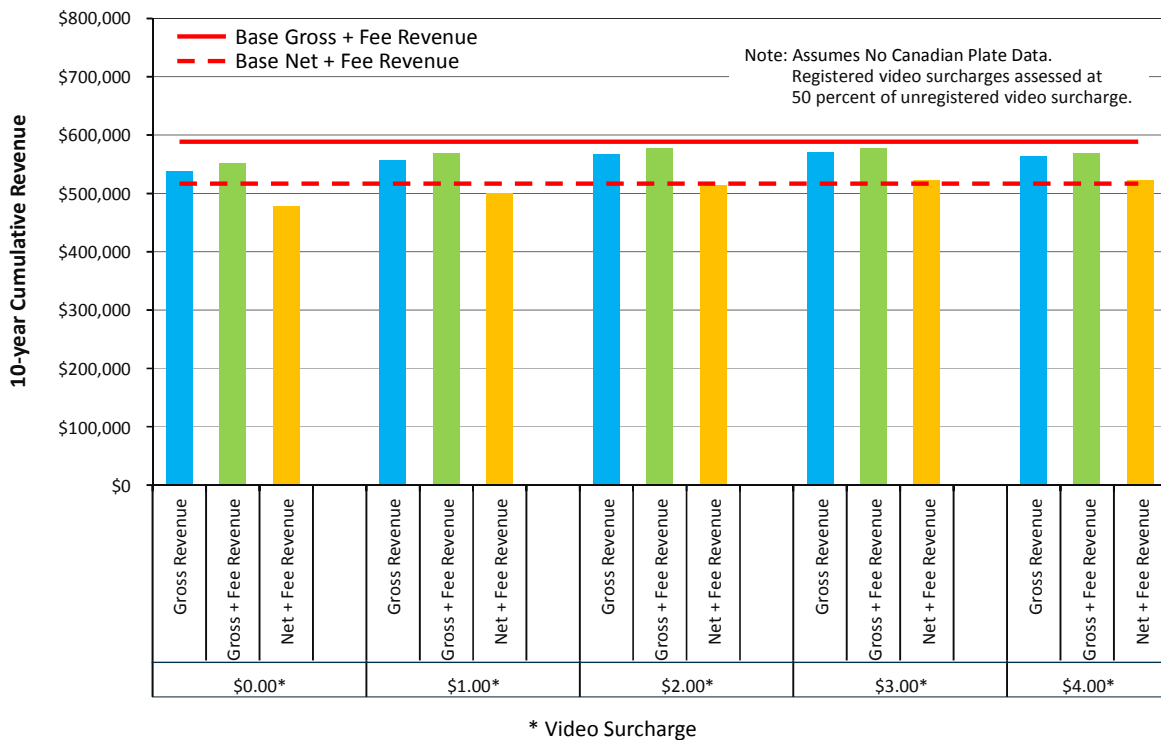
Figure 7 shows the estimated ten-year cumulative toll revenue comparison assuming AET at York Plaza for the tested video surcharge levels. The revenue for each surcharge level is shown for the gross toll revenue, the gross toll revenue plus the fee revenue, and the net toll revenue plus the fee revenue. The gross toll revenue plus fee revenue and the net toll revenue plus fee revenue for the existing condition are shown as horizontal lines. The estimated, cumulative 10-year net toll revenue plus fee revenue meets or exceeds the existing condition net plus fee revenue only at the \$3.00 and \$4.00 surcharge level.

Detailed traffic and toll revenue estimated impacts are shown in Table 5 for the York Toll Plaza at a \$3.00 video surcharge from 2015 through 2030. This table shows the estimated trends over time in toll transactions, leakage (uncollectible transactions), gross toll and fee revenue, and M&O costs for

both the existing condition and the AET condition. Also shown are the impacts between the existing and AET conditions for each year and cumulatively through the forecast period.

The leakage due to implementation of AET decreases from 2015 through 2025 primarily due to an increasing market share of E-ZPass vehicles, decreasing the number of video transactions. The leakage gradually increases from 2026 through 2030. The increase is caused by the saturation of the E-ZPass market and normal growth slowly increases the number of video transactions.

Figure 7
Estimated York Toll Plaza AET Ten Year Cumulative Revenue Comparison



The AET gross toll revenue impact is negative throughout the forecast period, but the size of the decrease in gross toll revenue diminishes over the years. The impact ranges from negative \$1,400,000 in 2015 to negative \$970,000 in 2030. This decrease is associated with the increasing E-ZPass market share and the decrease in video transaction toll revenue leakage.

Savings in M&O costs are estimated to be positive from 2015 through 2030, ranging from \$348,000 to \$2,912,000, respectively. While it is anticipated that the existing condition M&O costs continually increase through the forecast period, the M&O costs for the AET scenario are forecast to decrease through 2024 due to the decreasing video transaction market share. As video transaction market share decreases over time, fewer image reviews, DMV lookups and mailings will be required. As a result, fewer staff will be required to perform these processes. Additionally, this will lead to proportionate decreases in direct costs related to out-of-state DMV lookups and mailings. Total AET M&O costs are forecast to start increasing around 2025 due to the saturation of the E-ZPass market. When that saturation point is reached, the number of video transactions and related costs are

Table 5
Estimated Total York Toll Plaza AET Traffic and Toll Revenue Impacts Assuming a \$3.00 Video Surcharge (1)(2)
All Values in Thousands

	Year															
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Toll Transactions																
Existing Condition Toll Transactions: Cash	4,213	3,935	3,676	3,435	3,212	3,004	2,810	2,631	2,463	2,308	2,156	2,015	1,876	1,740	1,607	1,484
Existing Condition Toll Transactions: E-ZPass	9,752	10,227	10,682	11,117	11,535	11,935	12,318	12,686	13,038	13,376	13,696	13,995	14,275	14,535	14,778	14,994
Total Existing Condition Toll Transactions+Violations	13,965	14,162	14,358	14,553	14,746	14,938	15,129	15,317	15,502	15,684	15,862	16,036	16,208	16,378	16,546	16,711
AET Toll Transactions: Video	1,414	1,308	1,209	1,117	1,031	952	878	809	745	686	636	592	552	516	483	452
AET Toll Transactions: E-ZPass	10,341	10,815	11,269	11,703	12,119	12,518	12,901	13,268	13,619	13,956	14,285	14,605	14,915	15,215	15,505	15,785
Total AET Toll Transactions	11,755	12,123	12,478	12,820	13,150	13,470	13,779	14,077	14,364	14,642	14,921	15,200	15,480	15,760	16,040	16,320
AET Transaction Impacts	-2,209	-2,039	-1,881	-1,733	-1,596	-1,468	-1,350	-1,240	-1,138	-1,042	-1,011	-1,026	-1,041	-1,056	-1,070	-1,085
No Contact/Uncollectible Transactions																
Toll and Technology Diversion	1,259	1,164	1,076	994	918	847	782	721	664	611	594	603	611	620	628	637
Unreadable Plates and DMV No Hits	217	203	190	178	167	157	147	139	130	123	120	122	124	125	127	129
Unsuccessful Collection	815	754	697	645	596	551	509	469	433	399	388	394	400	405	411	416
Total AET No Contact/Uncollectible	2,290	2,121	1,964	1,817	1,681	1,555	1,438	1,329	1,227	1,133	1,102	1,119	1,135	1,151	1,166	1,182
Existing Condition Violations	81	82	83	84	85	87	88	89	90	91	92	93	94	95	96	97
AET Transaction Loss Impact	2,209	2,039	1,881	1,733	1,596	1,468	1,350	1,240	1,138	1,042	1,011	1,026	1,041	1,056	1,070	1,085
Gross Toll and Fee Revenue																
Existing Condition Gross Toll Revenue: Cash	\$14,776	\$13,967	\$13,216	\$12,519	\$11,872	\$11,273	\$10,719	\$10,204	\$9,728	\$9,287	\$9,156	\$9,257	\$9,356	\$9,454	\$9,551	\$9,646
Existing Condition Gross Toll Revenue: E-ZPass	40,710	42,242	43,714	45,130	46,493	47,807	49,073	50,290	51,462	52,589	53,407	53,994	54,573	55,145	55,710	56,267
Existing Condition Fee Revenue	189	191	193	196	198	201	203	206	208	210	213	215	217	220	222	224
Total Existing Condition Gross Toll+Fee Revenue	\$55,675	\$56,400	\$57,124	\$57,845	\$58,564	\$59,281	\$59,994	\$60,700	\$61,397	\$62,086	\$62,776	\$63,466	\$64,147	\$64,819	\$65,483	\$66,138
AET Gross Toll Revenue: Video	\$10,792	\$10,127	\$9,511	\$8,939	\$8,409	\$7,918	\$7,464	\$7,043	\$6,653	\$6,293	\$6,189	\$6,277	\$6,364	\$6,449	\$6,533	\$6,617
AET Gross Toll Revenue: E-ZPass	42,482	43,960	45,428	46,841	48,200	49,510	50,773	51,987	53,156	54,280	55,096	55,682	56,260	56,830	57,393	57,949
AET Collected Fee Revenue (30% of Maximum)	1,051	981	916	856	800	748	700	655	614	575	563	571	579	587	595	602
Total AET Gross Toll+Discounted Fee Revenue	\$54,275	\$55,068	\$55,855	\$56,635	\$57,409	\$58,176	\$58,936	\$59,685	\$60,422	\$61,148	\$61,849	\$62,530	\$63,202	\$63,866	\$64,521	\$65,168
Total AET Gross Toll Revenue Impact	-\$1,400	-\$1,332	-\$1,269	-\$1,210	-\$1,155	-\$1,105	-\$1,058	-\$1,015	-\$975	-\$938	-\$927	-\$936	-\$944	-\$953	-\$961	-\$970
Summary of Existing Condition M&O Costs																
Image Review	\$159	\$165	\$172	\$178	\$185	\$192	\$199	\$207	\$215	\$223	\$231	\$239	\$247	\$256	\$265	\$275
DMV Lookup	16	17	18	18	19	20	21	21	22	23	24	25	26	27	27	28
Mailing	59	62	64	66	69	72	74	77	80	83	86	89	92	95	99	102
Fare Collection/Administration	5,852	6,002	6,173	6,346	6,521	6,698	6,878	7,060	7,244	7,431	7,613	7,792	7,976	8,163	8,355	8,551
Total Annual Existing Condition M&O Costs	\$6,067	\$6,246	\$6,427	\$6,610	\$6,795	\$6,982	\$7,172	\$7,365	\$7,561	\$7,759	\$7,953	\$8,145	\$8,341	\$8,541	\$8,746	\$8,956
Summary of AET M&O Costs																
Image Review	\$411	\$394	\$377	\$361	\$346	\$332	\$319	\$306	\$294	\$283	\$284	\$295	\$307	\$318	\$331	\$343
DMV Lookup	959	920	883	848	815	784	755	727	702	677	681	708	736	764	793	823
Mailing	1,929	1,849	1,773	1,701	1,632	1,568	1,507	1,450	1,396	1,345	1,352	1,405	1,459	1,516	1,574	1,633
Fare Collection/Administration	2,419	2,484	2,547	2,609	2,671	2,731	2,791	2,850	2,908	2,966	3,016	3,061	3,106	3,152	3,198	3,244
Total Annual AET M&O Cost	\$5,719	\$5,646	\$5,580	\$5,519	\$5,464	\$5,415	\$5,372	\$5,333	\$5,299	\$5,270	\$5,333	\$5,469	\$5,608	\$5,750	\$5,895	\$6,044
AET Cost Savings	\$348	\$600	\$847	\$1,090	\$1,330	\$1,567	\$1,801	\$2,032	\$2,262	\$2,489	\$2,621	\$2,676	\$2,733	\$2,791	\$2,851	\$2,912
Net Revenue Impacts (3)																
Total Net Existing Condition Toll+Fee Revenue	\$49,608	\$50,154	\$50,697	\$51,235	\$51,770	\$52,299	\$52,822	\$53,335	\$53,836	\$54,326	\$54,823	\$55,321	\$55,806	\$56,278	\$56,737	\$57,182
Total Net AET Toll Revenue	48,556	49,422	50,275	51,116	51,944	52,761	53,565	54,352	55,123	55,878	56,516	57,061	57,595	58,116	58,626	59,124
Total Net AET Toll Revenue Impact	-\$1,052	-\$732	-\$422	-\$119	-\$175	-\$462	-\$743	-\$1,017	-\$1,287	-\$1,552	-\$1,694	-\$1,740	-\$1,789	-\$1,838	-\$1,890	-\$1,943
Cumulative AET Net Revenue Impact	-\$1,052	-\$1,784	-\$2,205	-\$2,325	-\$2,150	-\$1,688	-\$945	\$72	\$1,359	\$2,910	\$4,604	\$6,345	\$8,133	\$9,972	\$11,861	\$13,804

(1) Per MTA, it is assumed that no billing information can be obtained for vehicles with Canadian license plates.
 (2) These are the assumed passenger car video toll surcharge amounts that would be assessed to unregistered video transactions in addition to the \$3.00 cash toll.
 Registered video transaction surcharges were assessed at 50 percent of the unregistered video surcharge.
 (3) Net revenue is calculated by subtracting maintenance and operations costs from gross toll+fee revenue.

estimated to increase at a nominal annual growth rate without any further shift to E-ZPass. AET is expected to have a net positive impact on total M&O costs compared to the existing condition throughout the forecast period at the \$3.00 surcharge level.

The total impact on net toll revenue at the \$3.00 surcharge level is negative from 2015 (-\$1,052,000) through 2018 (-\$119,000). The net toll revenue impact goes positive in 2019, totaling about \$175,000. The net revenue impact reaches \$1,943,000 in 2030. Cumulatively, the net toll revenue impact becomes positive in year 2022.

York Toll Plaza ORT

While it is the current MTA policy not to implement a cash surcharge for cash transactions under ORT, CDM Smith initially thought it best to test various surcharge levels (including no surcharge) to see what impact they had on net toll revenue. This decision stemmed from the potential risk to net revenue posed by an anticipated increase in violations in the ORT lanes. Because the \$0.00 surcharge had a substantial positive impact on net toll revenue, the forecasts for the greater than \$0.00 surcharges were not included in this report.

Detailed traffic and toll revenue impacts are shown in Table 6 for the York Toll Plaza with no cash surcharge from 2015 through 2030. This table shows trends over time in estimated toll transactions, gross toll and fee revenue, and M&O costs for both the existing condition and the ORT condition. Also shown are the net impacts between the existing and ORT conditions for each year and cumulatively through the forecast period.

If ORT is implemented, total toll transactions are estimated to increase by 19,000 compared to the existing condition. The increase in toll transactions is primarily based on the assumption that video enforcement of cash toll violations (run-throughs) will be introduced to the cash lanes upon construction of an ORT plaza (they do not currently exist). By 2030, total annual ORT transactions are expected to exceed existing condition projections by 57,000. Under ORT, no technology diversion is assumed since the cash option still remains.

In 2015 ORT has an estimated positive gross revenue impact of \$177,000, representing a 0.3% increase over the existing condition forecast. This positive impact increases proportionately with forecast existing condition gross toll revenue throughout the forecast period.

York Toll Plaza 2015 ORT M&O costs are estimated to be \$775,000, or 12.8%, lower than those projected for existing condition. By 2030 ORT M&O cost savings are estimated to increase to \$1,472,000. As a percent of total annual existing condition M&O costs, this represents a savings of 16.4%. This savings is due primarily to the replacement of legacy system toll equipment that is costly to maintain, with some parts requiring frequent replacement.

Unlike under the AET alternative, existing condition and ORT costs are relatively similar across all cost categories. The differences that do occur are in the Fare Collection/Administration category. As mentioned above, ORT costs are slightly lower due to the replacement of the legacy toll equipment. All other cost categories are very similar between the existing condition and the ORT alternative.

Net revenue impacts are also shown for ORT compared to the existing condition. In 2015 it is estimated that ORT has a positive net toll revenue impact of \$952,000 without a cash surcharge. The

Table 6
Estimated Total York Toll Plaza ORT Traffic and Toll Revenue Impacts Assuming No Cash Surcharge
 All Values in Thousands

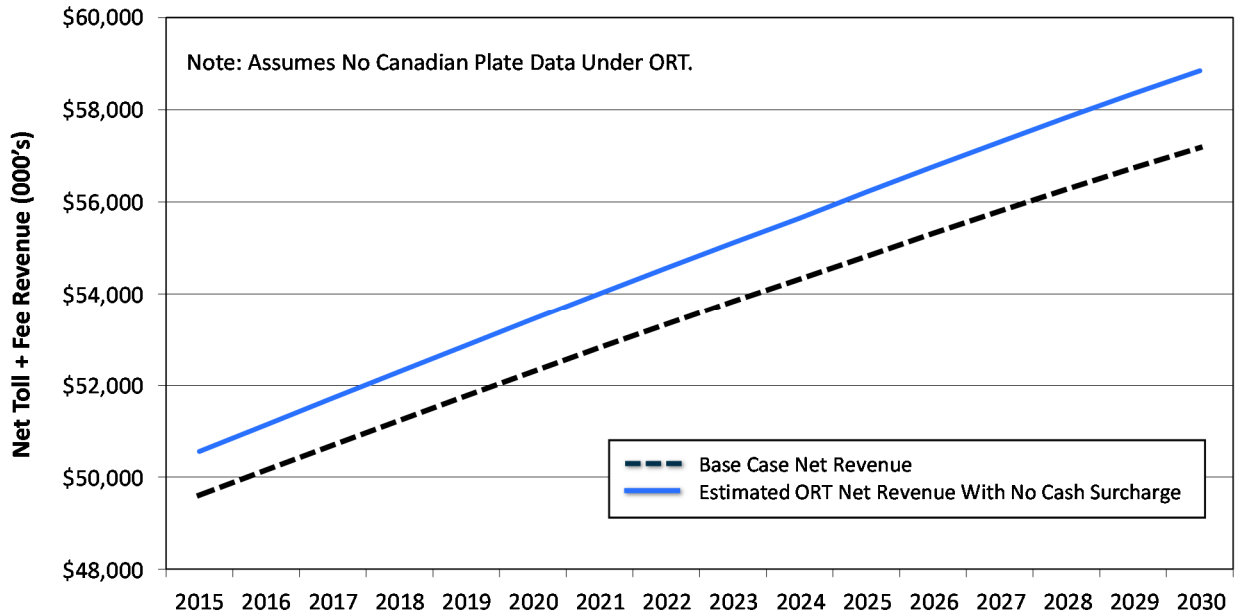
	Year															
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Toll Transactions																
Existing Condition Toll Transactions: Cash	4,213	3,935	3,676	3,435	3,212	3,004	2,810	2,631	2,463	2,308	2,256	2,281	2,305	2,330	2,353	2,377
Existing Condition Toll Transactions: E-ZPass	9,752	10,227	10,682	11,117	11,535	11,935	12,318	12,686	13,038	13,376	13,606	13,755	13,903	14,049	14,192	14,334
Total Existing Condition Toll Transactions	13,965	14,162	14,358	14,553	14,746	14,938	15,129	15,317	15,502	15,684	15,862	16,036	16,208	16,378	16,546	16,711
ORT Toll Transactions: Cash	4,149	3,876	3,622	3,386	3,166	2,962	2,773	2,597	2,433	2,281	2,230	2,256	2,281	2,306	2,330	2,354
ORT Toll Transactions: E-ZPass	9,834	10,309	10,764	11,199	11,616	12,015	12,399	12,767	13,119	13,456	13,686	13,835	13,983	14,128	14,272	14,414
Total ORT Toll Transactions	13,983	14,185	14,386	14,585	14,782	14,978	15,172	15,363	15,551	15,737	15,916	16,091	16,264	16,434	16,603	16,769
ORT Transaction Impacts	19	23	28	32	36	40	43	47	50	53	54	55	55	56	57	57
Gross Toll and Fee Revenue																
Existing Condition Gross Toll Revenue: Cash	\$14,776	\$13,967	\$13,216	\$12,519	\$11,872	\$11,273	\$10,719	\$10,204	\$9,728	\$9,287	\$9,156	\$9,257	\$9,356	\$9,454	\$9,551	\$9,646
Existing Condition Gross Toll Revenue: E-ZPass	40,710	42,242	43,714	45,130	46,493	47,807	49,073	50,290	51,462	52,589	53,407	53,994	54,573	55,145	55,710	56,267
Existing Condition Fee Revenue	189	191	193	196	198	201	203	206	208	210	213	215	217	220	222	224
Total Existing Condition Gross Toll+Fee Revenue	\$55,675	\$56,400	\$57,124	\$57,845	\$58,564	\$59,281	\$59,994	\$60,700	\$61,397	\$62,086	\$62,776	\$63,466	\$64,147	\$64,819	\$65,483	\$66,138
Gross Toll and Fee Revenue																
ORT Gross Toll Revenue: Cash	\$14,599	\$13,806	\$13,069	\$12,386	\$11,753	\$11,167	\$10,624	\$10,121	\$9,655	\$9,224	\$9,100	\$9,203	\$9,305	\$9,406	\$9,505	\$9,603
ORT Gross Toll Revenue: E-ZPass	40,948	42,479	43,950	45,366	46,728	48,041	49,306	50,523	51,694	52,821	53,638	54,225	54,804	55,376	55,940	56,497
ORT Collected Fee Revenue (30% of Maximum)	305	292	281	270	260	251	243	235	228	222	221	223	226	228	230	233
Total ORT Gross Toll+Discounted Fee Revenue	\$55,852	\$56,577	\$57,301	\$58,022	\$58,742	\$59,469	\$60,173	\$60,880	\$61,578	\$62,267	\$62,959	\$63,651	\$64,335	\$65,010	\$65,676	\$66,333
Total ORT Gross Toll Revenue Impact	\$177	\$177	\$177	\$177	\$178	\$178	\$179	\$179	\$180	\$181	\$183	\$186	\$188	\$191	\$193	\$195
Summary of Existing Condition M&O Costs																
Image Review	\$159	\$165	\$172	\$178	\$185	\$192	\$199	\$207	\$215	\$223	\$231	\$239	\$247	\$256	\$265	\$275
DMV Lookup	16	17	18	18	19	20	21	21	22	23	24	25	26	27	27	28
Mailing	59	62	64	66	69	72	74	77	80	83	86	89	92	95	99	102
Fare Collection/Administration	5,832	6,002	6,173	6,346	6,521	6,698	6,878	7,060	7,244	7,431	7,613	7,792	7,976	8,163	8,355	8,551
Total Annual Existing Condition M&O Costs	\$6,067	\$6,246	\$6,427	\$6,610	\$6,795	\$6,982	\$7,172	\$7,365	\$7,561	\$7,759	\$7,953	\$8,145	\$8,341	\$8,541	\$8,746	\$8,956
Summary of ORT M&O Costs																
Image Review	\$173	\$180	\$187	\$194	\$202	\$209	\$217	\$225	\$234	\$243	\$243	\$239	\$247	\$256	\$265	\$275
DMV Lookup	24	24	25	26	27	28	30	31	32	33	34	35	37	38	39	41
Mailing	85	88	91	95	99	102	106	110	114	118	123	127	132	136	141	146
Fare Collection/Administration	5,011	5,143	5,276	5,409	5,542	5,676	5,812	5,948	6,085	6,224	6,356	6,484	6,615	6,749	6,884	7,023
Total Annual ORT M&O Cost	\$5,292	\$5,436	\$5,579	\$5,724	\$5,870	\$6,017	\$6,165	\$6,314	\$6,465	\$6,618	\$6,743	\$6,886	\$7,031	\$7,179	\$7,330	\$7,484
ORT Cost Savings	\$775	\$810	\$847	\$886	\$925	\$966	\$1,008	\$1,051	\$1,096	\$1,142	\$1,210	\$1,259	\$1,310	\$1,362	\$1,416	\$1,472
Net Revenue Impacts (1)																
Total Net Existing Condition Toll+Fee Revenue	\$49,608	\$50,154	\$50,697	\$51,235	\$51,770	\$52,299	\$52,822	\$53,335	\$53,836	\$54,326	\$54,823	\$55,321	\$55,806	\$56,278	\$56,737	\$57,182
Total Net ORT Toll Revenue	50,560	51,142	51,721	52,298	52,872	53,442	54,008	54,565	55,112	55,649	56,215	56,765	57,304	57,830	58,346	58,849
Total Net ORT Toll Revenue Impact	\$952	\$987	\$1,024	\$1,063	\$1,103	\$1,144	\$1,186	\$1,230	\$1,276	\$1,323	\$1,393	\$1,444	\$1,498	\$1,553	\$1,609	\$1,667
Cumulative ORT Net Revenue Impact	\$952	\$1,939	\$2,964	\$4,027	\$5,129	\$6,273	\$7,459	\$8,689	\$9,965	\$11,288	\$12,681	\$14,126	\$15,623	\$17,176	\$18,785	\$20,452

(1) Net revenue is calculated by subtracting maintenance and operations costs from gross toll+fee revenue.

five-year cumulative ORT net revenue impact at the \$0.00 surcharge totals a \$5,129,000. The ten-year cumulative impact totals an estimated \$11,288,000.

A graphical summary of the estimated annual net toll revenue from 2015 through 2030 is shown for \$0.00 cash surcharge and for the existing condition in Figure 8.

Figure 8
Estimated York Toll Plaza ORT Annual Net Revenue Forecasts



Gardiner Toll Plaza

The following section presents estimated traffic and revenue for the Gardiner Toll Plaza under AET and ORT conditions. The results of surcharge sensitivity tests include the estimated annual net revenue forecasts associated with various surcharge levels. Estimated annual traffic and toll revenue impacts are presented assuming the optimal surcharge level.

Gardiner Toll Plaza AET

The results of the Gardiner AET surcharge sensitivity tests are presented in Table 7. These were also conducted at 2015 levels, the assumed opening year. Passenger-car unregistered video surcharge rates were tested at \$0.00, \$0.25, \$0.50, \$0.75 and \$1.00. These would be in addition to the existing \$1.00 cash toll. Registered video transaction surcharges were assessed at 50 percent of the unregistered video surcharge. Table 7 includes estimated toll transactions, no contact/uncollectable transactions, gross toll and fee revenue, M&O costs, and net revenue impacts associated with each of the video surcharge levels.

Estimated annual transactions are provided for the existing condition for both cash and E-ZPass (including violations). The number of uncollectible transactions due to AET is estimated to total

Table 7
Estimated 2015 Gardiner Toll Plaza AET Surcharge Sensitivity Summary (1)
All Values in Thousands

Toll Transactions	Unregistered Video Surcharge (2)				
	\$0.00	\$0.25	\$0.50	\$0.75	\$1.00
Existing Condition Toll Transactions: Cash	3,294	3,294	3,294	3,294	3,294
Existing Condition Toll Transactions: E-ZPass	5,152	5,152	5,152	5,152	5,152
Total Existing Condition Toll Transactions+Violations	8,446	8,446	8,446	8,446	8,446
AET Toll Transactions: Video	2,002	1,897	1,837	1,758	1,680
AET Toll Transactions: E-ZPass	5,249	5,354	5,389	5,424	5,460
Total AET Toll Transactions	7,251	7,251	7,226	7,182	7,140
AET Transaction Impacts	-1,195	-1,195	-1,220	-1,264	-1,306
No Contact/Uncollectable Transactions					
Toll and Technology Diversion	92	151	210	297	383
Unreadable Plates and DMV No Hits	117	110	106	101	95
Unsuccessful Collection	1,034	981	952	913	876
Total AET No Contact/Uncollectable	1,243	1,243	1,268	1,312	1,354
Existing Condition Violations	48	48	48	48	48
AET Transaction Loss Impact	1,195	1,195	1,220	1,264	1,306
Gross Toll and Fee Revenue					
Existing Condition Gross Toll Revenue: Cash	\$3,677	\$3,677	\$3,677	\$3,677	\$3,677
Existing Condition Gross Toll Revenue: E-ZPass	4,683	4,683	4,683	4,683	4,683
Existing Condition Fee Revenue	135	135	135	135	135
Total Existing Condition Gross Toll+Fee Revenue	\$8,495	\$8,495	\$8,495	\$8,495	\$8,495
AET Gross Toll Revenue: Video	\$2,311	\$2,764	\$3,232	\$3,655	\$4,034
AET Gross Toll Revenue: E-ZPass	4,733	4,792	4,812	4,832	4,852
AET Collected Fee Revenue (30% of Maximum)	1,381	1,308	1,265	1,208	1,151
Total AET Gross Toll+Discounted Fee Revenue	\$8,425	\$8,865	\$9,309	\$9,694	\$10,036
Total AET Gross Toll Revenue Impact	-\$69	\$370	\$814	\$1,199	\$1,542
Summary of Existing Condition M&O Costs					
Image Review	\$76	\$76	\$76	\$76	\$76
DMV Lookup	11	11	11	11	11
Mailing	41	41	41	41	41
Fare Collection/Administration	2,552	2,552	2,552	2,552	2,552
Total Annual Existing Condition M&O Costs	\$2,680	\$2,680	\$2,680	\$2,680	\$2,680
Summary of AET M&O Costs					
Image Review	\$522	\$496	\$480	\$460	\$439
DMV Lookup	481	453	436	413	390
Mailing	2,258	2,139	2,067	1,972	1,878
Fare Collection/Administration	866	868	870	870	869
Total Annual AET M&O Cost	\$4,127	\$3,956	\$3,853	\$3,714	\$3,577
AET Cost Savings	-\$1,447	-\$1,276	-\$1,173	-\$1,034	-\$897
Net Revenue Impacts (3)					
Total Net Existing Condition Toll+Fee Revenue	\$5,815	\$5,815	\$5,815	\$5,815	\$5,815
Total Net AET Toll Revenue	4,299	4,908	5,456	5,980	6,459
Total Net AET Toll Revenue Impact	-\$1,516	-\$907	-\$359	\$165	\$644
5-yr Cumulative AET Net Revenue Impact	-\$6,507	-\$3,607	-\$1,028	\$1,441	\$3,698
10-yr Cumulative AET Net Revenue Impact	-\$9,808	-\$4,405	\$329	\$4,863	\$8,998

(1) Per MTA, it is assumed that no billing information can be obtained for vehicles with Canadian license plates.

(2) These are the assumed passenger car video toll surcharge amounts that would be assessed to unregistered video transactions in addition to the \$1.00 cash toll. Registered video transaction surcharges were assessed at 50 percent of the unregistered video surcharge.

(3) Net revenue is calculated by subtracting maintenance and operations costs from gross toll+fee revenue.

1,195,000 in 2015 for the \$0.00 surcharge level. Uncollectible transactions increase as the unregistered video surcharge increases, totaling 1,306,000 at the \$1.00 surcharge in 2015.

The estimated AET gross toll revenue impact is negative \$69,000 at the \$0.00 surcharge and positive \$370,000 at the \$0.25 surcharge. At the \$1.00 surcharge, the estimated toll revenue impact of AET is a positive \$1,542,000. This toll revenue impact takes into account both the gross toll revenue and the discounted fee revenue. Similar to the York Toll Plaza analysis, it is assumed that only 30 percent of the eligible fee revenue is actually collected. This is because fee revenue is often discounted or entirely forgiven.

Maintenance and operation costs decrease under AET as the surcharge level increases. This is largely due to the decreasing numbers of video transactions. There are no AET M&O cost savings at any of the tested surcharge levels compared to the existing condition. The impacts on M&O range from a negative \$1,447,000 at \$0.00 surcharge to negative \$897,000 at the \$1.00 surcharge. The reason there are no positive AET M&O cost savings is twofold. First, the license plate lookup and mailing costs associated with invoicing, NOV, NOL, etc. are much larger compared to the existing \$1.00 cash toll at Gardiner. At York, these costs were expended in order to collect a \$3.00 cash toll. And second, there is a higher proportion of cash (and therefore video) transactions at Gardiner compared to York. This means that there are relatively higher costs associated with collecting a higher number of transactions at Gardiner compared to York.

The same general pattern between existing condition and the AET alternative M&O costs exists at Gardiner as it did at York. Under AET, the Fare Collection/Administration costs fall dramatically and only represent a fraction of those under the existing condition due to the elimination of manual toll collectors. However, as at York, back office costs associated with processing video transactions (Image Review, DMV Lookup, and Mailings) are significantly higher under AET.

The total net revenue impacts are negative in 2015 for the \$0.00, \$0.25, and \$0.50 surcharges. At the \$0.75 surcharge the net toll revenue impact becomes positive, totaling \$165,000. At the \$1.00 surcharge, the net toll revenue impact totals \$644,000. The five-year cumulative AET net revenue impact totals an estimated \$1,441,000 at the \$0.75 surcharge, while the ten-year cumulative impact is estimated to total \$4,863,000 at the same surcharge.

A graphical summary of the estimated annual net toll revenue from 2015 through 2030 at the various video surcharge levels and for the existing condition is shown in Figure 9. The net revenue forecasts at the \$0.75 and \$1.00 surcharges are always above the net toll revenue forecast for the existing condition.

Figure 10 shows the estimated ten-year cumulative toll revenue comparison assuming AET at Gardiner Toll Plaza for each tested video surcharge level. For each surcharge, the forecast cumulative gross toll revenue, gross toll revenue plus fee revenue, and net toll revenue plus the fee revenue are shown. The gross toll revenue plus fee revenue and the net toll revenue plus fee revenue for the existing condition are shown as horizontal lines. The estimated cumulative 10-year net toll revenue plus fee revenue meets or exceeds the existing condition net plus fee revenue at the \$0.50, \$0.75 and \$1.00 surcharge levels.

Figure 9
Estimated Gardiner Toll Plaza AET Annual Net Revenue Forecasts

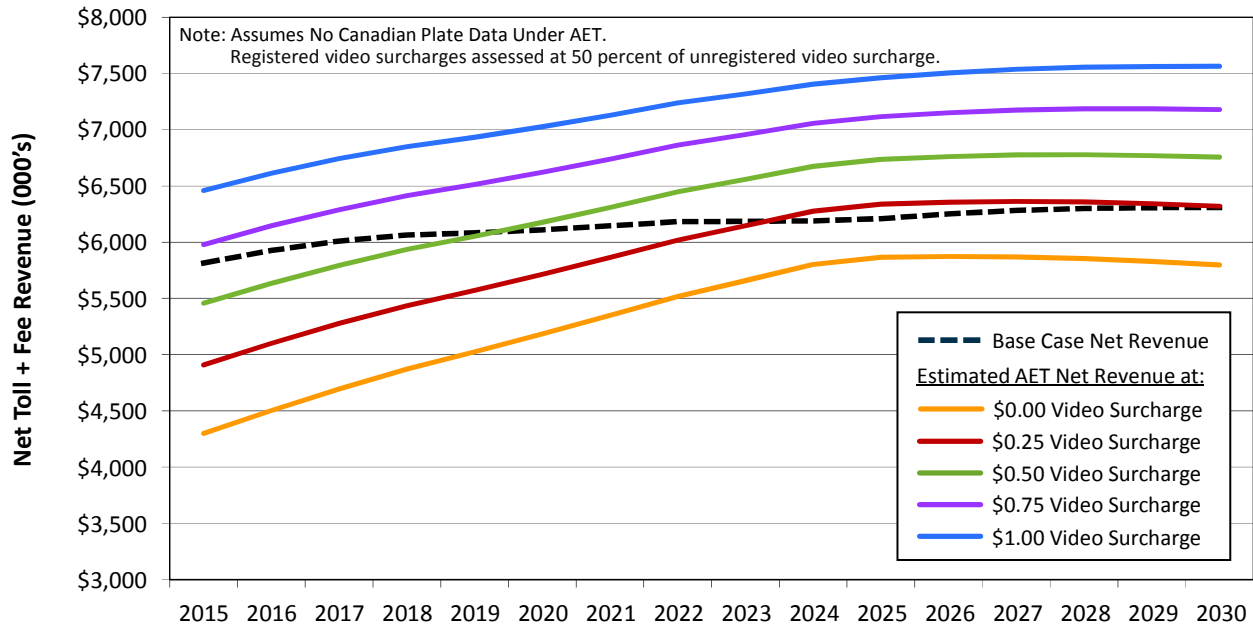
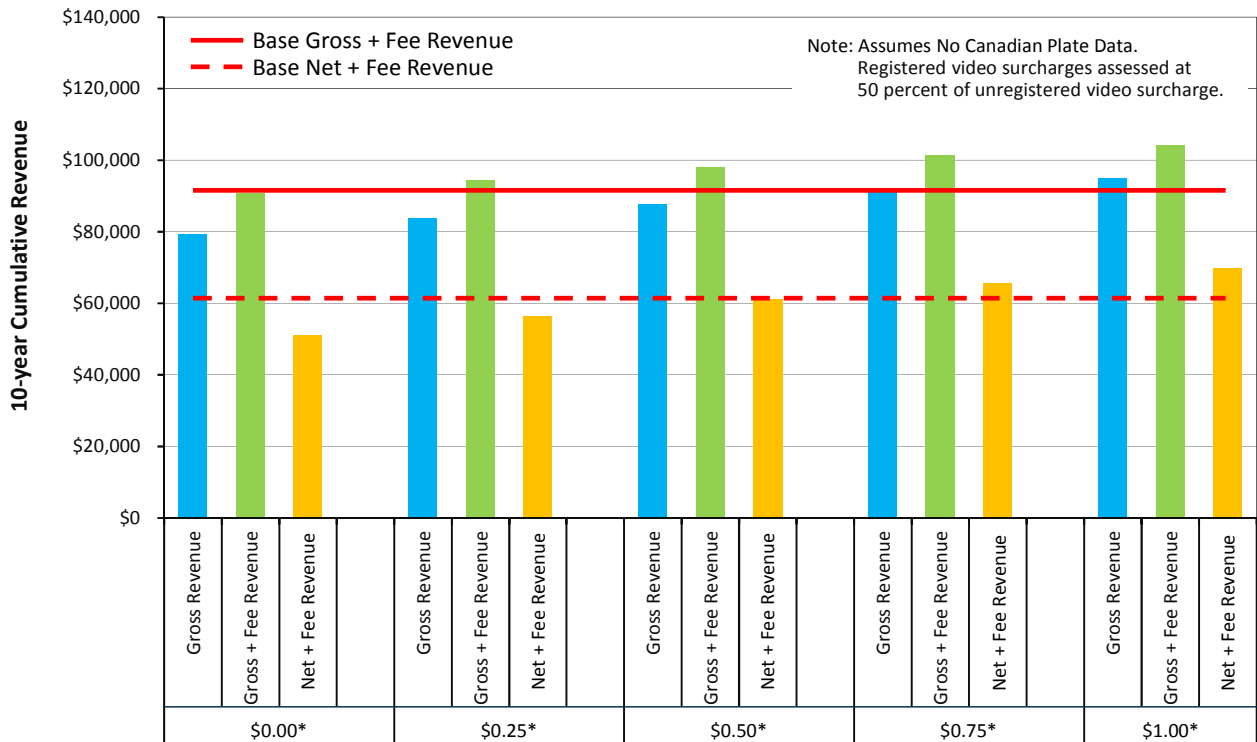


Figure 10
Estimated Gardiner Toll Plaza AET Ten Year Cumulative Revenue Comparison



* Video Surcharge

Detailed estimated traffic and toll revenue impacts are shown in Table 8 for the Gardiner Toll Plaza at a \$0.75 video surcharge from 2015 through 2030. This rate was selected for presentation here because it generates positive net toll revenue over both the five and ten year cumulative periods. This table shows the estimated trends over time in toll transactions, leakage (uncollectible transactions), gross toll and fee revenue, and M&O costs for both the existing condition and the AET condition. Also shown are the impacts between the existing and AET conditions for each year and cumulatively through the forecast period.

Leakage due to implementation of AET decreases from 2015 through 2025 primarily due to an increasing market share of E-ZPass vehicles, thus decreasing the number of video transactions. The leakage gradually increases from 2026 through 2030, caused by the saturation of the E-ZPass market and the normal growth of video transactions.

The AET gross toll revenue impact is positive throughout the forecast period. The size of the positive impact decreases slightly from 2015 through 2030, but ranges from positive \$1,199,000 in 2015 to positive \$741,000 in 2030.

Savings in M&O costs are estimated to be positive from about 2023 through 2030, ranging from \$24,000 to \$130,000, respectively. While it is anticipated that the existing condition M&O costs continually increase through the forecast period, the M&O costs for the AET scenario are forecast to decrease through 2024 due to the decreasing market share of video transactions. As discussed previously in relation to AET M&O costs at York, decreases in video toll transactions will result in fewer image reviews, DMV lookups and mailings. As a result, fewer staff will be required to perform these processes. Additionally, this will lead to proportionate decreases in direct costs related to out-of-state DMV lookups and mailings. Total AET M&O costs are forecast to start increasing around 2025 due to the saturation of the E-ZPass market. Again, when that saturation point is reached, the number of video transactions and related costs are estimated to increase at a nominal annual growth rate without any further shift to E-ZPass. AET is expected to have a net positive impact on total M&O costs compared to the existing condition throughout the forecast period.

The total impact on net toll revenue at the \$0.75 surcharge level is positive from 2015 (\$165,000) through 2030 (\$870,000). Cumulatively, the net toll revenue impact ranges from \$165,000 in 2015 to \$10,195,000 in 2030.

Gardiner Toll Plaza ORT

As was mentioned earlier, we understand that ORT cash surcharges are not in the current business rules for MTA operations. They were tested here, however, in order to see if they were needed, and if so, at what level to achieve toll revenue neutrality. Similar to York, \$0.00 surcharge had a substantial positive impact on net toll revenue, so the forecasts for the greater than \$0.00 surcharges were not included in this report.

Detailed traffic and toll revenue estimated impacts are shown in Table 9 for the Gardiner Toll Plaza at a \$0.00 cash surcharge from 2015 through 2030. This table shows the estimated trends over time in toll transactions, gross toll and fee revenue, and M&O costs for both the existing condition and the ORT condition.

Table 8
Estimated Total Gardiner Toll Plaza AET Traffic and Toll Revenue Impacts
Assuming a \$0.75 Video Surcharge (1)(2)
All Values in Thousands

	Year															
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Toll Transactions																
Existing Condition Toll Transactions: Cash	3,294	3,164	3,025	2,878	2,725	2,582	2,446	2,318	2,187	2,064	2,024	2,053	2,079	2,103	2,124	2,146
Existing Condition Toll Transactions: EZPass	5,152	5,552	5,932	6,287	6,611	6,934	7,256	7,577	7,858	8,135	8,314	8,430	8,538	8,636	8,724	8,812
Total Existing Condition Toll Transactions+Violat	8,446	8,717	8,957	9,165	9,336	9,515	9,702	9,895	10,044	10,199	10,338	10,483	10,617	10,739	10,849	10,957
AET Toll Transactions: Video	1,758	1,685	1,606	1,522	1,436	1,354	1,277	1,205	1,130	1,060	1,038	1,055	1,071	1,085	1,098	1,110
AET Toll Transactions: E-ZPass	5,424	5,824	6,204	6,558	6,881	7,204	7,525	7,846	8,126	8,403	8,582	8,698	8,805	8,903	8,992	9,079
Total AET Toll Transactions	7,182	7,509	7,810	8,080	8,317	8,558	8,802	9,050	9,256	9,464	9,620	9,753	9,876	9,988	10,089	10,189
AET Transaction Impacts	-1,264	-1,208	-1,148	-1,085	-1,019	-958	-899	-844	-788	-735	-718	-730	-741	-751	-759	-768
No Contact/Uncollectable Transactions																
Toll and Technology Diversion	297	285	272	258	243	229	216	204	191	179	176	178	181	183	186	188
Unreadable Plates and DMV No Hits	101	97	93	89	85	81	77	73	70	66	65	66	67	68	69	70
Unsuccessful Collection	913	875	835	792	747	704	665	627	588	552	541	550	558	565	572	578
Total AET No Contact/Uncollectable	1,312	1,258	1,200	1,138	1,074	1,014	958	904	849	798	782	794	806	817	826	836
Existing Condition Violations	48	50	52	54	55	57	58	60	61	63	64	64	65	66	67	67
AET Transaction Loss Impact	1,264	1,208	1,148	1,085	1,019	958	899	844	788	735	718	730	741	751	759	768
Gross Toll and Fee Revenue																
Existing Condition Gross Toll Revenue: Cash	\$3,677	\$3,564	\$3,441	\$3,308	\$3,169	\$3,038	\$2,915	\$2,800	\$2,680	\$2,568	\$2,537	\$2,573	\$2,606	\$2,636	\$2,663	\$2,689
Existing Condition Gross Toll Revenue: EZPass	4,683	5,001	5,302	5,580	5,831	6,083	6,336	6,588	6,807	7,024	7,168	7,268	7,361	7,445	7,522	7,597
Existing Condition Fee Revenue	135	139	142	144	146	148	150	152	154	155	157	159	161	163	165	167
Total Existing Condition Gross Toll+Fee Revenue	\$8,495	\$8,704	\$8,884	\$9,032	\$9,146	\$9,269	\$9,401	\$9,541	\$9,641	\$9,747	\$9,862	\$10,000	\$10,128	\$10,244	\$10,349	\$10,453
AET Gross Toll Revenue: Video	\$3,655	\$3,540	\$3,413	\$3,276	\$3,131	\$2,995	\$2,868	\$2,750	\$2,625	\$2,509	\$2,478	\$2,517	\$2,554	\$2,587	\$2,617	\$2,646
AET Gross Toll Revenue: E-ZPass	4,832	5,149	5,449	5,727	5,978	6,230	6,481	6,733	6,952	7,168	7,312	7,412	7,505	7,589	7,665	7,740
AET Collected Fee Revenue (30% of Maximum)	1,208	1,162	1,113	1,060	1,005	954	905	860	813	769	755	768	779	789	798	807
Total AET Gross Toll+Discounted Fee Revenue	\$9,694	\$9,851	\$9,975	\$10,063	\$10,114	\$10,178	\$10,255	\$10,343	\$10,389	\$10,445	\$10,545	\$10,697	\$10,837	\$10,965	\$11,080	\$11,193
Total AET Gross Toll Revenue Impact	\$1,199	\$1,147	\$1,091	\$1,031	\$969	\$910	\$854	\$802	\$749	\$698	\$683	\$697	\$709	\$720	\$731	\$741
Summary of Existing Condition M&O Costs																
Image Review	\$76	\$80	\$84	\$88	\$92	\$96	\$101	\$105	\$109	\$114	\$118	\$123	\$127	\$132	\$137	\$141
DMV Lookup	11	12	13	13	14	14	15	16	16	17	18	18	19	20	21	21
Mailing	41	43	45	48	50	52	54	57	59	61	64	66	69	71	74	76
Fare Collection/Administration	2,552	2,642	2,732	2,820	2,907	2,995	3,087	3,180	3,271	3,364	3,453	3,541	3,631	3,721	3,812	3,905
Total Annual Existing Condition M&O Costs	\$2,680	\$2,777	\$2,874	\$2,969	\$3,062	\$3,158	\$3,257	\$3,358	\$3,456	\$3,557	\$3,653	\$3,749	\$3,846	\$3,944	\$4,043	\$4,144
Summary of AET M&O Costs																
Image Review	\$460	\$453	\$445	\$435	\$422	\$411	\$400	\$389	\$377	\$365	\$368	\$383	\$398	\$414	\$429	\$445
DMV Lookup	413	409	402	394	384	375	366	358	349	340	343	357	371	385	400	414
Mailing	1,972	1,948	1,915	1,873	1,824	1,777	1,732	1,690	1,641	1,595	1,608	1,675	1,742	1,808	1,875	1,943
Fare Collection/Administration	870	888	924	949	971	995	1,019	1,044	1,066	1,089	1,110	1,131	1,152	1,172	1,192	1,212
Total Annual AET M&O Cost	\$3,714	\$3,707	\$3,686	\$3,650	\$3,602	\$3,558	\$3,517	\$3,481	\$3,432	\$3,388	\$3,429	\$3,546	\$3,663	\$3,779	\$3,896	\$4,015
AET Cost Savings	-\$1,034	-\$990	-\$812	-\$681	-\$540	-\$399	-\$261	-\$123	\$24	\$168	\$224	\$203	\$183	\$164	\$147	\$130
Net Revenue Impacts (3)																
Total Net Existing Condition Toll+Fee Revenue	\$5,815	\$5,927	\$6,010	\$6,063	\$6,083	\$6,111	\$6,144	\$6,183	\$6,185	\$6,190	\$6,209	\$6,251	\$6,282	\$6,300	\$6,306	\$6,308
Total Net AET Revenue	5,980	6,144	6,289	6,413	6,512	6,621	6,738	6,862	6,957	7,057	7,116	7,151	7,174	7,185	7,184	7,179
Total Net AET Toll Revenue Impact	\$165	\$218	\$279	\$350	\$429	\$510	\$594	\$679	\$772	\$867	\$907	\$899	\$882	\$878	\$870	\$870
Cumulative AET Net Revenue Impact	\$165	\$383	\$662	\$1,012	\$1,441	\$1,952	\$2,545	\$3,225	\$3,997	\$4,863	\$5,770	\$6,670	\$7,562	\$8,447	\$9,325	\$10,195

(1) Per MTA, it is assumed that no billing information can be obtained for vehicles with Canadian license plates.
 (2) These are the assumed passenger car video toll surcharge amounts that would be assessed to unregistered video transactions in addition to the \$3.00 cash toll.
 Registered video transaction surcharges were assessed at 50 percent of the unregistered video surcharge.
 (3) Net revenue is calculated by subtracting maintenance and operations costs from gross toll+fee revenue.

Table 9
Estimated Total Gardiner Toll Plaza ORT Traffic and Toll Revenue Impacts Assuming No Cash Surcharge
 All Values in Thousands

	Year															
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Toll Transactions																
Existing Condition Toll Transactions: Cash	3,294	3,164	3,025	2,878	2,725	2,582	2,446	2,318	2,187	2,064	2,024	2,053	2,079	2,103	2,124	2,146
Existing Condition Toll Transactions: E-ZPass	5,152	5,552	5,932	6,287	6,611	6,934	7,256	7,577	7,858	8,135	8,314	8,430	8,538	8,636	8,724	8,812
Total Existing Condition Toll Transactions	8,446	8,717	8,957	9,165	9,336	9,515	9,702	9,895	10,044	10,199	10,338	10,483	10,617	10,739	10,849	10,957
ORT Toll Transactions: Cash	3,250	3,123	2,986	2,842	2,692	2,550	2,417	2,291	2,162	2,041	2,003	2,032	2,059	2,083	2,105	2,127
ORT Toll Transactions: E-ZPass	5,241	5,643	6,024	6,380	6,704	7,028	7,351	7,673	7,955	8,233	8,412	8,529	8,637	8,735	8,824	8,911
Total ORT Toll Transactions	8,492	8,766	9,010	9,222	9,396	9,578	9,768	9,964	10,117	10,274	10,415	10,561	10,695	10,818	10,929	11,038
ORT Transaction Impacts	45	49	53	57	60	63	66	69	72	75	77	78	79	80	80	81
Gross Toll and Fee Revenue																
Existing Condition Gross Toll Revenue: Cash	\$3,677	\$3,564	\$3,441	\$3,308	\$3,169	\$3,038	\$2,915	\$2,800	\$2,680	\$2,568	\$2,537	\$2,573	\$2,606	\$2,636	\$2,663	\$2,689
Existing Condition Gross Toll Revenue: E-ZPass	4,683	5,001	5,302	5,580	5,831	6,083	6,336	6,588	6,807	7,024	7,168	7,268	7,361	7,445	7,522	7,597
Existing Condition Fee Revenue	135	139	142	144	146	148	150	152	154	155	157	159	161	163	165	167
Total Existing Condition Gross Toll+Fee Revenue	\$8,495	\$8,704	\$8,884	\$9,032	\$9,146	\$9,269	\$9,401	\$9,541	\$9,641	\$9,747	\$9,862	\$10,000	\$10,128	\$10,244	\$10,349	\$10,453
Gross Toll and Fee Revenue																
ORT Gross Toll Revenue: Cash	\$3,632	\$3,523	\$3,403	\$3,273	\$3,136	\$3,007	\$2,887	\$2,775	\$2,657	\$2,547	\$2,518	\$2,554	\$2,588	\$2,619	\$2,646	\$2,674
ORT Gross Toll Revenue: E-ZPass	4,746	5,066	5,367	5,647	5,900	6,153	6,406	6,660	6,879	7,097	7,242	7,343	7,436	7,521	7,597	7,673
ORT Collected Fee Revenue (30% of Maximum)	245	240	233	226	219	212	206	200	193	187	186	189	191	193	195	197
Total ORT Gross Toll+Discounted Fee Revenue	\$8,623	\$8,828	\$9,003	\$9,146	\$9,254	\$9,372	\$9,499	\$9,634	\$9,730	\$9,831	\$9,946	\$10,086	\$10,215	\$10,333	\$10,439	\$10,544
Total ORT Gross Toll Revenue Impact	\$128	\$124	\$119	\$114	\$108	\$103	\$98	\$94	\$89	\$85	\$84	\$85	\$87	\$88	\$90	\$91
Summary of Existing Condition M&O Costs																
Image Review	\$76	\$80	\$84	\$88	\$92	\$96	\$101	\$105	\$109	\$114	\$118	\$123	\$127	\$132	\$137	\$141
DMV Lookup	11	12	13	13	14	14	15	16	16	17	18	18	19	20	21	21
Mailing	41	43	45	48	50	52	54	57	59	61	64	66	69	71	74	76
Fare Collection/Administration	2,552	2,642	2,732	2,820	2,907	2,995	3,087	3,180	3,271	3,364	3,453	3,541	3,631	3,721	3,812	3,905
Total Annual Existing Condition M&O Costs	\$2,680	\$2,777	\$2,874	\$2,969	\$3,062	\$3,158	\$3,257	\$3,358	\$3,456	\$3,557	\$3,653	\$3,749	\$3,846	\$3,944	\$4,043	\$4,144
Summary of ORT M&O Costs																
Image Review	\$84	\$89	\$94	\$98	\$103	\$107	\$112	\$118	\$122	\$128	\$132	\$138	\$142	\$147	\$152	\$157
DMV Lookup	16	17	18	19	20	21	22	23	24	24	25	26	27	28	29	30
Mailing	58	62	65	68	71	74	78	81	84	88	91	95	98	102	106	109
Fare Collection/Administration	2,342	2,408	2,474	2,538	2,602	2,667	2,733	2,802	2,868	2,936	3,004	3,071	3,140	3,209	3,279	3,350
Total Annual ORT M&O Cost	\$2,501	\$2,576	\$2,651	\$2,724	\$2,796	\$2,869	\$2,945	\$3,023	\$3,099	\$3,176	\$3,258	\$3,315	\$3,393	\$3,471	\$3,550	\$3,631
ORT Cost Savings	\$179	\$201	\$223	\$245	\$267	\$289	\$312	\$335	\$357	\$380	\$415	\$434	\$453	\$473	\$493	\$513
Net Revenue Impacts (1)																
Total Net Existing Condition Toll+Fee Revenue	\$5,815	\$5,927	\$6,010	\$6,063	\$6,083	\$6,111	\$6,144	\$6,183	\$6,185	\$6,190	\$6,209	\$6,251	\$6,282	\$6,300	\$6,306	\$6,308
Total Net ORT Toll Revenue	6,122	6,252	6,353	6,422	6,459	6,503	6,554	6,612	6,631	6,655	6,707	6,771	6,822	6,862	6,889	6,913
Total Net ORT Toll Revenue Impact	\$307	\$325	\$343	\$359	\$375	\$392	\$410	\$429	\$446	\$465	\$498	\$519	\$540	\$561	\$583	\$604
Cumulative ORT Net Revenue Impact	\$307	\$633	\$975	\$1,335	\$1,710	\$2,102	\$2,512	\$2,941	\$3,387	\$3,852	\$4,350	\$4,869	\$5,410	\$5,971	\$6,553	\$7,158

(1) Net revenue is calculated by subtracting maintenance and operations costs from gross toll+fee revenue.

Under ORT, total toll transactions are expected to increase compared to the existing condition at the \$0.00 surcharge level. In 2015, an increase of 45,000 toll transactions is anticipated compared to the existing condition. The increase is due to the assumption that video enforcement of cash toll violations (run-throughs) will be introduced to the cash lanes upon construction of an ORT plaza. Since ORT maintains a cash payment option for MTA customers, the model does not assume any technology diversion.

ORT gross toll and fee revenue is estimated to be \$128,000 higher than the existing condition in 2015. Estimated future year gross plus fee revenue impacts remain positive throughout the forecasts period. By 2030 the ORT impact is estimated to be about \$91,000 greater than the existing condition. Variations in the impact occur due to the varying mix of cash and E-ZPass transactions and due to the particular mix of in-state versus out-of-state cash users over time.

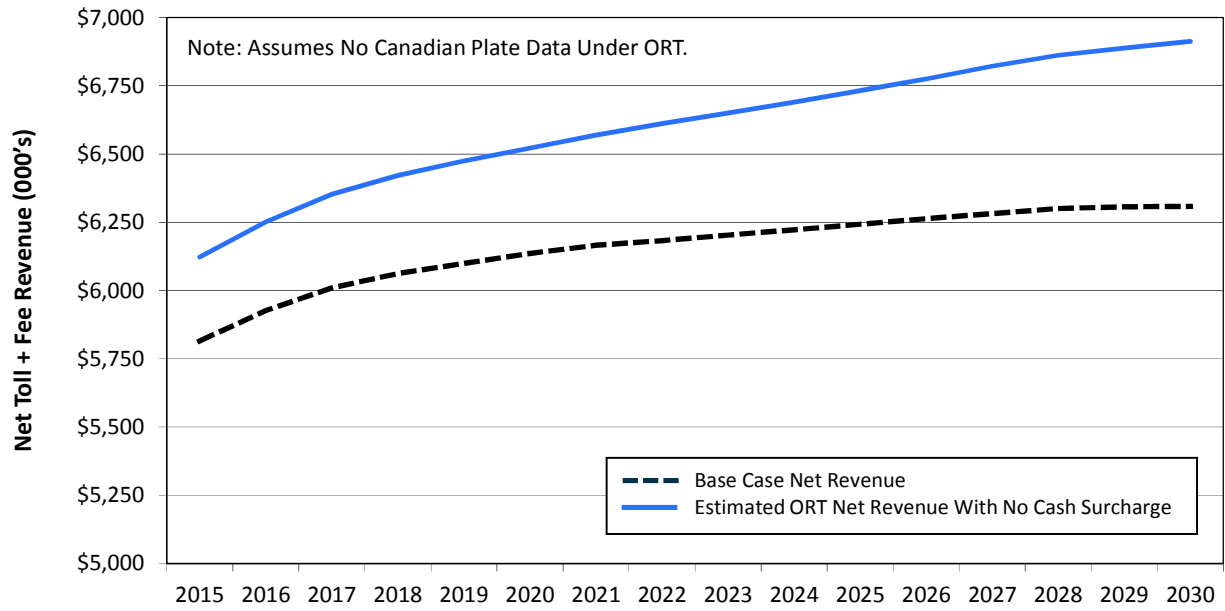
Gardiner Toll Plaza 2015 ORT M&O costs are estimated to be \$179,000 lower than those projected under the existing condition; reflecting about a 6.7 percent decrease. By 2030 ORT M&O cost savings are estimated to increase to \$513,000. As a percent of total annual existing condition M&O costs, this represents a savings of 12.4%. As described previously, this savings is due primarily to the replacement of legacy system toll equipment that is costly to maintain, with some parts requiring frequent replacement.

Just as was shown at York, under the AET alternative, existing condition and ORT costs are relatively similar across all cost categories. The differences that do occur are in the Fare Collection/Administration category. As mentioned above, ORT costs are slightly lower due to the replacement of the legacy toll equipment. All other cost categories are very similar between the existing condition and the ORT alternative.

Also shown are the impacts between the existing and ORT conditions for each year and cumulatively through the forecast period. As shown, the total estimated net revenue impact increases from \$307,000 in 2015 and increases to \$604,000 by 2030. The cumulative net revenue impact over that period amounts to \$7,158,000.

A graphical summary of the estimated annual net toll revenue from 2015 through 2030 is shown for the \$0.00 cash surcharge and for the existing condition in Figure 11. Due to the degree to which the \$0.00 surcharge scenario had a positive net revenue impact, net revenue forecast for surcharges greater than \$0.00 were not included in this figure.

Figure 11
Estimated Gardiner Toll Plaza ORT Annual Net Revenue Forecasts



Risk Analysis

Methodology

The risk analysis was performed in order to test the sensitivity of the AET and ORT waterfall models by applying a Monte Carlo Simulation directly to the model. This process involved generating random variables in order to test a large number of combinations of possible variable values, ultimately generating a distribution of possible revenue generation in the model. The process itself consisted of four major steps:

- Variable and range selection;
- Distribution fitting;
- Random variable generation; and
- Multivariate risk simulation within the waterfall model.

Variable and Range Selection

Tables 10 through 12 list variables that were selected for sensitivity testing within the risk analysis framework. Variables were selected based on their significance in affecting the outcome of the model results as well as the relative unpredictability of the variable in future years. Each selected variable was given a range based on reasonable upper and lower extreme values that were reasonable in practical application.

Distribution Fitting

Figure 12 provides a sample of a variable with a fitted distribution. Once models and ranges were selected, distributions were fitted to each variable, applying a symmetrical bell curve to the assumed data range. Variables were fit so that roughly 95 percent of the data would be between the upper and lower bounds, and that the base model input would be the 50th percentile value for the distribution.

Random Variable Generation

Random variable generation was performed using the random generation procedures within the R Statistical Software package, and supplemented with the random generation feature within Excel, where applicable. Three thousand randomly generated values were obtained for each of the variables in order to ensure adequate sampling of every distribution. Figure 13 shows examples of these randomly-generated variables plotted against their underlying distributions.

Table 10
York AET Risk Analysis Variable Ranges

Variable	Low	Expected	High
%Tech Diversion	0%	3%	10%
%In State ID'd in Initial Process	77%	96%	100%
%in state ID'd in second manual process	80%	85%	90%
%Fees Waived	48%	70%	88%
% IN-State Shift to E-ZPass from Cash, \$2 Surcharge	4%	11%	20%
% IN-State Shift to E-ZPass from Cash, \$2.50 Surcharge	5%	13%	23%
% IN-State Shift to E-ZPass from Cash, \$3 Surcharge	6%	15%	26%
% IN-State Shift to E-ZPass from Cash, \$3.50 Surcharge	8%	17%	30%
% IN-State Shift to E-ZPass from Cash, \$4 Surcharge	9%	19%	31%
% IN-State Shift to E-ZPass from Cash, \$4.50 Surcharge	11%	21%	33%
% IN-State Shift to E-ZPass from Cash, \$2 Surcharge	69%	80%	89%
RVA %Paid 1st invoice	64%	75%	84%
RVA %Paid NOL	30%	50%	70%
Maine UVA %Paid 1st invoice	19%	55%	75%
Maine UVA %Paid NOV	19%	55%	75%
Maine UVA %paid NOL	10%	35%	45%
Massachusetts/New Hampshire UVA %paid 1st Invoice	20%	50%	60%
Massachusetts/New Hampshire UVA %Paid NOV	15%	40%	51%
Massachusetts/New Hampshire UVA %paid NOL	10%	20%	25%
Other UVA %paid 1st Invoice	10%	25%	41%
Other UVA %Paid NOV	5%	20%	31%
Other UVA %paid NOL	4%	9%	17%
Toll Diversion Multiplier	0.5	1	1.5
Additional PC Shift Rate (E-ZPass to Cash)	0.95	1	1.05
Additional CV Shift Rate (E-ZPass to Cash)	0.95	1	1.05

Table 11
Gardiner AET Risk Analysis Variable Ranges

Variable	Low	Expected	High
%Tech Diversion	1%	3%	5%
%In State ID'd in Initial Process	77%	96%	100%
%in state ID'd in second manual process	80%	85%	90%
%Fees Waived	48%	70%	88%
% IN-State Shift to E-ZPass from Cash, \$0 Surcharge	2%	6%	12%
% IN-State Shift to E-ZPass from Cash, \$0.25 Surcharge	2%	7%	14%
% IN-State Shift to E-ZPass from Cash, \$0.5 Surcharge	3%	8%	16%
% IN-State Shift to E-ZPass from Cash, \$0.75 Surcharge	3%	9%	17%
RVA %paid 1st reminder	69%	80%	89%
RVA %paid NOV	64%	75%	84%
RVA %Paid NOL	30%	50%	70%
Maine UVA %Paid 1st invoice	19%	55%	75%
Maine UVA %Paid NOV	19%	55%	75%
Maine UVA %paid NOL	10%	35%	45%
Massachusetts/New Hampshire UVA %paid 1st Invoice	20%	50%	60%
Massachusetts/New Hampshire UVA %Paid NOV	15%	40%	51%
Massachusetts/New Hampshire UVA %paid NOL	10%	20%	25%
Other UVA %paid 1st Invoice	10%	25%	41%
Other UVA %Paid NOV	5%	20%	31%
Other UVA %paid NOL	4%	9%	17%
Toll Diversion Multiplier	0.5	1	1.5
Additional PC Shift Rate (E-ZPass to Cash)	0.96	1	1.04
Additional CV Shift Rate (E-ZPass to Cash)	0.96	1	1.04

Table 12
York & Gardiner ORT Risk Analysis Variable Ranges

Variable	Low	Expected	High
% In-State Shift to E-ZPass from Cash	1%	2%	5%
%Fees Waived	48%	70%	88%
%In-state Violators	1%	2%	5%
%Out of State Violators	1%	3%	5%
%Canadian Violators	2%	4%	7%
% In-state ID'd in initial process	77%	96%	100%
% In-state ID'd in second manual process	80%	85%	90%
%Pay 1st notice In-state	21%	40%	61%
%pay 1st notice out of state	11%	20%	31%
%pay NOV in-state	21%	40%	61%
%pay NOV out of state	11%	20%	31%
%pay NOL in-state	30%	50%	70%
%pay NOL out of state	6%	15%	26%
Toll Diversion Multiplier	0.5	1	1.5
Additional PC Shift Rate (E-ZPass to Cash)	0.95	1	1.05
Additional CV Shift Rate (E-ZPass to Cash)	0.95	1	1.05

Figure 12
Sample Variable Range with Fitted Distribution

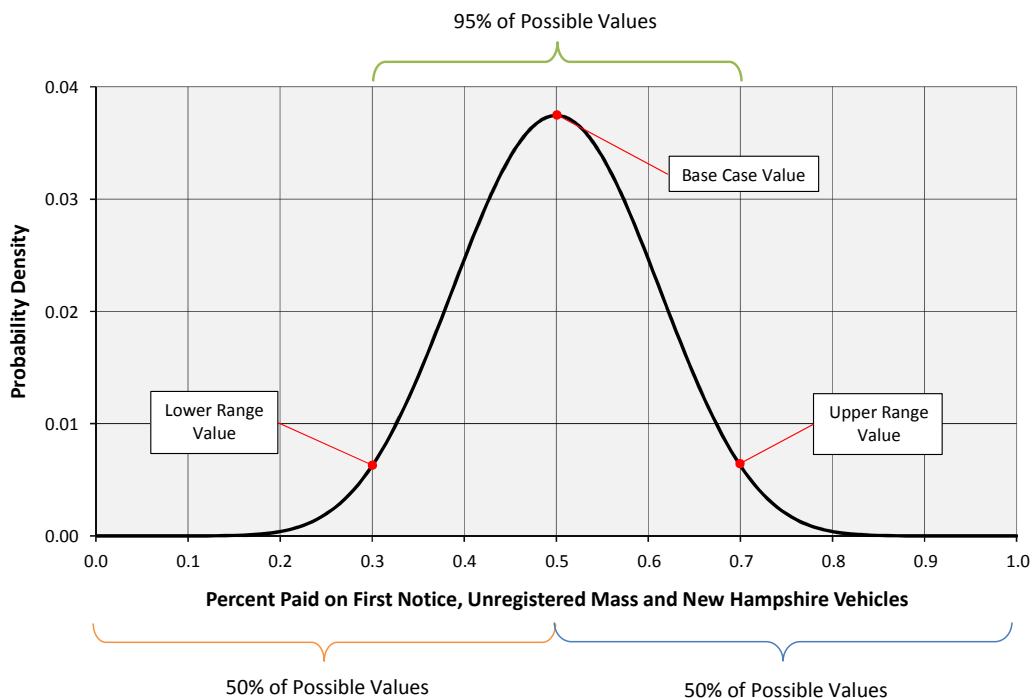
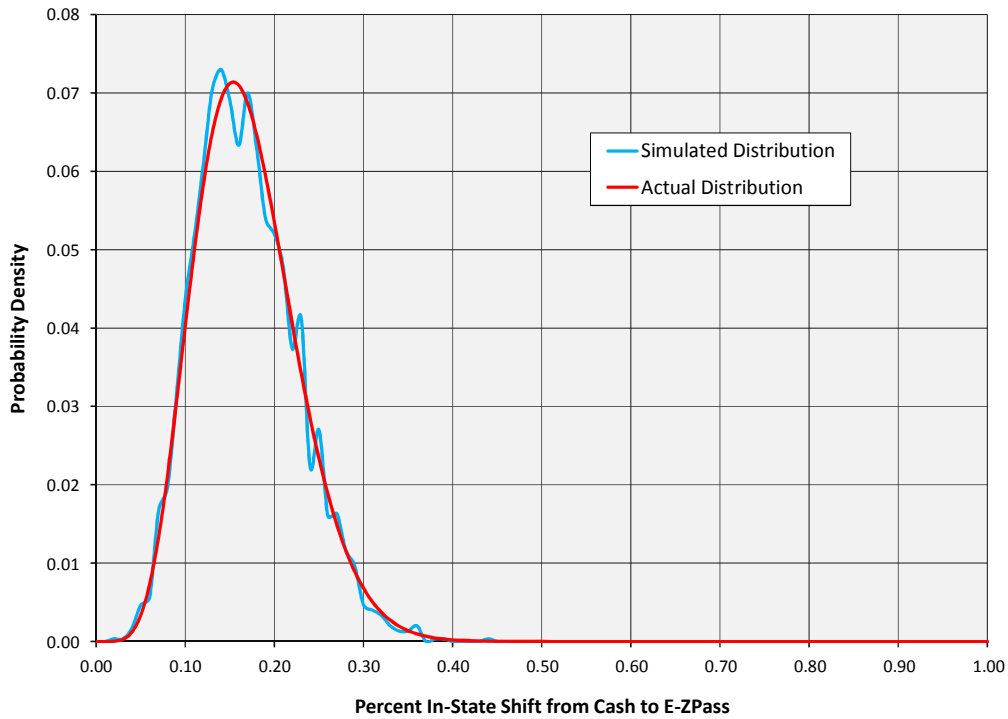


Figure 13
Sample Distribution with Randomly Generated Data



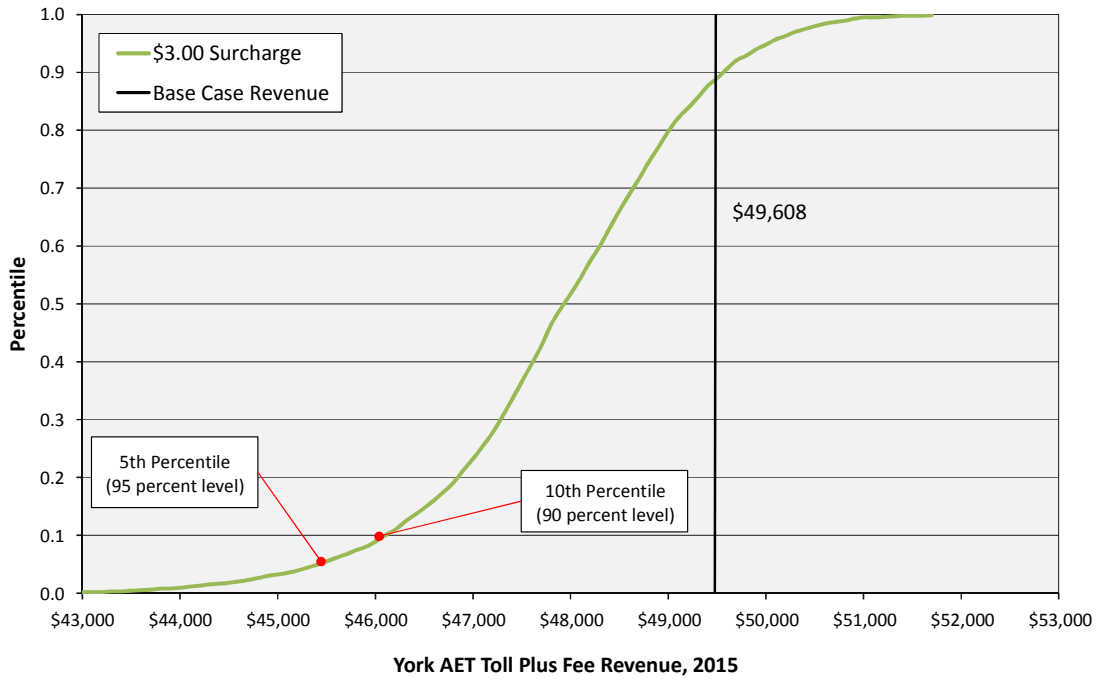
Multivariate Risk Simulation

The Monte Carlo simulation itself was performed by using each of the 3,000 randomly generated sets of variables as model inputs. Typically, simulation will employ a general process or mathematically-derived relationship between input and output variables. In this case, the model itself was used due to relatively low run times. From the distribution of the output values, we can determine an expected range of revenue generation, an example of which is shown in Figure 14. The values for the 10th and 5th percentiles of the data were selected as benchmark values for risk sensitivity. At the 10th percentile, for example, 300 of the 3,000 output values are less than this value, with 2,700 output values generating a greater level of revenue, translating into a 90 percent level of confidence that actual revenue values will meet or exceed this amount.

Risk Analysis Output

Risk models were run for the AET and ORT models for both the York and Gardiner plazas. Optimal surcharge levels were selected for each scenario and results were tabulated for the net toll plus fee revenue for future years between 2015 and 2030.

Figure 14
Sample Monte Carlo Output Distribution



Figures 15 through 18 show yearly net plus fee revenue for the York and Gardiner AET and ORT models for the selected surcharge level, expected model output, and the 90 and 95 percent confidence levels from the risk analysis. In general, the AET risk analysis shows a much greater variation between expected value and lower risk bound than its ORT counterpart. This would be the expected outcome, given the higher level of certainty associated with ORT (given its similarities with current operations) compared to AET.

Figure 15
Estimated York Toll Plaza AET Risk Analysis Annual Net Revenue Forecasts

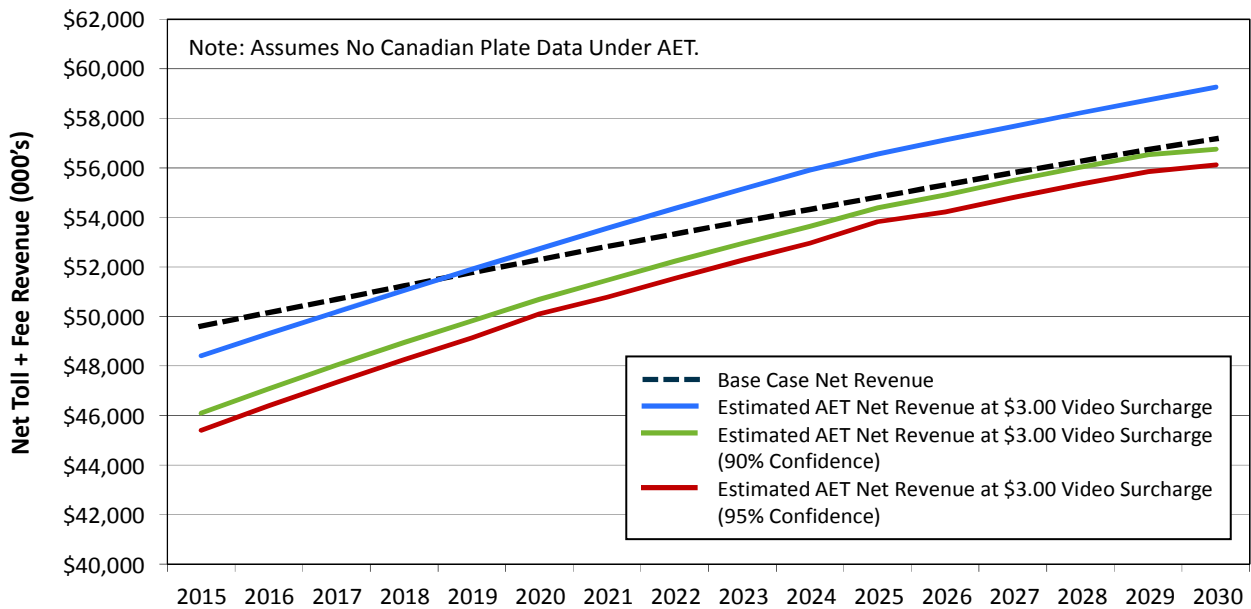


Figure 16
Estimated York Toll Plaza ORT Risk Analysis
Annual Net Revenue Forecasts

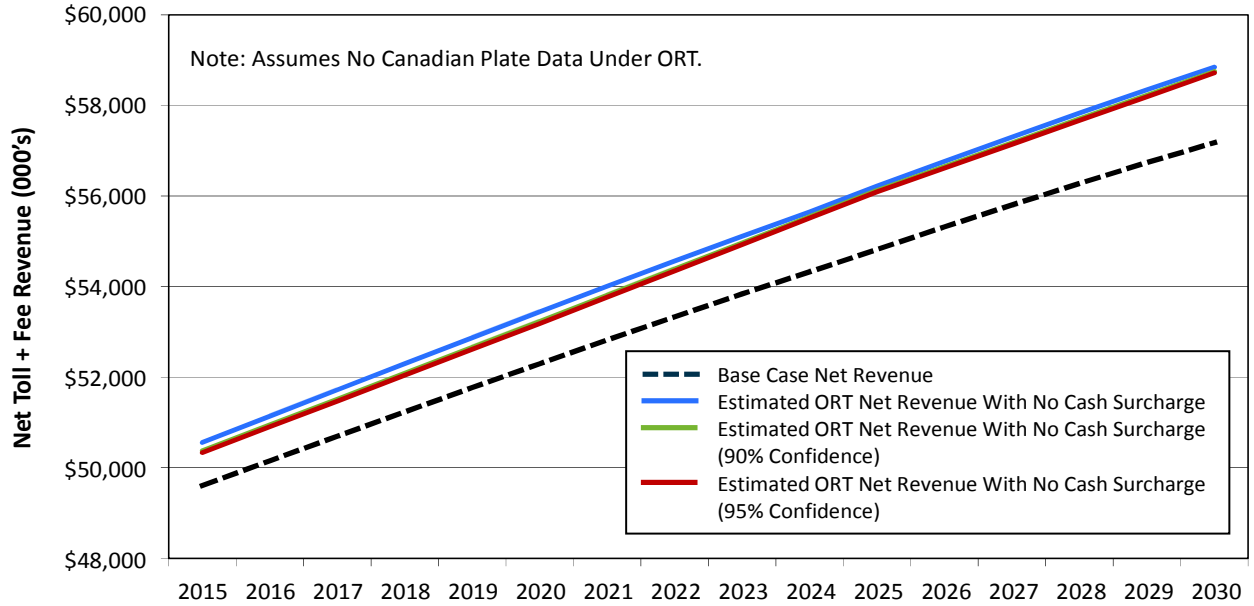


Figure 17
Estimated Gardiner Toll Plaza AET Risk Analysis
Annual Net Revenue Forecasts

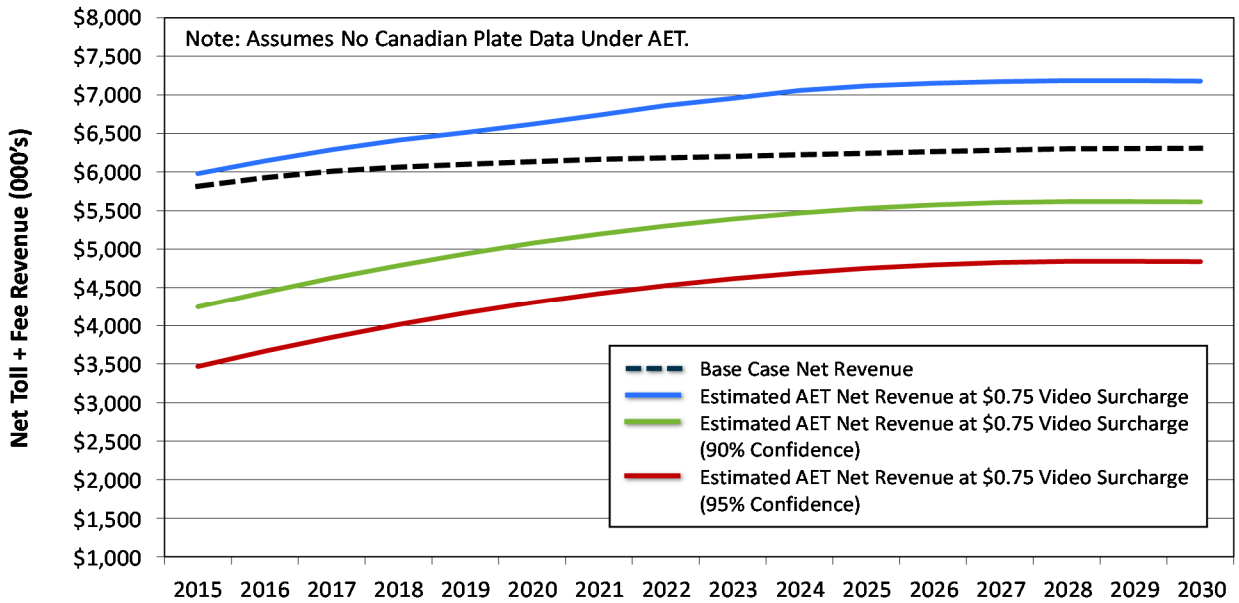
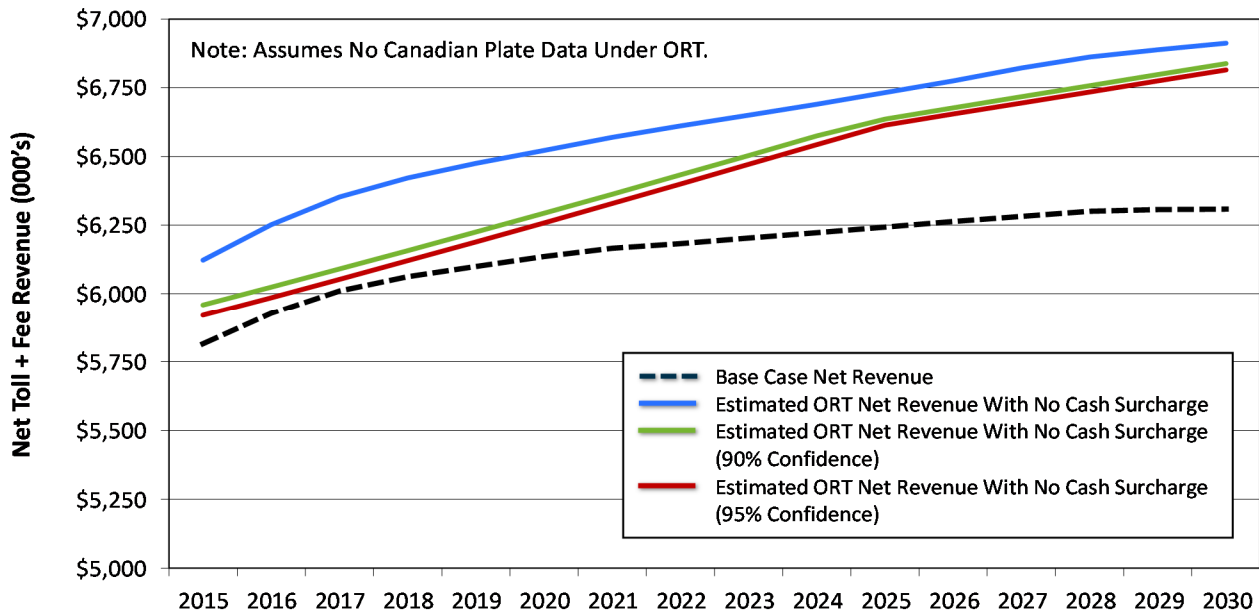


Figure 18
Estimated Gardiner Toll Plaza ORT Risk Analysis
Annual Net Revenue Forecasts



York Plaza

The York AET model (Figure 15) shows approximately a 5 percent drop in revenue between the expected scenario and the 90 percent confidence level, with approximately a 6 percent drop between the expected and the 95 percent level at 2015. The percent differences between expected and risk-generated revenue decrease slightly in the outer model years, to about 4 percent and 5 percent for the 90 and 95 percent levels, respectively. While the expected revenue generated for this model exceeds the annual revenue of the base case after 2019, the 90 and 95 percent confidence levels for revenue generation do not exceed the base case for any model year.

The risk results for the York ORT model (Figure 16) show very minimal difference between the expected revenue and the 90 and 95 percent confidence levels. Annual revenue for both expected revenue and 90 and 95 percent levels exceed base case revenue for all model years.

Gardiner Plaza

Gardiner AET (Figure 17) shows a significant difference between the expected values and the 90 and 95 percent confidence levels, with a 29 percent decrease between the expected value and 90 percent level for 2015 and a 42 percent decrease between the expected revenue and the 95 percent level. The expected annual revenue for Gardiner AET remains above the base case revenue for every year. The bigger divergence between expected and the 90 and 95 percent confidence level at Gardiner is attributable to the higher video market share at Gardiner (compared to York) and the bigger impact of relatively high collection costs at Gardiner (i.e., the cost of collecting a \$1.00 toll at Gardiner versus the cost of collecting a \$3.00 toll at York).

The ORT results for Gardiner (Figure 18) show relatively modest reductions between the expected revenue and the 90 and 95 percent levels, with a reduction between 4 and 1 percent for the 90

percent level and a reduction between 5 and 1 percent for the 95 percent level. In this case, both the 90 and 95 percent confidence levels for annual net toll plus fee revenue are higher than annual base case revenue throughout the entire forecast period.

Sensitivity Tests

The risk analysis described above was intended to demonstrate the range of outcomes in net revenue under a change in a variety of assumptions over which MTA may have little control. The potential impacts with respect to three other discrete conditions were also tested, in the forms of sensitivity tests, outside the risk analysis above. To an extent, MTA might be able to influence these uncertainty factors, either through strategic marketing initiatives or decisions regarding the enforcement of fee collection. Three issues were subjected to sensitivity testing:

- The proportion of “pre-registered” video transactions;
- The potential availability of Canadian plate data; and
- Fee revenue realization rate.

Pre-Registered Video Transactions

Many agencies now shifting to AET offer the option of one-time vehicle plate registration. This can be incentivized by allowing for significant reductions in the video surcharge and by providing convenient mechanisms for plate pre-registration, such as kiosks in former cash collection lanes and service areas, on line or telephone registration systems, etc. The concept of pre-registration typically involves the motorist registering their own license plate, without even the need to provide any vehicle ownership or other identification information. Pre-paid accounts can then be established for that particular license plate, regardless of state or province of registration. Lists are maintained of pre-registered plates and tolls due when that particular plate is encountered are simply deducted from the pre-paid account.

The pre-registration of accounts has very significant positive benefits for agencies operating AET facilities. There is no need to look up vehicle owner information, no need to send a bill, and no collection risks associated with post payment. In essence, for each vehicle with a pre-registered license plate, the video transaction functions essentially the same as an E-ZPass transaction, except that the vehicle is identified by video imaging of the plate rather than reading an electronic toll transponder.

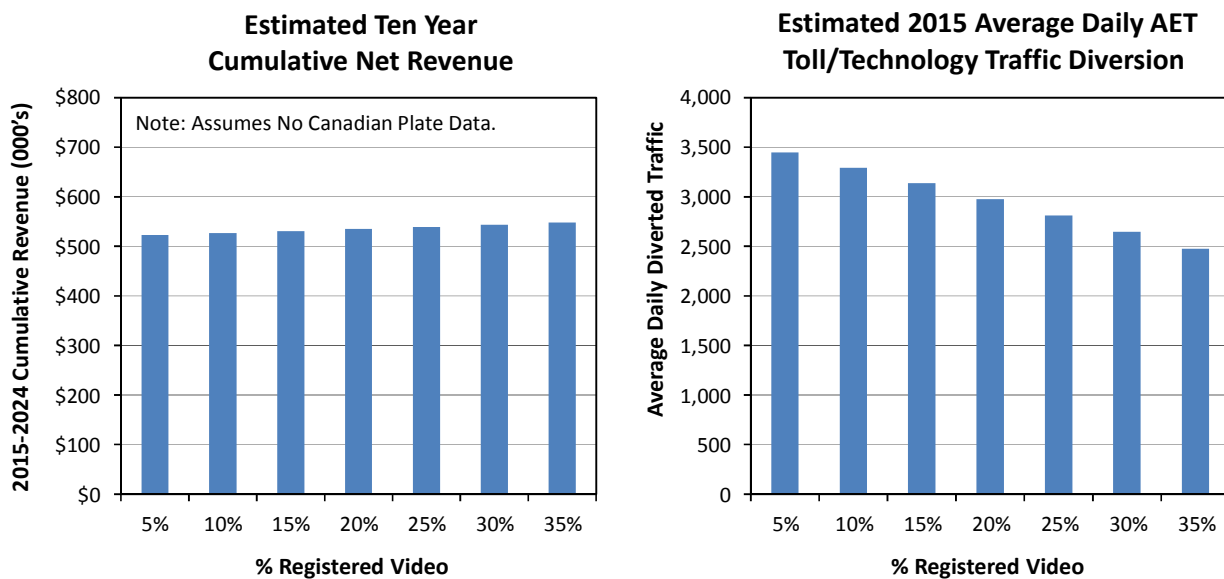
In the base analysis, CDM Smith assumed that the surcharge applied to pre-registered plates would be 50 percent of that applied to unregistered plates. The base analysis assumed just 5 percent of video transactions would be made by vehicles with pre-registered plates, based on actual experience in other toll facilities.

This sensitivity analysis tested the potential net revenue implications of a progressively higher share of video users choosing to pre-register their plates. As shown in Figure 19, 10-year net revenue at the York Plaza would actually increase slightly as the proportion of pre-registered video users increased, notwithstanding the lower toll surcharge being applied as compared to unregistered vehicles. As shown in the right half of Figure 19, since the surcharge applied to those pre-registered video users was half as high, the lower the traffic diversion to the alternative route, primarily US 1. Specifically, in the base forecast, with a \$3.00 unregistered surcharge and assuming a \$1.50 surcharge for registered vehicles, if only 5 percent of non-E-ZPass traffic pre-registered their plates, approximately 3,500 vehicles per day would shift to US 1. If 25 percent of non-ETC traffic pre-registered their plates, the diversions would be lowered to an estimated 2,800 and less than 2,500 if about one-third of all non-ETC traffic registered their plates.

Similar results are shown for the Gardiner Toll Plaza in Figure 20. Net revenue would be higher, and traffic diversions off the Turnpike would be lower, the higher the percentage of pre-registered plates.

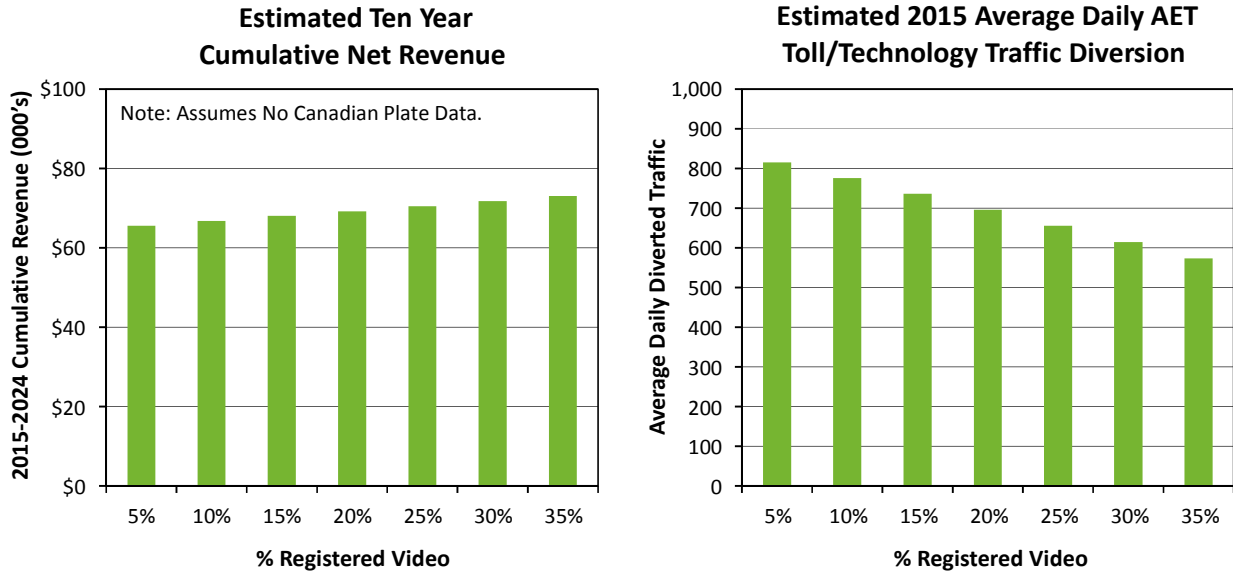
This is an important finding of the study, and suggests that if AET was ultimately implemented across the Maine Turnpike, maximum incentive should be provided for motorists to pre-register plates. This might include providing automated kiosks in some of the former cash collection lanes, and at Turnpike service areas, where motorists can simply register their plate, one time, and qualify for the lower surcharge rate as long as a balance is maintained in the account. Since many agencies across the U.S. are faced with the same situation, it is not unlikely that third party national plate registry providers may emerge in the future to operate pre-registration kiosks and maintain pre-paid balances which may be usable at AET toll facilities nationwide.

Figure 19
Registered Video Account Participation Sensitivity
York Toll Plaza



Note: Assumes unregistered video surcharge is \$3.00 and registered video surcharge is \$1.50.

Figure 20
Registered Video Account Participation Sensitivity
Gardiner Toll Plaza



Canadian Vehicle Owner Data Availability

As previously discussed, there is considerable uncertainty as to the ability to obtain vehicle owner information for Canadian registered vehicles. Just before the conclusion of our study, CDM Smith was advised that data may become available in the near future for some provinces. As such, we tested the potential implications of Canadian plate data becoming available.

Table 13 shows the relatively small impact that Canadian plate data would have on net revenues over the 10-year analysis period, at the range of video surcharges tested. In general, the net revenue impact of recovering all Canadian plates would be less than 1 percent, at the levels of surcharge being considered in this study.

The ability to obtain Canadian registrations is a significant policy consideration, but not one which would have very heavy impacts on net revenue. This is largely due to the fact that Canadian traffic generally represents 4 to 7 percent of cash vehicles, and cash traffic itself accounts for a minority of revenue collected. Further, the collection of revenue from video customers from “other states” has a relatively low yield, since high levels of repeat billings are assumed and a much higher level of collection risk is included in the analysis.

Table 13
Estimated 10-Year Net Revenue Impacts of Canadian Plate Data Availability

York Toll Plaza					
Scenario	Unregistered Video Surcharge				
	\$1.00	\$1.50	\$2.00	\$2.50	\$3.00
No Canadian Data Available	\$511,987	\$519,954	\$525,960	\$529,848	\$531,461
Canadian Plate Data Available	514,241	522,556	528,887	533,077	534,969
Percent Revenue Change	0.4%	0.5%	0.6%	0.6%	0.7%
Gardiner Toll Plaza					
Scenario	Unregistered Video Surcharge				
	\$0.25	\$0.50	\$0.75	\$1.00	\$1.25
No Canadian Data Available	\$57,125	\$61,834	\$66,318	\$70,390	\$73,936
Canadian Plate Data Available	57,064	61,999	66,702	70,987	74,728
Percent Revenue Change	-0.1%	0.3%	0.6%	0.8%	1.1%
Note: all revenue values in 000s					

Fee Revenue Realization Rate

As previously discussed, for the purposes of this study only 30 percent of potential fee revenue was assumed to be collected. The actual percent of fee revenue realized by MTA under AET toll operations could vary significantly from this assumption. Table 14 presents estimated AET fee revenue at the York toll plaza for fee collection rates ranging from 10 percent to 100 percent for years 2015 and 2020. Estimates are also shown as a percent of annual net AET toll + fee revenue. At the assumed fee collection rate of 30 percent, fee revenue constitutes 2.8 percent of estimated annual net AET toll + fee revenue in 2015. Since fee revenue stems primarily from unpaid video toll invoices, projected increases in E-ZPass participation rates result in that share decreasing to 1.9 percent by 2020.

Table 15 presents estimated AET fee revenue at the Gardiner toll plaza for fee collection rates ranging from 10 percent to 100 percent for years 2015 and 2020. At the assumed fee collection rate of 30 percent, fee revenue constitutes 21.2 percent of estimated annual net AET toll + fee revenue in 2015. Projected increases in E-ZPass participation rates result in that share decreasing to 14.4 percent by 2020.

Table 14
Estimated Annual AET Fee Revenue by Collection Rate

Fee Collection Rate	2015		2020	
	Estimated Fee Revenue	Fees as a Percent of Net AET Toll + Fee Revenue	Estimated Fee Revenue	Fees as a Percent of Net AET Toll + Fee Revenue
10%	\$460	1.0%	\$330	0.6%
20%	\$920	1.9%	\$660	1.3%
30%	\$1,380	2.8%	\$990	1.9%
40%	\$1,840	3.7%	\$1,320	2.5%
50%	\$2,300	4.6%	\$1,650	3.1%
75%	\$3,450	6.8%	\$2,480	4.5%
100%	\$4,600	8.9%	\$3,300	6.0%

Table 15
Estimated Annual AET Fee Revenue by Collection Rate
Gardiner Toll Plaza
All Revenues in Thousands

Fee Collection Rate	2015		2020	
	Estimated Fee Revenue	Fees as a Percent of Net AET Toll + Fee Revenue	Estimated Fee Revenue	Fees as a Percent of Net AET Toll + Fee Revenue
10%	\$410	8.3%	\$320	5.2%
20%	\$810	15.1%	\$650	10.1%
30%	\$1,220	21.2%	\$970	14.4%
40%	\$1,630	26.4%	\$1,290	18.3%
50%	\$2,040	31.0%	\$1,620	21.9%
75%	\$3,050	40.2%	\$2,420	29.5%
100%	\$4,070	47.3%	\$3,230	35.9%

Summary and Conclusions

Various impacts and implications of implementing either ORT or AET at the York and/or Gardiner Toll Plazas have been presented in this report. The study compared traffic, toll rates, operating costs and net revenue over a 10-year forecast period to a hypothetical continuation of the current cash collection of tolls. The analysis was conducted over a 10-year interval for each condition. This section provides a useful “bottom line” summary of the ORT and AET scenarios for each plaza studied, to aid in informed decision making by the Authority.

York Toll Plaza

Table 16 provides the bottom line summary for both AET and ORT at the York Toll Plaza. For each operational alternative, the base estimates as well as estimates at the 90 percent confidence interval are provided. These are all compared to current conditions, assuming cash collection would continue, without assuming any change in toll rates.

If (hypothetically) cash collection could continue at a reconstructed York Toll Plaza, the average toll rate for Maine-issued E-ZPass accounts would be \$2.41, consistent with current levels. Other E-ZPass cars would pay a toll of \$3.00, as would passenger car motorists using cash. Average daily traffic at this plaza is 38,500 (at estimated 2015 levels), although it increases significantly during peak summer weekends and holiday conditions.

Over the 10-year analysis period, cumulative net revenue is estimated at \$520,083,000. On a net present value basis, with a nominal discount rate of 5 percent, this is equivalent to \$399,965,000.

HNTB estimates that a total capital investment of about \$22.1 million would be required to restore and maintain cash operations at York. When related to the 10-year NPV under the base case, this provides a 10-year net total, for comparison purposes, of \$377,865,000. This is the estimated amount of total revenue, less all operating cost and the capital investment cost to restore the current plaza, between 2015 and 2024.

Similar information is provided for the ORT case, under both the base forecast and 90 percent confidence interval. The same toll rates are assumed and no traffic diversions are anticipated. The 10-year net revenue NPV is slightly higher under ORT, largely due to reductions in operating cost. However, a capital cost of \$36 million is estimated to replace the current plaza with an ORT facility, resulting in a 10-year net total NPV of \$372.5 million, or about \$5.3 million lower than continuation of the current base. At the 90 percent confidence interval, the 10-year total is only slightly different.

Under AET, toll rates for E-ZPass users are also assumed to remain the same. However, to overcome the potential revenue leakage and the higher cost of back office collection, a significant surcharge is required for video users. Non-E-ZPass traffic which chooses to pre-register the plate would be charged a \$1.50 surcharge, for a total toll of \$4.50. Unregistered video users, which would make up the majority of non-E-ZPass traffic, would be charged a surcharge of \$3.00 for a total toll of \$6.00.

Table 16
York Toll Plaza AET& ORT Bottom Line

Item	"Current" Base Case	ORT Scenario		AET Scenario (1)	
		Base Estimate	90% Conf. Estimate	Base Estimate	90% Conf. Estimate
Toll Rate (cars)					
Maine E-Zpass	\$2.41	\$2.41	\$2.41	\$2.41	\$2.41
Other E-ZPass	\$3.00	\$3.00	\$3.00	\$3.00	\$3.00
Cash	\$3.00	\$3.00	\$3.00	-	-
Registered Video	-	-	-	\$4.50	\$4.50
Unregistered Video	-	-	-	\$6.00	\$6.00
Average Daily Traffic (2015)	38,500	38,500	38,500	35,100	33,000
Net Traffic Diversion	-	-	-	(3,400)	(5,500)
10-Year Net Revenue (000)					
Cumulative Estimate	\$520,083	\$531,370	\$529,759	\$522,993	\$500,962
Cum Estimate NPV (5%)	\$399,965	\$408,554	\$407,315	\$401,317	\$384,222
Net NPV Impact	-	\$8,589	\$7,350	\$1,352	(\$15,743)
Capital Cost (HNTB) (000)	\$22,100	\$36,000	\$36,000	\$4,800	\$4,800
Cost Impact vs Current	-	\$13,900	\$13,900	(\$17,300)	(\$17,300)
10 Year Net Total (000) (2)	\$377,865	\$372,554	\$371,315	\$396,517	\$379,422
Net Difference from Base		(\$5,311)	(\$6,550)	\$18,652	\$1,557

(1) Assumes unregistered passenger car video surcharge is \$3.00 and the registered video surcharge is \$1.50.
 (2) 10 year net total equals NPV of 10 year net revenue less capital cost.

Because of the significantly higher toll, CDM Smith estimates a shift of approximately 3,400 vehicles off the Turnpike. While less than 10 percent of the total traffic, it is a much higher proportion of the cash traffic, recognizing that E-ZPass vehicles are not subjected to an increase and would not divert. Under the 90 percent confidence estimate, where higher diversion percentages were tested, the estimated shift to US 1 would be 5,500 vehicles per day.

Under the base estimate, the 10-year cumulative net revenue is estimated at just under \$523 million, slightly higher than the continuation of the current system, but lower than under an ORT case. The cumulative 10-year NPV is estimated at \$401.3 million, or about \$1.4 million above the hypothetical continuation of current operations. With the 90 percent confidence level, a somewhat lower \$384.2 million NPV of cumulative net revenue, more than \$15.7 less than a continuation of cash.

The HNTB estimate for capital costs associated with implementing AET at York is \$4.8 million; some \$17.3 million less than the current cost to keep the plaza running and than \$31.2 million less than building an ORT facility. When the capital cost is subtracted from the 10-year net present value, AET with a \$3.00 unregistered video surcharge is shown to produce a 10-year net total of \$396.5 million, some \$18.7 million greater than the 10-year total of maintaining the current plaza and about \$24

million greater than implementing ORT. Even at the 90 percent confidence level, the net AET revenue impact remains positive.

The above AET scenario is net revenue positive, however, only by imposing a \$3.00 video surcharge on unregistered customers. Toll diversion levels of between 3,400 and 5,500 per day would also result under this AET scenario as a result of the video surcharges.

In considering the optimum solution at York, several factors should be taken into consideration:

- The best 10-year net total revenue, after recognizing both operating and capital investment cost, would come from AET (assuming a significant video surcharge);
- However, this would be achieved through a significant increase in charges assessed to both registered and unregistered video vehicles, with a surcharge of as much as \$3.00; and
- As a result of the surcharge, there would be significant diversions of traffic to US 1 estimated to range from 3,400 to 5,500 per day (with higher amounts under peak weekend conditions).

Gardiner Toll Plaza

A similar bottom line analysis is presented in Table 17 for the Gardiner Toll Plaza. In this case, both toll rates and 10-year net revenue implications are much lower. As a result, there is considerably less overall risk associated with testing AET at the Gardiner location.

As shown in Table 17, the 10-year cumulative net revenue estimate if operations were to continue in their current mode is \$60.7 million. After adjusting for net present value, this is reduced to \$46.8 million; again representing a cumulative 10-year total. According to HNTB, the capital cost of restoring and preserving current operations (not recommended) is estimated at \$7 million. After subtracting this, a 10-year net total of \$39.8 million is shown for the Gardiner Plaza under current operations.

In the case of ORT, cumulative net revenue would be slightly increased, primarily due to the increased share of E-ZPass users and a reduction in the cost associated with cash collection. However, rebuilding the plaza as a full ORT facility is estimated at \$14.4 million, some \$7.4 million higher than simply maintaining it in its current location. After subtracting the additional capital cost, the 10-year bottom line total for ORT is estimated between \$34.0 and \$35.3 million, or generally around \$5-6 million less than continuing current operations.

Under the AET condition, HNTB estimates that the entire plaza could be replaced for \$3.8 million, about \$3.2 million less than simply trying to restore the plaza at its current location. However, motorists without E-ZPass would be required to pay a higher toll; unregistered plate vehicles would be assessed a surcharge of \$0.75, bringing the per transaction toll for cars to \$1.75. This would be expected to divert between 800 and 1,400 vehicles per day, spread over several routes.

Table 17
Gardiner Toll Plaza AET& ORT Bottom Line

Item	"Current" Base Case	ORT Scenario		AET Scenario (1)	
		Base Estimate	90% Conf. Estimate	Base Estimate	90% Conf. Estimate
Toll Rate (cars)					
Maine E-Zpass	\$0.50	\$0.50	\$0.50	\$0.50	\$0.50
Other E-ZPass	\$1.00	\$1.00	\$1.00	\$1.00	\$1.00
Cash	\$1.00	\$1.00	\$1.00	-	-
Registered Video	-	-	-	\$1.38	\$1.38
Unregistered Video	-	-	-	\$1.75	\$1.75
Average Daily Traffic (2015)	23,300	23,300	23,300	22,500	21,900
Net Traffic Diversion	-	-	-	(800)	(1,400)
10-Year Net Revenue (000)					
Cumulative Estimate	\$60,710	\$64,562	\$62,922	\$65,573	\$49,514
Cum Estimate NPV (5%)	\$46,757	\$49,678	\$48,417	\$50,270	\$37,807
Net NPV Impact	-	\$2,921	\$1,660	\$3,513	(\$8,950)
Capital Cost (HNTB) (000)	\$7,000	\$14,400	\$14,400	\$3,800	\$3,800
Cost Impact vs Current	-	\$7,400	\$7,400	(\$3,200)	(\$3,200)
10 Year Net Total (000) (2)	\$39,757	\$35,278	\$34,017	\$46,470	\$34,007
Net Difference from Base		(\$4,479)	(\$5,740)	\$6,713	(\$5,750)

(1) Assumes unregistered passenger car video surcharge is \$0.75 and the registered video surcharge is \$0.38.
 (2) 10 year net total equals NPV of 10 year net revenue less capital cost.

The NPV of the cumulative net revenue under the AET base case (assuming a \$0.75 unregistered video surcharge) is estimated at \$50.3 million or about \$3.5 million greater than if the current operations were retained. However, at the 90 percent confidence level, the NPV of net revenue drops to just \$37.8 million (there is a greater range of risk at the Gardiner Toll Plaza since E-ZPass represents a lower share of transactions). When compared with the lower capital cost of AET, the 10-year net total under the AET base case forecast is \$46.5 million (about \$6.7 million better than the “do nothing” scenario). However, at the 90 percent confidence level, the 10-year total NPV is estimated at \$34.0 million, almost \$6 million less than if current operations are retained.

A review of the bottom line assessment for the Gardiner Toll Plaza suggests:

- AET would generate about \$6.7 million more in 10-year NPV revenue, after recognizing capital cost, compared to the continuation of current operations and assuming a \$0.75 unregistered video surcharge;
- There is considerably higher risk associated with AET at the Gardiner Plaza (in percentage terms). But in dollar terms, the net risk is smaller. Even at the 90 percent confidence interval,

where AET would generate \$5.7 million less than the simple continuation of current operations, this is only slightly less than the 10-year net total for ORT;

- In essence, AET has the potential to improve net revenue, after capital costs, while shifting to ORT would likely reduce the 10-year net total, based on the \$14.4 million capital costs. Though it must be recognized that no cash surcharge is assumed for ORT while a \$0.75 unregistered video surcharge is assumed for AET; and
- Higher toll rates would have to be charged to video users at the Gardiner Plaza, but the surcharge would be considerably lower than that required at York.

In reviewing these bottom line conclusions, it should be recognized that the AET condition assumed only a very small percentage (5 percent) of former cash traffic would choose to register plates. If MTA considers implementation of AET in the future, it should more thoroughly investigate opportunities to encourage pre-registration of plates, as this would likely reduce traffic diversions and slightly improve net revenue performance. The Maine traveler market may be well adapted to this, since there are a large number of seasonal visitors which may not find it worthwhile to invest in electronic toll transponders, but who may make a sufficient number of trips (over a typical one to two week vacation period) to take advantage of the one-time registration of license plates.