BRINGING SUSTAINABLE TRANSPORTATION TO THE NORTH RIVER CANAL CORRIDOR
Submitted By: Gary L. Hebert, P.E., PTOE

OPERATIONAL ANALYSES OF VARIED TOLL PLAZA CONFIGURATIONS
Submitted By: Ian A. McKinnon, E.I.T.
Michael A. Knodler, Jr., Ph.D.
Eleni Christofa, Ph.D.
A Message from the New England Section President

MICHELLE LANGONE DANILA, P.E., PTOE
Senior Engineer
Toole Design Group, LLC

Dear NEITE Members:

Hope everyone is enjoying summer and the warm weather. The ITE International Annual Meeting and Exhibit will be in Seattle, Washington from August 10th through 13th. The Section would like to wish the University of Massachusetts Amherst’s ITE traffic bowl team the best of luck in the International Collegiate Traffic Bowl.

The Northeastern District Annual Meeting was held in Long Branch, New Jersey this past May. The meeting was a great success and congratulations are in order for the University of Massachusetts Amherst’s ITE Student Chapter for winning Student Chapter of the Year.

The 15th Annual Thomas E. Desjardins Scholarship Golf Tournament was held at Sandy Burr Country Club in Wayland, Massachusetts on June 4th. This year’s tournament attracted 40 golfers, with congratulations to the VHB team for winning again. Thank you again to all the participants for helping support the Desjardins Scholarship.

The New England Executive Board met in Wells, Maine as part of the joint New Hampshire and Maine’s Annual Meeting this past June. The Executive Board discussed our year goals, the 2014 budget, and potential trainings for our Annual Meeting in December. In addition, the New England Chronicle will be including a Transportation Issue Alert of any current legislative bills to inform member of potential changes through legislation.

Section Updates

The New England Section Strategic Plan is in the process of being updated and the committee will be having their next teleconference call in August. In addition, the New England Section Technical Committee will be holding a committee meeting in August at McMahon and Associates in Boston. If you are interested in participating in the Technical Committee, please contact the Committee Co-Chairs Tom A. Errico, P.E. (thomas.errico@tylin.com) or Steve C. Findlen (sfindlen@mcmahonassociates.com).

Upcoming Events

There are some great New England Section events coming up in the following months. The joint New England / Massachusetts Chapter Annual Meeting will be held on September 17th in Waltham, Massachusetts. This event is also being held in conjunction with the 5th Annual Scott M. Herr Memorial Golf Tournament at Brookmeadow Country Club in Canton, Massachusetts. Flyers for the events will be provided on the New England Section website.

Closing

In closing, I am encouraged by the continuing support and assistance by the New England Section membership. If you have any questions or suggestions, please contact me at (mdanila@tooledesign.com) or 617.619.9910 x201.

Sincerely,
Michelle Danila, P.E., PTOE
New England Section President

NEITE’s mission is to serve its members, the transportation profession, and the public by facilitating professional development and education, promoting the exchange of ideas, and enhancing the professional practice to provide safe efficient cost-effective and sustainable transportation solutions.
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APA Massachusetts Chapter:
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APA Rhode Island Chapter:
http://www.rhodeislandapo.org

On the Cover: View of US Route 201 just south of the mouth for the Dead River at the Kennebec River in The Forks, Maine. Photo Source: Samuel W. Gregorio, P.E.

On the Back Cover: Open Road Tolling along Interstate 93 in Hookset, New Hampshire. Photo Source: New Hampshire Department of Transportation
Hard to believe we are already more than halfway through the 2014 calendar year. Seems like only a week ago it was July!

Since our last issue, members of the New England Section has been active both locally and internationally. Over the next week, many members of ITE will converge on Seattle, Washington for the 2014 ITE International Annual Meeting and Exhibit. The New England Section should be well represented in both presentations and with UMass Amherst participating in the ITE Collegiate Traffic Bowl once again.

Northeastern District in the Leadership
As many of you already know, this past week, the Northeastern District's own Paula F. Benway was elected to serve as the 2015 ITE International Vice-President. During the 2015 calendar year, the Northeastern District will be well represented on the International Board of Direction with our Section's own John J. Kennedy, P.E., PTOE serving as International President.

Articles
In this quarterly issue, we feature a project right down the street from me in Salem, Massachusetts. Gary Hebert, P.E., PTOE has shared FST's work on the North River Canal Corridor Project. A project that aims to look at potential redevelopment sites along the corridor and how their redevelopment would effect all modes of transportation. In addition, Ian A. McKinnon, E.I.T., along with advisors Michael A. Knodler, Jr., Ph.D. and Eleni Christofa, Ph.D. of UMass Amherst share there report on Toll Plaza Configurations. This report was presented recently at the 2013 Road Safety and Simulation International Conference in Rome, Italy in October 2013.

Contributions to the Section
As I have stated in previously issues, I would also like to take this opportunity to welcome all within the New England Section to contribute their experiences, opportunities, challenges, and innovative strategies to the New England Chronicle; to share knowledge within the many aspects of transportation engineering and planning.

I would again like to thank all contributors to the first issue of 2014. Behind the scenes, it takes many people across the Section’s membership to put together the award winner newsletter publication of your New England Section. I hope you enjoy the first issue of the 2014 calendar year.

Samuel White Gregorio, P.E.
Chronicle Editor
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Please remember to visit the New England Section website at http://www.neite.org and our updated Section Directory for information on the New England Section.
The North River Canal Corridor (NRCC) is located in Salem, Massachusetts and largely comprised of the Salem portion of the North River Basin watershed area. Roughly a mile long and a quarter mile in width, the NRCC extends from North Street (Route 114) on the north to Boston Street in the south, Grove Street to the west, and Bridge Street to the east.

**Increasing Flood Storage**

One important contextual feature is the flooding that has often occurred near the Canal. The Army Corps of Engineers has developed a multi-year plan to reduce the incidence of flooding by widening the canal to increase its flood storage capabilities. Adding additional flood storage improves the long term viability of development in the NRCC.

Figure 1: Blubber Hollow Area Along the North River Canal Corridor

During the past several years, the City of Salem has been through an extensive and comprehensive process to rezone and upgrade the NRCC. The rezoning was needed to create incentives for redeveloping long-dormant industrial sites, including the ‘Blubber Hollow’ area - once a thriving whale oil refinery site in the 1850’s. The area went into disrepair after the whale oil industries died out.

Conveniently located within a half mile of the MBTA Salem Commuter Rail Station, the NRCC has several densely populated neighborhoods abutting the former industrial areas. Following the rezoning, five large areas (see right) within the NRCC are expected to be redeveloped with residential and commercial uses within the next few years. Construction is actively underway on three of the five potential redevelopment sites.

Several steps were needed to develop a circulation plan of the area that would provide both the nearby neighborhoods and the five redevelopment sites with sustainable transportation benefits, including:

- Identify **cumulative transportation** impacts of developments over a five year horizon,
- Develop **sustainable transportation system** improvements for all modes including motorists, bicyclists, and pedestrians,
- Identify **implementation** priorities,
- Obtain **consensus from** surrounding neighborhoods, and
- Provide **order of magnitude** costs for priorities

In aggregate, the new land uses, largely apartments and condominiums, but including some neighborhood retail space, health clubs, and a pediatrics medical center, are expected to generate approximately 570 and 750 vehicle trips per hour during the AM and PM peak hours, respectively and 8,400 vehicle trips on a daily basis. All are approved and

Figure 2: Redevelopment Areas within the North River Canal Corridor
should be occupied within the next several years.

After extensive technical review of alternative actions, working closely with the City and nearby neighbors, three of the potential circulation action areas were identified for immediate follow-up actions.

They included:

1) Enhancing pedestrian and bike access to the MBTA Salem Commuter Rail Station from nearby residential neighborhoods. The MBTA is nearing completion of a major Salem Commuter Rail Station makeover with a 700-space garage and new station. The new garage will replace what were 340 surface parking spaces and will help accommodate overflow commuter parking demands from nearby streets and neighborhoods.

2) Mason Street traffic calming measures to reduce crashes and improve the pedestrian/bike environment. These measures including new ADA compliant sidewalks, unsignalized intersection modifications and high visibility crosswalks were recently constructed using Chapter 90 funds and are operational.

3) Grove Street ‘complete street’ enhancements, the immediate access street for three of the five redevelopment sites. These are now under design and are scheduled to be constructed next year.

This article addresses two of the three priority areas — enhancing access to the MBTA Salem Commuter Rail Station and the Grove Street ‘Complete Streets’ enhancements.

Enhancing Salem T Station Pedestrian and Bike Access

The MBTA has made significant investments in the Salem Commuter Rail Station, including the new garage and major improvements to site accessible pedestrian access. Off-site ‘missing links’ were addressed separately by the City. FST evaluated active walking corridors that have been used for many years and will continue to be used long after Salem
As always, the Continuing Education Committee needs your feedback and fresh ideas for training opportunities that are innovative and that would draw significant interest to the Section membership. Most importantly, training opportunities that would serve you, the New England Section membership in the upcoming meetings and gatherings.

If you have ideas for training sessions that would benefit the membership the most and have a high interest level, whether a half-day or full-day or training, please contact:

Jason M. DeGray, P.E., PTOE
jdegray@gpinet.com

Applications for the future October 1 to 31, 2014 computer-based exams of Professional Traffic Operations Engineer (PTOE) and Professional Transportation Planner (PTP) are due August 14, 2014.

Please note that applications received after the deadline will require an additional $75 late fee to process the application in addition to the application and examination fee that must accompany the application. TPCB will try to accommodate late applications but there is no guarantee they will be able to do so.

For a list of available exam cities, please visit: http://castleworldwide.com/mainsite/ibtsites/default.aspx
Continued from Page 6

Commuter Rail Station improvements are implemented.

Three pedestrian/bike access corridors with access concerns are illustrated above.

Pedestrian corridors I–III were selected based on neighborhood concerns about pedestrian and bike access deficiencies. At issue for the MBTA was the fact that two of the corridors crossed a non-revenue freight rail siding. The single track crossing is not used for MBTA commuter rail revenue service, but is leased by the MBTA to Pan Am Railways. The rail crossing has very low-speed/low-frequency of 1-2 times per month operating with flagmen. The alternative unsignalized pedestrian crossings of Bridge Street were deemed as far more hazardous, as Bridge Street carries more than 20,000 vehicles per day.

Based on the study, it was recommended the City work with the MBTA to allow ADA-compliant crossings of the rail corridors for Pedestrian Corridors I and II. Animated visual displays were used to help Salem City officials, neighborhood residents and others see how the new pedestrian crossings might look. The City is implementing its portions of the improved Pedestrian Corridors I and II. Full implementation will require track insets, in cooperation with the MBTA and Pan Am Railways are required to ensure ADA-compliance of the newly refurbished corridors.

Pedestrian Corridor III was also rather challenging as Bridge Street (State Route 107) is programmed to be widened in the future. Though a specific timetable and design for the widening has not been completed, conceptually Bridge Street will be widened from two to four lanes.

One of the major issues for Bridge Street is how pedestrians was achieving ADA compliance on the north side of Bridge Street. Pedestrians had to traverse a bait shop that squeezed the sidewalk down to 2 feet on its north side. Though scheduled to be removed with the Bridge Street widening, the business is still in operation and the City did not want to adversely affect its operations.

After reviewing the possibility of traversing around the back of the bait shop, the proposed solution involved a 4-foot road narrowing - road diet - with a 5.5-foot

Continued on Page 9
Future vehicle operations than a modern roundabout and would not adversely affect access to and from nearby developments.

Conclusions

In conclusion, creating a sustainable transportation environment involves exploring many opportunities that are often easy to overlook. Project support is absolutely crucial to implementation. Key City officials, including Mayor Kimberley Driscoll and several City Councilors as well as City staff actively assisted narrowing options for implementation.

The Planning and Community Development Department, led by Lynn Duncan, Director, and Engineering Department led by David Knowlton, the Salem City Engineer. All were actively involved in the planning and design early on. All are firmly committed to a policy of maintaining positive and effective communications with concerned neighborhood residents. Early on and throughout planning, design, and construction. Members of the Mack Park Neighborhood Association contributed significantly to planning and design efforts.

FST found that the use of before/after photo visuals from existing to proposed were extremely helpful in creating an understanding of the ultimate purpose of the technical evaluation process – a project that benefits existing and new NRCC residents and workers. Visualization can be daunting to residents or local officials who may not have the background needed to evaluate complicated technical information, particularly as it pertains to traffic engineering data and findings.

For more information on various aspects of the City of Salem’s NRCC Project, please visit the City of Salem’s website at http://www.Salem.com.

Gary L. Hebert, P.E., PTOE is currently an Associate-Consultant and former Vice-President at Fay, Spofford, and Thorndike, Inc. in Boston, Massachusetts. He has served as both Chairman of the Northeastern District and the New England Section of ITE. He received the Distinguished Service Award from the New England Section in 2007 and the Harvey B. Boutwell Distinguished Service Award from the Northeastern District in 2013.
Quarterly Images

Bringing Home the Hardware
Paula Benway presents one of the three Student Paper Awards to Andrew Brunn of Northeastern University on behalf of the award sponsor, Stantec.

ITE Collegiate Traffic Bowl
Curt Harrington, Cole Fitzpatrick, Jon Freeman, and Christina Dube of UMass Amherst are victorious for the Northeastern District and will travel to Seattle, WA to compete in the ITE Collegiate Traffic Bowl next week.

EMERGING PROFESSIONALS GROUP
Co-Chair: Michael W. Fenley, P.E., EVP SP
Co-Chair: Alex Lovejoy, E.I.T.

The Emerging Professionals Group of the New England ITE chapter organized their first event under newly appointed co-chairs, Alex Lovejoy, E.I.T. of the MBTA and Michael W. Fenley, P.E. of CDM Smith. The event began with a tour of the Longfellow Bridge Reconstruction project in Cambridge, MA, escorted by the gracious and knowledgeable superintendent of the site, Mike Keville from J.F. White. The tour attracted 14 professionals and students from the region curious about the project’s background and progress.

The Longfellow (originally, the Cambridge) Bridge is one of the most architecturally distinguished bridges in Massachusetts. Located on the site of the 1793 West Boston Bridge, this steel and granite structure was completed in 1908, and renamed to honor Henry Wadsworth Longfellow in 1927. The bridge connects Cambridge Street in Boston with Main Street in Cambridge and carries the Massachusetts Bay Transportation Authority (MBTA) Red Line and two-way vehicular traffic across the Charles River. The bridge presently carries 28,000 motor vehicles, 90,000 transit users, and significant numbers of pedestrians and bicyclists each day.

The three and half year rehabilitation project by White-Skanska-Consigli JV will address the bridge’s current structural deficiencies, upgrade its structural capacity and bring it up to modern code, including improving multi-modal access and bridge-to-city-street connections to meet accessibility guidelines.

The flyer for the event indicated a requirement for ‘boots, gloves, hard hat, and goggles’. Little did the participants know, they would be rubbing shoulders with trade workers (up to 100 on site at any given time), scaling ladders, and walking on floating or suspended walkways. From giant bolts, to majestic views, this tour exceeded all expectations.

The event wrapped up at the Harvard Gardens, a bar and restaurant a few hundred feet from the project site. The calm environment was conducive to mingling and discussing what we had just witnessed. The success of this outing will lead to many others hosted by the Emerging Professionals Group.
Operational Analyses of Varied Toll Plaza Configurations

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Introduction
Toll plaza operation is a critical component of roadway operations throughout the United States, as tolls provide both a means of revenue for expansion and opportunity for demand management. Efforts to maximize vehicle throughput and reduce delay has led to the emergence of electronic toll collection (ETC), a paramount solution to congestion reduction at these major highway bottlenecks. While new payment collection strategies have arisen, traditional cash payments are generally still accepted. In turn, ETC has introduced a new form of driver decision making at toll plazas due to payment choices.

Methodology
As documented previous, an impending need has developed to investigate the role of electronic tolling collection configuration on toll plazas. The overall objective of this research is to evaluate issues related to toll plaza configuration and driver decision making resulting from the introduction of ETC toll lanes.

The driver decision making objective strives to understand and model how motorists chose lanes on toll plaza approach. A clear understanding of this behavior may lead to improved designs and recommendations for placement of lanes and configurations to minimize risk and improve overall traffic flow. The role of electronic toll collection lane availability and in what form (dedicated or mixed-use) is believed to have a large role in this decision. Furthermore, the function of lane type may influence weaving movements and other potentially risky vehicle movements. The role of upstream traffic and queue length are believed to have a large influence on the frequency and nature of lane movements. Analysis from these studies aimed to understand how drivers analyze, and act upon information on the approach to a toll plaza.

The intent of the operations-based research objective is to model driver behavior at toll plazas with multiple forms of payments forcing decision making. The stochastic microsimulation software VISSIM by PTV America, Inc., (Planung Transport Verkehr AG, 2008) was selected for its depth of configuration and dynamic traffic assignment features. The model was calibrated based on field data from Exit 4 of the Massachusetts Turnpike and validated with data from the same plaza under a different lane configuration pattern from an earlier time. The operational performance of the toll plaza could subsequently be evaluated under a variety of lane configuration combinations.

Computer-Based Static Evaluation
Driver decision making was identified as a central factor in the design and configuration of toll plazas. A computer-based static evaluation was developed to help determine the decision process of drivers during an approach to a toll plaza. The evaluation provided participants with a photo from the driving perspective shown in Figure 1 and asked them to select one lane to use based on the information they could deduce from that one frame. The static evaluation was created using Adobe Captivate, a learning management software (LMS) with built-in quiz and multimedia capabilities. A within subject design randomly assigned participants as either cash or ETC customers as they approach an interchange and answer a series of lane choice questions based on static photographs from toll plaza scenarios. After fifteen scenarios the participants’ role changed to the other payment method and those same scenarios were administered again.

Fifteen scenarios were presented with varied queue lengths (number of vehicles) at each of the toll lanes, number of lanes, ETC lane placement (left, right, center, both left and right), and combination of lane type (Manual, Automatic, ETC, Mixed). A total of 30 scenarios (2 of each 15 scenarios) were incorporated into the static evaluation in random order. Each scenario was created by manipulating photos taken from the four-lane toll plaza off Exit 4 of Interstate 90 in West Springfield, Massachusetts on December 20, 2012.

Participants did not know that scenario plaza had a downstream decision point nor were they told which direction they were going downstream of the plaza. Participants answered demographic questions following the evaluation indicating their age, gender, recent driving history, education, toll road experience, and payment method history.

The evaluation was shared with contacts and their acquaintances via a private email link, without a public or directory listing anywhere on the internet. The published evaluation was made available during a 3-week collection period during which 100 responses were gathered.

VISSIM Microsimulation
Based upon the safety and driver decision making analysis, an attempt was made to improve the operation modeling of toll plazas as a function of lane configuration. Unfortunately, VISSIM lacks a built-in toll plaza feature or module. As part of the development stage, steps were made to configure resources of VISSIM to act and control traffic as if a toll plaza were present. Stop signs were used to mimic cash transactions and reduced speed zones imitated ETC lanes. Massachusetts utilizes the interoperable E-ZPass tolling system with Mark IV Industries (now Kapsch TrafficCom) hardware. The West Springfield toll plaza was built in the microsimulation package. Video data was collected in January 2012 and...
analyzed to serve as an input for the VISSIM model. After model development, parameters were calibrated to mimic observed behavior. A visual inspection during calibration looked for weaving, queuing, and minor amounts of unpredictable maneuvers expected at a toll plaza. Following calibration, another toll plaza configuration representing the configuration in January 2013 as seen in Table 2, which was different than the one of January 2012, was built into VISSIM using the calibrated model to compare to actual performance. The validation’s measure of effectiveness target was a 10% or less difference in total throughput of the observed field volumes.

**Model Calibration**

The Federal Highway Administration’s Guidelines for Applying Traffic Microsimulation Modeling Software was referenced for guidance in model calibration (Downling et al., 2004). In order to highlight the decision making process explored in proposed models (Correa et al., 2004), origin and destination data were extracted. The interchange of Exit 4 has two entrances and two exits. Exits include one from the westbound direction of I-91 and one from the eastbound direction on the Turnpike. Destinations are the interchange with I-91 and US Route 5. While approaching the plaza, drivers may change their lane choice several times based on traffic demand and future destination. The origin-destination (O-D) information was collected with a two-camera setup as shown in Figure 2. Each vehicle was tracked from their entrance lane, through the toll plaza to their final destination from Camera 1 to Camera 2. Payment method, lane choice, and number of lane maneuvers were noted in addition to origin and destination. This process indicated how many customers of each toll payment method were originating from the east, from the west and their decision at the toll plaza to travel on to I-91 or US Route 5. These tracked vehicles formed an O-D volume matrix and served as the input volumes to the model.

The second calibration parameter was transaction time within the toll plaza boundaries. Transaction time was a form of the processing time at the plaza, but differed because it neglected time in queue and travel time to an exit point. Transaction time was calculated as the time differential between the time from when the front of the car passed the physical toll booth to the time when the rear bumper passed the end of the toll booth and passed the traffic signal displaying green. Transaction time allowed each payment method or lane type to be equitably compared. Brief transaction times commanded supreme time measurement accuracy. Therefore, video was analyzed on a frame-by-frame basis with an accuracy of 1/29th of a second. One hundred transaction times were randomly sampled from each lane from January 2012 video, and were recorded with transaction type and vehicle class.

Distributions and statistics were generated and cumulative distribution figures were plotted from raw data to serve as input for plaza dwell time in VISSIM. Figure 3 below shows the transaction time distributions and mean and standard deviation for cash transactions for both passenger vehicles and heavy vehicles for cash transactions.

The calibration model used 2012 data for volumes, O-D assignment and dwell times. Additionally, several car following model attributes and environmental settings used to tweak the base case model.

Based upon previous research, the 1999 Wiedemann car following model version was selected (Wiedemann, 1991; Russo, 2008). Each of these entities has several configurable parameters. Default values were used for the majority of driver behavior parameters. However, a couple values were tweaked during calibration. The Wiedemann 99 model has 10 parameters of which three were altered to best describe toll plaza activity. Standstill distance was changed to 4.92 feet from 2 feet to represent condensed queuing situations. Headway time was changed from 0.90 seconds to 0.50 seconds based on transaction time observations. Another car following related parameter change involved the number of observed vehicles. Observed vehicle count was raised from 2 to 4 vehicles; this change was consistent with other VISSIM toll plaza models.

Two lane changing parameters were tweaked to calibrate the model. The minimum front and rear headway was lowered from 1.64 feet to 0.5 feet. The waiting time before diffusion was decreased from 60 seconds to 10 seconds. This period of time is defined as the time a car sits waiting for a gap to change lanes in order to stay on its route before it is removed from the network. This parameter helped remove gridlock situations troubling the microsimulation tests.

**Model Validation**

For the process of validating the toll plaza model, video data throughput or collected volumes per lane were used. Individual sensors were placed on toll lanes 1-4 and configured to collect these data in the simulation model. Ten simulation runs were averaged together to obtain the throughput for each lane of the toll plaza, which was compared with the throughput obtained from the video data.

**Reduced Speed Limit Zones**

Reduced speed limit zones allowed the model to emulate ETC lanes. In VISSIM, established
reduced speed zones override speeds set by vehicle class and link. Restricting speeds provided the natural effect of deceleration behavior of E-ZPass customers who decelerate at plazas. Cash customer vehicle classes were unaffected by these zones. Reduced speed limits used default desired distributions based on toll plaza speed limits in Massachusetts. Heavy vehicles were assigned a speed distribution between 10 and 18 mph and cars were assigned 15-22 mph. In the case of a combination lane, the reduced speed zones would only apply to E-ZPass vehicles and cash customers would be unaffected by the zone.

Stop Signs and Dwell Distributions
Stop signs were used as a means to emulate cash toll transactions. This function of VISSIM was deemed suitable due to the majority of vehicles coming to a complete stop during a manual cash toll transaction. Field data generated empirical dwell distributions were designated by vehicle class to assign varying stop or transaction times randomly upon plaza arrival. Car and heavy vehicle dwell distributions that were used as input in this model are shown below in Figure 4.

Dynamic Assignment & Discrete Choice Modeling
VISSIM’s dynamic assignment feature was employed to capture driver decision making based on traffic conditions. Using zones of origin and destination called “parking lots” a discrete choice model can be made to evaluate the shortest paths in real time (Planung Transport Verkehr AG, 2008). VISSIM solves a modified version of the shortest path algorithm and distributes traffic demand based on a logit model.

Results
Initial static evaluation results provided feedback on the most interesting lane configurations that were chosen to be tested with the microsimulation model. Scenarios with distributed lane choices were seen as ideal. Additional alternatives were derived from the review of the literature.

The static evaluation was administered over the course of 3 weeks in spring 2013. One hundred evaluation responses were collected and tabulated. The region of participants was concentrated in the Northeast region of the United States and was solicited in a controlled manner to prevent falsified submissions. Participants ranged in age from 16 to 70 years old, with an equal 50% split of male and female respondents. Educational background of the evaluation pool was 74% college educated, 16% some college, 8% high school degree and 2% no degree. Fifteen percent of evaluation results indicated over 10,000 miles of driving per year, 45% selected 1 to 10,000 miles per year and 40% did not drive at all. Fifty seven percent of participants indicated they are typically ETC users, 33% were cash users and 10% used a mix of both. Eleven percent of the participants were daily toll users, 12% were weekly users, 44% were monthly users and 33% used toll lanes less than 10 times per year.

Results from the static evaluation yielded several lane choice trends. In one scenario, a one-car queue was enough to motivate the majority of cash payment respondents to make lane changes across three lanes. This lane change created a “buffer” or region of safety between the faster moving E-ZPass network and the slower moving cash toll lanes.
lane. In another scenario with dedicated lanes and combination lanes available to E-ZPass customers, preference was given to dedicated lanes. Drivers may be considering the relative transaction time of one E-ZPass customer versus one cash customer. When approaching the toll plaza, combination lanes are enticing but require a second round of decision making that involves weighing the risk of waiting behind a cash customer versus waiting in a queue of slowly moving vehicle(s) such as a tractor trailer in a dedicated ETC lane. While a driver may only wait 5-6 seconds behind a queue on the dedicated ETC lane, he could potentially remain behind a cash transaction for 20-60 seconds. This weighing of travel time benefit to cost is a cyclical evaluation that drivers must make on toll plaza approaches where combination lanes are present. While combination lanes may provide an outlet for vehicles who become trapped in a toll plaza away from their section of payment type lanes, these lanes may be invoking driver inattention.

West Springfield’s Exit 4 of the Massachusetts Turnpike provided the base case for the microsimulation model development and testing of different lane configurations. The base case scenario used December 2012 volumes, O-D data and lane configuration of the plaza. Lane configuration offered two cash lanes on the outside, and two inner dedicated ETC lanes. Average volumes were calculated from 10 simulation runs with different random seeds starting at 1 and increasing by 10 per iteration. The simulation had a 2 minute or 120 second warm up period where no results were recorded, followed by a period of 15 minutes of data collection. Volume throughputs are collected for 15 minutes from the 120 second mark up to 1020 seconds. Fifteen minute values were multiplied by a factor of 4 to compare to industry toll standards for hourly flows. The results from the calibration can be located in Table 1. The microsimulation model resulted in a similar distribution of lane choices. Parameter tweaking resulted in a throughput of 8% lower than the observed.

**West Springfield Prior Configuration Validation**

The toll plaza model validation began by examining the configuration that existed when the first round of video data was collected back in January 2012. During 2012 the plaza’s configuration was modified by the Massachusetts Department of Transportation to remove two combination lanes, and transition to the current configuration of Cash, E-ZPass, E-ZPass, and Cash. Using traffic flow volumes from the base case, the model was retested for performance and operations. The comparison of this configuration to the base case served as validation of the model’s effectiveness. The validation was successful in terms of total throughput volumes with only a 3% difference in throughput as seen in Table 2 below. The distribution of lane choices were different in the simulated case, but overall plaza throughput was within tolerance. The model’s dynamic assignment may have shifted volumes to combination lanes 1 and 4 due to their lower average travel time when cash and ETC vehicle classes are combined in iterative link cost analysis.

**New Configurations**

The research goals outlined the practicality of this research as a tool for toll plaza operational performance prediction. Building off prior configuration scenario results of the static evaluation, configurations of interest were pinpointed for analysis. Stemming from the analysis of static evaluation feedback, several driver decision making concepts were introduced that may be at work in the plaza environment. Among these ideas were the addition of a buffer of one or more lanes between ETC lanes may improve operations as drivers choose to use separated lanes was prevalent. Lane grouping was the second strategy employed in the new configuration development. Moving lanes next to one another may minimize dangerous merging maneuvers. A third strategy aimed to remove driver confusion by allowing ETC and cash payments at every lane. Previous conceptualizations reason that the consequence of opening up these possibilities will be drivers ignoring lane choices based on payment method and will look to queues and preference alone. These cases along with the throughput outcomes of the simulation tests are summarized in Table 3 below. Combination lanes are abbreviated “combo”

<table>
<thead>
<tr>
<th>Case</th>
<th>Lane Configuration</th>
<th>Volume (Vehicles per hour)</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013 Observed Data</td>
<td>Cash-E-ZPass-E-ZPass-Cash</td>
<td>270 390 503 277 1440</td>
<td></td>
</tr>
<tr>
<td>2013 Configuration</td>
<td>Cash-EZPass-EZPass-Cash</td>
<td>220 368 496 240 1324</td>
<td>-8%</td>
</tr>
</tbody>
</table>

Table 1: Model Calibration Volumes

<table>
<thead>
<tr>
<th>Case</th>
<th>Lane Configuration</th>
<th>Volume (Vehicles per hour)</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012 Observed Data</td>
<td>Combo-Cash-EZPass+Combo</td>
<td>149 189 455 340 1133</td>
<td></td>
</tr>
<tr>
<td>2012 Simulated Data</td>
<td>Combo-Cash-EZPass+Combo</td>
<td>400 84 212 476 1172</td>
<td>3%</td>
</tr>
</tbody>
</table>

Table 2: Model Validation Volumes

<table>
<thead>
<tr>
<th>Case</th>
<th>Lane Configuration</th>
<th>Volume (Vehicles per hour)</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013 Simulation</td>
<td>Cash-E-ZPass-E-ZPass-Cash</td>
<td>220 368 496 240 1324</td>
<td></td>
</tr>
<tr>
<td>Scenario 1</td>
<td>E-ZPass-Cash-EZPass</td>
<td>284 148 240 388 1060</td>
<td>-20%</td>
</tr>
<tr>
<td>Scenario 2</td>
<td>EZPass-Combo-Combo-EZPass</td>
<td>156 220 324 240 948</td>
<td>-29%</td>
</tr>
<tr>
<td>Scenario 3</td>
<td>E-ZPass-E-ZPass-Cash</td>
<td>576 304 200 232 1312</td>
<td>-1%</td>
</tr>
<tr>
<td>Scenario 4</td>
<td>EZPass-Combo-E-ZPass-Cash</td>
<td>188 228 160 368 944</td>
<td>-29%</td>
</tr>
<tr>
<td>Scenario 5</td>
<td>Combo-E-ZPass-EZPass-Combo</td>
<td>368 108 164 408 1048</td>
<td>-21%</td>
</tr>
<tr>
<td>Scenario 6</td>
<td>Combo-Combo-Combo-Combo</td>
<td>364 208 336 484 1392</td>
<td>5%</td>
</tr>
</tbody>
</table>

Table 3: Microsimulation Alternate Configuration Results

Continued from Page 13
in the scenario comparison table. Percent change as referred in the table, highlights the difference in percentage of total throughput of each scenario as compared to the base 2013 simulation case.

Scenario 2 configuration provided the lowest plaza throughput as a whole, while the all combination lane configuration, scenario 6, provided the highest throughput of all alternatives. The current configuration remained the one with the highest throughput result compared to all other configurations tested.

Conclusions
Toll plazas, while designed to be an undemanding and forthright revenue generator, are often times vastly unpredictable and make driver behavior difficult to understand. Driver decision making scenarios were designed and tested with a static evaluation to gain insight into how drivers react to alternate configurations. Observations from the static evaluation scenarios indicated drivers took efforts to minimize their time in the plaza and their overall travel times. Even a small queue of one car can provide motivation to maneuver to open lanes. Combination lanes that accept multiple forms of payment help disperse demand in peak hour situations. Additionally, they provide opportunities for unfamiliar drivers to utilize any lane for their transaction. However, added ETC payment users to lanes that serve cash customers degrade the level of service and increase delays for both types of drivers. Motorist mental workload may increase as they scan more lanes for the shortest path. ETC customers may be calculating the risks of falling behind a cash customer by choosing a combination lane with a queue versus a several cars in an ETC lane. The type of vehicles queued may also be guiding driver decision making. In more than one occasion drivers avoided queued heavy vehicles in both cash and E-ZPass exclusive lanes. Drivers seem sensitive to these slower moving vehicles and anticipate a longer transaction time. Consequently, motorists will go out of their way to avoid heavy vehicles such as tractor trailers even if it means joining a queue of two to three cars. All vehicles, when given the opportunity, spring for a buffer from queued lanes. Cash customers are perhaps more aware of the speed differential and add space between their vehicles and their ETC payment counterparts.

Using the feedback from the static evaluation, six other lane configurations were simulated using the December 2012 volume and O-D data. Scenario 3 with grouped payment lanes from the static evaluation provided the best overall performance with less than 1% difference from the baseline case. However, the currently configured plaza with exterior cash lanes and central E-ZPass lanes was verified by the simulation model to provide the highest plaza throughput.

The model represents driver confusion well, often times a driver will advance to a toll booth, unbeknownst that their payment method requires them to wait in the queue they just bypassed. In several simulation runs, decision guidance allocated vehicles properly in a manner that would most likely represent field traffic demand. From both observations of simulation and field video, weaving degraded overall plaza performance.

The VISSIM model developed in the process of this research could be a useful tool for toll authorizes and transportation agencies in the design or retrofit of toll facilities. The model could be improved for wider applicability in the analysis of different demands, origin-destination distributions, and other toll plazas to test their operational performance. The benefit to this continued research is the importance of toll plaza efficiency and realizing the best use of existing infrastructure.

References
Vermont ITE is having our fall meeting Wednesday September 10, 2014 at VTrans in Montpelier, Vermont from 11:30 AM through 2:00 PM with lunch served. Our topic will be roundabouts and we plan to have a speaker on lessons learned on recent roundabout projects and another speaker on mini-roundabouts.

Vermont ITE is currently planning our winter event. It will be held on January 21, 2014 at Mount Snow Ski Resort in Dover, Vermont. This annual event has grown in popularity as it includes a morning of skiing followed by lunch with technical sessions, the NEITE Executive Board Meeting, more skiing and then a happy hour networking session. Details will be forthcoming.

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Committee, Chapter, and Student Chapter Updates

THOMAS E. DESJARDINS MEMORIAL GOLF TOURNAMENT
Committee Chair: Fayssal J. Husseini, P.E., PTOE

The Thomas E. Desjardins Memorial Golf Tournament was successful this year; the weather did cooperate and there was no rain during the game. The weather forecast was to have sporadic rain showers and we were fortunate not having any during the play. The tournament featured 10 foursomes and almost everyone was a Hole Sponsor. This group of companies is our loyal core support for making the tournament successful and I want to extend my sincere thanks you to all.

As always, the tournament had prizes for the lowest scores, longest drive, and closest to the pin. Team Vanasse Hangen Brustlin, Inc. (Dave, Mark, Sean, and Matt) took in 1st Place. I also would like to thank Paul Nauyokas and Rod Emery for their time in running the event for the past 15 years.

I also would like to thank Tom’s parents and relative for attending the event and their financial support. The revenue from the event will support two scholarships to students enrolled in the transportation engineering field. We have received request for applications and the selection process is being chaired by Ken Petraglia, P.E., PTOE and I am certain that he will be posting the required information. Scholarships will be awarded at the Joint Massachusetts Chapter / New England Section Meeting this September in Waltham, Massachusetts.

NEW HAMPSHIRE STATE CHAPTER
MAINE STATE CHAPTER
Submitted by: David Saladino, P.E.

The Maine and New Hampshire Chapters of ITE gathered for their annual joint meeting on June 26th at the Village by the Sea Conference Center in Wells, Maine. Tim Taylor, Highway Safety Engineer from the Federal Highway Administration’s Resource Center, provided a five hour technical program covering aspects related to integrating geometric design and traffic control for improved safety. Following the technical program was a panel discussion on ways to incorporate technology into highway and arterial projects. The panel members represented the full cross-section of ITS user groups and included: Jimmy Fountaine, Regional Sales Manager with Wavetronics, Matthew J. Picanso, Senior Engineer with Highway Tech, Jeff Arch, Associate Vice President with TransCore, and Von López-Jacobs, PE, ITS/Traffic Engineer with Gannett Fleming, Inc.
Full Employment Opportunity Notices are Available on the New England Section Webpage

To submit Employment Opportunities, Please contact:
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Chronicle Editor
sgregorio@theengineeringcorp.com
http://neite.org/job-opportunities/

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Fax: (866) 233-7014
Cell: (207) 678-0644

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To learn more and to apply online please visit: http://jobs.brassring.com/1033/ASP/TG/cim_jobdetail.asp?partnerid=25038&siteid=5220&Areq=139948R

Employment Opportunities
For Detailed Employment Opportunity Information, please visit: http://neite.org/job-opportunities/

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**MAITE, NEITE**
Wednesday, September 17, 2014

Joint Annual Meeting of

"MAITE, NEITE"

**where**

PTV Vistro - The Traffic Engineering Tool
Jongwon Won, P.E.

**technical sessions**
1. TBD
2. TBD

**dinner program**

Schedule

<table>
<thead>
<tr>
<th>Day &amp; All Dinner Program</th>
<th>NEITE Section Board Meeting</th>
<th>Technical Sessions</th>
<th>Social Hour</th>
<th>Dinner Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 a.m. - 5:00 p.m.</td>
<td>11:00 a.m. - 12:00 p.m.</td>
<td>3:30 p.m.</td>
<td>5:00 - 6:00 p.m.</td>
<td>6:00 - 9:00 p.m.</td>
</tr>
</tbody>
</table>

**train the trainer**

5th Annual Scott M. Herr Memorial Golf Tournament
September 29, 2014

**costs**

All Day & Dinner Program:

- $250
- $200
- $150

Social Hour:

- $55

Dinner Program:

- $30

Contact Paul Norey at paul.norey@neite.org for more information on how you can support this important event.
Employment Opportunities

WorldTech Engineering, LLC

WorldTech Engineering’s growing transportation practice is searching for a talented engineer. This is a great opportunity for career-oriented professionals. We offer competitive salary and benefits.

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Candidates should have four to six years of traffic and highway engineering experience in the transportation engineering field. They must be experienced in summarizing and analyzing field data and assisting in the development of effective solutions for traffic, highway, and civil engineering challenges. Experience in designing roadway geometrics and pedestrian accommodations preferred. Excellent organizational, analytical, verbal and written communications are a must as well as the ability to prioritize multiple projects and maintain a professional demeanor. The candidate should have a Bachelor’s degree in Civil Engineering, Traffic Engineering, or closely related field. Experience with Microsoft Office and AutoCAD required; experience with GIS software desirable.

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Woburn, Massachusetts

WorldTech Engineering’s growing transportation practice is searching for a talented engineer. This is a great opportunity for career-oriented professionals. We offer competitive salary and benefits.

Candidates should have five to seven years of highway design engineering experience assessing existing conditions and developing effective solutions for traffic, highway, and civil engineering challenges. They must be skilled in designing roadway geometrics and pedestrian accommodations, using AutoCAD Civil 3D, and have a thorough knowledge of MassDOT Design Guide Book and submission process. Excellent organizational, analytical, verbal, and written communications are a must as well as the ability to prioritize multiple projects and maintain a professional demeanor. The candidate should have a Bachelor’s degree in Civil Engineering, Traffic Engineering, or closely related field. Experience with Microsoft Office required; experience with GIS software desirable.

To Apply, please go to this link: http://worldtechengineering.com/careers.html

BETA Group, Inc.

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BETA is seeking an Owner. Our Employee Stock Ownership Plan (ESOP) means that every employee owns a piece of the business. This is just one of the great benefits the employees of BETA enjoy. As a regional leader in the fields of Transportation & Traffic Engineering, Civil Engineering, Environmental Engineering, the Environmental Sciences, GIS, Landscape Architecture/Urban Design and Structural Engineering, we know how to take a project from good to great.

BETA has exceptionally strong traffic practice. We are seeking a highly motivated individual to join our team in a key position. Candidate should have 8-12 years of experience in traffic engineering and/or transportation planning. Skill in making presentations and managing assignment/project a plus. Thorough knowledge of traffic analysis software and MassDOT requirements are requirements. Bachelor of Science Degree in Civil Engineering and Professional Registration required. PTOE preferred.


For Detailed Employment Opportunity Information, please visit: http://nette.org/job-opportunities/

Tetra Tech

Tetra Tech currently seeks an experienced Senior Traffic Engineer for a broad spectrum of public and private sector projects. Candidate should be familiar with MassDOT and Boston Transportation Department standards. The position is located in our Framingham, Massachusetts office.

Primary responsibilities of the Senior Traffic Engineer include: preparation of traffic impact/access studies, corridor and parking studies; management of projects from inception to completion; transportation modeling and traffic simulations; planning and design of roundabouts, traffic calming measures, and pedestrian facilities; design of traffic signals, fire/railroad preemption and coordinated systems; design of pavement markings/signs including highway guide signs and CMS; and design of traffic management plans (TMP) including phasing/staging plans.

Candidate should have a B.S. in Civil Engineering, a PE/PTOE license and good written and verbal communication skills. Familiarity with Synchro, Simtraffic, HCS, SignCAD, Vissim, and AutoCAD is required. Ideal candidate will have 8 to 10 years of experience working as a Traffic Engineer with public speaking and project management experience.

If you are interested in this opportunity please apply on-line at: https://tetrattech.tms.hrwdepartment.com/jobs/15806/Senior-Traffic-Engineer-Framingham-MA?clid=en-CA

Tetra Tech
Senior Traffic Engineer
Framingham, Massachusetts

Job Code: INE-PrTrafEng-DVY

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Framingham, Massachusetts

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Primary responsibilities will include: management and execution of transportation design and planning projects; public presentations; leadership, management and mentoring of technical staff; maintaining client relationships; and business development and proposal activities.

The ideal candidate will have the following skills and abilities: a Bachelor’s Degree in Civil/Transportation Engineering; a minimum of 15 years of experience; a Professional Engineer (PE) and Professional Traffic Operations Engineer (PTOE); excellent written and verbal communication skills; prior experience managing transportation project teams and leading project teams; experience working in multi-disciplinary project settings; and familiar with MassDOT design and permitting requirements and the MEPA regulatory process.

We provide an excellent compensation and comprehensive benefits package.

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Tetra Tech
Senior Traffic Engineer
Framingham, Massachusetts

Job Code: INE-TrfPryProjMgr-DVY

City of Quincy, Massachusetts

City Traffic Engineer
Quincy, Massachusetts

The City of Quincy has an opening for a talented Traffic Engineer to join our Traffic Division. The candidate will oversee all phases of traffic engineering and transportation planning for the City of Quincy.

BETA Group, Inc.

Senior Traffic Engineer

BETA is seeking an Owner. Our Employee Stock Ownership Plan (ESOP) means that every employee owns a piece of the business. This is just one of the great benefits the employees of BETA enjoy. As a regional leader in the fields of Transportation & Traffic Engineering, Civil Engineering, Environmental Engineering, the Environmental Sciences, GIS, Landscape Architecture/Urban Design and Structural Engineering, we know how to take a project from good to great.

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The New England Chronicle is interested in short articles on innovative projects and cutting-edge solutions.

Please send articles, listings (ITE and other relevant), graphics and photographs to the Editor: Samuel W. Gregorio, P.E. at sgregorio@theengineeringcorp.com

The New England Section Chronicle staff thanks you and we hope you enjoy the issue.

REMINDERS

Those members of the New England Section that have not updated your personal and/or business contact information recently should visit the ITE website and do so. An updated contact directory allows the Section to properly send information emails, election information, and other details such as the NEITE calendar.

http://www.ite.org

For those members of the New England Section that would like to be included on the Section email list for Google Groups, please contact Nick M. Fomenko, P.E., PTOE at BETA Group, Inc.

nfomenko@BETA-inc.com