APPLICATION OF ELECTRICAL CIRCUIT THEORY TO TRAFFIC CALMING PLANNING AND IMPLEMENTATION

Submitted By: William F. Lyons, Jr., P.E., ESO

LIGHT RAIL CENTRAL SUBWAY BUNCHING

Submitted By: Andrew L. Brunn, BSCE
Dear NEITE Members:

Happy Spring! After our winter, we are ready for warm weather and more New England Section events! First, I would like to congratulate all our 2014 student graduates. We wish you luck in your future and hope to see you again at future New England Section events!

To be honest, I am currently not up-to-date on the latest happenings in the transportation industry. However, I can tell you the top transportation-related baby toys and clothing. It seems that airplanes and trains are always the best sellers although bicycles are starting to climb the charts. As many of you know, my husband, Jim, and I welcomed Lukas John Danila on March 6th. We were immediately in love with all 22.5 inches and 11 pounds of him! He is keeping us busy but I am able to catch up with the Section in person.

Section Updates
The New England Section website has gone under a transformation thanks to Webmaster Ian A. McKinnon, E.I.T., BETA Group. Please check it out at (http://www.neite.org). In addition, the New England Section is now on Twitter! Please follow us @NewEnglandITE.

The University of Massachusetts Amherst held its Annual Technical Day in March at the Mullins Center. The day consisted of a roundtable discussion on the Future of Transportation which brought out the unique perspectives of our membership. We heard from the students, emerging professionals, professors and senior leaders in transportation. This discussion was just the beginning. It opened up many more questions on the future of our industry and the direction we are moving towards. Following the roundtable there were networking opportunities during the student research poster session and the student chapter’s annual awards dinner.

On April 2nd, the 10th Annual Student Symposium was held at the University of Connecticut’s Storrs’ Campus in conjunction with the Connecticut Chapter’s Spring Meeting. The student presentations varied in topics from transportation planning and policy to sustainable mobility and access. The keynote speakers were Jim Redeker, Connecticut DOT Commissioner, and State Representative Tony Guerrera, House Chair of the Transportation Committee. Thank you to all the student presenters. We’d also like to congratulate Mike Morehouse, P.E. the newly elected CTITE chapter president.

At the April 2nd event the Section Board held its second meeting of the year during which we reviewed the Treasurer’s Report, got an update from Kenneth J. Petraglia, P.E., PTOE on International ITE’s emphasis areas, heard from the District’s Michael A. Knodler, Ph.D. on the upcoming meeting in Long Branch, New Jersey, kicked-off the strategic plan update, and scheduled upcoming events.

Upcoming Events
There are some great New England Section events coming up in the following months. This week the Northeastern District Annual Meeting is being held on the Jersey Shore. With over 40 presentations, a golf outing, bicycle tour and more, it is sure to be an excellent meeting in both technical and networking events. We hope to see you there!

In June, there are two great New England Section events to add to the calendar. The 15th Annual Thomas E. Desjardins Scholarship Golf Tournament will be held at Sandy Burr Country Club in Wayland, MA on June 4th. For more information on attending or sponsoring the event, please check out our website. In addition, look out for a meeting flyer for the joint New Hampshire and Maine Annual Meeting being held on June 26th at the Village by the Sea in Wells, Maine.

In closing, I would like to thank the New England Section Executive Board for all their help during my maternity leave and I am excited to be fully involved with the Section again in June. I look forward to working with everyone again and keeping with the mission while moving the Section forward! 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
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http://www.northeasternite.org

ITE New England Section:
http://www.neite.org

ITE Upstate New York Section:
http://www.itynypstate.org

ITE New York Metro Section:
http://ite-metsection.org

Young Professionals in Transportation - Boston Chapter
http://www.yptboston.org/

Boston Society of Civil Engineers:
http://www.bsoces.org

American Society of Civil Engineers:
http://www.asce.org

ASCE New Hampshire Chapter:
http://www.ascenh.org

ASCE Vermont Chapter:
http://sections.asce.org/vermont

ASCE Maine Chapter:
http://www.mainescasce.org

ASCE Connecticut Chapter:
http://www.csce.org

ASCE Rhode Island Chapter:
http://riasce.org

Urban Land Institute:
http://www.uli.org

MA Association of Consultant Planners:
http://www.maconline.org

The American Planning Association Northern New England Chapter:
http://www.mncponline.org

APA Massachusetts Chapter:
http://www.massapa.org

APA Connecticut Chapter:
http://www.ccapa.org

APA Rhode Island Chapter
http://www.rhodeislandapa.org

On the Cover: View of the Bruce Freeman Rail Trail passing over Pond Street in Chelmsford, Massachusetts. Photo Source: Samuel W. Gregorio, E.I.T.

On the Back Cover: Spring view of the Bourne Bridge over the Cape Cod Canal in Bourne, Massachusetts. Photo Source: Steven M. Tupper, E.I.T.
Hello once again New England Section

Can you believe it’s already May? Although after that brutal winter, I bet many of us have been counting down the day until its stays that constant 70 degrees or higher. At least we had two day this week!

Inside the Issue

In this quarterly issue, we feature an article from Past New England Section President Bill Lyons, P.E., PTOE of Fort Hill Infrastructure, LLC. Bill examines the “Application of Electrical Circuit Theory on Traffic Calming Planning and Implementation.” The article provides a simple and verifiable means of calculating the likely diffusion of new traffic volumes on a series of parallel roadway networks in optimal traffic conditions.

A special thanks to Andrew Brunn, a BSCE graduate at Northeastern University, who has shared his paper focusing on subway bunching on the MBTA Green Line in Boston. Andrew submitted this paper of one of the many applicants for the Daniel B. Fambro Student Paper Award. The Northeastern District will award the District Student Paper Award later this week at the Northeastern District Annual Meeting in Long Branch, NJ. Good luck to all the applicants!

Upcoming Elections

It seems like ITE Election season is always upon us. Once again, a member of the Northeastern District is up for election as the 2015 International Vice-President. Page 13 of the Chronicle overviews the two candidates up for election. Additional information can be found on the New England Section website at [http://www.neite.org/](http://www.neite.org/).

Contributions from 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 second 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 second issue of the 2014 calendar year.

Samuel White Gregorio, E.I.T.
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Please remember to visit the New England Section website at [http://www.neite.org](http://www.neite.org) and our updated Section Directory for information on the New England Section.

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As of this issue of the Chronicle, our Facebook group has nearly 60 “Likes”. Here you can get updates on future and current events, and even see photos from many of our past events. Feel free to post any discussions or comments on our wall.

Our LinkedIn group is also growing fast. We already have nearly 275 members. Search for “New England Section of the Institute of Transportation Engineers” or follow the link from the NEITE webpage and join the group. We will be posting info on future events here as well. While we can’t post photos here, there are areas for discussions, notices, and even job postings.

Finally, the New England Section is now on Twitter with 20 followers and growing every day. Please find your quick hit updates by following @NewEngland_ITE

Please remember to receive all your updates, news, and Section information at the New England Section website:

http://www.neite.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 Fomenko, P.E., PTOE at BETA Group, Inc. at nfomenko@beta-inc.com.
Application of Electrical Circuit Theory to Traffic Calming Planning and Implementation

WILLIAM F. LYONS, JR., P.E., PTOE, ESQ
President
Fort Hill Infrastructure Services, LLC

Introduction

Traffic engineers and transportation planners are often called upon to estimate traffic volumes in a network of roadways. The need for these estimates can arise in a number of different contexts, such as traffic studies for urban centers or corridor studies for suburban and rural environments. Recently, the need for traffic volume estimates on alternate routes seems to be more prevalent for context sensitive solutions, such as traffic calming and sustainable neighborhood design. The problem of estimating traffic volumes on parallel routes can be quite vexing. That problem is compounded when we attempt to estimate traffic volumes on parallel routes in order to evaluate the impact of traffic control devices on travel times and traffic volumes.

The options for traffic engineers attempting this type of analysis include a wide range of possible approaches with significantly different costs. Typical approaches include the most expensive computer models to the least expensive data collection efforts. However, for the average practitioner, there is no substitute for a cost effective calculation that delivers acceptably accurate results.

This article provides a simple and verifiable means of calculating the likely diffusion of new traffic volumes on a series of parallel roadway networks in optimal traffic conditions. It also provides a methodology to estimate the effects of introducing new roadway elements to a network in order to induce a target traffic flow. I propose this methodology to assist traffic engineers and transportation planners in their daily efforts to consider solutions to the problems presented by constituents on a routine basis.

Traffic Flow Theory – Past and Present

For the typical traffic engineer, the theory of traffic flow as reflected in most academic and scholarly journals is simply out of touch with their daily lives. The theories are dense and difficult to understand. They are even more difficult to apply to every-day traffic studies for municipal boards and state agencies.

Traffic flow theory has often been contemplated in the context of fluid dynamics (or fluid mechanics). The scientific application of fluid dynamics to traffic flow theory dates back to the 1950s, when many traffic engineers were applying the basic concepts of fluid dynamics to traffic flow in an attempt to explain how traffic flowed in a variety of conditions. This theory of traffic flow has been expanded upon over a period of sixty years, with a wide variety of research results. However, most of the research dedicated to traffic theory has focused on a single segment of road or an intersection where the effects of traffic congestion are to be examined. The Highway Capacity Manual provides exhaustive theory and calculations on the subject of traffic flow under these conditions.

Absent from the body of research is a simple tool to help practitioners provide estimates of traffic flows on parallel roadways under normal traffic conditions. In fairness, the more powerful traffic simulation and dynamic assignment models will provide estimates of traffic flow on parallel routes. However, such methods are costly and generally unavailable for routine traffic studies. These models are generally used for regional or urban modeling.

An Approach to Traffic Flow Theory Applying Electrical Circuit Theory

In an effort to identify an inexpensive and intuitive method of estimating traffic flows on parallel routes, I have explored the application of electrical circuit analysis to traffic flow theory. This theory is rooted in the principle of conservation of energy. For electrical theory, this takes the form of Kirchhoff’s Current Law (KCL) and Ohm’s Law. Applying electrical theory, I have analogized the basic components of traffic flow to the basic components of an electrical circuit. Accordingly, I have used the overall traffic demand (or volume) in the place of potential, or voltage. I have used the lengths of the parallel routes (measured in time or in physical length) as the resistance of the circuit. With V and R provided as known values, we can solve for a proxy of current, or flow, to determine how much of the overall volumes will use each individual parallel route.

KCL states that the sum of currents entering a node in a circuit must equal the sum of the currents leading a node in a circuit.

In Ohms law, the relationship between voltage, current, and resistance is expressed as:

\[ V = I \times R \]

Where V = Voltage, I = Current, and R = Resistance.

A simple series circuit representing this relationship is shown in Figure 1. A series circuit is a circuit where all current passes through all resistors in sequence, or in series. A more advanced circuit would be a parallel circuit. A parallel circuit is shown in Figure 2.

In a series circuit, current passes through only one branch of a circuit and only the resistors in that branch. In a parallel circuit, the current going through the resistor in any one branch is inversely proportionate to the resistance in the resistor. Specifically, Ohms law is expressed as follows:

\[ V = I \times R \]

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\[ V_1 = V_2 = V \]

where \( V_1 \) equals total voltage, \( V_2 \) equals the voltage across Resistor 1 (\( R_1 \)), and \( V \) equals the voltage across Resistor 2 (\( R_2 \)).

And

\[ V_1 = I_1 \times R_1 \quad \text{and} \quad V_2 = I_2 \times R_2 \]

\[
I_1 = I_1 + I_2
\]

For the traffic analogy, we are interested in determining the proportion of the overall traffic volume that is likely to take one route versus another parallel route. Assuming all other potential factors are equal (horizontal and vertical geometry, land use attractions on roadway segments, road and lane widths, traffic control features, etc.), the proportion of traffic inclined to travel one route is inversely proportionate to the resistance. The longer the roadway segments on the route or the slower the speed, the smaller the traffic flow.

The first task is to calculate the total resistance in the circuit, which is:

\[ \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} \quad (\text{Ohm's Law}) \]

Once one has the total resistance of the circuit, one can calculate the current in the total circuit and the current in each parallel branch.

\[ I_1 = \frac{V}{R_1}, \quad I_1 = \frac{V}{R_1}, \quad I_2 = \frac{V}{R_2} \]

Finally, the proportion (\( P \)) of current in each parallel branch represents the proportion of total current that would be expected in each branch.

\[ P_1 = \frac{I_1}{I_1}, \quad P_2 = \frac{I_2}{I_1} \]

For example, assume a total potential (the total traffic volume to be split between two parallel routes) for the roadway network shown in Figure 3 is 2,000 vehicles in an hour. Further assume that the length of segment 1 = 1000 meters and the length of segment 2 = 1200 meters.

Solving the equations for the parallel circuit for our example:

\[ V = 2,000, \quad R_1 = 1000, \quad \text{and} \quad R_2 = 1200 \]

Solving for total resistance (\( R_t \)):

\[
R_t = \frac{1}{\left(\frac{1}{R_1} + \frac{1}{R_2}\right)}
\]

\[ R_t = \frac{1}{0.0010000000083} \]

\[ R_t = 1,000 \]

Solving for total circuit current (\( I_1 \)):

\[ I_1 = \frac{V}{R_t}, \quad I_1 = 2000/1200 \]

\[ I_1 = 3.66 \]

Figure 3: Example 2-Segment Roadway Network

Solving for current in each segment:

\[ I_1 = \frac{V}{R_1}, \quad I_1 = 2000/1000 \]

\[ I_1 = 2 \]

\[ I_2 = \frac{V}{R_2}, \quad I_2 = 2000/1200 \]

\[ I_2 = 1.67 \]

The proportion (\( P \)) of traffic flow in each leg can be calculated as:

\[ P_1 = \frac{I_1}{I_1}, \quad P_1 = 2/3.66 \]

\[ P_2 = \frac{I_2}{I_1}, \quad P_2 = 1.67/3.66 \]

Now we can calculate the projected traffic flows on each leg:

\[ I_1 = \frac{V}{I_1}, \quad I_1 = 2000 * 0.55 \]

\[ I_2 = \frac{V}{I_2}, \quad I_2 = 2000 * 0.45 \]

According to our calculations, 55% of the traffic would use roadway segment 1 and 45% of the traffic would use roadway segment 2. This would result in a total traffic volume on roadway segment 1 of 1100 vehicles and a total traffic volume on roadway segment 2 of 900 vehicles.

Application

As municipal and regional governmental agencies consider the benefits and costs associated with context sensitive solutions, the ability to simply and quickly predict the likely outcome of changes to roadway networks is essential. Without the benefit of sophisticated and expensive traffic modeling software, the ability of traffic engineers and transportation planners to estimate iterative outcomes is invaluable. The application of Kirchoff’s Current Law and Ohms Law provides the practitioner with a simple a repeatable method that can fill this gap.

One simple application of this methodology could be determining the impact of traffic calming on a corridor and/or a broader network of parallel roadways. If instead of segment length the equation includes travel time as the “resistance” in Ohms law, the practitioner can vary the resistance to adjust to the optimum desired volume on the roadway segment. Since travel time can be calculated as a result of several variables (average speed, affect of traffic control devices, effect of traffic calming features [including deceleration and acceleration], and the length of the roadway segment), the practitioner can add or delete traffic control devices/traffic calming devices to achieve a desirable volume split between roadway segments. In the alternative, the practitioner can

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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:

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### Section Calendar

**May 2014**

Northeastern District Annual Meeting  
May 14th-16th, 2014  
Ocean Place Resort  
Long Branch, New Jersey

**June 2014**

Desjardins Golf Tournament  
June 4th, 2014  
Sandy Burr Country Club  
Wayland, Massachusetts

Joint NHITE & MaineITE Meeting  
June 26th, 2014  
Village by the Sea  
Wells, Maine (tentative)

**July 2014**

Joint CTITE & CSCE Golf Outing  
July 25, 2014  
Timberlin Golf Club  
Berlin, Connecticut

**August 2014**

ITE International Annual Meeting  
August 10th-13th, 2014  
Washington State Convention & Trade Center  
Seattle, Washington

Please send all calendar announcements, including the name of event, the contact person, event location and date to:

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### Applications for the 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:


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**Why Sponsor and Place an Advertisement:**

- The New England Chronicle reaches more than 700 ITE professional and student members within the New England Section and many other transportation professionals around the northeastern U.S.,
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Quarterly Images

Scholarships
Holly Linder of the University of Connecticut receives the CT-ITE Scholarship in Storrs, CT.

Connecticut State Chapter Executive Board
In April, the Connecticut Chapter of ITE welcomed its new Executive Board.

UMass Student Awards
At the Annual UMass Technical Day, Professor Michael Knodler presented Curt Harrington and Christina Dube with the UMass ITE Student Service Award.

Field Visit
Members of the Connecticut Chapter and New England Section participated in a tour of the new mixed use Storrs Town Center and Intermodal Center.

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Solving for current in each segment:

\[ I_1 = \frac{V_1}{R_1}, \]
\[ I_1 = 600/60, \quad I_1 = 10 \]
\[ I_2 = \frac{V_2}{R_2}, \]
\[ I_2 = 600/80, \quad I_2 = 7.5 \]
\[ I_3 = \frac{V_3}{R_3}, \]
\[ I_3 = 600/90, \quad I_3 = 6.67 \]

The proportion (P) of traffic flow in each leg can be calculated as:

\[ P_1 = I_1/I, \]
\[ P_1 = 10/I, \quad P_1 = 0.41 \]
\[ P_2 = I_2/I, \quad P_2 = 0.31 \]
\[ P_3 = I_3/I, \quad P_3 = 0.28 \]

Now we can calculate the projected traffic flows on each leg:

\[ T_1 = V_1 * P_1, \]
Solving the traffic flows on segments 1, 2, and 3 (T_1, T_2, and T_3):

\[ T_1 = 600 * 0.41 \quad T_1 = 246 \]
\[ T_2 = 600 * 0.31 \quad T_2 = 186 \]
\[ T_3 = 600 * 0.28 \quad T_3 = 168 \]

In our scenario, if the residents of Harvard Street (segment 1) are complaining about an unfair proportion of traffic, the municipality could propose traffic calming that would add 10 seconds of travel time to segment 1. As a result, one would find the following traffic volumes:

\[ V_1 = 600, \quad R_1 = 70, \quad R_2 = 80, \quad R_3 = 90. \]
Solving for total resistance (R_i):

\[ R_i = 1/((1/R_1) + (1/R_2) + (1/R_3)) \]
\[ R_i = 1/(0.0142 + 0.0125 + 0.0111) = 24.81 \]
\[ R_i = 70, \quad R_i = 80, \quad R_i = 90. \]
Solving for total circuit current (I_i):

\[ I_i = V_i/R_i, \]
\[ I_i = 22.68 \]
Solving for current in each segment:

\[ I_1 = V_1/R_1, \quad I_1 = 600/26.45 \]
\[ I_1 = 22.68 \]
\[ I_2 = V_2/R_2, \]
\[ I_2 = 8.57 \]
\[ I_3 = V_3/R_3, \]
\[ I_3 = 7.5 \]
\[ I_3 = 6.67 \]

The proportion (P) of traffic flow in each leg can be calculated as:

\[ P_i = I_i/I, \]
\[ P_1 = 0.41 \]
\[ P_2 = 0.31 \]
\[ P_3 = 0.28 \]

Now we can calculate the projected traffic flows on each leg:

\[ T_1 = V_1 * P_1, \]
Solving the traffic flows on segments 1, 2, and 3 (T_1, T_2, and T_3):

\[ T_1 = 600 * 0.38 \quad T_1 = 228 \]

Continued on Page 9
The goal of the committee is twofold: that was prepared by Jon Mirabito in 2007. Discussions on updating the Strategic Plan on March 21, 2014 to kick off the initial Committee held a teleconference call on The New England Section Strategic Plan ATTENTION STUDENT CHAPTER MEMBERS!!! The application of Kirchhoff’s Current Law and Ohm’s Law have broad application in the conclusion. The application of Kirchhoff’s Current Law and Ohm’s Law have broad application in the field of traffic engineering. One application is the calculation of projected traffic flows on a street network. The use of these two electrical circuit theory calculations provides a methodology to estimate the effects of introducing new roadway elements to a network in order to induce a target traffic flow. This methodology can be used to assist traffic engineers and transportation planners in their efforts to iteratively develop traffic calming plans with a goal of redirecting the right traffic to the right roadway, and reducing the impact of regional traffic on neighborhood streets.

William F. Lyons Jr., Esq., P.E. is the President and Founder of Fort Hill Infrastructure Services in Boston, Massachusetts and is a licensed Professional Engineer and a Lieutenant Colonel in the United States Army Reserves.

General Announcements

ATTENTION STUDENT CHAPTER MEMBERS!!!

The New England Chronicle is soliciting submissions by active student chapter members to the “Student Research/Project Spotlight” article. The New England Section would like to highlight the research and projects of our student chapters and student chapter members. Articles to be submitted should be 750-1,500 words, properly sourced, and include a bio of all participating authors. If you would like to submit an article or receive more details, please contact Chronicle Editor, Samuel W. Gregorio, E.I.T. at sgregorio@theengineeringcorp.com.

New England Section Strategic Plan Update

The New England Section Strategic Plan Committee held a teleconference call on March 21, 2014 to kick off the initial discussions on updating the Strategic Plan that was prepared by Jon Mirabito in 2007. The goal of the committee is twofold:

- Review the plan, given our current state of ITE and the Section and solicit feedback from the committee members and
- Jointly develop an update of the plan for presentation at the New England Section Annual Meeting in December

The Committee made significant progress in our initial discussions, as detailed in the attached notes. The Committee also had a 2nd teleconference call scheduled on May 9.


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.

SAVE THE DATE!!!

On Wednesday, June 4, 2014 the New England Section will be hosting the 15th Annual Thomas E. Desjardins Golf Tournament to benefit scholarships for college students in the field of transportation engineering. Last year’s tournament took place again at Sandy Burr Country Club and we will return for our 15th year. We’re hoping for good weather and our usual rematches with past winners.

Last year we awarded two scholarships, thanks to your support and dedication to raising money for our students. As always, the two scholarships will be presented at the Joint New England Section and Massachusetts Chapter Annual Meeting this September in Waltham, MA.

We are already looking forward to this year’s tournament at Sandy Burr in Wayland, MA. Our start time this year will be at 9:00AM, so plan to arrive between 8:00AM and 8:30AM to give us a chance to register and be ready to go on time. Don’t worry, coffee and donuts will be available.

For more information please contact Paul Nauyokas at (617) 924-1770, fax (617) 532-4251 or via email at pnauyokas@vhb.com.

We are looking for firms to sponsor this year’s tournament. Please find the sponsor and registration form at the NEITE website (http://www.neite.org) and return it along with payment by May 27, 2014.
LeadershipITE is an interactive and fully engaged program where participants will hone their leadership skills via interactive workshops, active problem solving and engagement with transportation leaders. Graduates will leave with a broadened leadership perspective and skills to engage in their communities and shape the future of their transportation careers, organization, and profession.

Join a diverse group of transportation professionals to:

- Enhance your leadership skills
- Collaborate in team building exercises
- Engage in transportation policy issues
- Build professional relationships.

For more information and to apply to LeadershipITE, visit www.ite.org/Leadership.

Eligibility
To be eligible to participate in LeadershipITE the applicant must:

- Be an active ITE Member or Fellow in good standing with the ITE.
- Be able to demonstrate contributions to ITE through volunteer activities.

Application Process
The application period for LeadershipITE is open through July 14, 2014. A completed application packet includes:

- Completed application form submitted by the due date;
- Responses to short essay questions;
- Nomination letter from current or past ITE District or Section officer;
- Support letter from current employer; and
- Support letter from non-employer.

Tuition
Tuition for the program is to be determined in the near future. This includes all workshops (some meals during workshops), course materials, webinars, web conferences and registration to ITE's Technical Conference and Exhibit and Annual Meeting and Exhibit during the program year.

Application deadline is July 14, 2014.

Meet the New Members of the New England Section Executive Board

Jason M. DeGray, P.E., PTOE
Project Manager
Greenman-Pedersen, Inc.

State of Residence:
Massachusetts

ITE Positions Held:
ITEITE Junior Director (presently)
Emerging Professionals Group Chairman

Education:
M.S., Transportation Engineering, UMass Amherst, 2002
B.S., Mechanical Engineering, Boston University, 2000

Work History:
Currently a Project Manager with Greenman-Pedersen, Inc. (GPI), Jason began his career in transportation in 2000 pursuing a MS degree in Transportation Engineering from UMass Amherst after obtaining a BS in Mechanical Engineering from Boston University. In 2002, having completed graduate work, Jason began his professional career with BETA Group in their Norwood, MA location. Since that time his twelve years of professional experience in the transportation planning and engineering fields includes work in both the municipal and private sectors in both a leadership role and as a member of an integrated team. Jason has had the privilege to work for three leading multi-disciplinary engineering firms, BETA Group, Vanasse Hangen Brustlin, and GPI. His experience with each of these firms has had a profound impact on his career development and led to numerous lasting friendships and professional associations.

ITE History:
Jason’s association with ITE began at UMass where he was the treasurer of the student chapter. He chaired the Emerging Professionals Group from 2009-2013 and was the recipient of the Section’s 2011 Emerging Professionals Award. In addition to ITE Jason has been active in other professional organizations including YPT, APA, ITS, WTS, LivableStreets & NAIOP.

Samuel W. Gregorio, E.I.T.
Project Engineer
TEC, Inc.

State of Residence:
Massachusetts

ITE Positions Held:
ITEITE Junior Director (presently)
New England Chronicle Editor (presently)
ITE Webmaster

Education:
M.S., Transportation Engineering, UMass Amherst, 2010
B.S., Civil Engineering, UMass Amherst, 2008

Work History:
Samuel has been a Project Engineer at The Engineering Corp (TEC, Inc.) since July 2010 and has over four years of experience in civil engineering. Prior to TEC, Sam briefly worked as a Data Collection Sub-Contractor for Innovative Data, LLC. He is a graduate of the University of Massachusetts Amherst with a concentration in traffic engineering, traffic operations, traffic safety, and transportation design. Cross your fingers as Sam is currently awaiting results of his recent P.E. exam. Sam’s extensive experience in transportation engineering has stretched from traffic impact analyses to highway design, and Road Safety Audits to strategic site planning.

ITE History:
Throughout his undergraduate career, Sam’s focus was mostly on participating within ASCE. After discovering ITE as a graduate student, Sam has quickly risen the ranks serving as the UMass Student Chapter’s Vice-President, Webmaster, and Crosswalk Editor. After graduating, Sam assisted the New England Section as Webmaster and is now currently serving as New England Chronicle Editor and the Section’s Junior Director. For his service, Sam received the UMass Student Service Award and received the New England Section’s Emerging Professionals Award both in 2010.
Would You Like to Contribute to the New England Chronicle?

Would you like to contribute to an award-winning New England Chronicle newsletter? The New England Chronicle’s Editor Staff at TEC, Inc. is seeking members (both professionals and students) who are interested to write both short and feature articles for publication in the upcoming New England Chronicle issues. Both short and feature articles should be about technical topics, professional matters, innovative projects, and cutting-edge solutions that affect transportation engineering and planning.

Typically short article would consist of 750 to 1,500 words and feature articles would consist of 2,000 to 4,000 words. Each article should include a head shot and bio of all participating authors. Further details for each article submission can be given upon request.

For more information on how you can become a New England Chronicle contributor contact the New England Chronicle Editor: Samuel W. Gregorio, E.I.T. at sgregorio@theengineeringcorp.com.
Northeastern District Chair’s Report - Spring 2014

Michael A. Knodler Ph.D.
Associate Professor
University of Massachusetts Amherst

Hello ITE Northeastern District Members!

As many of you may know, this is going to be an active and exciting year in the ITE Northeastern District, and I am honored to be serving as your District Chairperson for 2014. Before going any further, I'd like to thank and acknowledge the fine leadership provided by the 2013 District Chair, Mike Wieszchowski. Many of the activities Mike helped to initiate in 2013 will continue in 2014, and are highlighted below. Thanks Mike!

There are a myriad of opportunities for members to be active in 2014. One activity currently underway is the development of a District Strategic Plan, which will provide us with the ability to shape the direction of our organization as we move forward. Although the process is ongoing, under the capable leadership of Steve Gayle, the strategic planning committee has developed the following draft mission statement:

“The Institute of Transportation Engineers Northeastern District serves to connect our Sections, Chapters, and members with the ITE International community, and to be a resource for our members for training, education, and networking opportunities that lead to improving their professional practice.”

With this mission in mind, I encourage members to engage in all manner of District activities, whether it be volunteering in support of ongoing initiatives, attending ITE meetings at all levels or more importantly, voting in the upcoming ITE election.

Similarly to 2013, this will be an important year for our District with regard to elections. Paula Benway of the Upstate NY Section has spent the past 3 years representing the Northeastern District as the District Director on the ITE International Board of Direction, and is now a candidate for International Vice President. Paula worked tirelessly to ensure that our District was well represented within ITE, and I have no doubt that Paula would be an excellent leader of our organization. Please be on the lookout for electronic ballots when they are sent out next month. Our District was successful in helping to elect one of our own, John Kennedy, as International Vice President in 2013. Let’s keep it going in 2014!

Perhaps the highlight of the District Calendar is the Annual Meeting, taking place this year in Long Branch, New Jersey (aka the Jersey Shore) from May 14th-16th. The venue looks spectacular, and the Local Arrangements Committee has worked hard to provide an excellent meeting experience. The meeting promises to be a fantastic event, with a nice mix of networking along with many Professional Development Hours (PDHs) to be earned. The technical program includes excellent presentation topics, including the response to special events (Superstorm Sandy and the Super Bowl), safety programs, pedestrian accommodation and many others. Typical District meeting staples such as the Bike Tour, a golf outing, the Awards Banquet and the annual Traffic Bowl will also be included. In fact, at this year’s meeting, we plan to offer two Traffic Bowls, with one for “professionals” and another for students that are competing to represent our District at the Grand Championships in Seattle during the ITE Annual Meeting later this summer. There will be more than a dozen vendors on hand, displaying the latest and greatest transportation technology and services. Another meeting highlight will be Wednesday’s Technical Workshop, which will cover traffic incident management and ITS deployment in New Jersey, and will include a tour of the Statewide Traffic Management Center. Registration is open now, so please visit (http://northeasternite.org/annual-meeting/) to learn more and to register. I hope to see you all at the Jersey Shore!

In other news, the inaugural class of LeadershipITE is underway. Our District is well represented with 4 members; including Amir Rizavi, Andy Kaplan, Adam Allen and Grace Van Kirk. Although I am certain this will be of benefit to each of the members individually, this will also be greatly helpful to our District, as they identify unique opportunities to bring elements of LeadershipITE into District activities. Applications for the Class of 2015 are due in mid-September, and I would encourage any members with an interest to consider applying or nominating a deserving candidate.

Previously I noted that a strategic planning effort had been initiated and is now ongoing. In short, we are attempting to provide a vision and direction for our District. We want to identify critical “issues” facing our organization and identify specific actions that will allow us to get where we want to be. I am excited about the work to date, and look forward to sharing the progress with District members in the coming months. I strongly encourage anyone with specific ideas or concerns to let me know (mknodler@ecs.umass.edu). Our organization has so much to offer, but there are always opportunities for improvement.

I am really looking forward to the remainder of the year, and all that we have underway. I look forward to seeing all of you at an upcoming meeting, but in the meantime, please do not hesitate to contact me with any specific ideas you may have.

Michael A. Knodler, Jr., Ph.D.
Northeastern District Chair

The following are quick updates on activities that remain ongoing.

- **Modernization of the District Webpage** - One area of emphasis over the past year was the updating of the District web page. Kudos to Mike Wieszchowski and Mike Collins for shepherding this along. We are envisioning a fair amount of tweaks to the webpage, such as an interactive calendar that allows for linkage with Chapter and Section calendars within our District. However, the webpage is a significant upgrade. Check it out here: (http://northeasternite.org/). Better yet, help us to develop and populate the web page with content!

- **Review of District By-Laws** - Last year a review of the District By-Laws was initiated. As has been noted in the past, the By-laws are the instruction manual for the District, and provide guidance for District leaders. The By-laws Committee, led by Kim Hazarvartian, has spent considerable time reviewing elements of the By-laws that may be out of date and proposing changes that may be in order. Stay tuned.
Raymond E. Davis, III, P.E., PTOE, FITE
Vice President - TrafficDuco Inc.
San Francisco, California USA
www.ite.org/Ray4ITE | Ray4ITE@gmail.com
Follow me on Twitter @ray4ite, Facebook, or LinkedIn

MAKING ITE WORK FOR YOU

I celebrate 40 years of active involvement in ITE in 2014. The return on my investment has exceeded my expectations every step of the way, for the public and for me, professionally and personally. I’m a better professional because of ITE and being a better professional made my career advancements possible. Now, I want to make sure you have the same opportunities to grow that I did, tailored to meet your needs.

We all have competing activities that make it a challenge to be active in ITE. We need to increase opportunities to participate and access information and remove barriers to involvement. We need to make sure that ITE publications, conferences, and training are relevant to dealing with today’s issues in a cost effective manner.

My vision for Making ITE Work for you:
- Leverage Technology and Social Media to better serve our members.
- Continued support of LeadershipITE.
- Expand our electronic library to enable instant access to all of our publications.
- Define out global role to identify how we can support transportation professionals worldwide, especially in Asia.

Implementing this vision will allow you to become a better professional, and that will enhance our profession as a whole.

I have been very fortunate to serve at all levels of ITE leadership (21 years at elected or appointed positions). I was co-founder and President of a Student Chapter, Section President of two sections, Western District President and a Director on the International Board. I have served on the Executive Committees of three ITE Councils and chaired the Public Sector Council as well as serving on numerous technical committees. This combined with my experience in the public sector as a City Traffic Engineer and Public Works Director and in the private sector in senior management positions has enabled me to listen and recognize the needs of our members at all levels of ITE. My passion, experience, vision, and time available to commit to ITE will make sure that with your support I will Make ITE Work for You.

Candidates for 2015 International Vice-President

Paula F. Benway, FITE
Associate, Transportation - Stantec Consulting, Inc.
Rochester, New York USA
paulaforitevp@gmail.com
Follow me on Twitter @paula_benway, Facebook, or LinkedIn

My Vision for ITE

We are living in an era of transformation! Led by forces like technological advancement; funding policies and sustainability; economic, societal, and environmental trend. This provides us with an immense opportunity to transform alongside our industry. Our organization must be at the forefront of a positive movement, using the power of our networks to collaborate with others in creating new solutions to the challenges before us.

Visibility
We must promote and enhance ITE’s role as a respected transportation authority while being an advocate for our members’ needs, goals, and capabilities. Transportation professionals need an institute that helps them address the issues facing our communities. Collaborating with other organizations to address community needs and working with policymakers at all levels of government elevates our position as leaders in the industry.

Accessibility
To make ITE the premier organization, we need to be more accessible to our members. We can do this by providing platforms that expand our use of the digital technology of today and tomorrow to educate the next generation. We need to provide useful tools that allow our members to draw on realistic assessments and forecasts of cities, economies, and the environment. In addition to technical expertise, diversified professionals with strong skills in facilitation to engage the public, advocacy to influence policymakers, and collaboration to engage partners are critical to our success. We must bridge the knowledge, wisdom and experience of current and past generations to guide and propel the success of the next generation.

Affordability
We must provide cost-effective professional development opportunities such as webinars and briefings, and improve our annual meetings. Our annual meetings offer an invaluable opportunity by providing technical knowledge, workforce development, global information exchange, and networking. We must explore the use of technology to expand the reach of the meeting and make it more affordable to the majority of members who rarely have the opportunity to attend.
Charles F. Sterling III, AKA Chuck Sterling, graduated from Lowell Tech in 1973 with a Bachelor of Science in Engineering Technology, and a Master of Science in Civil Engineering (MSCE) from Penn State in 1974. Chuck earned additional advanced degrees from the Bureau of Highway Traffic (Graduate Certificate, Penn State, 1974) and from Harvard’s Kennedy School of Government (Master of Public Administration, 1983). Yes, that’s right, two Masters Degrees and a Graduate Certificate. Perhaps this impressive educational background accounts for Chuck’s combination of technical and communication skills. He was awarded National Transportation Safety Fellowships in 1973 and 1984 from Federal Highway.

In March of 1968 Chuck began his professional career with the Metropolitan District Commission (MDC), which is now the Department of Conservation and Recreation (DCR). In of December of 1968, he moved to the then Massachusetts Department of Public Works, which became MassHighway during Chuck’s career and is now the Massachusetts Department of Transportation (MassDOT). Chuck went on to spend the rest of his career with the State, for a total of 35 years, beginning with two years in Planning and the rest in Traffic Engineering, culminating with his appointment as the State Traffic Engineer. Many don’t know about Chuck’s second career with the Army Reserve and National Guard, from which he retired as a Lt. Colonel in 1993, ten years before his retirement from MassHighway in 2003.

Chuck’s greatest challenges include his transition from MassHighway to the Mass Turnpike at the age of 60, and balancing the need to maintain city traffic flow while accommodating construction. On a personal note, he regrets not knowing about the services for his long-time friend and co-worker Bob Fay. He remembered Bob for his contributions to the profession; Bob was always trying to help rather than be critical.

Asked about his greatest satisfactions, Chuck noted: the planning required for the Massachusetts Bicentennial in 1975, working with Ed Fitzgerald, Art Davis and Jim D’Angelo; and the other wonderful people he worked with throughout his career. He also noted development of the Highway Safety Management Plan. His only regret is that he did not take up golf soon enough.

When asked about the biggest changes he has seen in transportation, Chuck replied, “I am alarmed at the current funding levels for transportation, and it keeps getting worse”. In particular, he cited the current infrastructure, which needs significant upgrading. He also noted that highway funding is often diverted for other uses.

Chuck has received an impressive list of awards:

- 1973-74 National Highway Safety Fellow
- 1974 National ITE Past Presidents Young Professional Award, based on his Penn State Thesis
- 1975 Outstanding Young Engineer, November, Massachusetts Society of Professional Engineers
- 1982-83 National Transportation Fellow
- 1991 National ITE Technical Council Award
- 2003 NEITE Transportation Engineer of the Year Award

Chuck also served on the ITE National MUTCD Committee (for signing) from 1993 to 1997.

Since retiring Chuck has spent his time golfing; and then golfing more; and then... well, you get the picture. In addition to golf, he has also held numerous leadership positions in his “Over 55” community. He and his wife of 45 years, Jane, have two children. Charles (Chip) and his wife, Carmel, have three children; Charles, Grace and Timothy. His daughter, Beth, and son-in-law, Kevin Zorn, have three children; Abbie, Caroline and Catherine. Beth and Kevin work at the US Embassy in Arman, Jordan. Chuck and Jane do a fair amount of traveling; they winter in Florida, have traveled in Western Europe, and have visited their family in Jordan.

I took great pleasure with this assignment and the opportunity to visit with a long-time friend. In speaking with him, I was reminded of Chuck’s retirement party held at Ten Park Plaza. Many of us got to speak about his accomplishments. Mostly, however, the talk was of Chuck’s integrity, dedication and the degree of professionalism he brought to the traffic group.
Light Rail Central Subway Bunching

ANDREW L. BRUNN
Bachelor’s of Science in Civil Engineering Graduate
Northeastern University

Introduction
The City of Boston is served with public transportation by the Massachusetts Bay Transportation Authority (MBTA) over three heavy rail lines and one light rail line, the Green Line. The Green Line is broken into five sections, the B, C, D, and E Branches as well as the Central Subway. The Central Subway is the oldest subway in the United States, built in 1897. Service in the Central Subway, between the Government Center stop and the Copley stop, is operated in both directions by all four branch lines (Figure 1).

Passengers commonly notice that the specific train line that they are waiting for seems to never arrive, while the other lines alternate arrivals as they pass through the Central Subway. While this complaint is not always the case, the complaint is relative as the cause of the large gap in service for that specific line is the bunching or platooning of trains prior the passengers arrival. For the purpose of this study, bunching will be defined as any headway between trains on the same line less than four minutes. This can be defined as bunching, as scheduled service on the B, C, D, and E Branch headways during this time period are nine, 10, 11 and eight minutes respectively.

Literature Review
The MBTA’s Green Line is a light rail line which can be compared to other forms of transit, as they face similar issues. Most research studies on platooning focus on transit, as they face similar issues. Most which can be compared to other forms of transportation by the Massachusetts Bay Transportation Authority (MBTA) over three heavy rail lines and one light rail line, the Green Line. The Green Line is broken into five sections, the B, C, D, and E Branches as well as the Central Subway. The Central Subway is the oldest subway in the United States, built in 1897. Service in the Central Subway, between the Government Center stop and the Copley stop, is operated in both directions by all four branch lines (Figure 1).

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Figure 2: MBTA Green Line Typical Vehicle

To compensate, many bus operators will insert “slack” into their bus schedule. “Slack” is extra time that is built in the schedule to make sure the route operates “on-time”. Buses are “held” at the control points to keep the buses on schedule. This measure reduces the commercial speed. The commercial speed is the overall speed that it takes for the bus to complete the total route, including stops. This is the travel speed that a passenger experiences. Another side effect of additional slack in the schedule are irregular headways, which the additional slack was added to correct. Therefore, a bus can only be slowed at the end stations or control points. One approach at control points focuses on a target headway. If the bus arrives at the control point prior to its pre-specified target, the bus will be held longer than normal. The reverse is also true, if the bus arrives later than the target, the bus will layover for a shorter time period.

While this tool is useful, Bartholdi and Eisenstein’s method abandons the concept of a schedule and target headway and prefers to allow for a natural headway. They feel that headways will equalize, even after unpredictable disruptions like mechanical failure. They also make use of Automatic Vehicle Locator (AVL); however, they do not focus on AVL as Global Positioning System (GPS) is inaccurate in the urban setting and during weather events. They feel that they can reduce both the average headway and the variation of headways to better serve...
Continued from Page 15

riders. They conducted an experiment at the Georgia Institute of Technology, where shuttle bus drivers were told to ignore headways and schedule, but rather drive with the flow of traffic. Overall, drivers felt safer as they were focused on driving rather than the schedule.

In order to solve internal causes, for example, in timetable development, it is necessary to evenly distribute headways and evenly distribute loads. While a set schedule during various peak periods is easy to plan due to repetition, setting headways during transition times is a challenge. One way to accommodate for this situation is to use an average headway between the time periods to transition.

The study most similar to the Green Line situation is a study based in Toronto, Canada. The Toronto Transit Commission’s Route 504 King streetcar was studied to see the impact of converting from single unit street cars to multiple-unit to improve on reliability issues such as bunching and gapping, which are obvious signs of inefficient transit operation. These issues result in many street cars being short turned to the opposite direction in order to fill gaps in the most heavily used sections. The route being studied is U-shaped and has four subway stations. The route carries about 50,000 passengers daily and crosses 32 signalized intersections, 27 of which have transit signal priority. This is quite similar to the Green Line, outside of the Central Subway, as it crosses a multitude of signalized intersections. The difference is that the signals are city owned and controlled and do not include transit signal priority.

The route in Toronto has two minute headways during the peak period, in which more than 25% of streetcars are short turned. Shalaby et al. state that “Routes with frequent service such as this are very unstable and even “normal” minor delays can cause the route to break down.” This quote is especially noticeable in Boston, as the headways are so frequent and with four lines running in one trunk line, a minor delay can delay every train.

Some suggested changes to be made to the system include separation from traffic and a change in the fare from a pay-as-you-enter system to a proof of payment system. This fare change would make all stops much quicker as passengers will be expected to pay, without delaying the train due to payment. In Toronto, whenever a long headway is observed, a supervisor will have the first train behind the gap short turn. Shalaby et al. suggest that headways greater than 1.5 times the scheduled headway should trigger a short turn. They also suggest that headway variability should be measured through the use of the coefficient of variation when there are different headways, instead of the more traditional approach of using the standard deviation. While some of these suggestions are already implemented in Boston, it needs to be examined if, these changes would help Boston.

Design of Experiment

In order to study the bunching of MBTA Green Line trains in the central subway, one data collector was positioned at Arlington Station’s outbound platform for a period of two days for two hours (See Figure 1 for location). Data were only collected during off-peak hours, as service is quite frequent during peak times, where the problems caused by bunching (i.e. people waiting for long periods of time for their specific train) do not occur. Arlington Station was chosen, as it is a central subway station where all four service branches (B, C, D, and E), and the outbound direction is the necessary study direction as going inbound all four lines serve the same core stations, while in the outbound direction there is a split in the destinations and therefore patrons are waiting for a specific train to go to their destination. Data were collected over the span of multiple days at a random time, to try to normalize data and determine if there are any outliers caused by a specific issue that day. Any day where there is a published service disruption prior to collecting data, no data from that day was used due to any potential aftershocks of the disruption.

While at Arlington Station, the data collector recorded the time that the light rail vehicle comes to a complete stop. The data collector also recorded the lead vehicle’s identification number (3XXX), solely to identify the specific train and the train’s route displayed on the LED screen on the vehicles. The collector made all efforts to collect the number of boardings and alightings from the train to determine ridership; however, this was not a priority in this experiment. Other useful information collected is the number of vehicles that are coupled together, as the MBTA mostly runs trains of two vehicles coupled together; however, sometimes there is only one vehicle and sometimes there are three vehicles.

Data collected on the time will then be used to determine the headway between each vehicle overall, as well as on each specific route. These headways will then be compared to the minimum 2009 Service Delivery Policy and the Fall 2013 MBTA Green Line schedule (Figure 2).

Results

Utilizing the methodology outlined, 109 trains passed through Arlington Station going outbound during the approximately three and a half hours of observation time, spanning two days. Observations occurred over two days during two different times of the off-peak time period, to normalize the data. In order to determine the quality of service the MBTA’s 2010 Service Delivery Policy’s minimum headway of 15 minutes during off-peak time period, is used to compare to the data collected and is plotted. When recording headways between trains on the same branch, when no specific branch is examined 8% of train headways exceed the 15 minute minimum service. While 8% seems like a minimal percentage, it is quite significant as the 15 minute minimum already

Continued on Page 17
Linearity was examined to determine how consistent headways were over the examined time periods. When headways are consistent, the trend line will not be linear. One thing that is expected is that the coefficient of determination ($R^2$) should be close to zero, thereby making the Pearson coefficient ($R$) close to zero. Both values were determined by Microsoft Excel by fitting a linear trend line to the data. An $R$ value close to zero indicates a low amount of linearity. In this case low linearity means that the service is uniform, which means that headways on the MBTA’s Green Line are overall very uniform (Table 1) (Figure 3).

Service for passengers within the central subway core area, experience an average headway of two minutes. While sometimes passengers travelling outbound in the Central Subway experience headways as small as 42 seconds, the median headway is one minute and 20 seconds (Table 2).

It should also be noted that service for passengers on this segment is so frequent that headways did not exceed the 15 minute minimum; however, it was noted that while this service was quite frequent passengers were still waiting on the platform for their specific train branch (Figure 4).

The MBTA’s published Fall 2013 Schedule states that the headway on the $B$ branch during the mid-day period (the time period studied) is nine minutes, well within the service delivery policy’s 15 minute minimum. During the study period three trains or 11% exceeded the 15 minute minimum, while another two trains, seven percent, exceeded the schedule. Only 11% of trains operated within one minute of the scheduled nine minute headway. This means that 71% of trains are operating with headways under the desired schedule leading to bunching. Based on the definition established for bunching, 33% of $B$ Branch trains are bunched (Figure 5).

The MBTA’s published Fall 2013 Schedule states that the headway on the $C$ Branch during the mid-day period is 10 minutes. During the study period two trains or nine percent exceeded the 15 minute minimum, while another three trains, 13%, exceeded the schedule. Better than the $B$ Branch, 17%
of trains operated within one minute of the scheduled 10 minute headway. This means that 61% of trains are operating with headways under the desired schedule leading to bunching. One of the more extreme violations of the service delivery policy was found on the C Branch was when the headway between C Branch trains was 22 minutes and 30 seconds. Prior to this train two of the three C Branch trains were bunched. Based on the definition established for bunching, 17% of C Branch trains are bunched\(^8,9\) (Figure 6).

The most infrequently scheduled branch, the D Branch’s headway is closest to the service delivery policy’s minimum. This is more than likely due to the nature of the line, which is the longest route (approximately 10.5 miles past the Kenmore stop) on the Green Line and has exclusive Right-of-Way (ROW). The MBTA’s published Fall 2013 Schedule states that the headway on the D Branch during the mid-day period is 11 minutes. During the study period only one train or five percent exceeded the 15 minute minimum, while another three trains, 15%, exceeded the schedule. 25% of trains operated within one minute of the scheduled 11 minute headway. This means that 55% of trains are operating with headways under the desired schedule leading to bunching. Based on the small number of trains exceeding the service delivery policy, it is expected that there also be a small amount of bunching. Utilizing the definition established only 10% of D Branch trains are bunched\(^8,9\) (Figure 7).

The most frequently scheduled branch, the E Branch is the only branch that extends to the northern terminus of the Lechmere. The MBTA’s published Fall 2013 Schedule states that the headway on the E Branch during the mid-day period is eight minutes. During the study period only two trains or eight percent exceeded the 15 minute minimum, while another six trains, 24%, exceeded the schedule. Having the best predictability, 28% of trains operated within one minute of the scheduled eight minute headway. This means that 60% of trains are operating with headways under the desired schedule leading to bunching. Utilizing the definition established 24% of E Branch trains are bunched.\(^8,9\) (Figure 8).

Conclusions
Overall, it was found that there is inconsistency in service on the MBTA's

![Figure 6: MBTA Green Line C Branch Headway during Off-Peak Hours at Arlington Station](image)

![Figure 7: MBTA Green Line D Branch Headway during Off-Peak Hours at Arlington Station](image)

![Figure 8: MBTA Green Line E Branch Headway during Off-Peak Hours at Arlington Station](image)
Central Subway and a lack of adherence to the schedule. It was found that 20% of trains are bunched on their respective route, 8% of trains exceed the 15 minute minimum, and only 16% of trains are within one minute of their scheduled headways. This discourages ridership, and creates a mode shift due to unreliability (Table 3).

In order to best fix these reliability issues, there are two options. The first option would be to extend the B, C, D Branches to the terminus of Lechmere, instead of Government Center and North Station. This will allow E trains to be less crowded and more efficient. It will also allow for the correction of headways caused by the street level and subway delays. By not utilizing North Station and Government Center for short turns it will minimize delays for through travelling trains. An alternative to extending full service and eliminating short turns is to closely monitor headways of trains entering the tunnel at their respective portal and make sure it is at a coordinated time as the other trains enter their portal, to eliminate conflict. To resolve any gaps entering the tunnel, trains should be short-turned from outbound to inbound at the entrances to the tunnel, to maintain the schedule to within one minute of the published schedule. Efforts will be made to work with the MBTA to provide more consistent service to the passengers.

References


Andrew Brunn graduated with a Bachelor’s of Science in Civil Engineering from Northeastern University in May of 2014. During his time at Northeastern he was the ITE Student Chapter President, Project Manager for the Concrete Canoe Team, and Vice President for the ASCE Student Chapter. At Northeastern he has explored his passion for transportation, in particular transit and rail, through co-op’s, and a study abroad trip in the Netherlands. As part of his capstone project, he redesigned Route 106 in Mansfield, MA, using turbo roundabouts complemented by a complete streets approach and designed over 5 miles of roadway for several villages in Haiti for the ITE student chapter.
What would we do if we came upon this sign cluster? I, for one, would turn around and look for alternate routes! However, MAITE is in such a much better position, as we look to new members to help plan for the future. Recently, two members stepped forward to join the MAITE team, Matt Starkey of McMahon Associates and Jeff Bandini from Nitsch Engineering. They have provided invaluable help in planning several events and I look forward to them serving on the MAITE board in the near future. A thank you also goes to Bryan Zimolka and Hans Kuebler from HSH. MAITE meets monthly and are always looking for members to join and contribute.

Socially and educationally, MAITE recently hosted Northeastern University’s Transportation Engineering capstone groups for the MAITE spring social. Approximately thirty students and twenty professionals gathered at UNO’s on Huntington Avenue to learn and celebrate the graduating class’s exciting projects and their accomplishments. The projects evaluated transportation networks in Boston, Newton, and Mansfield. The Boston group designed improvements for the Massachusetts Avenue corridor between Huntington Avenue and Memorial Drive. The improvements included a dedicated bus lane on the Massachusetts Avenue Bridge, off-peak parking, and one way cycle tracks. The two Newton groups each improved a section of Brookline Avenue by incorporating complete street principles. Both groups suggested traffic calming techniques, updated intersection designs, parking reductions, and new social areas to activate the neighborhood. In Mansfield, one group worked to improve traffic circulation and livability near the Mansfield commuter rail station, and a second group improved a corridor connecting to the station. The station improvements included enhanced circulation, reversed angle parking, new parkland, and a mixed use path. The corridor improvements included a road diet with enhanced pedestrian and bicycle facilities as well as two Turbo Roundabouts at major intersections. Turbo Roundabouts, popular in the Netherlands, provide capacity similar to a multi-lane roundabout but with less conflict points. The event was a great opportunity for the students to showcase their projects and for the professionals to hear about fresh transportation ideas.

We are currently planning a Red Sox game event in August and of course the annual joint MAITE/NEITE meeting, which will be held on Wednesday September 17, 2014 in Waltham. We are on the WEB at http://www.neite.org/MA/index.shtml.

Lastly, two guys in a car drive right through the red light. "Man, you just ran that red light!" exclaimed the passenger. "Don’t worry, my brother does it all the time," said the driver. They continue driving through town and then proceed to drive through another stop light. "You just ran another stop light! You're going to get us killed!" screamed the nervous passenger. "Don’t worry, my brother does it all the time," repeated the driver. Moments later, they approached a green light and they came to a halting stop. “Why are you stopping?” asked the anxious passenger. The driver turned and said, "Because my brother might be coming!!"
Chapter, and Student Chapter Updates

CONNECTICUT STATE CHAPTER
Report Submitted by: Kwesi Brown, P.E., PTOE

The Connecticut Chapter of ITE held their 10th annual joint Transportation Student Research Symposium with the New England Section and the University Of Connecticut (UCONN) School of Engineering on Wednesday, April 2, 2014 at the University of Connecticut Storrs campus. The meeting had a turnout of over 70 people. The morning and afternoon programs featured a number of poster sessions and research presentations from UCONN and University of Massachusetts engineering students.

The lunch keynote speaker was James P. Redeker, Commissioner of CTDOT, who talked about Connecticut’s transportation outlook and key transportation projects within the State. Following lunch, participants went on a tour of the ongoing Storrs Town Center / Intermodal Center Project.

The evening program featured an informative presentation by Tony Guerrera, State Representative and House Chair of the Transportation Committee, who talked about transportation funding and the outlook for electronic tolling in Connecticut. During the evening program, Holly Linder from the University of Connecticut was presented with the student scholarship award.

The following 2014 ITE Connecticut Chapter awards were also presented at the meeting.

- **James W. Ford, P.E. – Transportation Leadership Award**
  Jim Ford was recognized for his many years of dedication and leadership in the transportation industry and for his service and involvement with the Institute of Transportation Engineers.

- **Fred Greenberg, P.E. – Transportation Achievement Award**
  Fred Greenberg was recognized for his many years of dedicated service to the traffic and transportation engineering professions and the Institute of Transportation Engineers.

- **Ted DeSantos, P.E., PTOE – Service to the Chapter Award**
  Ted DeSantos received the Service to the Chapter Award for outstanding service, constant dedication, and professional contribution to the Connecticut Chapter of ITE as past president.

- **Ranjit Bhave, P.E. – President’s Award**
  Ranjit Bhave received the President’s award in appreciation for outstanding service as President of the Connecticut Chapter of ITE.

Election ballots for Connecticut Chapter officers were tallied during the meeting and the following officers were announced for 2014-2015:

- President: Mike Morehouse, P.E. (Fitzgerald & Halliday, Inc.)
- Vice President: Kwesi Brown, P.E., PTOE (Milone & MacBroom, Inc.)
- Secretary/Treasurer: Craig Yannes, P.E., PTOE (Tighe & Bond, Inc.)

It was announced that a golf outing with CSCE is tentatively scheduled for Friday, July 25, 2014 at the Timberlin Golf Club in Berlin, CT.

Employment Opportunities

Fort Hill Infrastructure, LLC.

**Entry Level - Executive Level Positions**

**Multiple Locations**

The Fort Hill Companies are growing! We are a vibrant, multi-disciplined engineering and architecture firm based in Boston. We are looking for qualified candidates to fill positions in our engineering division, from entry level positions through executive level positions. We value team members who can work independently, take initiative, and contribute to team efforts. Key competencies include transportation planning and engineering, site civil design, and federal and state government experience. Additional desired competencies include: international experience, Spanish language skills, military experience, and a broad background in engineering disciplines. We are specifically interested in a junior to mid-level candidate with at least 2 years of engineering experience. We are also interested in a proven leader with demonstrable experience to join our executive team. The executive candidate will have strong business development and project management skills. The executive position will be filled by a licensed professional engineer with strong academic and business credentials. Fort Hill is a Service Disabled Veteran Owned Small Business (SDVOSB)/Service Disabled Veteran Owned Enterprise (SDVOBE). Preference will be given to candidates who are veterans, but all qualified candidates will be considered.

If interested, please email your resume to Scott Bosworth at sbosworth@fhillc.com.
Employment Opportunities

Howard/Stein-Hudson Associates, Inc.

Now in our twenty-seventh year of service to the transportation industry, Howard/Stein-Hudson Associates, Inc. (HSH) provides consulting services in the areas of transportation and municipal planning, traffic engineering, and public involvement/strategic planning. We at HSH take pride in our creative approaches to transportation issues, which synthesize sound planning and engineering practice with an understanding of community concerns. The firm’s principals, along with a team of outstanding professionals, provide transportation consulting services to public and private-sector clients around the country.

Senior Transportation Engineer/Planner
Boston, Massachusetts

This is an excellent opportunity for a candidate with 8-12 years of experience in managing transportation planning and design projects including roadway design, safety improvement, Complete Street projects, traffic signal improvements, and other related project types. Work with Principals on strategic pursuits including proposal development while maintaining strong relationships with public and private clients. You will be responsible for Quality Assurance/Quality Control of key project deliverables. High-level planning and analysis work including preparation of technical documents and reports is required.

Direct experience with project management is preferred. The successful candidate will have excellent communication, motivational, and leadership skills. BS degree in Civil/Transportation Engineering or City Planning required. P.E., PTOE, and/or AICP desirable, but not required.

Senior Transportation Engineer/Planner/Manager
Boston, Massachusetts

Due to sustained growth we seek an engineer or planner with 12+ years of experience in managing land development projects and support staff. The successful candidate will work with Principals on maintaining growth, strategic pursuits including proposal development while maintaining strong relationships with public and private clients. You will be responsible for Quality Assurance / Quality Control of key project deliverables. High-level planning and analysis work including preparation of technical documents and reports is required.

Direct experience with traffic impact studies and project management is required. The successful candidate will have excellent communication, public speaking, motivational, and leadership skills. BS degree in Civil/Transportation Engineering or City Planning required. Master’s degree preferred. P.E., PTOE, and/or AICP desirable, but not required.

BETA Group, Inc.

Senior Traffic Engineer

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.


Vanasse & Associates, Inc.

Vanasse & Associates, Inc. (VAI), a leading full-service Traffic Engineering, Transportation Planning and Highway Design firm located in Andover, Massachusetts, has immediate openings for Traffic and Highway Engineers. VAI offers excellent opportunities for career advancement and a competitive salary and benefit package. Qualified candidates should email their resume to Ms. Dusty Beeley at dbbeeley@rdva.com.

Highway Engineer
Andover, Massachusetts

Applicants with 2 to 5-years highway design experience to conduct technical analysis and prepare highway design documents. Responsibilities include field inventory, record plan research, roadway design, grading and drainage analysis and design; and preparation of construction plans, specifications and quantity and cost estimates. Candidate must possess a Bachelor of Science Degree in Civil Engineering from an accredited university and an F.E./E.I.T. certification is desired; good communication and computer skills with working knowledge of AutoCAD Civil 3D; and familiarity with MassDOT design guidelines.

Senior Highway Engineer
Andover, Massachusetts

Applicants with a minimum of 10-years highway design experience. Candidate must be able to lead design staff in the preparation of technical analysis and highway design documents for the development of highway engineering projects for both private and public sector clients. Responsibilities include project scope and budget development, project administration; all aspects of highway design; grading and drainage analysis and design; preparation of construction plans, specifications and quantity and cost estimates; and client representation at project and public meetings. Candidate must possess a Bachelor of Science Degree in Civil Engineering from an accredited university and licensure as a Professional Engineer; good communication and computer skills with working knowledge of AutoCAD Civil 3D; and familiarity with MassDOT design guidelines.

Traffic Engineer / Traffic Signal Designer
Andover, Massachusetts

Applicants with a minimum of 5-years traffic engineering and design experience to conduct traffic analysis and prepare traffic signal design plans. Responsibilities include traffic impact and corridor studies, traffic signal warrant analysis and traffic signal system design, including preparation of plans and written specifications. Candidate must possess a Bachelor of Science Degree in Civil Engineering from an accredited university and an F.E./E.I.T. certification or licensure as a Professional Engineer; good communication and computer skills with working knowledge of AutoCAD Civil 3D; and familiarity with MassDOT design guidelines.

Sr. Traffic Engineer / Transportation Planner
Andover, Massachusetts

Applicants with a minimum of 5-years transportation planning and traffic engineering experience to prepare Traffic Impact Assessments and Functional Design Reports, with emphasis on traffic operations analysis and traffic modeling (SimTraffic and VisSim). Additional experience with traffic signal and roadway/intersection design is highly desirable. Candidate must possess a Bachelor of Science or Master Degree in Civil Engineering from an accredited university and licensure as a Professional Engineer; good communication and computer skills; and familiarity with MassDOT design guidelines.

For Detailed Employment Opportunity Information, please visit: [http://neite.org/job-opportunities/](http://neite.org/job-opportunities/)

Professional Services Directory

For More Details, please visit: [http://neite.org/job-opportunities/](http://neite.org/job-opportunities/)
Employment Opportunities

World Tech 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.

Transportation Engineer

Woburn, Massachusetts

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.

Highway Design Engineer

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

Milone and MacBroom, Inc.

Highway Design Engineer

Cheshire, Connecticut

Milone & MacBroom, Inc. is a growing multidisciplinary engineering, landscape architecture, planning and environmental science consulting firm. Our corporate office is located in Cheshire, Connecticut, with satellite office locations in Maine, South Carolina, Massachusetts, New York and Vermont.

Our Cheshire, CT office seeks to hire a junior level highway design engineer to work in our Transportation Engineering Department. The group provides a full range of professional services including design of highways, bridges, pedestrian- and bicycle facilities; transportation planning for all travel modes; and traffic engineering. The position will provide for exposure in all phases of project planning, design and construction for a diverse range of public and private sector projects.

The candidate should have a Bachelor’s Degree in Civil Engineering or Transportation Engineering, three to five years highway design or closely related experience and shall be proficient in the use of AutoCAD Civil 3D and Microstation and related support software. Familiarity with CTDOT and FHWA policies and procedures is required. Engineer-in-Training Certification required with ability to obtain Professional Engineer licensure.

We provide a comprehensive benefits package, competitive salary, opportunities for advancement, and a pleasant and cohesive working environment. We are committed to giving back to the community in which we live and work. We are a team of talented, committed, energetic people who are motivated by challenge, diversity, and team success.

To learn more about this exciting opportunity, please submit your resume to:

Pamela Harris
Human Resources Manager
Milone & MacBroom, Inc.
pambah@milonemandmacbroom.com
(203) 271-1773

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

Gannett Fleming, Inc.

Gannett Fleming is a global planning, design, and construction management firm with more than 60 offices worldwide. Founded in 1915, we have fostered a culture of service and innovation with close to 2,000 diverse and talented professionals. Consistently ranked among the nation’s most prestigious engineering firms, we provide multi-discipline engineering services, including civil, transportation, environmental, structural, and construction management. Gannett Fleming is an Equal Opportunity Employer.

Highway Design Engineer

Newton, Massachusetts

Our Civil/Highway Engineering Practice is looking for a Highway Design Engineer to join our Newton, MA office. Responsibilities include: performing engineering design tasks for roadway projects; develop plans, specifications and cost estimates, reports, and prepare final bid packages; provide engineering design services on traditional design, bid-build projects and design-build highway projects; manage and mentor junior engineers on project assignments; coordinate design activities and meetings between staff, subcontractors, and client managers; coordinate the planning, staffing, scheduling, budget management, quality control, of subcontractors and internal technical and support staff; participate in project decisions regarding technical approaches, cost and scheduling performance; lead projects and complete tasks within schedule and budget with teams comprised of different disciplines; project QA/QC; have strong written and oral communication skills and a team-oriented attitude; and assist project managers with various other tasks.

Qualifications include:

A BS Degree in Civil Engineering is required; P.E. registered in Massachusetts required; must have 6-8 years of engineering experience possessing a broad knowledge and experience in transportation/design and strong technical skills in highway design; experience working with MassDOT is required and experience working with MBTA and MassPort is highly desired; must be proficient and have experience with AutoCAD, Civil 3D, Microstation, Inroads, and Microsoft Office.

To Apply, please go to this link: https://careers-gannettfleming.icims.com/jobs/2404/highway-design-engineer/job
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, E.I.T. at sgregorio@theengineeringcorp.com

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

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William P. McNamara - Ocean State Signal Co.

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

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