SCESNEWS

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Committee on Sustainability/Sustainability

Infrastructure Rating Systems as a Useful Part of the "Sustainability Toolbox"

by Kari Hewitt, CEM, LEED AP, ENV SP, Director of Sustainability, VHB

As engineers, designers, planners, and scientists, we place a strong emphasis on balancing infrastructure development with the social, environmental, and economic performance that benefits both present and future communities. Increasingly, we have found that our clients and our staff can benefit from the utilization of rating systems and other frameworks for advancing sustainability. Rating systems are beneficial because:

- Rating system checklists can help organize and streamline processes;
- Most systems cover numerous aspects of socioeconomic and environmental sustainability and provide a comprehensive framework for meeting sustainability goals;
- They provide methods and guidance for bringing together stakeholders and decision-makers early and often;
- They can help an agency gain recognition for advancing sustainability in their projects; and
- They provide enhanced transparency.

In addition to the Institute for Sustainable Infrastructure's (ISI) Envision[®] rating system, the Federal Highway Administration's INVEST self-evaluation tool for sustainability can be utilized as an effective rating system for infrastructure projects. Other systems include Greenroads, STAR Communities Rating System, AASHE STARS, and the numerous forms of USGBC's LEED program. Though not a rating system, the Urban Land Institute's Healthy Community Design Principles can also help guide development of neighborhoods in ways that promote healthy living.

Just as LEED was a game-changer for the building industry, we see Envision as having that same potential for infrastructure projects due to its applicability to all types of infrastructure while being technically rigorous and requiring third-party verification. VHB is currently assessing a recent "road diet" project because it meets the breadth of sustainability goals outlined by Envision and will provide valuable lessons for understanding Envision as well as the

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UPCOMING EVENTS

Younger Member Group Event October 18, 2015

SEI Lecture Series October 21, 27, & November 3, 2015

ASCE and BSCES Sponsored Seminar November 4 - 6, 2015

Charles C. Ladd Memorial Lecture November 16, 2015

T&DI Boston Chapter Webinar November 18, 2015

Southeastern Massachusetts Committee Event November 19, 2015

ASCE and BSCES Sponsored Seminar November 19 & 20, 2015

COPRI and EWRI Boston Chapters Event December 1, 2015

EWRI Boston Chapter Workshops December 8 & 15, 2015

ASCE and BSCES Sponsored Seminar December 10 & 11, 2015 Further Details Inside



2015-16 Corporate Sponsors:



President's Report

by Ellen P. White, PE, Senior Program Manager, Patrick Engineering Inc.



Fall is a busy time for me professionally and personally and it has been a busy time for us at BSCES.

On September 30th we hosted our 167th Annual Awards Dinner at the Boston Marriott

Long Wharf in Boston. This annual meeting served as an opportunity to award those who have contributed to the profession and to our Society. Ali Touran, as past-president, was the master of ceremonies and Professor Bernard Amadei, the founding president of Engineers Without Borders—USA, was the featured speaker. Professor Amadei's speech was inspiring and reminded us all of the importance of our profession and its potential impact on society. I wish to congratulate the award recipients and thank all those, particularly TECET staff, who made this such a successful event.

Cara Pirkey of HNTB, chair of the Younger Members Group, and I also had the opportunity to go to ASCE headquarters in Reston, VA in September to meet with ASCE leadership and our counterparts throughout the country. I attended the annual Presidents and Governors Forum and Cara attended the Younger Members Leadership Symposium. The purpose of these meetings was to help incoming leaders provide superior service to their members. Each forum featured a variety of roundtable discussions, breakout sessions, and networking opportunities, many led by past and present ASCE leaders.

BSCES Executive Director Tony Puntin, and I attended ASCE's National Convention in New York in early October. Session topics included construction of the Tappan Zee Bridge, Case Studies of P3 Projects, Managing Risks of Coastal Disasters, Claims Mitigation, Roadway Access Management, and Driving Change though

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Infrastructure Rating Systems

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opportunities for more advanced sustainability components for future roadway projects.

Developed by the Federal Highway Administration, Infrastructure Voluntary Evaluation Sustainability Tool (INVEST) is a free, selfevaluation tool to measure sustainability and provide best practice information to practitioners. INVEST can be a tool in incorporating sustainability principles into system planning, project development, as well as operations and maintenance. Recently, VHB worked with the Massachusetts Department of Transportation (MassDOT) to train staff on INVEST, work with MassDOT teams to evaluate their operations and maintenance (O&M) practices, and develop sustainability initiatives for implementation through a series of four workshops across the state. Three workshops focused on O&M, including fuel efficiency, energy use, and recycling. At the fourth workshop, VHB worked with the Casey Arborway Project design team using the INVEST project development module to evaluate the sustainability measures incorporated into that project. MassDOT next plans to run a similar process to evaluate road weather management including snow and ice removal practices.

In line with sustainable infrastructure design and operation is a commitment to designing and planning for complete healthy communities. This is why, in addition to specific rating systems, Healthy Community Design Principles are included in our approach to community and neighborhood planning. Similar to Envision's emphasis on enhancing public health and quality of life, Healthy Community Design is described as planning and designing communities and their built environment in a way that encourages people to live healthy lives. VHB most recently utilized this approach in the award-winning Parramore Comprehensive Neighborhood Plan in Orlando, Florida.

The holistic approach that Healthy Community Principles, Envision, and other sustainability rating systems provide, focuses on creating an understanding of how a plan, policy or project impacts and advances the needs of people living in the community and not just the infrastructure that serves the people. This approach allows clients to engage the public by using transparent guiding principles that are both understandable and easy to communicate.

Our approach has not been to advocate for one rating system over another, but to work with our clients to promote sustainable projects and outcomes. We have developed expertise in these tools to supplement the best practices we already exercise in order to help our clients address their infrastructure needs in manner that is costeffective, efficient, and provides long-term benefits to our communities.





Advancing Sustainable Infrastructure with Envision[®]

by Denise Nelson, PE, ENV SP, LEED AP, Vice President for Public Education, Institute for Sustainable Infrastructure

The Envision[®] rating system for sustainable infrastructure is the new international reference for best practices for all types of infrastructure. After three years in the industry, hundreds of municipalities, consulting firms, and contractors are using Envision to improve the sustainability of infrastructure projects in North America and world-wide.

The Envision rating system for sustainable infrastructure is a collection of best practices that provides guidance for decision making throughout the entire project lifecycle. It includes 60 credits, or sustainability concepts, organized into five general categories: Quality of Life, Leadership, Resource Allocation, Natural World, and Climate and Risk. Envision is freely available online as a guidance manual, a project pre-assessment checklist, and a comprehensive project assessment scoresheet.

Envision is also available as a rating and scoring system for determining sustainable achievement and earning project awards. Award levels, based on the points achieved by addressing the 60 credits, include bronze, silver, gold, and platinum. Beyond the hundreds of project selfassessments, seven projects have completed third-party verification and received awards, several projects are currently in the verification process, and dozens more are on the path toward an award. The projects with Envision awards are:

• The William Jack Hernandez Sport Fish Hatchery in Anchorage, Alaska, received an Envision Gold award in July 2013. This brownfield redevelopment incorporated sophisticated recirculation technology that reduced the water and energy normally used by conventional hatcheries by 95 percent while supporting sport fishing industry. The project restored a public park with viewing areas, trails, a boardwalk, and educational signs while protecting the on-site stream.

- The Snow Creek Stream Environment Zone Restoration in Placer County, California, earned an Envision Platinum award in November 2013. Another brownfield restoration, this project also restored historic wetlands and the stream environment zone by removing fill and debris and reestablishing vegetation and wildlife habitats. This project also created a public park with walking paths.
- The South Los Angeles Wetland Park in the city of Los Angeles, California, earned an Envision Platinum award in January 2014. The purpose of the wetland was to enhance the quality of stormwater runoff by treating runoff from a 525-acre contributing watershed and create a new public park in a community with little green space.
- The Sun Valley Watershed Multi-benefit Project in Los Angeles County, California, earned an Envision Platinum award in August 2014. The project consists of several improvements in the watershed to manage stormwater runoff, provide flood protection, improve watershed health, increase open space and recreational opportunities, and increase wildlife habitat.
- The Line J, Section 1 Pipeline in the Tarrant Regional Water District of north central Texas earned an Envision Silver award in October 2014. This two mile, 108-inch diameter pipeline delivers water from reservoir for use to meet potable demand. The project improves the ability to meet growing water demands and future projections.
- The Grand Bend Area Wastewater Treatment Facility in Ontario, Canada, on the shoreline of Lake Huron, earned an Envision Platinum

award in February 2015. This project is the first Envision verification in Canada, and the first wastewater facility to earn an Envision award. The project expanded the capacity of the facility by converting an existing lagoon into an extended aeration mechanical treatment facility and wetland nature reserve.

• The 26th Ward Wastewater Treatment Plant in New York, New York, earned the Envision Silver award in August 2015. The \$150 million project upgraded the plant and provided critical redundancies to ensure it remains in a state of good repair for decades to come.

Evaluating the application of Envision on these projects, we found that, on average, the projects:

- Addressed 39 of the 60 Envision credits. Five were found to be not applicable, and 16 (including four innovation credits) were not addressed.
- Addressed one innovation credit. Innovation points have been awarded in the Quality of Life, Leadership, Resource Allocation, and Natural World categories.
- Addressed all five categories. The percentage of points earned per category ranged from 31% in Natural World up to 66% in Leadership.
- Addressed credits at all levels of achievement. The percent of credits addressed by level of achievement ranged from 11% for improved up to 34% for conserving.

The Institute for Sustainable Infrastructure (ISI), the non-profit organization that administers Envision, also offers the Envision Sustainability Professional (ENV SP) credential. To date, there are over 3,550 professionals worldwide who have earned the ENV SP credential. While 98% of ENV SPs are from the US and Canada, there are credentialed users in

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Sustainable Infrastructure

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20 countries around the world. Across the US, there is at least one ENV SP in every state. California is leading the pack with 660, and Massachusetts has 160.

This year, ISI announced the release of updated Envision materials as part of our on-going commitment to improving industry best practices in sustainable development. These materials are now available on our website.

• The **updated Envision guidance manual**. This update includes editorial revisions and clarifications, expanded references to standards and metrics typically used in North America, and a streamlined introductory section focused specifically on Envision. There were no changes to the technical criteria.

President's Report

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Sustainability using Envision. Featured speakers included Luke Williams who is a professor of marketing at New York University and author of Disrupt: Think the Unthinkable. He discussed the importance of incorporating innovative strategies within the workplace. Another featured speaker was Nicholas DeNichilo, President and CEO of Hatch Mott MacDonald who discussed effective leadership. During the conference, dozens of national ASCE awards were presented to their recipients. If you would like to find out more or have any interest in applying for any of these awards, please visit the ASCE website. The conference also served as the official "changing of guards" for ASCE leadership. Currently Robert Stevens serves as past-president, Mark Woodson serves as president, and Norma Jean Mattei as president-elect.

Bill Lyons of Fort Hill Infrastructure, co-chair of the BSCES Government Affairs & Professional Practice Committee, testified at the Joint Committee on State Administration and Regulatory Oversight at the Massachusetts State House earlier this month in support of Senate Bill 1722. This bill supports P3 legislation for municipal water projects in Massachusetts. It addresses the exacerbating funding gap identified by the state's Water Infrastructure Financing Commission. This gap was created by the demonstrated investment needs required to be made to our aging infrastructure and the expected decline in traditional government • The **updated Envision Pre-Assessment Checklist.** The Envision Checklist was renamed to highlight its intended use as an introductory step in evaluating a project against the Envision credits. The category percentage charts were removed to further clarify that the Pre-Assessment Checklist is intended to identify the number and type of credits addressed and not provide a rating score. Other editorial and calculation updates were also made.

- The **new Envision credential training**. The online webinar-style training modules were replaced with new, interactive e-learning modules. Anyone who has completed the previous training program now has access to the new program if they would like to get a refresher on the training.
- The **updated Envision credential exam**. The exam questions were updated to reflect the

revisions to the Envision guidance manual. In addition, questions with low performance rates were revised or replaced. These changes are applicable to anyone starting a new exam and have no impact on people who have already passed the exam.

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More information on the industry's adoption of Envision is available in the ENR article "Envision Tool Moves Project Sustainability Beyond Buildings" (Debra Rubin, June 2015) and the Governing article "<u>The New Tool</u> <u>Helping Cities Build Sustainably</u>" (Daniel C. Vock, September 2015).

For additional information on ISI, Envision, and our community of practice, please consider visiting our website for the latest news and blog posts, subscribing to the ISI Envision email <u>newsletter</u>, joining our <u>LinkedIn group</u>, following us on Twitter (@ISIEnvision), and subscribing to our YouTube channel.

funding sources available for such purposes. The bill is modeled after existing special legislation granting similar authority to municipalities across the state and P3 legislation found in other jurisdictions. Besides BSCES, Senate Bill 1722 is supported by the Massachusetts Municipal Lawyers Association (MMA), American Council of Engineering Companies of Massachusetts (ACEC/MA), and the Massachusetts Water Works Association (MWWA).

Last month I also had the opportunity to speak to the New Hampshire Executive Council at the State House in Concord. I spoke in support of the nomination of Victoria Sheehan to serve as Commissioner of the Department of Transportation.

On October 19th, BSCES will be hosting the annual ASCE Student Chapter Officers' Caucus Fall Kickoff Meeting at Louis Berger's Office in Needham. All ten student chapters throughout the commonwealth are invited to discuss their programs, learn how ASCE and BSCES can serve them better, network, and learn more about entering the workforce. The ten student chapters are: University of Massachusetts Amherst, University of Massachusetts Dartmouth, University of Massachusetts Lowell, Massachusetts Institute of Technology, Merrimack College, Northeastern University, Tufts University, Wentworth Institute of Technology, Western New England University, and Worcester Polytechnic Institute. We are all looking forward to this event.

We are also looking forward to the Charles C. Ladd Memorial Lecture on November 16th. The guest speaker is Professor John T. Germaine, ScD, who will discuss Trends in Mechanically Compressed Sediment Behavior with Stress and Plasticity. This inaugural Ladd Lecture was made possible by the generous donations to the recently established Charles C. Ladd Fund. BSCES is grateful to all those who have donated and to the Geo-Institute Boston Chapter's Charles Ladd Fund Committee for organizing this event.

There are many other BSCES events including the Structural Lecture Series, several other institute chapter and technical group events, and numerous groups and committee meetings that are open to those who wish to become engaged. To find out more, please review the event inserts at the end of this newsletter or visit the BSCES events page.

In closing, I would like to thank all of our corporate sponsors, particularly this month's featured sponsor, VHB. We are grateful to VHB's long-time support of BSCES and encourage you to read their feature article about utilizing Infrastructure Rating Systems written by their Director of Sustainability Kari Hewitt. This is consistent with the overall theme of this month's newsletter, Sustainability, and I urge you learn more about the BSCES Committee on Sustainability, which is chaired by Melissa Carter of MWH Global. You can read her article about the 2015 BSCES Sustainability in Civil Engineering Award winner, which starts on page 6, or contact her if you wish to become involved with the committee. I also want to wish all those who will be taking the Professional Engineering Exam on October 30th the best of luck.

BSCESNEWS

Branch & Committee Reports

Southeastern Massachusetts Committee Schedules Third Event

by John C. Cavanaro, PE, Managing Principal, Cavanaro Consulting

Following two successful Technical Events since inception, the Southeastern Massachusetts Committee (SEMAC) is planning their third event on November 19, 2015. Please save the date and see the insert at the end of this newsletter for more details including how to register for this event!

Dr. Wissmann and his associates will discuss the ongoing evolution in the design and construction of aggregate pier ground support systems used in New England and will focus on design assumptions, considerations for organic and soft cohesive soils, construction techniques for cemented piers, geotechnical and structural engineering related design of ground support for floor slabs, and ground improvement for soil liquefaction and slope stabilization. Discussion will emphasize the importance for design professionals to thoroughly understand the concepts behind ground improvement design, construction, and verification so that they can make informed recommendations to their clients regarding ground support alternatives that are safe, reliable, cost effective, and designed in accordance with the intent and requirements of the building code.

Speaker bios are provided below.

Kord J. Wissmann, PhD, PE, DGE is the president and chief engineer at Geopier

Foundation Company, Inc. based in Davidson, NC. Kord has more than 25 years of experience in geotechnical engineering spanning the gamut from consultants to designers to specialty contracting.

Mike Pockoski, PE has been the eastern region lead engineer for Geopier Foundations for over eight years, and was previously with Kleinfelder in Las Vegas and GZA GeoEnvironmental in Norwood, MA.

James R. Wheeler, PE is the principal engineer at Design/Build Geotechnical, LLC. Jim received his BS and MS Degrees in geotechnical engineering from Lehigh University, Bethlehem, PA, before joining Haley & Aldrich, Inc. in 1976 where he spent nearly 21 years as a geotechnical consultant and becoming a vice president of the firm.

SEMAC has been holding monthly lunch meetings on the third Friday of the month on the South Shore, and extends an open invitation to all interested parties.

Please contact any of the folks below for additional information on becoming active in the SEMAC.

Azu Etoniru, SE, PE, PLS, Committee Chair aetoniru@etengineering.com

Charles Gross, PE, Committee Vice Chair chgpellc@me.com

John Cavanaro, PE, Committee Clerk/Secretary jcavanaro@cavanaroconsulting.com

Submit an Article to BSCESNews

The BSCES Newsletter Editorial Board invites BSCES members to write and submit an article for publication in *BSCESNews*. Typically 400 to 800 words, *BSCESNews* featured articles are about technical topics or professional matters of interest to civil engineers. The December 2015 issue of the newsletter for example, will highlight the ASCE Geo-Institute Boston Chapter and feature one or more articles about energy.

Email your article in Microsoft Word format to BSCES Newsletter Editorial Board Chair Mike Cunningham at mcunningham@kleinfelder.com or BSCES Association Manager Rich Keenan at rkeenan@engineers.org.

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Featured Group

2015 BSCES Sustainability in Civil Engineering Award Winner: Alewife Stormwater Wetland

by Melissa Carter, PE, Director of Project Management, MWH and Chair of the BSCES Committee on Sustainability

This year, BSCES awarded its first ever project award for Sustainability in Civil Engineering. The award was presented to the City of Cambridge for its Alewife Stormwater Wetland project at the annual BSCES awards dinner held on September 30, 2015. The Alewife Stormwater Wetland project is the highlight of a recent \$26 million project and a \$125 million ongoing program in Cambridge. It embodies the concept of multi-use and sustainable infrastructure. It was conceived as a concrete storage tank to serve a 420 acre neighborhood as a result of court-ordered combined sewer separation. Through broad stakeholder involvement, the project transformed into an "environmental miracle" that restored wildlife habitat and added features for the general public's use and improved quality of life.

Award Winning Project Description

As part of the Boston Harbor Cleanup, the city partnered with the Massachusetts Water Resources Authority (MWRA) to eliminate combined sewer overflows (CSOs) to the Alewife Brook. The City also desired to improve stormwater quality and reduce roadway flooding and sanitary sewer overflows (SSOs) threatening the general public. Ten acre-feet of stormwater storage was deemed necessary, for which the city had no available land. A partnership with state agencies was thus born, converting 3.5 acres of low value conservation land into a wetland engineered for stormwater management that unlocked opportunities for bio-diversity and new open space.

The Alewife Stormwater Wetland is a powerful example of how innovative approaches to science, engineering, landscape architecture, ecology and construction can concurrently resolve infrastructure needs, enhance the environment and create new resources for the community. A collaborative team consisting of the MWRA, the City of Cambridge and its consulting engineers, Kleinfelder, Inc., MWH Global, Inc. and Chester Engineers, Inc., joined several state and local agencies and engaged public stakeholder groups to create this project. In 1998, when planning began, the "sustainability" principles that guided this project were derived organically from those involved, and focused on making the project an environmental and social game-changer.

As a stormwater asset, the wetland holds up to 10.3 acre-feet of runoff, which enables upstream sewer separation and a 43.6 MG annual CSO reduction. By using a bioengineered system to



Wetland Boardwalk Overlook (2014)

meet the primary objective of storage, it enabled myriad other uses. Moreover, it avoids the need for costly tanks, which only activate during heavy rainfall and serve no function when dormant. Beyond storage, the wetland was engineered as a multistage ecological filter. Fine sediments are first allowed to settle, then stormwater passes through a vegetated swale as a rough filter. Once in the main basin, the natural biota uptake organic nutrients and other diverse

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Figure 1. Illustration of Alewife Stormwater Wetland in Cambridge, Massachusetts

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Sustainability in Civil Engineering Award Winner

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pollutants. UV sunlight provides disinfection. This natural treatment is largely self-cleansing, in contrast with conventional alternatives such as adsorptive filters that require frequent maintenance and target limited pollutants.

Once the concept of the wetland took hold, the potential for it to transform the Alewife Reservation was realized. This 120-acre park was established in 1893 by the Olmstead brothers as an "urban wild", but had become overgrown with invasive plants. The Wetland was thus sited in a location that had been largely forgotten, and so was creatively landscaped to reconnect the public with the waterway. Passive recreational amenities such as interconnected trails, access for bird watching and encounters with wildlife, and scenic overlooks were incorporated. An ecological assessment also identified the desired natural conditions and landforms and targeted the eradication of invasive plants while re-establishing diminished native species (culminating in over 120,000 wetland and 4,000 upland plantings). Several types of habitats were created to provide a diverse ecological community with food and cover for wildlife. Island areas provide breeding grounds, and an artificial oxbow provides spawning habitat for endangered migratory fish. Consider these features in contrast with conventional stormwater retention ponds, which can be isolated from natural hydrology and uninviting to both the public and natural fauna.

During construction, work was staged to sustain adjacent habitat and public uses. Wildlife escape routes, soft night-lighting and work restrictions during spawning season were enacted. Work hours were shifted to reduce noise, representatives were assigned to mitigate impacted properties, an updated project website informed the community, and extensive traffic management kept routes accessible. Through this process, the project team generated advocates out of adversaries, which led to wildlife and the general public eagerly populating the Wetland upon its grand opening.

From inception, the project's impact on the natural world was paramount, driven largely by the Department of Environmental Protection (DEP), the Department of Conservation and Recreation (DCR) and the Friends of the Alewife Reservation, a local steward of the project site. These organizations each offered their own interpretation of the environmental detriments and benefits of the project, which the engineering team continuously adapted to enhance the project. Restorative "natural



Wetland Forebay (2014)



Completed Wetland and Boardwalk (2014)

infrastructure" became heavily featured to transform undervalued conservation land within the Alewife Reservation into the type of rich and diverse ecosystem that once dominated the region. The bioengineering of open water, wetland and upland habitats tremendously increased the project's environmental value while serving the function of stormwater management and enabling combined sewer separation. Conserving "grey infrastructure" was then utilized to protect the engineered wetland from the fouling and erosive effects of incoming stormwater and to balance the area's natural hydrology. Lastly, a long-term maintenance strategy was adopted to ensure that the wetland would serve its environmental function for future generations.

Participating agencies and stakeholders further shaped the projects' social impact. The DCR

envisioned a beautiful urban park with educational recreational and amenities consistent with its master planning. Via a broad community involvement process, other organizations representing regional and neighborhood issues advocated for broad quality of life such as the project's cultural, historical and aesthetic appeal, its potential to shape modes of transportation and environmental stewardship, and that construction would be considerate of abutters. These principles were incorporated into the facility's design and installation to such an extent that the social aspects of the project gained equal footing with the stormwater engineering and environmental restoration taking place. The wetland now also serves as a destination for commuters and outdoor education. A multi-use pathway was

Sustainability in Civil Engineering Award Winner

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restored that provides a connection to the Minuteman Bikeway and the Alewife T Station. Visitors are lured in to explore the project via way finding through informational kiosks, a stone amphitheater, an elevated boardwalk, interpretive signage and engraved boulders. These features offer a close-up view of a functioning wetland and describe the impacts of urban stormwater runoff. Visitors are likely to leave with a greater appreciation of their local infrastructure and engage in environmental stewardship. In contrast, conventional stormwater infrastructure is often buried, lying out of sight and out of mind.

As a whole, the Alewife Stormwater Wetland showcases how an integrated facility based on sustainable engineering principles can address the needs and goals of multiple agencies and stakeholders simultaneously, rather than each taking on their own traditional, expensive and uncoordinated methods. The project team took a long-term (15 year) integrated sustainable planning approach and developed a single, affordable solution that derived multi-use benefits.



Figure 2. Alewife Stormwater Wetland Stakeholders

About the BSCES Sustainability in Civil Engineering Award

BSCES through its Committee on Sustainability will soon be seeking nominations for the 2016 BSCES Sustainability in Civil Engineering Award. This award will be presented at the annual BSCES Awards Dinner in the fall of 2016. The award will recognize a Massachusetts civil engineering project constructed within the last three years that exemplifies the principles of sustainability espoused by the Institute of Sustainable Infrastructure (ISI). Project nominations will be accepted beginning in January 2016 and will then be evaluated by an independent judging panel. Submission guidelines and evaluation criteria will be published in future issues of BSCESNews and the BSCES website.

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About the BSCES Committee on Sustainability

Formed by vote of the BSCES Executive Committee in April of 2012, the Committee on Sustainability was established to provide a sustainability resource to BSCES members, increase public awareness of sustainable engineering initiatives, and to take on a leadership role in developing BSCES policies related to sustainable development and engineering in Massachusetts. All BSCES members are invited and encouraged to join the Sustainability Committee. The Committee on Sustainability is currently holding meetings the second Monday of every month from 4:00 – 5:00 PM. We typically meet by conference call.

If you'd like more information, please contact me at melissa.carter@mwhglobal.com or 617/314-7108.

We Need a Plan to be More Resilient to Natural Disasters and Climate Change

by Peter A. Richardson, P.E., CFM, LEED AP, ENV SP, Vice President, Green International Affiliates, Inc.

This year marks the tenth anniversary of Hurricanes Katrina and Rita, the fourth anniversary of Tropical Storm Irene and the third anniversary of Super Storm Sandy. These three major flood events alone have contributed greatly to the large deficit in the National Flood Insurance Program (which the GAO reported to be \$24 Billion in 2014). In other parts of the country we are witnessing the effects of severe droughts and wildfires. Severe weather related events like those mentioned above demonstrate that we need to take a more proactive approach in regards to climate adaptation and resiliency. If we don't, we could soon find ourselves in a position of not being able to pay for future disaster recoveries and/or permanently losing critical natural resource areas after a natural disaster occurs.

The most effective mitigation (and disaster response) occurs when stakeholders at the local level are engaged and educated as to their vulnerabilities and risks. That said, proper planning and support from the state and federal level are also required, and when this support and planning is combined with an engaged community, the chances of being able to cope sustainably with extreme weather events is greatly enhanced.

Nationally, our general acceptance of flood risk continues to be the 1% chance flood. This theoretical flood event is infamously referred to as the "100-year flood" and really means a flood with a probability of occurring once in a 100 years, or having a 1% chance of occurring in any given year. As engineers, we need to educate the public as to what this term really means and we need to have a serious conversation at the national level (beyond Executive Order 13690) as to whether we can continue to accept the 1% chance flood as an acceptable level of risk and still remain economically, environmentally and socially sustainable.

At the State level, we need to develop a comprehensive plan that ensures sustainability and resiliency in both our built and natural environments. Economically, this plan needs to assess the built environment in the Commonwealth, such as our electrical grid, buildings, roads, bridges, airports, dams, water and wastewater facilities, and make recommendations on how to make them more resilient to natural disasters. Environmentally, this plan needs to account for the protective value of our beaches, wetlands, wooded uplands, and rivers, and their natural abilities to buffer communities from the disastrous impacts of extreme storms. Lastly, from a social perspective, we need a plan that identifies our most vulnerable human populations (like the elderly and low income neighborhoods) and determines how best to keep them out of harm's way.

Right now in the Massachusetts Legislature, the House Ways and Means Committee, chaired by Representative Brian Dempsey, is reviewing a Bill entitled An Act providing for the establishment of a comprehensive adaptation management plan in response to climate change (S.1979) filed by Senator Marc Pacheco (D. Taunton) and Representative Frank Smizik (D. Brookline), that will help address sustainability and resiliency at the state level. Please contact Representative Dempsey and ask him to support this bill and report it out of committee. Then, learn more about the infrastructure and natural resources in your own community so you can help them be better engaged and prepared when the next big storm hits.

Recent News and Updates

BSCES Thanks 2015–2016 Technical Program and Special Event Sponsors

The BSCES Board of Government would like to thank the following organizations for their support as 2015–2016 BSCES Technical Program and Special Event Sponsors:

Advanced Drainage Systems, Inc. AECOM BETA Group, Inc. BSC Group, Inc. CDM Smith Inc. **Childs Engineering Corporation** Dewberry Fay, Spofford & Thorndike, Inc. Gale Associates, Inc. **Gradient Corporation** Haley and Aldrich, Inc. Hayward Baker, Inc. **HNTB** Corporation Howard/Stein-Hudson Associates Inc. Hoyle, Tanner & Associates, Inc. MWH Global, Inc. Nobis Engineering, Inc. Northeastern University PMA Consultants, LLC Simpson Gumpertz & Heger, Inc. TranSystems Corporation Vanasse & Associates, Inc. VJ Associates of New England, Inc. Weston & Sampson, Inc.

ASCE Student Chapters

Massachusetts, and especially the greater Boston area, is known for the number and quality of its institutes of higher education. In the civil engineering field, there are 10 colleges or universities: University of Massachusetts–Amherst, Dartmouth, and Lowell, Massachusetts Institute of Technology, Merrimack College, Northeastern University, Tufts University, Wentworth Institute of Technology, Western New England University and Worcester Polytechnic Institute. All of them include Student Chapters of ASCE. In fact, some of the most recognized student chapters in the country are within BSCES. The students in these chapters are the next generation of ASCE/BSCES members and are vital to the future of the society. Recognizing the importance of student chapters, BSCES several years ago established the Student Chapters Committee. The committee is comprised of younger engineers that are assigned as liaisons to each student chapter. In this role, they provide information to the students about ASCE and BSCES activities in which they should be involved. They also act as a conduit between BSCES professionals that may want to reconnect with their college. This year the Student Chapter Committee and the Younger Member Group will be very busy in the spring as Wentworth will be hosting the regional Concrete Canoe contest and Northeastern will be hosting the Steel Bridge competition. More details to follow. The chair of the committee is Jess Yarmarkovich; feel free to contact her if you have any questions about the committee.

ASCE's #1 Region

Representation of membership on ASCE's National Board of Direction is accomplished through 10 Regional Directors. The United States is divided into nine geographic regions; the rest of the world is Region 10. BSCES is a member of Region 1 (or the #1 Region as is it sometimes referred) along the other New England States, New Jersey, New York and Puerto Rico... yes, Puerto Rico. Our Region Director, Len Cilli from New Jersey, provides monthly updates on regional activities and reports on the results at the four Board meetings held annually. The regional leadership includes seven "Governors" that are assigned to specific sections in the region. We are represented on a regional level by BSCES past-president Linda Hager. Questions regarding activities on a National level can be directed to Len or Linda.

#GameChangers

Building upon the success of their Report Card for America's Infrastructure, ASCE is highlighting those projects that have been undertaken in an innovative and unique manner. They have called these projects Game Changers. It's no secret that there is a backlog of needed infrastructure improvements. Communities across the country are seizing the opportunity to build infrastructure in innovative ways—taking advantage of lower prices, new project delivery methods, and innovative engineering and technology. Two local projects have been identified as Game Changers. The city of Boston recently completed a new 508-square-foot "porous alley" that absorbs stormwater and filters it into the ground, rather than allowing it to make its way into the sewer system where it has to be treated. Also, the town of Arlington, Massachusetts, also used porous pavement for a project on Hurd Field to protect the water quality of adjacent Mill Brook.

Social Media

Did you know that BSCES is "connected?" As the forms of communication continue to expand, BSCES is trying to keep up with all of the social media outlets. Our twitter account has over 300 followers from state agencies to engineering firms. We invite you to follow us and #BSCES if you attend one of our events. The BSCES Facebook page has almost 800 "likes." The page is used to announce upcoming events, provides pictures galleries of some of our signature events, and sometimes shows the lighter side of engineering. Almost 1,800 individuals have connected with BSCES on LinkedIn. This forum is used for meeting announcement and discussions that are more technical in nature. These sites, in addition to the BSCES homepage, will provide information on upcoming events and highlight BSCES accomplishments.

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The Younger Member Group Hits a Home Run to Start the Year

by Alyson Stuer, Project Engineer, C&C Consulting Engineers, LLC and Vice Chair, BSCES Younger Member Group

The Younger Member Group (YMG) started the year with a bang by hosting two overwhelmingly successful events. On August 19th the group attended a Red Sox game against the Cleveland Indians where the Red Sox were led to victory on the perfect summer evening. Prior to the game attendees met at Copperfield's for networking and drinks. The event was sold out for a total attendance of nearly thirty. With similar weather perfection on September 16th the YMG hosted the Annual Bocce Tournament, this year in conjunction with Young Professionals in Transportation (YPT). The event drew a crowd larger than any previous year with nearly 40 participants. The event was held on the Boston Common on a gorgeous end of summer day with spectacular sunset views of the Millennial Tower construction as the backdrop. Creating a random bracket system to pair unfamiliar



Bocce Tournament winners, Chis and Justin, celebrate their victory

attendees with others to network, the tournament began with eight simultaneous games. After a short break for some well-earned pizza, the tournament continued until a close final match between Andrew & Nick and Chris & Justin. In the end, Chris & Justin were victorious taking home the prize of a restaurant gift card for each teammate. Eliminated teams continued to play socially well into the evening, fostering connections. The YMG will be busy working tirelessly throughout the year to provide additional programming to encourage younger members, students, and section members to not only attend events but also make meaningful connections.

The YMG intends to hold monthly events ranging from social and technical joint meetings to community service in addition to the monthly business meetings. Please keep a lookout for future event announcements, including both annual traditions, such as the holiday party and billiards tournament, and new additions! We are always welcoming new members! To get involved and receive direct updates email bscesymg@gmail.com.

BSCES Legislative Fellow Update from Beacon Hill Adequate Funding for Public Infrastructure

by Michael Sullivan, PE, Structural Project Engineer, Kleinfelder, 2015-2016 BSCES Legislative Fellow



Adequate funding for public infrastructure is a perpetual issue here in the Commonwealth and there are a few bills proposed in the legislature to address this. The first bill, H3725 authorizes

the town of Lee to institute a 3 cents per gallon excise tax on all gasoline and diesel fuel sold in the town. The money collected would be placed in a Public Way Maintenance Fund with disbursements towards town infrastructure projects made by a majority vote from the board of selectmen. An additional bill, HD 4125, which is still being filed with the Clerk's office will give other municipalities the authorization to also levy their own 3 cent per gallon gas tax. If passed, these two bills signal a major shift in infrastructure funding by placing the funding authorization directly with the municipalities. Hearings for these two bills have not been scheduled yet.

As an alternative to raising the gasoline tax, there is another bill currently filed with the Joint Committee on Transportation which proposes to create a task force and pilot program for a mileage-based tax. The bill, <u>S1851</u>–An Act to explore alternative funding sources to ensure safe and reliable transportation, would provide a mechanism for MassDOT to study the feasibility of a mileage-based tax. The task force would be comprised of the Secretary of Transportation, or designee, three members appointed by the governor, and four members appointed by the legislature. The task force will be authorized to direct MassDOT to develop and implement a pilot program to assess owners of a motor vehicle user fee based on number of miles driven. The program shall include at least 1,000 volunteers from across the state and evaluate different technology and its ability to protect the integrity of data collected, ensure drivers' privacy, and vary pricing based on the time of driving, type of road, proximity to transit, and vehicle fuel efficiency. The pilot program would last one year.

There are a few other transportation-related bills and updates that could affect our Society. <u>S1878</u>–An Act promoting fairness and equity in transportation planning, was originally filed back in April and was sent to the Joint Committee on Transportation. A hearing on the bill is expected in October. The bill grants authority to the Secretary of Transportation, in consultation with the Secretary of Housing and Economic Development, to identify and create sub-regions within the Metropolitan Planning Organizations (MPO's) in order to realize a more comprehensive and coordinated intermodal transportation improvement plan. Identification factors for cities and towns to be recognized as a sub-region may include major roadways or limited access highways, regional commuting patterns, a region's economic and industrial base, cultural assets, and evidence of unmet need for transportation planning. The transportation improvement plan developed by the sub-region shall be provided to MassDOT for inclusion in the state transportation plan and the Secretary of Transportation will be responsible for developing a formula for determining funding allocation.

The newly formed MBTA Fiscal and Management Control board recently filed their first report to the Joint Committee on Transportation.

Finally, a push to formally study a north-south link between North Station and South Station is picking up some steam as over 150 senators and legislators have signed on to a letter supporting the project. Chapter 79 of the Acts of 2014 authorized up to \$2 million to be used to update the Draft Environmental Impact Statement and Draft Environmental Impact Report in order to protect the corridor right-of-way.

BSCESNEWS

Upcoming Events

For more information and to register for events, please visit www.bsces.org

To register online for an event at the BSCES member rate you must login using your BSCES assigned username and password. If you do not know your BSCES member login information, call 617/227-5551.

Younger Member Group Event

Sunday, October 18, 2015 Middlesex Fells Reservation, Stoneham, MA 10:30 AM – 1:00 PM

10.30 AIVI - 1.00 FIVI

Younger Member Group Fall Hike

Come join the BSCES Younger Member Group on a short hike and picnic lunch to enjoy the fall foliage at the local Middlesex Fells Reservation. Pack your lunch and bring your friends & family for a fun afternoon outdoors. The hike will last about two hours with a lunch break mid-hike. All levels of hiking experience welcome!

Please see the Insert at the end of this month's newsletter for further details.

Structural Engineering Institute Boston Chapter Lecture Series— Wicked Fast Bridge Construction

Wednesday, Oct. 21, Tuesday, Oct. 27, and Tuesday, Nov. 3, 2015 Tufts University, Barnum Hall 163 Packard Avenue, Medford, MA

6:00 PM Registration, 6:30 PM – 8:30 PM Lecture

Organized around the theme of *Wicked Fast Bridge Construction* (WFBC), there is still time to attend one or more of the SEI Boston Chapter's 2015 Lecture Series three remaining sessions consisting of two case studies and a lecture/panel discussion examining the state of, lessons learned, and the future of accelerated bridge construction in New England. Session topics include:

Lecture 3 – Wednesday, October 21, 2015 WFBC Local Case Study I— MassDOT Bridges

Brian Brenner, PE, Vice President, Fay, Spofford & Thorndike, Inc.

Nicholas Scenna, PE, Senior Structural Engineer, Fay, Spofford & Thorndike, Inc.

Lecture 4 – Tuesday, October 27, 2015 WFBC Local Case Study II—MBTA Bridges

Erik J. Stoothoff, PE, Chief Engineer, MBTA John C. Schwarz, PE, Director of Bridge & Tunnel Projects, MBTA

Lecture 5 – Tuesday, November 3, 2015 Durability of WFBC Bridges

Michael P. Culmo, PE, Vice President of Transportation and Structures, CME Associates, Inc.

The Future of WFBC (Panel Discussion)

Moderator: Alexander K. Bardow, PE, State Bridge Engineer, MassDOT Panelists: Presenters of Lectures 1 - 4Please see the Insert at the end of this month's newsletter for further details.

ASCE and BSCES Sponsored Seminar

Wednesday – Friday, November 4 – 6, 2015 Hyatt Place Boston Braintree 50 Forbes Rd, Braintree, MA

8:00 AM – 5:00 PM

GIS for Hydraulic and Hydrologic Modeling Using ArcGIS Desktop

James Heyen, PE, CFM, Senior Hydraulic Engineer, WEST Consultants

This workshop-oriented, three-day seminar presents the practical application of the ArcGIS extensions ArcHydro, HEC-GeoHMS, and HEC-GeoRAS. Seminar participants will learn how to process data and create hydro networks using ArcHydro, develop HEC-RAS geometry and process HEC-RAS data results, build a project in HEC-GeoHMS and prepare the data files for HEC-HMS, and set up projects within the HEC-RAS and HEC-HMS environments.

<u>Click here</u> for further details including how to register to attend this course and pay by credit card online.

Save the Date!

Tuesday, December 1, 2015 Preparing for a Flood: Resiliency at Massport

Joint COPRI and EWRI Boston Chapters Meeting

Presented by: Robbin Peach, MPA, MA Program Manager of Resiliency, Massport

Please see the insert at the end of this month's newsletter for further details.

Charles C. Ladd Memorial Lecture

Monday, November 16, 2015

MIT Tang Center, Wong Auditorium 70 Memorial Drive, Cambridge, MA

5:30 PM Social/Registration 6:30 PM Presentation

Trends in Mechanically Compressed Sediment Behavior with Stress and Plasticity

John T. Germaine, ScD, Research Professor, Civil and Environmental Engineering Department, Tufts University

The SHANSEP concept, developed by Charles Ladd and Roger Foott, has become one of the underpinning foundations of stability evaluation in engineering practice. It is based on the principle that the strength properties of mechanically

continued on page 12

Mark Your Calendar!

2015-2016 BSCES Program Committee-Sponsored Training

The BSCES Program Committee is pleased o announce that it has arranged for BSCES to host the following programs during the current fiscal year:

Bridge Inspection Refresher Training

(FHWA-NHI-130053) February 2 – 4, 2016 Hilton Garden Inn Worcester

Safety Inspection of In-Service Bridges

(FHWA-NHI-130055) April 4 – 15, 2016 Hilton Garden Inn Worcester

Tunnel Safety Inspection

(FHWA-NHI-130110) Two Offerings: April 18 – 22, 2016 and June 20 – 24, 2016 Hilton Garden Inn Worcester

Look to future issues of BSCESNews for information on how you can register for these BSCES Program Committee events.

BSCESNEWS

Upcoming Events (continued from page 11)

compressed fine grained sediments normalize with consolidation stress. This lecture presents results of an extensive experimental program that establishes a new understanding of the variation in behavior as a function of stress and plasticity. One very important outcome is the observation that clayrich sediments do not follow the rules of normalized behavior. This has resulted in a significant modification to the SHANSEP equation and created a need for a new generation of soil models.

Please see the Insert at the end of this month's newsletter for further details.

T&DI Boston Chapter Webinar

Wednesday, November 18, 2015 12:30 PM – 1:30 PM

Critical Elements of Roundabout Design

Andy Paul, PE, Senior Engineering Associate, Kittelson & Associates, Inc.

This webinar will provide a brief overview of key roundabout design elements, peer review "fatal flaw" details, public outreach techniques and maintenance considerations. It will also feature case studies of the critical design elements that are discussed. This webinar is appropriate for planners, engineers, and public officials responsible for planning, design, construction, and maintenance of traffic control devices.

Please see the Insert at the end of this month's newsletter for further details.

Southeastern Massachusetts Committee Event

Thursday, November 19, 2015 Abington Ale House 1235 Bedford Street, Abington, MA

7:00 AM – 7:45 AM Registration/Continental Breakfast; 8:00 AM – 11:00 AM Presentation

Aggregate Pier Ground Support Systems

Kord J. Wissmann, PhD, PE, President and Chief Engineer, Geopier Foundation Company, Inc. Mike Pockoski, PE, Eastern Region Lead Engineer, Geopier Foundation Company, Inc. James R. Wheeler, PE, Principal Engineer, Design/Build Geotechnical, LLC

Dr. Wissmann and his associates will discuss the ongoing evolution in the design and construction of aggregate pier ground support systems used in New England and will focus on design assumptions, considerations for organic and soft cohesive soils, construction techniques for cemented piers, geotechnical and structural engineering-related design of ground support for floor slabs, and ground improvement for soil liquefaction and slope stabilization. This discussion will emphasize the importance for design professionals to thoroughly understand the concepts behind ground improvement design, construction, and verification so that they can make informed recommendations to their clients regarding ground support alternatives and designed in accordance with the building code.

Please see the Insert at the end of this month's newsletter for further details.

ASCE and BSCES Sponsored Seminar

Thursday & Friday, November 19 & 20, 2015 Hyatt Place Boston Braintree 50 Forbes Rd, Braintree, MA 02184-2602

8:30 AM – 4:30 PM

Deep Foundations: Design, Construction, and Quality Control

Aaron Budge, PhD, PE, Professor of Civil Engineering, Minnesota State University Joseph A. Caliendo, PhD, PE, Professor of Geotechnical Engineering, Utah State University Jerry A. DiMaggio, PE, D.GE, Principal, Jerry A. DiMaggio Consulting, LLC Mohamad H. Hussein, PE, Vice President, GRL Engineers, Inc.

The purpose of this seminar is to present modern techniques for the design, installation and verification of deep foundations. Over the past twenty-five years major changes have occurred in the deep foundations industry. New improved methods have been developed for installing all types of deep foundations, increased loads are being used, and new quality control procedures have been developed. This seminar will present modern design procedures for deep foundations including discussions on new developments.

<u>Click here</u> for further details including how to register to attend this course and pay by credit card online.

EWRI Boston Chapter Events

Tuesday, December 8 & 15, 2015

VHB, 101 Walnut Street, Watertown, MA 5:30 PM Social/ Dinner; 6:15 PM Presentation

Workshops: HEC-RAS 2D & GRASS GIS Hydraulic Models

Karen M. Madsen, PE, Civil Engineer, AECOM Derek Etkin, PE, Water Resources Engineer, CDM Smith These two workshops aim to teach attendees about HEC-RAS 2D and GRASS GIS Hydraulic Models. The first workshop will provide an overview of two numerical models embedded GRASS GIS: a sediment transport/ erosion/ deposition model and a numerical model for transient groundwater-flow in two dimensions. The results of the GRASS GIS models will be compared against more conventional approaches at two New England sites. The second workshop discusses the new capabilities of HEC-RAS version 5.0 and is aimed at practitioners with familiarity in open channel flow modeling or experience in flood plain mapping projects.

Please see the Insert at the end of this month's newsletter for further details.

ASCE and BSCES Sponsored Seminar

Thursday & Friday, December 10 & 11, 2015 Hyatt Place Boston Braintree 50 Forbes Rd, Braintree, MA 02184-2602 8:30 AM – 4:30 PM

Structural-Condition Assessment of Existing Structures

Brian K. Brashau, PhD, Director, Wood Materials and Engineering Program, University of Minnesota Duluth Zhiyong Cai, PhD, PE, Research Engineer, USDA Forest Products Laboratory Gregory Fehr, PE, Principal Engineer, ATMG Larry D. Olson, PE, President, Olson Engineering Dennis A. Sack, PE, Senior Vice President, Olson Engineering Steven Smith, CWI, Senior Technical Specialist, ATMG

Xiping Wang, PhD, Research Engineer, USDA Forest Products Laboratory

This seminar is an intensive overview of material evaluation practices and procedures used for assessing the structural condition of existing structures and covers as many aspects of evaluating structures and structural material conditions as possible. State-of-the-art information on visual inspections, destructive and nondestructive testing (NDT), and the handson experience provided in this seminar, are essential for those involved in evaluating concrete, masonry, wood, and metal structures.

<u>Click here</u> for further details including how to register to attend this course and pay by credit card online.

Classifieds

Gale Associates, Inc.

Gale Associates, Inc., a well-respected engineering/planning firm celebrating over 50 years in business, seeks candidates for the following positions:

Civil Engineer/Sr. P.M.—For Weymouth, MA and Towson, MD—Licensed Sr. Civil Engineers with 10+ years' experience in civil/site design, land planning and permitting for industrial, institutional, commercial, multifamily residential and athletic/recreation facilities. Qualified candidates will have direct experience related to all aspects of civil design (hydrology, grading, utilities, etc.) for a wide variety of development types. Must be well-versed in state and local permitting (environmental and municipal) practices and familiar with sustainable design applications for civil work. A proven history of successful project management, well-honed writing skills, communication/presentation aptitude, and the ability to lead design teams are essential. LEED®AP certification desirable.

Structural Engineer—Licensed with 3 to 7 years' experience and a strong resume in the evaluation and renovation of existing structures and facades, foundation design and concrete rehabilitation. Knowledge of waterproofing and building envelope assemblies helpful. Ability to assist with managing projects, computer efficiency and effective presentation/ communication skills essential.

Entry-Level Staff Engineer—ABET accredited BSCE with E.I.T. for a variety of planning, design, and permitting projects involving industrial, institutional, commercial, multifamily residential, and athletic/ recreation facilities development for both public and private clients. Candidates will have some design experience (grading, drainage, utilities, etc.) and strong technical writing/communication skills. Working knowledge of Civil 3D and Hydro CAD essential.

Recently voted one of the 2015 "Best Firms to Work For" by Zweig White, Gale offers an excellent salary and full array of great benefits. If you have the qualifications for any of these positions, we would like to hear from you. Please send resume and salary requirement to kaf@gainc.com. Ask us about additional opportunities in our other offices, or visit our Employment Section at www.galeassociates.com.

Gale is an EO Employer/AA/Veterans/Disabilities





2015 Fall Lecture Series *Wicked Fast Bridge Construction* October 6, 13, 21, 27 and November 3, 2015 Tufts University, Barnum Hall, 163 Packard Avenue, Medford, MA 6:00 PM Registration; 6:30 PM – 8:30 PM Lecture

ASCE SEI Boston Chapter is pleased to present the 22nd Fall Lecture Series, entitled "Wicked Fast Bridge Construction." Topics include: The State of Wicked Fast Bridge Construction (WFBC) in New England; Detailing of WFBC; WFBC local case studies of MassDOT and MBTA bridges; durability of WFBC Bridges and The Future of WFBC (Panel Discussion). This lecture series is cosponsored by the Tufts ASCE Student Chapter.



LECTURE 1 – Tuesday, October 6, 2015 The State of Wicked Fast Bridge Construction in New England

Michael P. Culmo, PE, Vice President of Transportation and Structures, CME Associates, Inc.

All of the New England States have constructed WFBC projects and several states have instituted Accelerated Bridge Construction (ABC) programs. The design community has adapted to these new technologies using resources made available by owner agencies,

industry, and the Federal Highway Administration (FHWA). The benefits of ABC or WFBC have been well documented by FHWA and others. The primary benefits include higher quality, improved safety through reduced exposure of workers and travelers to work zones, reduced mobility impacts to the traveling public, and reduced impact to the environment. This presentation will provide an overview of how the New England States are implementing WFBC, and cover topics such as decision making process, prefabricated bridge elements, bridge system installations, accelerated project delivery and ABC tolerances.

LECTURE 2 – Tuesday, October 13, 2015 Detailing of WFBC – Lessons Learned

Joseph P. Gill, PE, President, Gill Engineering Associates, Inc.

This presentation will focus on various design issues and construction details encountered on a number of accelerated bridge construction projects in Massachusetts and elsewhere. Methods of erection/placement, along with development of details compatible with construction sequence and schedule, as well as the lessons learned on these projects will be presented. Discussions will cover design approach and detailing for various bridge elements including footings, wall/column to footing connection, pier cap to wall/column connection,





Completion of each Lecture provides 2 Professional Development Hours (PDH) Supported by the staff of The Engineering Center Education Trust backwalls, approach slabs, superstructure connections to deck, barriers, waterproofing, membrane and wearing surfaces. The design approach to short term as well as long term (final design) loading along with the impact of tolerances will also be discussed.

LECTURE 3 – Wednesday, October 21, 2015 WFBC Local Case Study I – MassDOT Bridges

Brian Brenner, PE, Vice President, Fay, Spofford & Thorndike, Inc. Nicholas Scenna, PE, Senior Structural Engineer, Fay, Spofford & Thorndike, Inc.

This presentation will discuss case studies of select MassDOT bridges. Topics covered will include utility relocation, utility bridge, Self-Propelled Modular



Transporter (SPMT) construction, MBTA commuter rail station reconstruction and lessons learned. "Lessons learned" discussions will cover various topics including issues unique to design-bid-build procurement approach, contractor's means and methods, special specifications, precast concrete details and construction tolerances, and protection of adjacent existing structures during rapid demolition. Use of the innovative early utility relocation contract will also be discussed.



LECTURE 4 – Tuesday, October 27, 2015 WFBC Local Case Study II – MBTA Bridges

Erik J. Stoothoff, PE, Chief Engineer, MBTA John C. Schwarz, PE, Director of Bridge & Tunnel

Projects, MBTA

The primary mission of the MBTA is to move their customers safely and on schedule. The MBTA owns and maintains over 350 rail bridges, however, advanced age and condition of these

structures require multiple bridges to be replaced yearly for the foreseeable future in order to maintain a good state of repair. This presentation will discuss past usage of WFBC at the MBTA using case studies to offer lessons learned from successful implementation, as well as the decision making process and future use of ABC or WFBC techniques on MBTA bridge projects. To date, MBTA has used these techniques for the construction of three bridges, and a future bridge replacement is in the final design stage. Discussion will also include the use of SPMTs, which has been very successful on MBTA projects.

LECTURE 5 – Tuesday, November 3, 2015 Durability of WFBC (ABC) Bridges

Michael P. Culmo, PE, Vice President of Transportation and Structures, CME Associates, Inc.

CME Associates has inspected several bridges constructed with various ABC methods. This session will include a discussion on what works and what does not work.

The Future of WFBC – Panel Discussion

Moderated By Alexander K. Bardow, PE, State Bridge Engineer, MassDOT

This session will include a brief update on WFBC or ABC at MassDOT followed by a panel discussion with speakers of lectures 1 through 4. The panel will answer questions from attendees.

SPEAKERS

Michael P. Culmo, PE, Vice President of Transportation and Structures, CME Associates, Inc.

Michael Culmo is the Vice President of CME Associates, Inc. responsible for directing structures and transportation design department on new expressway bridges, bridge rehabilitation and related highway structures. He has over 31 years of experience in the design of steel, concrete, pre-stressed concrete and timber bridges. He has special expertise in the field of accelerated bridge construction technologies. Mr. Culmo holds a Bachelor's degree in Civil Engineering and a Master's degree in Structural Engineering, both from the University of Connecticut.

Joseph P. Gill, PE, President, Gill Engineering Associates, Inc.

Joseph Gill is the President and Owner of Gill Engineering Associates, Inc., a local structural design firm in Needham, Massachusetts focused on the bridge infrastructure market. Before founding Gill Engineering in 2000, he had over 17 years of project experience with the Massachusetts Highway Department and the Massachusetts Turnpike Authority. As former MassHighway Bridge Engineer and MassPike Chief Engineer, Mr. Gill gained a thorough knowledge of bridge projects from inception through planning, permitting, design, construction, operation and maintenance. He was recently involved in the successful completion of various accelerated bridge construction projects, including the award-winning Wellesley Cedar Street Heavy Lift and Medford Fast 14 Bridge Replacement.

Brian Brenner, PE, Vice President, Fay, Spofford & Thorndike, Inc.

Brian Brenner is a Vice President with Fay, Spofford & Thorndike in Boston, Massachusetts. His professional practice includes technical management and structural design of bridge and transportation projects throughout New England and the New York metropolitan area. He is the lead structural engineer for three WFBC or ABC projects: River Street over MBTA, Morton Street over MBTA, and Massachusetts Avenue over Commonwealth Avenue in Boston. As a professor of the Practice at Tufts University, Mr. Brenner teaches classes in reinforced concrete design, bridge design, bridge history and aesthetics, and introduction to engineering. His research includes an NSF Partnership for Innovation project focusing on long term and sustainable bridge design. Mr. Brenner is the editor of multiple ASCE and BSCES journals and is the author of over 100 papers as well as three collection of essays, "Don't Throw This Away", "Bridginess", and "Too Much Information" published by ASCE.

Nicholas Scenna, PE, Senior Structural Engineer, Fay, Spofford & Thorndike, Inc.

Nicholas Scenna is a Senior Structural Engineer and Deputy Bridge Team Leader with Fay, Spofford & Thorndike in Boston. He has over 10 years of experience in bridge planning, design, construction, inspection and rating. His work experience includes public and private sector clients, including state agencies, municipalities, railroads and private owners. Mr. Scenna has experience working on complex bridge design and construction contracts with accelerated schedules, and strict scope and budget constraints. He recently managed two high profile ABC contracts for MassDOT – the Burns Bridge Replacement D-B in Worcester and the Morton Street SPMT Bridge Replacement in Boston. He also co-authored and presented a paper entitled "When is an Historic Bridge No Longer an Historic Bridge?" at the 2014 SEI Structures Congress.

Erik J. Stoothoff, PE, Chief Engineer, MBTA

Erik Stoothoff is the Chief Engineer for the Design and Construction department of the MBTA, where he oversees all capital infrastructure projects. Prior to joining the MBTA as Chief Engineer in April 2013, he worked at Jacobs Engineering Group for the previous 13 years in various capacities as a design engineer and project manager. His work experience as a structural engineer includes designing and delivering numerous bridge and station projects for the MBTA and MassDOT. Mr. Stoothoff was the Engineer of Record for two of the rapid bridge replacement projects by the MBTA along the Fairmount Corridor at the Woodrow Avenue and Talbot Avenue crossings. He has a Bachelor's degree in Civil Engineering from Northeastern University.

John C. Schwarz, PE, Director of Bridge & Tunnel Projects, MBTA

John Schwarz is the Director of Bridge and Tunnel Projects at the MBTA, and oversees the inspection, rehabilitation and replacement of the Authority's bridge and tunnel infrastructure. He has over 30 years of experience in a wide range of projects. Mr. Schwartz joined the MBTA in 2003 after working in the private sector for several years. At the MBTA, he has worked on a variety of projects including Green Line Relocation at North Station, Fairmount Corridor Improvements, CNG Bus Facility Retrofits and the Redundant Elevator Program. He is a Civil Engineering graduate from Northeastern University.

Alexander K. Bardow, PE, State Bridge Engineer, MassDOT

Alexander Bardow has worked for MassDOT's Bridge Section in various positions since 1983, and has been the Massachusetts State Bridge Engineer since 1995. In this position, he oversees the Bridge Design, Bridge Inspection, Ratings and Overloads, Metal Control, and the Geotechnical and Hydraulic Sections. Mr. Bardow is a voting member of the American Association of State Highway and Transportation Officials (AASHTO) Subcommittee on Bridges and Structures (SCOBS), and serves on following SCOBS technical committees: Welding (Chair), Timber (Vice Chair), Seismic Design, and Guard Rail and Bridge Rail. He has also been a member of the PCI New England Technical Committee since 1991. Mr. Bardow is a member of ASCE and BSCES and has served in several elected offices within BSCES, including as President in 2004-2005. He has received both his BSCE and MSCE degrees from the Massachusetts Institute of Technology.

REGISTRATION DEADLINE: Thursday, October 1, 2015

Registration Information:

Registration Fees: See registration form below.

Register to attend this seminar and pay by credit card online at <u>http://bit.ly/SEILectureSeries</u>. To register online for an event at the BSCES member rate you must login using your BSCES assigned username and password. If you do not know your BSCES member login information call 617/227-5551. You can also register for this event by completing the registration form below and mailing, emailing or faxing it to BSCES, The Engineering Center, One Walnut Street, Boston, MA 02108, <u>bscesreg@engineers.org</u> or 617/227-6783, respectively. Cancellations received after October 1, 2015 and no-shows will be billed.

Directions to Lecture Hall and Parking:

Lecture Hall: Tufts University, Barnum Hall Room 008, 163 Packard Avenue, Medford, MA http://campusmaps.tufts.edu/medford/#fid=m004 Parking: Tufts University, Dowling Hall Garage, 419 Boston Avenue, Medford, MA http://publicsafety.tufts.edu/adminsvc/parking-services/medford-somerville-campus-parking-services/parking-garages/

Handouts: Registered attendees will be provided a website reference for downloading handouts/notes.

Pizza! New in 2015, we begin each evening with pizza starting at 6 pm during registration.

Registration Form BSCES SEI Boston 2015 Fall Lecture Series

Tuesdays, October 6, 13, 21, 27 and November 3, 2015

Tufts University, Barnum Hall, 163 Packard Avenue, Medford, MA 6:00 PM Registration, 6:30 – 8:30 PM Lecture

Registrant Information		
Name:		
Company (if applicable):		
Address:		
City:	State:	Zip Code:
hone Fax:		Email:*
* Please note that email communication	ons to BSCES members about this event wil	be sent to the email address that they have on file with ASCE.
Registration Fees		
Full Series of Five Lectures		Single Lectures
\$195 BSCES/ASCE Member		\$60 BSCES/ASCE Member
\$245 Non-Member		\$75 Non-Member
\$170 Public Employee Member		\$55 Public Employee Member
\$195 Public Employee Non-Member		\$60 Public Employee Non-Member
\$70 Senior/Student		\$25 Senior/Student
		Circle Lectures Attending: 1 2 2 4 5
		Circle Lectures Attending. 1 2 5 4 5
Total Amount Enclosed	\$	
Make checks payable to "I	3SCES" and mail with complet	ed form to: BSCES, The Engineering Center, One
Walnut Street, Boston, MA	4 02108-3616	
Or Pay with (Check one):	Visa Ma	ster Card American Express
Card Name:		
Card Number:		Exp. Date:
Billing Address:		
City:	State:	Zip:
Signature:		



Please join us!

Fall Hike Sunday, October 18, 2015

Date & Time: Sunday, October 18, 2015 Time: Check-in 10:30AM – 11:00AM; Hike Leaves at 11:00AM Sharp

Come join the BSCES Younger Member Group on a short hike and picnic lunch to enjoy the fall foliage at the local Middlesex Fells Reservation. Pack your lunch and bring your friends & family for a fun afternoon outdoors. The hike will last about 2 hours with a lunch break mid-hike. All levels of hiking experience welcome!

Fee: FREE

Location:

Middlesex Fells Reservation

Stoneham, MA

(Meeting Location TBA)

Please RSVP (and include the size of your group) to <u>*BSCESYMG@gmail.com*</u> by Friday October 16, 2015.







First Charles C. Ladd Memorial Lecture Trends in Mechanically Compressed Sediment Behavior with Stress and Plasticity



John T. Germaine, ScD

Research Professor, Civil and Environmental Engineering Department, Tufts University

Monday, November 16, 2015

MIT Tang Center, Wong Auditorium 70 Memorial Drive Cambridge, MA

Schedule:

5:30 PM Social/Registration; 6:30 Presentation

The SHANSEP concept, developed by Charles Ladd and Roger Foott, has become one of the underpinning foundations of stability evaluation in engineering practice. It is based on the principle that the strength properties of mechanically compressed, fine-grained sediments normalize with consolidation stress. Further, this basic strength principle is codified in many soil models, including Modified Cam Clay and MITE3.

Amazing advances in technology have increased borehole drilling capabilities to nearly 40,000 ft. In the Gulf of Mexico, sediments are normally consolidated to great depth but have extreme excess pore pressure and complex states of stress due to salt deposit modification. Predicting the in situ stress state is necessary for accurate geophysical interpretation, as well as effective borehole design. Clearly, the mechanical behavior of the sediments is extremely important to these predictions.

Recent advances in experimental technology have enabled a detailed study of the compression, permeability, and shear behavior of materials over a wide range of stresses. In combination with resedimentation, we have been able to study these behaviors for a wide range of soils without dealing with the complexity of sample disturbance or specimen variability.

This lecture presents results of an extensive experimental program that establishes a new understanding of the variation in behavior as a function of stress and plasticity. Trends in mechanical behavior are very consistent with liquid limit. One very important outcome is the observation that clay rich sediments do not follow the rules of normalized behavior. This has resulted in a significant modification to the SHANSEP equation and created a need for a new generation of soil models.



This presentation provides 1.0 Professional Development Hours (PDH) Supported by the staff of The Engineering Center Education Trust

Speaker

John T. Germaine is a Research Professor in the Civil and Environmental Engineering Department at Tufts University. He has over thirty years of experience teaching undergraduate and graduate-level materials and geotechnical laboratory courses, directing a significant sponsored research program, and serving the profession while a Research Associate in the CEE Department at MIT. He joined the Tufts faculty in June of 2015.

Dr. Germaine specializes in experimental observation to explore geo-material behavior. He has developed new instrumentation and automation technology for laboratory and field-testing programs in order to study key aspects of geo-material behavior. Through these experimental research efforts, he has identified phenomena that are important to the understanding of geo-material strength, stiffness, and particle filtration/transport behavior. These efforts have enabled measurements of fundamental parameters for model development and engineering design. Examples of this research include: i) measurement technology, automation, and innovation; ii) behavior of unsaturated, frozen, soft, and anisotropic soils; iii) stress dependence of fine grained material properties, iv) off-shore exploration and design; and v) quantification of coupled porous media flow and transport phenomena.

His achievements in instrumentation and experimentation are complemented by his involvement in ASTM International Committee D18 on Soil and Rock, a technical committee consisting of over 1200 academic, industrial, commercial, and government testing specialists and responsible for more than 370 standards. In this capacity, he contributes to the engineering profession through the authorship of standard test methods, guides, and terminology in the geotechnical and geo-environmental areas. In addition, he provides leadership to ASTM through membership on the Executive Committee and currently as Chairman of Committee D18. The Committee has recognized his efforts with numerous awards. He is also a Fellow of the Society.

On the educational front, in addition to extensive thesis supervision, he has developed and taught experimental undergraduate and graduate classes taken by civil engineering students. He has enhanced the quality and depth of the engineering educational experience through a pedagogical approach that is centered on providing students with hands-on-learning experiences, a fundamental understanding of the technology, and a hypothesis testing methodology. He has received teaching awards from the Graduate Student Council, the Civil Engineering Department, Chi Epsilon, and named ASTM's Professor of the Year in 2011. Dr. Germaine has supervised over 50 Master of Science students and 30 Doctorate students. His graduates are distributed in companies throughout the world and seven are now university faculty members.

Registration Deadline: Monday, November 9, 2015

Registration Information:

Free to Members and Non-Members

Register to attend this lecture online at <u>http://bit.ly/Ladd_Registration</u>. You can also register for this event by mail or email. To do so, download and complete a <u>BSCES Event Registration Form</u> and follow the submission instructions. If you have questions about registration, please call The Engineering Center at 617-227-5551.

Charles C. Ladd Memorial Fund

Professor Charles C. Ladd was renowned as a gifted teacher (with a style emulated by many former students who became faculty members) and innovative researcher on advanced technical topics. He was internationally sought after as a consultant working on large, complex and difficult civil projects. Among his numerous professional achievements, Professor Ladd was elected in 1983 to the US National Academy of Engineering and was the recipient of many research awards from the American Society of Civil Engineers (ASCE) including the Walter L. Huber Civil Engineering Research Prize, the Croes Medal, the Norman Medal and the Terzaghi Lecture Award. In 1995, he was elected as a distinguished member of ASCE and received the Hogentogler Award from the American Society for Testing and Materials. In 2012, Professor Ladd was awarded the ASCE Outstanding Project and Leaders lifetime achievement award for his contributions to engineering education. Professor Ladd leaves a lasting legacy and tribute to his life's work with his commitment to his students at M.I.T. and significant contributions to geotechnical engineering.

The Charles C. Ladd Memorial Fund was established in 2015 to support a lecture presented biennially by an eminent academic or practitioner on a topic related to soil behavior and construction on soft ground. Donations to the fund can made with check payable to BSCES with Charles C. Ladd Fund noted in the memo line. Check should be mailed to BSCES, Charles C. Ladd Fund, The Engineering Center, One Walnut Street, Boston, MA 02108-3616.





& DEVELOPMENT Institute

TRANSPORTATION

Boston Chapter

SAVE THE DATE BSCES T&DI Chapter Sponsored Webinar "Critical Elements of Roundabout Design"

Andy Paul Senior Engineering Associate Kittelson & Associates, Inc.

Wednesday, November 18, 2015

12:30 PM – 1:30 PM

This webinar will provide a brief overview of key roundabout design elements, peer review "fatal flaw" details, and public outreach techniques and maintenance considerations. In addition, this webinar will include case studies of the critical design elements discussed.

The speaker, Andy Paul, has been involved in roundabout design, operations, and project delivery in Massachusetts since 2004 when he was involved in the design of the Washington Square roundabout in Worcester - the first multi-lane roundabout in the State. Andy later worked in the MassDOT State Traffic Engineer's office as the State Roundabout Coordinator. He has presented on roundabouts and rotaries to local jurisdictions, planning organizations, DOT's, FHWA, TRB, and ITE. Andy is a past member of the TRB Roundabout Committee and is currently the Co-Principal Investigator for NCHRP Synthesis 46-02. The project captures the current state-of-the practice for roundabout design, operations, and safety for roundabouts in the US.

This course is appropriate for planners, engineers, and public officials responsible for planning, design, construction, and maintenance of traffic control devices.

More information will follow as the event date approaches. Feel free to contact Bryan Zimolka at <u>bzimolka@hshassoc.com</u> or James Turnbull at <u>jturnbull@hshassoc.com</u> if you have any questions.





Aggregate Pier Ground Support Systems Workshop

Kord J. Wissmann, PhD, PE, D.GE

President and Chief Engineer, Geopier Foundation Company, Inc. **Mike Pockoski, PE**

Eastern Region Lead Engineer, Geopier Foundation Company, Inc.

James R. Wheeler, PE

Principal Engineer, Design/Build Geotechnical, LLC

Thursday, November 19, 2015

Abington Ale House, 1235 Bedford Street, Abington, MA 7:00 AM – 7:45 AM Registration/Continental Breakfast; 8:00 AM – 11:00 AM Presentation

Dr. Wissmann and his associates will discuss the ongoing evolution in the design and construction of aggregate pier ground support systems used in New England and will focus on design assumptions, considerations for organic and soft cohesive soils, construction techniques for cemented piers, geotechnical and structural engineering related design of ground support for floor slabs, and ground improvement for soil liquefaction and slope stabilization. Discussion will emphasize the importance for design professionals to thoroughly understand the concepts behind ground improvement design, construction, and verification so that they can make informed recommendations to their clients regarding ground support alternatives that are safe, reliable, cost effective, and designed in accordance with the intent and requirements of the building code.

This talk should be attended by anyone with an interest in innovative foundation systems including structural engineers, geotechnical engineers, civil engineers, architects, planners, contractors, real estate developers, and facility managers, both public and private.

Registration Deadline: Monday, November 16, 2015

\$45 Members, \$55 Non-Members \$40 Public Sector Members, \$45 Public Sector Non-Members \$20 Senior Members (65+), \$20 Students

Information/Registration:

Register to attend this meeting and pay by credit card online at <u>http://bit.ly/GroundSupportWorkshop</u>. To register online for an event at the BSCES member rate you must login using your BSCES assigned username and password. If you do not know your BSCES member login information call 617/227-5551. You can also register for this event by mail or email. To do so, download and complete a <u>BSCES Event</u> <u>Registration Form</u> and follow the submission instructions. Cancellations received after **Monday**, **November 16, 2015** and no-shows will be billed.







COASTS, OCEANS, PORTS & RIVERS INSTITUTE





ENVIRONMENTAL & WATER RESOURCES INSTITUTE

Boston Chapter

SAVE THE DATE Tuesday, December 1, 2015

Preparing for a Flood: Resiliency at Massport

Robbin Peach, MPA, MA

Program Manager of Resiliency, Massport

Robbin Peach will give an overview of the Massport process to make its assets more resilient to flooding - therefore protecting our region's economy. She will discuss the planning process for identifying threats and critical assets, architectural and engineering solutions, and operational preparedness. Please join us for what will be a very interesting presentation. This talk should be attended by anyone with an interest in coastal resiliency including civil engineers, architects, administrators, and planners.

Robbin Peach is Massport's program manager of resiliency. She managed Massport's award-winning Disaster Infrastructure Resiliency Plan and is currently overseeing implementation of capital and operational improvements to make Massport's assets resilient to extreme flooding. She regularly sits on committees and collaborates with federal, state, regional, and intermodal transportation agencies around resiliency. Ms. Peach holds a Masters in Public Administration from Harvard Kennedy School, a Master of Arts in Landscape Design and Land-use Planning from the Conway School, and a Bachelor of Science in Horticulture from Virginia Polytechnic Institute and State University.







ENVIRONMENTAL & WATER RESOURCES INSTITUTE Boston Chapter

Workshops: HEC-RAS 2D & GRASS GIS Hydraulic Models

Karen Madsen, PE Water Resources Engineer, AECOM Derek Etkin, PE Water Resources Engineer, CDM Smith

Tuesday, December 8, 2015 & Tuesday, December 15, 2015

VHB, 101 Walnut Street, Watertown, MA 02472 5:30 PM Social/Dinner; 6:15 PM Presentation

GRASS GIS Hydraulic Models: GRASS GIS is a geographic mapping software with an open-source license. This open-source license means that anyone can freely program the software, and it has allowed academics to build environmental models inside of the GRASS GIS software. This workshop will provide an overview of two numerical models embedded in GRASS GIS: a sediment transport/ erosion/deposition model, and a numerical model for transient groundwater-flow in two dimensions. The results of the GRASS GIS models will be compared against more conventional approaches at two New England sites. This workshop is aimed at modelers interested in learning about open-source tools.

HEC-RAS 2D: In the Fall of 2015, the USACE Hydrologic Engineering Center (HEC) plans to release HEC-RAS version 5.0, which includes many new features, most notably a 2D surface flow module. The new capabilities provide users with the flexibility to add overland flow areas to a traditional HEC-RAS model without the cost or startup time associated with other vendor packages. This workshop is aimed at practitioners with familiarity in open channel flow modeling or experience in flood plain mapping projects. A presentation of the new capabilities will be followed by a model demonstration and an open discussion of applications.

Registration Deadline: Tuesday, November 24, 2015

Registration Fees: \$90 Member, \$115 Non-Members \$75 Public Sector Member, \$90 Public Sector Non-Member \$30 Senior Members (65+) and Students

Information/Registration:

Register to attend this meeting and pay by credit card online at <u>http://bit.ly/EWRI_ModelingWorkshop</u>. To register online for an event at the BSCES member rate you must login using your BSCES assigned username and password. If you do not know your BSCES member login information call 617/227-5551. You can also register for this event by mail or email. To do so, download and complete a <u>BSCES Event</u> <u>Registration Form</u> and follow the submission instructions. Cancellations received after November 24, 2015 and no-shows will be billed.



This presentation provides 4.0 Professional Development Hours (PDH) Supported by the staff of The Engineering Center Education Trust