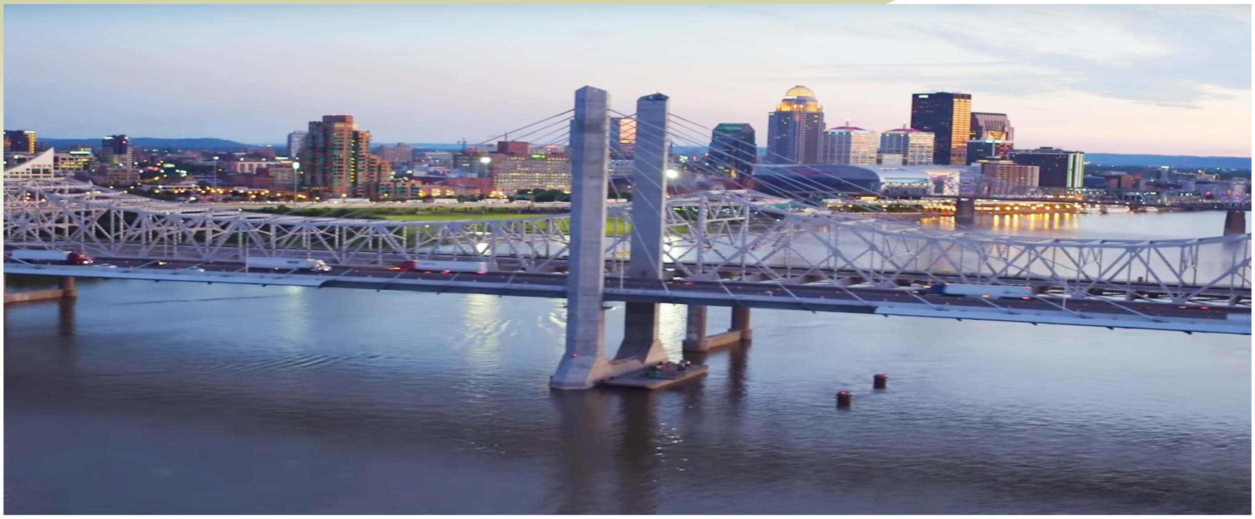


STGEC 2018

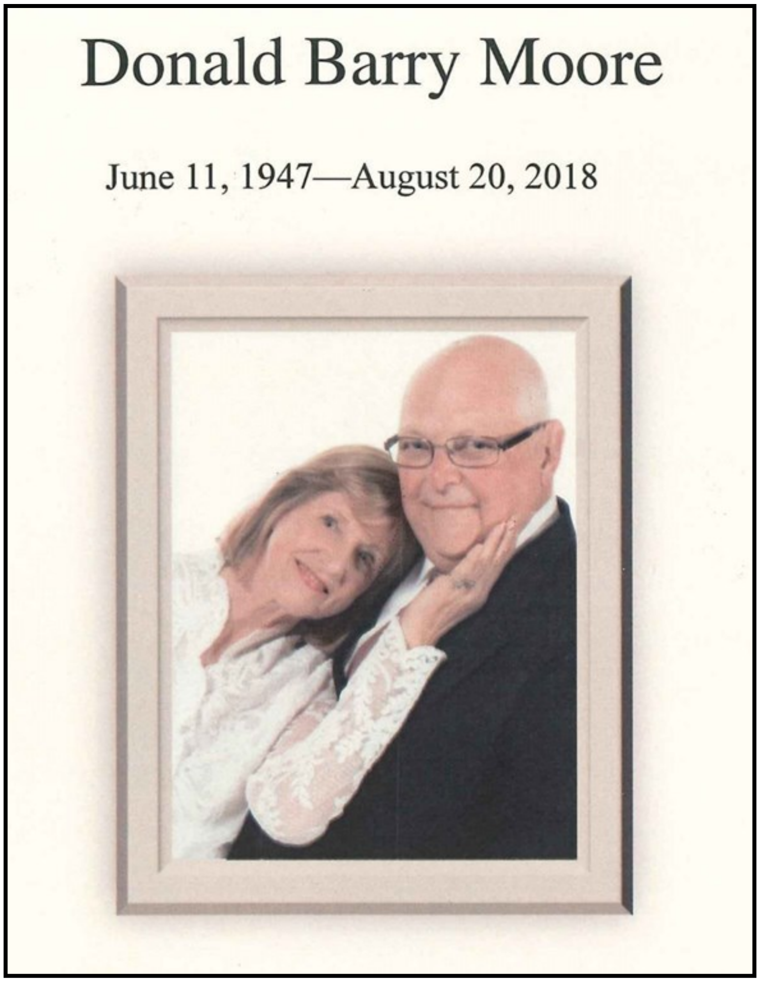
Southeastern Transportation Geotechnical Engineering Conference

October 8-11, 2018

Louisville, KY

Hosted by

KENTUCKY TRANSPORTATION CABINET



The 49th Southeastern Transportation Geotechnical Engineering Conference is dedicated to Donald Barry Moore. In 2009, Don became the first longstanding officer of the Southeastern Transportation Geotechnical Engineering Conference (STGEC) in its history, as Treasurer. Under his leadership, STGEC was established as an official organization under the Articles of Association in-place today. His work ensures that this knowledge exchange forum will continue for many years to come.

We are forever grateful for Don's commitment, support, leadership, financial skills and contributions to STGEC, and for his public service to the North Carolina Department of Transportation for over 38 years. We are forever grateful for enriching our lives with his.

As his family referred to him, so do we: The man, the myth, the legend.

Thank you, Don.

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WELCOME LETTER

Dear 2018 STGEC Attendees,

The Kentucky Transportation Cabinet, Geotechnical Branch is very pleased to host the 49th Annual Southeastern Transportation Geotechnical Engineering Conference (STGEC) in Louisville. We are excited to have the opportunity to present this year's conference, and hope that this experience will be both enjoyable and beneficial to each of you. We encourage you to take advantage of this opportunity and spend time with each other to discover different perspectives on our profession.

This year's conference will offer more than thirty presentations on topics ranging from subsurface explorations to deep foundations. In addition to our presentations we hope that you will attend our conference events. They will include Monday's Ice Breaker, Wednesday's Banquet and Thursday's field trip. We will be sharing information on the Ohio River Bridges project recently completed here in Louisville. An overview of this project will be presented on Tuesday morning by our State Highway Engineer, Andy Barber, who served as the KYTC project manager. This project will be featured during the Thursday morning technical session, and portions will be viewed during our tour on The Belle of Louisville steamboat this Thursday.

We'd like to express our appreciation to Bill Broyles and the late Don Moore who served STGEC volunteers, our Secretary Gregg Thomas and his staff, and our State Highway Engineer Andy Barber and his staff. It is by their permission and assistance that this year's conference is possible. We'd also like to express gratitude to the Georgia Department of Transportation's Geotechnical Bureau for providing a wonderful example of a conference last year. It gave us something to aspire to! I'd like to personally thank the staff of our Geotechnical Branch for working so hard in support of this effort. Special recognition is extended to Daryl Greer in our office. This year's conference was primarily conceived and executed though his efforts. Finally, we thank all of you for attending our conference. We hope that your experience is both enjoyable and informative.

Sincerely,

Michael Carpenter, P.E.
Transportation Engineering Branch Manager
Geotechnical Branch
Kentucky Transportation Cabinet

STGEC 2018 AGENDA

MONDAY, OCTOBER 8, 2018

10:00 a.m. - 10:00 p.m.	Registration
10:00 a.m. - 5:00 p.m.	Exhibitor Setup
6:00 p.m. - 9:00 p.m.	Opening Reception in Exhibit Hall

TUESDAY, OCTOBER 9, 2018

7:00 a.m. - 7:50 a.m.		Breakfast in Exhibit Hall
7:00 a.m. - 4:30 p.m.		Registration Desk Open
7:50 a.m. - 8:00 a.m.		Opening Announcements
SESSION 1		**OPENING SESSION**
8:00 a.m. - 8:25 a.m.	Pg. 13	Andy Barber, KYTC - Welcome and Louisville-Southern Indiana Ohio River Bridges Project Overview
8:25 a.m. - 9:15 a.m.	Pg. 14	Keynote Speaker—Jerry DiMaggio, Applied Research Associates, Inc. Advancements in Geotechnical Engineering and Geo-Construction
9:15 a.m. - 9:40 a.m.	Pg. 15	Benjamin Rivers, FHWA—Advanced Geotechnical Exploration
9:45 a.m. - 10:15 a.m.		**Break in Exhibit Hall**
SESSION 2		**SUBSURFACE EXPLORATION/CASE HISTORIES**
10:15 a.m. - 10:40 a.m.	Pg. 16	John Lynk, Vatten Geotechnical - CPT-WESS
10:40 a.m. - 11:05 a.m.	Pg. 17	Clint Ervin/Dennis Mitchell, AEI - KY Lock Exploration
11:05 a.m. - 11:30 a.m.	Pg. 18	Chris Jones, HDR - Durham-Orange Light Rail
11:30 a.m. - 11:55 a.m.	Pg. 19	Ashraf Elsayed, Geotechnology - I-240 Bridge Replacement
12:00 p.m. — 1:00 p.m.		**Lunch in Exhibit Hall**
SESSION 3		**DEEP FOUNDATION DESIGN AND CONSTRUCTION**
1:00 p.m. - 1:25 p.m.	Pg. 20	Darrin Beckett, KYTC - Herrington Lake Drilled Shafts
1:25 p.m. - 1:50 p.m.	Pg. 21	Austin Hart, KYTC - Lake Barkley Bridge Construction in Karst
1:50 p.m. - 2:15 p.m.	Pg. 22	Mike Batten, HDR - Deep Foundation Optimization
2:15 p.m. - 2:40 p.m.	Pg. 23	Silas Nichols, FHWA - Drilled Shaft Policy Changes
2:45 p.m. - 3:15 p.m.		**Break in Exhibit Hall**

STGEC 2018 AGENDA

TUESDAY, OCTOBER 9, 2018 (CONTINUED)

SESSION 4		**SLOPES/EMBANKMENTS**
3:15 p.m. - 3:40 p.m.	Pg. 24	Theresa Loux, AeroAggregates - Ultra-lightweight Foamed Glass Aggregate
3:40 p.m. - 4:05 p.m.	Pg. 25	Allen Cadden, Schnabel Engineering - Yeager Airport Wall
4:05 p.m. - 4:30 p.m.	Pg. 26	Steven Zhou, Visual Slope - Slope Remediation with Piles
4:30 p.m. - 4:55 p.m.	Pg. 27	Stephen Bartlett, Univ. of Utah - LDCC Seismic Design

WEDNESDAY, OCTOBER 10, 2018

7:00 a.m. - 8:00 a.m.		Breakfast in Exhibit Hall
7:00 a.m. - 4:30 p.m.		Registration Desk Open
SESSION 5		**EARTH RETENTION**
8:00 a.m. - 8:25 a.m.	Pg. 28	Stan Worst, Schnabel Foundation Co. - Secant Pile Access Shafts
8:25 a.m. - 8:50 a.m.	Pg. 29	Anand Govindasamy, Geocomp - MSE Wall Asset Management
8:50 a.m. - 9:15 a.m.	Pg. 30	Brad Armstrong, McMahon & Mann - Hollow Bar Soil Nail Wall
9:15 a.m. - 9:40 a.m.	Pg. 31	Nick Harman/Ani Carignan, SCDOT - LRFD Overall Stability
9:45 a.m. - 10:15 a.m.		**Break in Exhibit Hall**
SESSION 6		**PAVEMENTS/SUBGRADES**
10:15 a.m. - 10:40 a.m.	Pg. 32	Doug Smith, Great Lakes Cement - Full Depth Reclamation
10:40 a.m. - 11:05 a.m.	Pg. 33	Jesse Rauser, LADOTD - Interstate Cracked Pavement
11:05 a.m. - 11:30 a.m.	Pg. 34	Rex Klentzman, Uretek - US 65 Emergency Pavement
11:30 a.m. - 11:55 a.m.	Pg. 35	Joe Harris, Hayward Baker - In-Place Subgrade Improvement
12:00 p.m. - 1:00 p.m.		**Lunch in Exhibit Hall**
SESSION 7		**SLOPES/EMBANKMENTS**
1:00 p.m. - 1:25 p.m.	Pg. 36	Joe Hauber, Geotechnology - US 68 Bridge Abutment Settlement
1:25 p.m. - 1:50 p.m.	Pg. 37	Daryl Greer, KYTC - Treatment of End Bent Backfill
1:50 p.m. - 2:15 p.m.	Pg. 38	Marianna Ferrara, Maccaferri - High Strength Geogrids
2:15 p.m. - 2:40 p.m.	Pg. 39	Taylor Towle, Menard - Hybrid Ground Improvement
2:45 p.m. - 3:15 p.m.		**Break in Exhibit Hall**

STGEC 2018 AGENDA

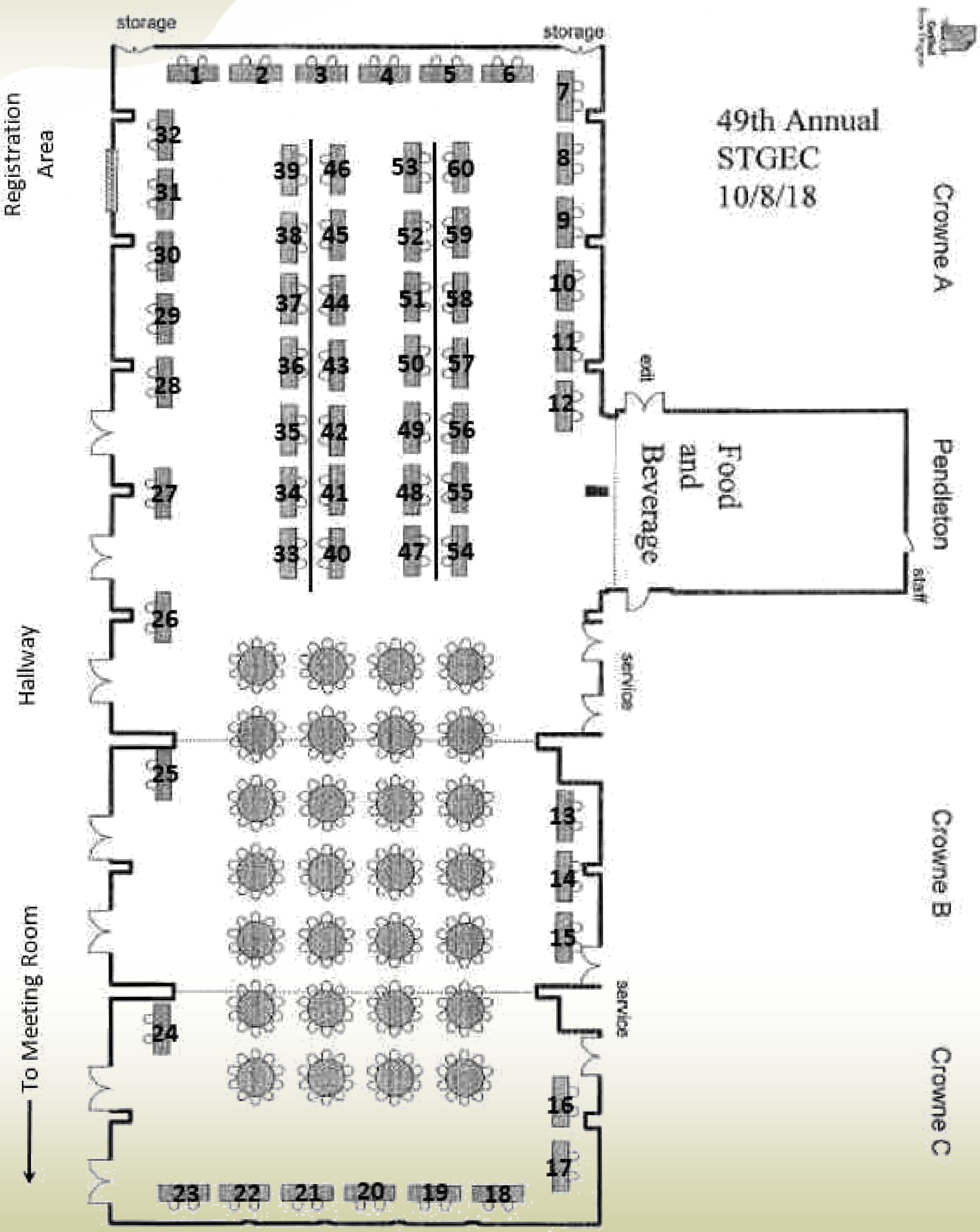
WEDNESDAY, OCTOBER 10, 2018 (CONTINUED)

SESSION 8		**DEEP FOUNDATION TESTING**
3:15 p.m. - 3:40 p.m.	Pg. 40	Vivek Samu, NCSU - Nondestructive Pile Length Evaluation
3:40 p.m. - 4:05 p.m.	Pg. 41	S. Sternberg/R. Thompson, Dan Brown & Assoc. - Mobile River Bridge
4:05 p.m. - 4:30 p.m.	Pg. 42	Jon Sinnreich, Load Test Consulting - Deep Foundation Test Results
4:30 p.m. - 4:55 p.m.	Pg. 43	A. Goly/S. Putcha, Smart Structures - Advanced Dynamic Test Methods
5:00 p.m. - 6:00 p.m.		**Steering Committee Meeting**
6:00 p.m. - 9:00 p.m.		**Banquet** Speaker - John Dietrick, PE, SE, Michael Baker International "An Overview of the Bridges to Prosperity Program"

THURSDAY, OCTOBER 11, 2018

7:00 a.m. - 8:00 a.m.		Breakfast in Meeting Room
7:00 a.m. - 10:30 a.m.		Registration Desk Open
SESSION 9		**LOUISVILLE-SOUTHERN INDIANA OHIO RIVER BRIDGES (LSIORB) PROJECT**
8:00 a.m. - 8:35 a.m.	Pg. 44	Mark Litkenhus/Steve Bickel, Stantec - Geotech Aspects of LSIORB Project
8:35 a.m. - 9:10 a.m.	Pg. 45	Scott Zang, Michael Baker - Pier 3R Shaft Remediation
9:10 a.m. - 9:45 a.m.	Pg. 46	David Neil, Parsons - East End Tunnel
9:45 a.m. - 10:30 a.m.		**Break**
10:30 a.m. - 11:30 a.m.		**Load Buses and Travel to Downtown**
11:30 a.m. - 2:00 p.m.		**Load Riverboat, Lunch, Tour Downtown Bridge**
2:00 p.m. - 3:00 p.m.		**Return to Hotel**

EXHIBITORS' HALL



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Session 1 - Opening Session
Speaker 1

WELCOME AND OVERVIEW OF THE LOUISVILLE-SOUTHERN INDIANA OHIO RIVER BRIDGES PROJECT

Andy Barber, P.E.
State Highway Engineer
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The presentation will include a welcome to STGEC on behalf of the Kentucky Transportation Cabinet. Additionally, it will provide an overview of the Louisville-Southern Indiana Ohio River Bridges Project and include a general background and history of the project with regard to design, technical, political, and financial challenges. Furthermore, the funding sources and financing for both the downtown and east end bridges will be addressed. Finally, the presentation will explain why the project procurement was bifurcated resulting in Kentucky overseeing delivery of the downtown phase and Indiana being responsible for the east end.

Session 1 - Opening Session
Speaker 2

ADVANCEMENTS AND DISAPPOINTMENTS IN GEOTECHNICAL ENGINEERING AND GEO-CONSTRUCTION - A 45 YEAR REFLECTION AND FUTURE OPPORTUNITIES

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My career in Geotechnical Engineering and Geo-Construction has been most rewarding and fulfilling. In hindsight, I would like to state my 45 years of practice was well planned and premediated. Nothing could be further from the truth. Honestly, my post high school plan was to obtain a degree in accounting and then complete law school. My engineering career plan was simple and consistent; try to periodically discover new interests and refocus my attention as I became bored or interested (or both), in new and innovative materials, processes and systems crossed my path. I have been most fortunate in the paths and directions that I selected, or more correctly stated selected me.

In some small way, I believe I have contributed to the many changes in our profession and industry during the past 4½ decades. My experience has been broad and diverse (technically, professionally and geographically). Planning for future (looking ahead) always is fun and always presents a challenge, a degree of risk, some uncertainty and a bit of luck. By comparison, reflections are much easier and always include personal bias that few can challenge (based on my age if nothing more).

This presentation provides both, a reflection what I have experienced (disappointments, successes and advancements) and a future prediction of what I believe is ahead for this audience and those who follow. I will address both professional and technical topics and will discuss the following:

- professional development, communication, work ethic
- subsurface investigations,
- geotechnical design and analysis,
- extreme events,
- specifications and contracting,
- construction monitoring,
- asset management of geotechnical features,
- dispute resolution.

Session 1 - Opening Session
Speaker 3

ADVANCED GEOTECHNICAL EXPLORATION METHODS

Benjamin S. Rivers, P.E.
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Understanding how subsurface site conditions affect project design and construction is critical to ensuring safe and cost-effective projects. Implementing advanced geotechnical exploration methods will improve project decisions, leading to shortened project delivery times and cost savings that significantly benefit the traveling public.

Improved Subsurface Investigation Data

Differing site conditions represent a significant number of cost escalations and delays on highway and bridge construction projects. These problems arise when the site conditions encountered differ from those documented in the geotechnical reports and contract documents developed from prescriptive and minimal subsurface exploration programs. Currently, design engineers rely on limited investigation data for subsurface characterization and inference to generate the geotechnical profile used for the design. Unfortunately, since ground conditions influencing design and construction can vary widely within the project site, making decisions with incomplete or limited information can result in costly constructability issues and claims.

Nondestructive geophysical methods provide two-dimensional (2D) and three-dimensional (3D) subsurface images, distinguishing material and groundwater changes both laterally and with depth across a project site. Mischaracterized groundwater and other unanticipated “changed conditions” that delay projects and escalate costs can be reduced or altogether avoided. When coupled with rapid and reliable in-situ field testing, project designs become more efficient and less conservative.

Benefits

Reduced Risk. Reducing uncertainties in subsurface conditions mitigates design and construction risks.
Improved Quality. Improving confidence in the geotechnical characterization reduces unnecessary conservatism in design and establishes a more reliable basis for design and construction of foundations and other geotechnical features impacting the highway system.
Accelerated Project Delivery. Since a significant number of construction delays can be attributed to inadequate knowledge of subsurface site conditions, advanced methods improve decision making and constructability, providing time and cost savings for transportation agencies.

Advanced Geotechnical Exploration Methods was chosen to be one of ten initiatives to be implemented through FHWA’s Round 5 of Every Day Counts (EDC). EDC is a State-based model that identifies and rapidly deploys proven, yet underutilized innovations to shorten the project delivery process, enhance roadway safety, reduce traffic congestion, and improve environmental sustainability.

This presentation introduces this implementation effort, explains the current proposed approach, and welcomes feedback from all stakeholders to maximize its value to practice.

Session 2 — Subsurface Exploration/Case Histories
Speaker 4

INTRODUCING CPT-WESS: WHIPSTOCK-ENABLED SOIL SAMPLING AND ITS' USE IN CONJUNCTION WITH THE STATIC CONE PENETROMETER

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The static cone penetrometer (CPT) is a useful tool for creating geotechnical soil behavior profiles, but suffers from its inability to retrieve soil samples. This inability inhibits engineers utilizing the CPT in several ways, including less robust analyses for pile design, consolidation calculations, liquefaction design, drained strength estimation, and general soil profile creation. Numerous improvements have been made to the CPT to reduce the effects of this problem, including the addition of samplers that can take just one soil or fluid sample; the addition of gauges and tooling for pore pressure, permeability, resistivity, or photos; and extensive correlations between tip and sleeve resistance to determine soil behavior type. Within the past few years, an invention has been created that arguably solves this problem: CPT with whipstock-enabled soil sampling (CPT-WESS, patent pending). CPT-WESS efficiently enables unlimited disturbed sidewall "grab" samples to be taken from the sidewall of a CPT sounding. These samples are withdrawn to surface and standardized engineering tests can be performed on them, such as visual-manual description, hydrometer grain size analysis, Atterberg limits, and moisture and organic matter contents. CPT-WESS utilizes tooling from the upstream petroleum drilling industry, combined with classic CPT equipment, as well as new innovative improvements, to enable soil sampling throughout the depth of a CPT profile. Several field trials of CPT-WESS in northeast Texas and central Louisiana have been conducted and the results are presented herein.

Session 2 — Subsurface Exploration/Case Histories
Speaker 5

KENTUCKY LOCK EXPLORATION

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The purpose of the project is to alleviate the delay time of commercial barge tows passing through the Kentucky and Barkley Locks. Products originating from or designated to 20 states pass through the system of Locks. Over 80% of the commercial tows hauling these products pass through Kentucky Lock due to difficult navigation downstream of the Barkley Lock. Since most of the tows are greater than 600' in length, they must perform a time-consuming double lockage to transit through the existing 600' long Kentucky Lock. Due to this, Kentucky Lock's delay times are some of the longest in the inland waterway system ranging from 4 to 7 hours.

The role of American Engineers, Inc. (AEI) in this expansion is to perform the geotechnical investigation to provide subsurface data to assist in the design of foundations for the proposed Lock expansion. The geotechnical investigation consisted of advancing 19 borings utilizing HWT sized casing and HWL sized coring equipment. The project was broken into three phases, land based drilling, floating platform based drilling and aerial platform based drilling. The borings were drilled to identify and quantify the overburden thicknesses and to evaluate underlying bedrock. The floating platform based drilling consisted of drilling from a barge on the Tennessee River downstream of the lock. The final phase of the geotechnical investigation consisted of drilling three aerial platform based borings. These borings were performed from a platform affixed on the guide wall of the existing lock.

The geology at the site is comprised of limestone with chert nodules. This formation is susceptible to solutioning creating karst features within the bedrock. Voids that were encountered were to have Standard Penetration Tests (SPT) performed within the formation to determine the extents of the void and classify the material contained within the void. Additionally, when the boring was completed, pressure testing was performed within the borehole utilizing wireline packers.

At the completion of drilling and pressure testing of each boring location, the borings were terminated by pressure grouting borings via tremie method. AEI completed this activity utilizing a stand-alone grout pump mounted on a trailer that allowed a theoretical volume of grout to be injected into the borehole as directed by Nashville District USACE Geologists.

Session 2 — Subsurface Exploration/Case Histories
Speaker 6

GEOTECHNICAL INVESTIGATION EXECUTION FOR THE DURHAM-ORANGE LIGHT RAIL

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The Durham-Orange Light Rail Transit Project is a 17.7 mile passenger rail between Chapel Hill and Durham, North Carolina. It is currently in the design phase and scheduled to begin construction in 2020. It is located in a heavily urbanized environment within the heart of North Carolina's Research Triangle Region. The project involves clearing major hurdles such as utility relocation, right of way acquisition, and coordinating with major universities and hospitals for approval.

The site is located within one of several trough shaped basins that are present within the Piedmont Physiographic Province. Two primary rock types were cored during the field investigation. Metamorphosed Granitic Rock can be found in the first 1.5 miles of the project and Triassic Sandstone, Siltstone, and Claystone can be found in the rest of the alignment. Over 400 lab samples were assigned including classification, moisture, unconfined compressive strength testing (rock) and slake durability. This will also be discussed in detail.

The geotechnical field investigation involved drilling approximately 1,000 borings over a sixteen month period in a relatively urban, well developed area. Borings ranged in depth from 10 to 80 feet in depth, with varying amounts of rock cored up to 30 feet in length depending on quality. This resulted in a total drilling depth of approximately 21,000 feet.

During this time, the geotechnical team had to coordinate with both public and private utility owners and locators to stay ahead of the two drill rigs on the project. The field work was performed in a politically charged environment that required very careful coordination between public and private property owners. Many of the borings were drilled within NCDOT right of way, which required coordination of traffic control efforts on a daily basis.

This presentation will discuss the practical aspects of managing such a large scale drilling program in an urban area of varying geology, with emphasis on the need for careful planning and coordinating with stakeholders and property owners.

Session 2 — Subsurface Exploration/Case Histories
Speaker 7

MEMFIX 4: I-240 BRIDGE REPLACEMENT

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CM/GC (Construction Manager/ General Contractor) is a delivery method that involves selecting a contractor that works side-by-side with the design team during the design phase; the contractor then provides a construction fee to be approved by the owner. It is being used for bridge replacement project over Interstate I-240, which contains three to four lanes in each direction. A previous widening project of I-240 included a plan to have four lanes in each direction and a collector/distributer (CD) road within the Poplar Avenue interchange. During construction, excavation of the slope in front of stub abutments revealed short driven piles counter to what was specified in the original construction plans. The purpose of this CM/GC project is to provide eight lanes for the I-240 mainline by completing the widening and improving the vertical and horizontal clearance at the bridge crossings. This requires a full replacement of the Poplar Avenue and NS bridges and seismic rehabilitation of the Park Avenue Bridge. The design team faced several geotechnical and structural challenges during exploration and design phases. These included physical constraints during the exploration phase, demanding seismic requirements per AASHTO specifications, designing around recently constructed elements, limited accessibility and other constructability challenges. These challenges created opportunities for innovation. The geotechnical team combined conventional drilling and Cone Penetration Testing (CPT) and performed a site-specific seismic study to develop design response spectra. The structural team minimized construction impacts to the traveling public and NS by utilizing accelerated bridge construction (ABC). This involves replacing bridge superstructures with prefabricated units during weekend road closures and retrofitting existing substructures with low overhead clearance. Retrofitting existing substructures under traffic in a high seismic region required innovative approaches such as the utilization of ASTM A706 reinforcing steel and micropiles. The application of the CM/GC delivery method allowed collaboration between the design team, TDOT, and the contractor, provided value to the project and met with the satisfaction of TDOT.

Session 3 - Deep Foundation Design and Construction
Speaker 8

DEEP WATER DRILLED SHAFT CONSTRUCTION FOR THE HERRINGTON LAKE BRIDGE REPLACEMENT PROJECT

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The Kentucky Transportation Cabinet (KYTC) is currently administering an approximately $30 million construction contract for the replacement of the KY 152 Bridge over Herrington Lake in Mercer and Garrard Counties, Kentucky. The original two-lane bridge was constructed in the 1920's and is being replaced by a two -lane bridge. The new three-span bridge has two 350-ft. steel plate girder spans and one 121.5-ft. prestressed concrete I-beam span.

Pier 1, which connects the two longer spans, presented several design and construction challenges and this presentation will focus on the drilled shaft foundations for that pier. The water level in Herrington Lake is highly variable and, during installation of drilled shafts, the water depth at Pier 1 ranged from about 170 to 200 ft. The foundation system about Pier 1 consists of four drilled shafts with rock sockets 8 ft. in diameter and approximately 40 ft. long. The total cost associated with constructing and testing these four shafts was approximately $10 million, which is about one third of the total contract. Karstic features were encountered in all four shafts and these were remediated by pouring and re-drilling through stabilization concrete in the sockets. Non-destructive drilled shaft testing consisting of video inspection, sonar calipering, thermal integrity profiling and crosshole sonic logging was performed. The presentation will address challenges, successes and lessons learned.

Session 3 - Deep Foundation Design and Construction
Speaker 9

US60 / KY 80 LAKE BARKLEY BRIDGE: DRILLED SHAFT CONSTRUCTION METHODS, KARST CHALLENGES AND LESSONS LEARNED

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The Lake Barkley Bridge Replacement project was to replace the Eastern crossing of the Land Between the Lakes National Recreation Area on US 68 / KY 80. The original bridge was a 2-lane 22’ wide structure built in 1932 and had become functionally obsolete. The new bridge is a 4-lane, 75’ and 3,805’ long structure with welded plate girder approaches and 550’ basket handle tied arch. The prime contractor on the $128 million project was PCL Civil Constructors, who self-performed the water based shafts. Richard Goettle, Inc. installed the land based shafts. The design team included; Foundation: Terracon Consultants, Approach: Palmer Engineering, Main Span: Michael Baker International.

This presentation will address the difficulties encountered during the installation of the drilled shafts and H-Piling foundations. These difficulties included re-designs to multiple substructures, remediation of land and water based shafts, cost overruns, and schedule impacts.

Session 3 - Deep Foundation Design and Construction
Speaker 10

OPTIMIZATION OF DEEP FOUNDATIONS WITH FB-MULTIPIER

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As the use of design-build projects spreads throughout the industry, the incentive to optimize deep foundations is increased. HDR, among many other engineering firms, is using software to model soil-structure interaction of deep foundations on both conventional foundation design projects and mega bridge projects. FB MultiPier is a powerful software tool used to model the non-linear soil-structure interaction of pile groups, the flexibility of pile and pier caps, and the foundation stiffness of multiple pile groups connected in the same bridge unit. As use of the FB MultiPier program becomes more prevalent in the industry, geotechnical engineers need to understand its uses and limitations, particularly the varying types of soil models. Foundation stiffness is modeled with 4 different components in the program: lateral stiffness (P-Y curves), axial side stiffness (T-Z curves), axial end bearing stiffness (Q-Z curves), and torsional stiffness (T-theta curves). Example soil parameters and FB MultiPier analyses will be shown to demonstrate how and why FB MultiPier uses certain soil parameters. FB MultiPier determines individual pile loads by modeling the pile cap or pier cap as a stiffness matrix and distributing the load to individual piles according to the stiffness of the cap. This allows for a more realistic evaluation of pile loads than conventional methods, and can be used to evaluate individual piles if isolated pile issues are encountered during construction. Piles can be modeled at differing depths and different soil profiles within the same foundation unit to account for the effects of non-uniform foundations and the varying pile load distribution that results from this configuration. Example projects where FB MultiPier was used to optimize foundations will be highlighted such as the Tappan Zee Bridge across the Hudson River, Fayetteville Outer Loop bridges in Fayetteville, North Carolina, and the Bonner Bridge Replacement on the North Carolina Outer Banks.

Session 3 - Deep Foundation Design and Construction
Speaker 11

POLICY CHANGES IN DRILLED SHAFT DESIGN AND CONSTRUCTION

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The Federal Highway Administration (FHWA) will publish an update to Geotechnical Engineering Circular (GEC) – 10 on the design and construction of drilled shaft foundations in Fall 2018. The primary goals of the update are to streamline content to make the document more useable for highway agencies and our partners, and to address some issues identified throughout the current version of the manual. One of the most significant issues that will be addressed in the update will be a series of policy changes related to how acceptance will be defined for drilled shafts. Innovations in drilled shaft construction equipment over the last two decades, combined with increased load carrying demands for foundation elements have resulted in significantly larger and deeper shaft excavations that have tested our abilities in many areas including equipment requirements, materials, and construction means and methods.

This presentation will focus on policy changes being implemented by the FHWA to address issues associated with the rapid evolution of drilled shaft construction. Policy changes are being implemented for use of prototype shafts for demonstration piles and load testing, the interpretation of bi-directional testing of shafts, and the use and interpretation of non-destructive integrity testing for drilled shafts. In addition, FHWA will be addressing some issues with procedures for conducting concrete pours.

Session 4 - Slopes/Embankments
Speaker 12

ULTRA-LIGHTWEIGHT FOAMED GLASS AGGREGATE: AN INNOVATIVE AND SUSTAINABLE LIGHTWEIGHT FILL OPTION

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Ultra-lightweight foamed glass aggregate (UL-FGA) may now be considered as a lightweight fill material for use in the construction of retaining structures, embankments, highways, and bridge abutments in the United States. This granular material has dry bulk densities ranging from 8-15 pcf and a closed cell structure which provides good insulation properties and minimal water absorption. This presentation will cover the history and development of foamed glass aggregate in Europe, physical and engineering properties of the material, and research and testing that is currently underway. Additionally, there will be a focus on U.S. -based case studies.

Session 4 - Slopes/Embankments
Speaker 13

YEAGER AIRPORT, DISMANTLING OF A 240 FEET HIGH REINFORCED SLOPE AND BUILDING AN 85 FT. WALL TO RESTORE THE RUNWAY SAFETY AREA

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The reinforced slope failure in 2015 at Yeager Airport in Charleston, WV posed significant challenges and risks to the airport, engineers and contractors charged with the cleanup. Using risk informed decision tools the dismantling process was completed safely and alternatives were evaluated for replacement options. The deconstruction work to stabilize the site and reopen Keystone Drive to traffic flow was critical to the community and airport operations. The risk informed process continued following deconstruction and shaped the selection of an interim soltion for the airport. The interim solution selected consisted of design and construction of a retaining wall up to the 86 ft high to restore a safety zone at the end of the runway. This wall is a combination of soldier pile and concrete lagging with anchors for the lower 28 ft. The upper 58 ft is a continuation of the post and panel system, however geofoam blocks are being used as backfill material to limit loading on the wall. This presentation will provide a brief overview of the deconstruction but focus primarily on the alternatives and risk assessment effort and new wall construction.

Session 4 - Slopes/Embankments
Speaker 14

REMEDIATION OF AN INSTABLE SLOPE WITH RETAINING PILES

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A common approach to remediating an instable slope is installing a row of retaining piles near the toe of the slope to buttress the upper slope. When designing a retaining pile, the engineer must know how much resisting force is required to support the upper slope. With this resisting force, the embedment and section of the pile can then be determined. However, determining the resisting force can be a complicated process since the resisting force varies with the location of the pile. Nowadays, most slope-stability-analyzing programs can provide the required resisting force for the designer; however, designing a retaining pile without knowing the concept of how the resisting force is determined can sometimes undermine the design. If a slope is divided into upslope and downslope at the location where the resisting piles are installed, the factor of safety of the upslope is usually much lower than that of the downslope. In many cases, even though the factor of safety of the entire sliding body is lower than the required factor of safety, the factor of safety of the downslope could still be above the required factor of safety; the downslope can still provide supporting force to the upslope. This presentation will discuss the design process in detail, including the interaction between retaining piles and the slope. A case history of a large-scale landslide that occurred in Cincinnati, Ohio will be presented to outline the retaining pile design procedure.

Session 4 - Slopes/Embankments
Speaker 15

SEISMIC CONSIDERATIONS AND DESIGN METHODOLOGY FOR LOW-DENSITY CELLULAR CONCRETE (LDCC) EMBANKMENTS AND BACKFILL

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This presentation is an introduction to the utilization of Low-Density Cellular Concrete (LDCC) under 50 lb/ft³ (801 kg/m³) and the discussion of design methodologies with an emphasis on seismic considerations. This presentation will also showcase projects and construction and how they relate to the seismic applications and real world geotechnical challenges. It will also cover a brief history of Low-Density Cellular Concrete technology as defined by the ACI523.

Points covered will be:

1. Understand the history, definition, and properties of LDCC
2. Recognize the advantages of LDCC in embankment and backfill construction
3. Identify seismic design considerations for cellular concrete
4. Understand the basic approaches of simplified design methods and more detailed numerical evaluations for these materials

Session 5 - Earth Retention
Speaker 16

CIRCULAR SECANT PILE ACCESS SHAFTS FOR THE OHIO RIVER TUNNEL PROJECT

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A deep rock tunnel is currently in the process of being constructed under downtown Louisville. The purpose of the tunnel is to mitigate combined storm and sanitary sewer overflows. Since the 1800's, sewers have been overflowing both storm water and sanitary sewage into streams and rivers in the Louisville area, including the Ohio River. The Ohio River Tunnel (ORT) project will allow for temporary collection of the surge in storm water during rain events, preventing future contamination of the waterways.

As part of the solution to this problem, three circular secant pile shafts were installed along the tunnel alignment for the ORT. The shafts are being excavated up to 220' deep to reach the tunnel invert. A 20' diameter tunnel will connect the shafts, providing storage for the storm water.

Drilled up to 107' deep, the secant piles were socketed into rock in order to effectively cutoff groundwater and retain the soil up to existing grade. Pile diameters of 1,180mm were filled with unreinforced concrete to complete a full-height compression ring for this support of excavation. As part of the quality control program, verticality was measured to verify the effective thickness, and concrete volumes and strengths were documented to ensure compliance with the design.

This presentation will discuss the overall project concept and will focus on the design, construction and quality control of the secant piles for this project.

Session 5 — Earth Retention
Speaker 17

RISK-BASED PROTOCOL FOR ASSET MANAGEMENT OF METALLICALLY REINFORCED MECHANICALLY STABILIZED EARTH WALLS

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Owners of Metallically Reinforced Mechanically Stabilized Earth (MSE) walls, which include transportation agencies and private entities, face challenges in developing and implementing protocols to assess and manage risks associated with poor wall performance. This situation has led to a growing need of a convenient and efficient method to identify walls that require attention and resources for preservation and/or replacement. This presentation describes a risk-based protocol developed to identify Metallically Reinforced MSE walls that have relatively high risk associated with poor performance. In this context, Metallically Reinforced MSE walls refer to walls with metallic reinforcements, facings, and/or facing connections. The service life of these walls is governed principally by the degradation of their structural metallic components due to corrosion occurring over time. Corrosion reduces the cross-sectional area of the metallic components and thus their tensile capacity. Metallically Reinforced MSE walls can exhibit sudden distress that causes loss of function which could subsequently lead to disruption of traffic flow and/or damage to property. The service life of these walls is often unknown or may be overestimated because metallic wall components may deteriorate faster than expected. Additionally, some of these walls may now exist beyond their design life. The risk-based protocol presented herein produces an index that classifies the risk associated with poor performance of a given Metallically Reinforced MSE wall according to five risk levels: very low, low, medium, high, and very high. This risk index, which is developed using checklists and charts that combine the effects of vulnerability and consequence of poor performance, is used to prioritize walls within an asset inventory so that time and effort is focused efficiently on relatively high-risk structures. According to the protocol, walls with very low, low, and medium risk levels only require a reassessment using the protocol within a period of 5 years or when new information that may impact the risk level becomes available. Walls with high and very high-risk levels are shortlisted for risk mitigation strategies which include performing further investigative studies to determine wall service life, implementation of risk monitoring programs, and implementation of rehabilitation measures. This protocol provides a decision-making framework to efficiently maximize investments for long-term sustainability, accountability, and performance of Metallically Reinforced MSE walls. It could be adopted as an implementation guide for owners to manage walls within their inventories using the concept of risk management.

Session 5 - Earth Retention
Speaker 18

CORROSION MONITORING OF SELF DRILLING HOLLOW BAR SOIL NAIL WALL

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Corrosion monitoring on hollow bar soil nail (HBSN) walls is relatively new in construction. McMahon & Mann Consulting Engineers, P.C. (MMCE) has been working on a Corrosion Monitoring System for a HBSN wall project located outside of Prince George, British Columbia along the Fraser River on H97 also known as the Cariboo Highway.

The project is one of the first corrosion monitoring systems installed for a HBSN wall with initial electrochemical measurements using a potentiostat measuring linear polarization resistance (LPR). Electrochemical tests such as LPR are non-destructive and can be useful to assess the remaining service life for soil reinforcements. The electrochemical tests also allow for measurements to be obtained for corrosion rates at particular time intervals providing information about the spatial distribution of measurements. Since, the electrochemical tests are nondestructive, they also allow for multiple measurements to be taken from the corrosion monitoring stations across the wall such that effects of time on corrosion rates and performance can be observed.

This presentation will include a description of the HBSN construction method along with the installation of the corrosion monitoring system. The sampling by MMCE and electrochemical laboratory tests performed by the University of Texas El Paso (UTEP) will be presented as well as an overview of the testing methods which include: sieve analyses, resistivity, pH, conductivity, sulfate content, and chloride content. The laboratory testing was performed using American Association of State Highway Officials (AASHTO) Standards and the results describing the corrosion potential were developed using “Criteria for Assessing Ground Corrosion Potential” and “Corrosion Classification for Soil Nail Installations” (after Clouterre, 1993; CEN, 2009). The electrochemical testing in the field was performed by MMCE from the corrosion monitoring system that consists of dummy soil nails (grouted and ungrouted) combined with conduits to the soil behind the wall at each corrosion monitoring station which allow testing of in-situ conditions to be made possible. There are 10 corrosion monitoring stations along 428 meters of the HBSN wall and MMCE was able to collect a full set of initial readings from 9 of the 10 corrosion monitoring stations. The testing devices used to measure the moisture content, temperature, pH, conductivity, half-cell potential, and LPR will be explained in further detail during the presentation along with the analysis of the collected data. In addition, the presentation will include conclusions drawn from the analyzed data as well as the plans for future monitoring.

Session 5 - Earth Retention
Speaker 19

OVERALL STABILITY MOVING FROM SERVICE TO STRENGTH LIMIT STATE: WHY?

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Prior to the adoption of LRFD for Geotechnical Engineering problems, overall (global) stability was performed at the "ultimate limit state" in ASD, i.e., neither instability nor movement was allowed. Changing to LRFD in 2003 complicated overall stability analysis, since load and resistance factors were required to achieve stability and some of the soil qualities appeared on both the load as well as the resistance side of the equation. To uncomplicate this situation, a decision was made to determine overall stability as a Service limit state condition, because both the load and resistance factors are 1.0. Fast forward to today, the decision was made to add soil nail wall design to the AASHTO Bridge Specifications which has necessitated the changing overall stability from Service limit state to Strength limit state design. SCDOT has worked with T-15 on this change. The change is expected to come out with the next update to AASHTO in 2020.

Session 6 - Pavements/Subgrades
Speaker 20

FULL DEPTH RECLAMATION

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Full-depth reclamation (FDR) rebuilds worn out asphalt pavements by recycling the existing roadway. The old asphalt and base materials are pulverized, mixed with cement and water, and compacted to produce a strong, durable base for either an asphalt or concrete surface.

Full-depth reclamation uses the materials from the deteriorated asphalt or gravel pavement, and, with the addition of cement, creates a new stabilized base.

A surface consisting of a thin bituminous chip seal, hot-mix asphalt, or concrete completes the road. The recycled base will be stronger, more uniform, and more moisture resistant than the original base, resulting in a long, low-maintenance life. And most important, recycling costs are normally at least 25 to 50 percent less than the removal and replacement of the old pavement.

Session 6 - Pavements/Subgrades
Speaker 21

NEW INTERSTATE CRACKED PAVEMENT – CASE STUDY

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The Louisiana Department of Transportation recently completed construction of a new Interstate corridor in the northern part of the state. Just prior to opening one of the new segments of Interstate, a 400-foot long, straight longitudinal crack was noticed in one of the northbound lanes. The LADOTD Pavement & Geotechnical section worked with the Louisiana Transportation Research Center (LTRC) to investigate potential causes of the crack as well as corresponding solutions. Behavior of the natural subgrade soils (slope stability and consolidation settlement) was considered as well as the quality of construction (pavement and embankment). Ultimately, the investigation led to a change in some of the test methods used by the District for construction inspection.

Session 6 - Pavements/Subgrades
Speaker 22

US HIGHWAY 65 EMERGENCY PAVEMENT SUBGRADE IMPROVEMENT

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In May 2011, only days before a very busy traveling holiday, the Missouri Department of Transportation observed rutting and cracking in a stretch of flexible highway pavement. The section of pavement was being prepared to be put in service on the Friday before Memorial Day Weekend. As the base layer of asphalt was being placed the roadway began to rut and crack due to a subbase failure, most likely attributable to poorly compacted and/or saturated soils.

To rapidly improve the load-bearing support capability of the underlying soils, a patterned injection (with depth) of an expanding polymer grout was selected as the treatment option. This mitigation technique proved effective and efficient, as work was expeditiously performed and the roadway was adequately stabilized prior to the holiday weekend. The road was opened to traffic in time for the holiday weekend and five years later is still in good condition.

This presentation demonstrates the improvements achieved using insitu measurements from a falling weight deflectometer (FWD). These improvements can be readily seen using before-treatment and after-treatment measures suggesting valuable enhancements to the mechanistic engineering properties of the pavement system.

Session 6 - Pavements/Subgrades
Speaker 23

IN-PLACE ROADWAY SUBGRADE IMPROVEMENT AND PAVEMENT GRADE RESTORATION

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With an aging infrastructure it has been necessary for limited access or limited disturbance techniques to be developed to strengthen existing subgrades. This presentation uses several case studies to discuss subgrade improvement and grade restoration of existing roadways without extensive road closures or reconstruction of the entire pavement section. Pavement subgrades often settle in areas where subgrade soils have loosened with time or have experienced changes in character. Compaction Grouting has been used for over 40 years for all types of structures: Railroads, Tanks, Roadways, Culverts, MSE Walls, and Bridge Abutments to densify existing soil in situ. Additionally, polyurethane grouting has been used to restore grades under similar structures. This presentation will discuss both techniques used either together or separately to remediate roadways, often with no more than a temporary lane closure. Costs, benefits and lessons learned will be included in the presentation.

Session 7 - Slopes/Embankments
Speaker 24

US 68 BRIDGE ABUTMENT SETTLEMENT

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The US 68 Bridge over Lawrence Creek in Mason County Kentucky is a five-span prestressed concrete I-girder bridge, 757 feet in length. Bridge inspectors began noticing problems on the bridge shortly after its opening in the late 1990's. Since then, both abutments have moved inward, resulting in an elimination of the gap between the backwall and ends of the prestressed concrete girders; the elastomeric bearings are showing excessive deformations; and the abutment backwalls and bridge seats exhibit heavy cracking. Significant settlement of the approach fill embankments (upwards of 100 feet thick and comprised of shale and limestone shot-rock) has also occurred over the years. Both battered and vertical piles were driven through the approach fill embankments to support the abutments. The Kentucky Transportation Cabinet retained AECOM, who teamed with Geotechnology, Inc., to investigate the problem and to determine the appropriate course of action. This presentation will discuss the findings of a geotechnical exploration, which included field testing and drilling, laboratory testing, slope stability analyses, settlement analyses, batter pile foundation analyses, slope and settlement monitoring, and the evaluation of repair/rehabilitation alternatives. The slope and settlement monitoring included: four slope inclinometers; two settlement magnetometers; and thirty-six ground rods, which were driven into the surface of the fill embankments along cross sections. Additionally, the settlement analyses included both finite element and empirical methods for comparison.

Session 7 - Slopes/Embankments
Speaker 25

TREATMENT OF END BENT OR ABUTMENT BACKFILLS USING GEOTEXTILE REINFORCEMENT AND ELASTIC INCLUSION

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The use of integral end bents for bridges has increased due the elimination of the expansion joint detail and the related reduction in post-construction maintenance of the joint. This, however, does not eliminate seasonal changes in bridge lengths, and these thermal movements affect the backfill behind the end bent wall. The cyclic expansion and contraction of the bridge can create settlement of the backfill behind the end bent wall, erosion where surface runoff enters the gap between the end bent and backfill, and structural problems from increased lateral earth pressures on the structure from the "ratcheting" effect of the repeated loading and unloading of the backfill.

In response to these issues, the Kentucky Transportation Cabinet began implementing a treatment for end bents or abutment backfills using geotextile reinforcement and elastic inclusion. The elastic inclusion consists of an elasticized expanded polystyrene placed on the end bent back wall. The geotextile reinforced granular backfill consists of a high-strength fabric placed in layers with a wrapped face in order to minimize the backfill movement and maintain the function of the elastic inclusion.

The Kentucky Transportation Center at the University of Kentucky instrumented several bridges with the treatment and monitored the performance of the backfill. Development of the treatment and results of the monitoring will be presented.

Session 7 - Slopes/Embankments
Speaker 26

HIGH STRENGTH GEOGRIDS FOR BASAL REINFORCEMENT, CASE STUDIES

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Construction of embankments or any kind of structure over weak/soft foundation soils can be very challenging for engineers. Soft soils present very low shear strength, excessive differential settlements, poor bearing capacity, surface instability associated with sinkhole development and require special construction practices. Traditional construction methods used in fine grained saturated soils such as removal and replacement of soft soil, pre-loading the site to reduce settlements and achieve higher strength or stabilize the soil by injecting additives, can be expensive and time-consuming. An alternative, more cost-effective solution is the use of high strength geogrids placed directly onto soft soils in different layers at the base of the embankment. Such application of a geosynthetic is often called basal reinforcement. The combination of high strength geogrids and granular fill material is also called Reinforced Granular Mattress (RGM), it creates an adhesive interface with the soft soil, and a stiff platform ensuring a uniform distribution of loads onto soft soil. The RGM promotes the distribution of loads and minimize differential settlements. In some cases, when primary and secondary settlements need to be controlled, rigid intrusions are commonly installed to provide support and settlement control by transferring the load to a stiffer foundation. In these cases, a load transfer platform designed with one or multiple layers of high strength geogrids can be considered to better redistribute the loads to the piles and optimize the design. This paper presents recent case studies of basal reinforcement over piles, sinkholes and weak foundations.

Session 7 - Slopes/Embankments
Speaker 27

USING HYBRID GROUND IMPROVEMENT TECHNIQUES IN SOFT CLAYS AS A COST SAVING ALTERNATIVE

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The I-564 Intermodal Connector project links the existing I-564 highway in Norfolk, VA to the Norfolk Naval Station and the Port of Virginia. At two ramps over Boush Creek, the site soils included very soft and slow-draining surficial clays, which led to ground improvement support of several Mechanically Stabilized Earth (MSE) walls being selected as a design-build alternative solution. Ground improvement offered cost savings over traditional pile supported embankment systems and offered an expedited construction duration when compared to a surcharge and monitoring approach. The ground improvement support consisted of rigid inclusions drilled through the soft clays and terminating into a lower bearing layer, combined with the installation of vertical drains to expedite the consolidation of the clays to meet project performance criteria.

This presentation will give an overview of the project, including geotechnical conditions, site constraints, and project challenges, and will include an analysis of why rigid inclusions were the ideal technical solution for the challenges presented. Additionally, the presentation will examine how the programs and techniques selected during the design process were used to overcome those challenges and optimize construction schedule and cost. Finally, the presentation will review the performance data collected and compare the results to the modeled predictions.

Session 8 - Deep Foundation Testing
Speaker 28

EFFECTIVE DISPERSION ANALYSIS OF REFLECTIONS: A NONDESTRUCTIVE EVALUATION METHOD FOR ESTIMATING EMBEDDED PILE LENGTH

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Unknown foundation susceptible to scour has been a longstanding problem threatening the safety of bridges. There are still about 28,000 highway bridges in United States with unknown foundations that could be scour susceptible in 2016 according to the National Bridge Inventory records along with numerous other bridges with missing records. Several methods have been developed over the years with varied levels of success including the sonic echo/ impulse response method, bending wave method, borehole methods and many extensions and modifications of these methods. The borehole methods are considered reliable but are expensive, and the surface based methods are inexpensive but lack the same level of reliability as borehole methods. Towards filling this gap, we developed a new surface based NDE method named Effective Dispersion Analysis of Reflections (EDAR) that is shown to be accurate and reliable. The method is based on accurately capturing the wave dispersion as it propagates through the pile, and applicable to both longitudinal and bending waves. Specifically, EDAR processes measured accelerations at two distinct locations on the pile due to hammer impact, resulting in an estimate of pile length, by examining the phase oscillations due to reflection as a function of wavenumber. Experimental validation of EDAR was conducted using side impact on concrete filled steel tubes, consistently resulting in less than 5% error in laboratory setting, and about 10% in field conditions. It was observed that soil could have a significant effect of the waves propagating due to the differential attenuation of longitudinal and flexural waves and it accounted for in the analysis leading to improved length estimates. This talk would contain the formulation of underlying EDAR, verification with synthetic data, as well as details of laboratory and field validation.

Session 8 - Deep Foundation Testing
Speaker 29

PRE-BID LOAD TESTING FOR THE MOBILE RIVER BRIDGE AND BAYWAY PUBLIC PRIVATE PARTNERSHIP (P3) PROJECT

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The Mobile River Bridge and Bayway project represents Alabama's largest ever investment for a single infrastructure project. The project includes a cable stayed bridge over the Mobile River and seven (7) miles of bridge over Mobile Bay. Bridge foundations therefore represent a major component of the estimated $2 billion project cost. Foundation design and construction, which contains significant risks relative to both engineering performance and construction, is a critical path item early in the schedule. For a project of such magnitude, an extensive foundation testing program is essential to provide information for preliminary design, planning, and bidding. Performing a deep foundation load test program prior to letting of a Public Private Partnership project helps the prospective bidders better define design parameters and reduce uncertainties and risks related to constructability of the foundations. The reduced risk leads to reduced costs by allowing the concessionaire to develop a more efficient design while minimizing contingency costs and potential delays related to foundation constructability or performance.

This presentation will include information concerning an overview of the project, factors in the decision for a pre-bid load test program, a discussion of the different load tests performed, results, and path forward for the project. Load tests performed included 78in drilled shaft (load cell and lateral Statnamic), 54in Precast Prestressed Concrete (PPC) cylinder (PDA, restrikes and axial Statnamic), 30in. PPC square (PDA, restrike and axial Statnamic), 18in PPC square (PDA, restrike and static), 60in steel pipe (PDA, restrike and axial Statnamic), and H-Pile (PDA, restrike and axial static). Restrikes were conducted to evaluate potential strength gain with time. Jetting techniques were specified for some piles to evaluate this installation technique which would potentially be used during construction. The cost for the load test program was approximately $3.7 million.

Session 8 - Deep Foundation Testing
Speaker 30

FINDING VALUE IN DEEP FOUNDATION TEST RESULTS

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Five separate bi-directional load tests were performed on 18” to 24” diameter auger-cast piles at three projects in the Dallas-Ft. Worth metroplex. The piles were all constructed by the same contractor and all socketed in clay shale. The contractor’s expectations for unit capacity in the shale sockets, derived from previous experience, were not met. However, all five of the test results correlated fairly well, and the computed socket unit shear strengths were reasonable given the soil borings and the TxDOT design method. The client perceived the value of the test programs as poor because of the lower-than-expected unit shear values. However, an objective analysis indicates that there is real value for overall project success in a poor test result, possibly higher than the value of a good result.

Session 8 - Deep Foundation Testing
Speaker 31

ADVANCED DYNAMIC TESTING METHODS- DRIVEN CONCRETE PILES-COMPREHENSIVE PILE INTEGRITY EVALUATION AND PILE INDEPENDENT TIP AND SKIN CAPACITIES

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Advancements in pile driving science and technology have historically progressed unceasingly as indicated by the published literature. This paper deals with the progress of Dynamic Load Testing of Piles including Various Methods of Analyses.

During the past three to four decades, the advent of dynamic testing consisted of external instrumentation attached at the pile top. This system consists of field data monitoring (dynamic monitoring) followed by signal match analysis that is dependent on user analysis. The subsequent development consisted of embedding sensors in the piles called Embedded Data Collectors (EDC). This is a system of internal sensors embedded in the concrete piling at the tip and top consists of a wireless radio/controller transmitter, a receiver, and workstation software to analyze the data. The University of Florida (UF) Method computes damping factor for every blow and uses the Case Equation to obtain total pile capacity. Unloading Point method is used to estimate the tip capacity.

The latest advancement in dynamic testing is the Florida Department of Transportation (FDOT) Method of Analysis that obtains independent pile tip and skin resistances. Tip resistance is obtained by conservation of energy method. Static tip capacity can be accurately extracted directly from the measured dynamic force. Skin Capacity is evaluated based on segmental skin friction method with Tip & Top gage data as the boundary conditions. Tip and skin resistances are independently obtained. Since optimum tip and skin settlements do not occur at the same hammer blow, appropriate blows are analyzed to obtain optimum tip and skin resistances and settlements.

Session 9 - Louisville-Southern Indiana Ohio River Bridges Project
Speaker 32

GEOTECHNICAL ASPECTS OF THE OHIO RIVER BRIDGES PROJECT, LOUISVILLE, KENTUCKY

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The Ohio River Bridges Project addressed cross-river transportation needs in Louisville and Southern Indiana for the long term with two new bridges and the rebuilding of a major interstate highway. It provides safer trips, less congestion, and improved access to destinations in the region, a major hub in the nation's highway transportation system.

The Downtown Crossing rebuilt the interchange where three major interstates converge in downtown Louisville, Kentucky. Walsh/Jacobs Design-Build Team, a collaboration of construction and several engineering consulting firms, was the design-build team (DBT) for Sections 1 thru 3. The Downtown Crossing included many miles of reconstructed highway, over 40 bridges, construction of approximately 21 plus retaining walls, a three-tower, four-span cable-stayed structure over the Ohio River, and a new ramp system to enhance access to Jeffersonville and Clarksville from I-65. The project was managed by the Kentucky Transportation Cabinet.

The East End Crossing connects State Road 265 in Indiana with the Gene Snyder Freeway, completing an outer loop around the Louisville/Southern Indiana metropolitan area. WVB East End Partners – a team of Walsh Investors, LLC, VINCI Concessions, Bilfinger Project Investments and others built, financed the project, as well as operate and maintain the crossing. The project includes 8 miles of highway, a 2,510-foot long, three span cable-stayed bridge over the Ohio River, and a 1,680-foot long tunnel. The project was managed by the Indiana Finance Authority and Indiana Department of Transportation.

The projects are located in the northwestern portion of Central Kentucky within the Outer Bluegrass Physiographic Region and the southeastern portion of Indiana. The topography varies from rolling hills to relatively flat, low-lying areas adjacent to major drainage features including the Ohio River. This presentation will provide the geologic setting for the Ohio River Bridges projects.

Session 9 - Louisville-Southern Indiana Ohio River Bridges Project
Speaker 33

PROBLEMS WITH DRILLED SHAFTS AT PIER 3R AND REMEDIATION

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Anomalies observed during placement of concrete in one of the 12 foot diameter drilled shafts that would support Pier 3 of the new Ohio River Bridge Downtown crossing, lead to concerns regarding the integrity of the drilled shaft. Subsequent testing and coring confirmed that the bottom 60 feet of the 115' long shaft contained weak concrete that did not meet the design specification. A remediation plan was implemented that consisted of:

- Compaction grouting of loosened soils outside the shaft.
- Drilling a 7.5 foot diameter shaft down the center of the 12 foot diameter shaft.
- Installing a large reinforcing beam to increase the moment capacity and stiffness of the smaller diameter shaft.
- Placing new concrete.
- Verifying the integrity of the smaller diameter shaft.

This presentation discusses the investigation methods, construction methods, remediation methods and potential causes of the deficient concrete.

Session 9 - Louisville-Southern Indiana Ohio River Bridges Project
Speaker 34

GEOTECHNICAL EXPLORATION AND CONSIDERATIONS FOR THE OHIO RIVER BRIDGES EAST END CROSSING—DRUMANARD TUNNEL

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The ORBEEC alignment crosses the Drumanard property to connect I-265 between Kentucky and Indiana. The property is on the National Historic Register and surface disturbance was not allowed. To avoid disturbing the property, two shallow 60’ wide by 30’ high tunnels each approximately 1700’ long was required. To determine the feasibility of the tunnels a geotechnical investigation was performed, including groundwater monitoring, core sampling and geophysical mapping. This was supplemented by three 1700’ long horizontal core holes, one in each tunnel crown and one in the pillar. The development of the geotechnical program and impacts to design and construction are summarized.

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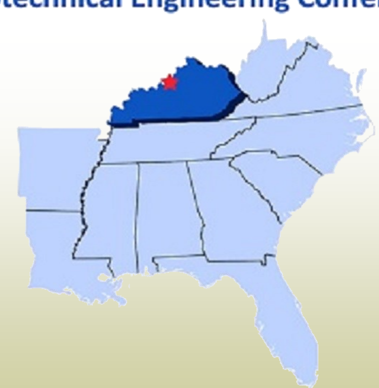
STGEC HISTORY

The Southeastern Transportation Geotechnical Engineering Conference (STGEC) is an annual meeting that has been taking place since 1969 when the Federal Highway Administration proposed that the southeastern states should meet to discuss landslide problems along I-40 near Rockwood, Tennessee, along I-75 in northern Georgia, and settlement problems with high interstate embankments.

The first STGEC meeting was held in Atlanta, Georgia, near the Georgia Tech campus from December 5-7, 1969. Professor George Sowers was the guest speaker. There were approximately 50 attendees to the meeting. Because this event was such a success, interest spread quickly and an annual conference was soon established. A steering committee was formed to be a governing body consisting of one member of each state transportation agency involved as well as one member each from the Federal Highway Administration and the Transportation Research Board. The committee also established a set of by-laws to assist in governing the group. The main objective in these meetings is to discuss the transfer of technology concerning the rapidly advancing technology of soil mechanics and to share success or problems in the geotechnical field to meet the demands for economical and successful transportation systems.

The previous name of this conference was, until 1976, the Southeastern Soil Engineering Conference. The steering committee chaired by the host member selects the time, place, and duration of each conference for the following year. The conference rotates among member states, and this method ensures that each state involved has hosted multiple times since the conference's existence.

STGEC2018
Southeastern Transportation
Geotechnical Engineering Conference



STGEC HISTORY

No.	Year	Site	Date
1	1969	Atlanta, Georgia	Dec. 5-7
2	1970	Jackson, Mississippi	Dec. 2-4
3	1971	New Orleans, Louisiana	Dec. 7-9
4	1972	Montgomery, Alabama	Nov. 13-16
5	1973	Orlando, Florida	Nov. 26-30
6	1974	Covington, Kentucky	Sept. 16-19
7	1975	Gatlinburg, Tennessee	Sept. 22-25
8	1976	Raleigh, North Carolina	Sept. 21-23
9	1977	Hot Springs, Arkansas	Oct. 25-28
10	1978	Wheeling, West Virginia	Oct. 9-12
11	1979	Charleston, South Carolina	Oct. 29-Nov. 1
12	1980	Atlanta, Georgia	Nov. 3-6
13	1981	Virginia Beach, Virginia	Oct. 12-15
14	1982	Jackson, Mississippi	Oct. 18-21
15	1983	Montgomery, Alabama	Oct. 18-21
16	1984	Winter Park, Florida	Oct. 2-5
17	1985	Gatlinburg, Tennessee	Sept. 30-Oct. 4
18	1986	Louisville, Kentucky	Oct. 6-10
19	1987	Hot Springs, Arkansas	Oct. 5-8
20	1988	Raleigh, North Carolina	Oct. 3-6
21	1989	Charleston, West Virginia	Oct. 7-11
22	1990	New Orleans, Louisiana	Oct. 29-Nov.1
23	1991	Charleston, South Carolina	Oct. 7-11
24	1992	Williamsburg, Virginia	Nov. 9-13
25	1993	Natchez, Mississippi	Oct. 4-8
26	1994	Atlanta, Georgia	Oct. 24-28
27	1995	Huntsville, Alabama	Oct. 23-27
28	1996	Cocoa Beach, Florida	Oct. 21-25
29	1997	Chattanooga, Tennessee	Oct. 27-31
30	1998	Louisville, Kentucky	Oct. 13-16
31	1999	Asheville, North Carolina	Oct. 4-8
32	2000	Little Rock, Arkansas	Oct. 2-6
33	2001	Roanoke, Virginia	Oct. 15-19
34	2002	Baton Rouge, Louisiana	Oct. 7-11
35	2003	Charleston, South Carolina	Oct. 20-24
36	2004	Biloxi, Mississippi	Oct. 18-22
37	2005	Lake Lanier Islands, Georgia	Oct. 31-Nov. 4
38	2006	Florence, Alabama	Oct. 30-Nov. 3
39	2007	Bowling Green, Kentucky	Oct. 8-12
40	2008	Pigeon Forge, Tennessee	Oct. 27-31
41	2009	Wilmington, North Carolina	Nov. 2-5
42	2010	Charleston, West Virginia	Oct. 4-7
43	2012	Richmond, Virginia	Oct. 22-25
44	2013	Baton Rouge, Louisiana	Dec. 2-5
45	2014	Mobile, Alabama	Oct. 27-30
46	2015	Greenville, South Carolina	Oct. 19-23
47	2016	Biloxi, Mississippi	Nov. 7-10
48	2017	Savannah, Georgia	Dec. 11-15
49	2018	Louisville, Kentucky	Oct. 8-11

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The Kentucky Transportation Cabinet
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