The 45th Southeastern Transportation Geotechnical Engineering Conference

Participant's Manual

Hosted by
Alabama Department of Transportation
Materials and Tests Bureau

Sponsored by
Federal Highway Administration

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WELCOME

Hello and Welcome!

On behalf of ALDOT's Materials and Tests Bureau, we would like to welcome you to STGEC 2014. We have been planning this event for quite a few months. We are excited that each of you could attend this year's conference. It is our hope that each and every attendee will leave with new knowledge of the geotechnical field.

On this year's agenda we have Austal's President, Mr. Craig Perciavalle to deliver the keynote address. This will be an exciting keynote speaker since one of Austal's shipyards is right across from the Riverview Renaissance Plaza Hotel. Along with Austal's keynote address we also have 26 presentations on the agenda this year. Each of these presentations will bring something different to the table.

The 2014 STGEC includes events each night we hope you all will attend. Events start with Monday's Ice Breaker, Tuesday's Social, Wednesday's Reception and Banquet, and Thursday's Field Trip.
Thank you again for coming. We hope everyone enjoys the 2014 Conference here at the Renaissance Mobile Riverview Plaza Hotel in Mobile, Alabama.

Kaye Chancellor Davis, P.E.
ALDOT Geotechnical Engineer

Monday, October 27, 2014

11:30-5:30	Golf Tournament (Timber Creek Golf Club)
2:00-6:00	Registration
6:30-8:30	Ice Breaker (Jubilee Suite) *Sponsored by: Building & Earth Sciences, Inc.* *Tractor Equipment Company* *TTL, Inc.*

Tuesday, October, 28, 2014

6:30-8:00	Breakfast *Sponsored by: CDG Engineers* *Southern Earth Sciences, Inc.*
7:00-10:30	Registration
8:00-9:00	*Open and Welcome* ***Kaye Chancellor Davis,P.E.,*** ***ALDOT Geotechnical Engineer*** ***Vince Calametti, P.E.,*** ***ALDOT Southwest Region Engineer*** ***Mayor of Mobile Sandy Stimpson***
9:00-10:00	*Keynote Address* ***Craig Perciavalle, Austal President***
10:00-10:15	Break *Sponsored by: United Consulting* *AMEC E&I, Inc.*
Technical Session I	**Moderator: Carl Benson, VDOT**
10:20-10:45	*Overview of Current State of the Practice with LRFD Based Design and Construction Drilled Shafts for Transportation* Dan Brown, P.D. Dan Brown and Associates
10:45-11:10	*An Overview of the Construction of the Corridor X/ I-65 Interchange Project from a Geotechnical Perspective* Jacob Hudson, P.E. KBR Technical Services
11:10-11:35	*DIGGS: A Dream Become Reality-Implementation Status* Robert C. Bachus Geosyntec Consultants

11:35-12:55	Lunch *Sponsored by: Thompson Engineering* *Goodwyn Mills and Cawood*
Technical Session II	**Moderator: Robert Jowers, TDOT**
1:00-1:25	*Database Evaluation of Energy Transfer for CME Automatic Hammer Standard Penetration Tests* Dr. Brian Anderson Auburn University
1:25-1:50	*GeoGIS: A GIS-Based Geotechnical Engineering Document Management System* Andrew J. Graettinger University of Alabama
1:50-2:15	*FDOT- GRS Bridge Project* Larry Jones FDOT
2:15-2:40	*LRFD Foundation Design for Flyover 13 over I-95 & I-73* Sanjoy Chakraborty, Ph.D., P.E. CDM Smith
2:40-3:10	Break *Sponsored by: TTL, Inc.* *BECC, Inc.*
Technical Session III	**Moderator: James Chatagnier, LaDOTD**
3:10-3:30	*Kentucky Cable Rail* Erik Scott Kentucky Transportation Cabinet
3:30-4:30	*National Corvette Museum* Michael Marasa Hayward Baker
6:30-8:30	Hospitality Social w/ cocktails and hors d'oeuvres (Fathoms Street Courtyard) *Sponsored by: ADSC*

Wednesday, October 29, 2014

6:30-8:00	Breakfast *Sponsored by: Terracon*
Technical Session IV	**Moderator: Larry Jones, FDOT**
8:00-8:25	*Reverse Battered Piles Use to Stabilize a Landslide* Joe D. Carte, P.E. WVDOT

8:30-8:55	*Landslide Stabilization for Large Slope on Newly Constructed Interstate* J. Reid Bailey, P.E. GeoStabilization International Matt Revell, P.E. ALDOT
9:00-9:25	*Permanent Micropile Foundations for the NCDOT in Elizabeth City, NC* Stephen Dimino, P.E Schnabel Foundation Company
9:30-9:55	*Evaluation of Pile Setup using Dynamic Restrike Analysis in the State of Alabama* Eric J. Steward, Ph.D. University of South Alabama
10:00-10:15	Break *Sponsored by: CTL, Inc.*
Technical Session V	**Moderator: Glen Foster, GDOT**
10:20-10:45	*Challenges and Solutions to the Implementation of LRFD for GDOT's* Ian Rish, P.E. GDOT
10:50-11:15	*Kentucky Lake Pipe Pile Load Test Program* Darrin Beckett, P.E. KY Transportation Cabinet Ronald J. Ebelhar, P.E., D.GE, F.ASCE Terracon
11:20-11:45	*Seismic Design-Times are Changing* Nick Harman, P.E SCDOT
11:50-12:55	Lunch *Sponsored by: Geotechnical Engineering and Testing* *Tractor & Equipment Company*
Technical Session VI	**Moderator: Sean Ferguson, MDOT**
1:00-1:25	*Accelerated Roadway Construction: Rigid Inclusions for Support of Embankments and MSE Walls in Soft Ground* Aaron D. Goldberg, P.E., D.GE U.S. Wick Drain, Inc.
1:30-1:55	*Who's Doing What? An Overview of Foundation Supports for Highway Signs, Luminaires, and Traffic Signals* Sam Sternberg III, M.S., P.E. Thompson Engineering

2:00-2:25	*ALDOT Birmingham Central Business District (CBD) Project- Subsurface Utility Engineering (SUE) Services* Uday R. Bhate, P.E. Bhate Geosciences
2:30-2:55	*MSE Wall and Ground Improvement in Karst Terrain- Birmingham Northern Bypass* Luther H. Boudra, P.E., D.GE AMEC Environment and Infrastructure
3:00-3:30	Break *Sponsored by: Bhate Geosciences*
Technical Session VII	**Moderator: Darrin Beckett, KY Transportation Cabinet**
3:35-4:00	*NCDOT's Recent Experience with Static Load Testing on Large Concrete Piles* Michael Valiquette NCDOT
4:00-4:25	*Utilizing Driven Pile Installations to Predict Ground Vibration Propagation* John C. Cleary University of South Alabama
5:00-6:00	Director's Meeting (Riverboat Suite)
6:00-7:00	Reception *Sponsored by: Acker Drill Company*
7:00-9:00	Banquet (Bon Secour III) *Sponsored by: Acker Drill Company.*

Thursday, October, 30, 2014

6:30-8:00	Breakfast *Sponsored by: United Consulting* *BECC, Inc.*
Technical Session VIII	**Moderator: Joe Carte, WVDOT**
8:00-8:25	*Large Diameter Open End Pipe Piles for Transportation Structures* W. Robert Thompson, III, P.E., D.GE Dan Brown and Associates
8:30-8:55	*A "Greener" Approach- Examining FDR from a Geotech's Point of View* Mark D. Luskin, P.E., P.G. K.S. Ware and Associates, L.L.C

9:00-9:25	*Scour Potential of Alabama Hard Cohesive Soils of the Black Belt and Coastal Plain* Dr. Brian Anderson Auburn University
9:30-9:55	*Geotechnical Considerations During Design and Construction of the ASPA Mobile Container Terminal at Choctaw Point in Mobile, Alabama* Lynn C. Doyle, P.E. Geotechnical Engineering-Testing, Inc.
10:00-10:15	Break *Bhate Geosciences*
10:20-11:30	STATES ROUND TABLE
11:45-1:45	Lunch *Sponsored by: Stantec* *Building & Earth Sciences, Inc.* Fort Conde (Directly Across from Riverview Plaza)
2:00-4:00	Field Trip Alabama State Docks Choctaw Point

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TECHNICAL SESSION I

MODERATOR: CARL BENSON, VDOT

PRESENTATION 1:

Overview of Current State of the Practice with LRFD Based Design and Construction Drilled Shafts for Transportation Structures

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ABSTRACT

This presentation provides an overview of the current state of the practice for drilled shaft foundations, and highlights the most significant factors impacting the use of drilled shafts for transportation structures. Design in accordance with AASHTO has been fully implemented to an LRFD approach, although many rail projects are still performed using allowable stress (ASD) design. The FHWA manual and NHI course have been revised and updated to LRFD format and many of the more significant changes from the 1999 version will be summarized. The presentation will also describe the evolution of the industry in recent years and how improvements in materials and construction techniques present new opportunities and challenges in the selection and design of drilled shaft foundations.

TECHNICAL SESSION I
MODERATOR: CARL BENSON, VDOT
PRESENTATION 2:
An Overview of the Construction of the Corridor X / I-65 Interchange Project from a Geotechnical Perspective

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ABSTRACT
The objective of the presentation is to supply an overview of construction activities relating to geotechnical engineering from a field engineer's point of view. The presentation will focus on a single roadway and bridge construction project, the Corridor X / I-65 Interchange Project in Birmingham, Alabama. It will include a general synopsis of the contract as well as a wide variety of construction activities relating to geotechnical engineering. The first construction activity which will be discussed is retaining walls. The project includes mechanically stabilized earth walls, cast-in-place walls, and soil nail walls. During construction of the soil nail walls, there were several issues that required remediation procedures. Next, a general look at different types of bridge footings will be discussed with an emphasis on several construction issues and their resolutions. Also, excavation will be a topic with an in-depth look at the following: amount of rock on the jobsite, blasting, undercutting due to unsuitable material in roadbed, and a lack of suitable material for use as improved roadbed. Finally, there will be a detailed look at the contract requirements, installation procedure, and cost savings of using a unique type of material classified as lightweight backfill. Overall, the presentation will cover a variety of construction activities relating to geotechnical engineering as well as the issues and resolutions that occurred during the construction phase.

PRESENTATION 3:

DIGGS: A Dream Becomes Reality – Implementation Status

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ABSTRACT

As many of the State Departments of Transportation (DOTs) recall, Data Interchange for Geotechnical and GeoEnvironmental Specialists (DIGGS) was developed as a coalition of government agencies, universities, and industry partners whose focus was on the creation and maintenance of an international data transfer standard for transportation-related data. The coalition was coordinated by the Federal Highway Administration (FHWA) and became the Transportation Pooled Fund project TPF-5(111) titled: "Development of Standards for Geotechnical Management Systems." After a brief hiatus, the project was re-started in October 2011. As a result of a workshop that was convened at the end of the pooled fund study, the DIGGS community of members achieved a major milestone and responsibility for completion of the DIGGS standard was awarded to the Geo-Institute of the American Society of Civil Engineers (ASCE) in October 2013. Currently, the project is on track and is scheduled for completion and full release to the public in October 2015.

The purpose of this presentation will be to apprise the State DOTs in the Southeastern U.S. of the current implementation schedule for the DIGGS efforts regarding: (i) release of a data dictionary to define all elements of the DIGGS schema; (ii) transition ownership and responsibility of DIGGS to the Geo-Institute; (iii) training for the State DOTs on the use and adoption of the DIGGS schema/format; and (iv) development of a long term business plan and management structure for DIGGS. Examples will be provided to show how DIGGS can be used and implemented by the state DOTs, as well as how the adoption of such system will result in long-term benefits to the DOTs.

Presentation 4:

Database Evaluation of Energy Transfer for CME Automatic Hammer Standard Penetration Tests

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ABSTRACT

This study examined the Energy Transfer Ratio (ETR) of Central Mine Equipment (CME) automatic SPT hammers utilizing a large database of SPT energy measurements. The database consisted of energy measurements from 17,825 SPT hammer blows obtained from 33 CME automatic hammers over a 5 year period. The relatively long time duration of the testing program allowed for multiple hammer calibration of 22 hammers in the database. Statistical analyses were used to determine a broad-based average Energy Transfer Ratio (ETR) and standard deviation in order to provide a significant measurement of CME energy transfer. The ETR variation between SPT depths was also evaluated, along with the assessment of ETR variation between calibration intervals.

TECHNICAL SESSION II
MODERATOR: ROBERT JOWERS, TDOT
PRESENTATION 5:

GeoGIS: A GIS-Based Geotechnical Engineering Document Management System

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ABSTRACT

A web-based Geotechnical Geographic Information System (GeoGIS) was developed and tested for the Alabama Department of Transportation. This web-based system stores geotechnical information about transportation projects, such as subsurface data, construction drawings, and design information. Typically, this information is in a report or plan sheet format, but raw geotechnical data can also be accommodated in the GeoGIS. The goal of this system is to provide easy access and storage for all geotechnical and subsurface structural information from across a state. Access through a secure web interface allows consultants and DOT engineers to upload documents and access information by keyword searches and interactive map selection. The web-based GeoGIS has three layers (geotechnical, materials, and environmental) that can be displayed on a road map, aerial photos, or USGS 7.5 minute quadrangles. The GeoGIS currently contains over 5000 documents associated with 845 geolocated projects.

TECHNICAL SESSION II
MODERATOR: ROBERT JOWERS, TDOT
PRESENTATION 6:
FDOT-GRS Bridge Project

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ABSTRACT

FDOT’s last GRS Bridge project required significant earthwork to lower the vertical curve, move utilities, install storm drainage and shorten the bridge. The GRS & precast bridge were designed in-house, however, consultants did the roadway plans and managed the overall effort. Construction was completed in only 7 weeks this past summer. The roads were closed and demolition began June 02; the road was reopened and the contractor demobilized July 20. The presentation provides an overview of the project, soft soil site conditions, and lessons learned in overcoming the various difficulties and perceptions encountered.

Technical Session II
Moderator: Robert Jowers, TDOT
Presentation 7:
LRFD Foundation Design for Flyover 13 over I-95 and I-73

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ABSTRACT

CDM Smith has completed the foundation design for an approximately half-mile long flyover at the proposed new I-73 interchange with existing I-95 in Dillon County, South Carolina. Flyover 13 will be supported on large groups of driven steel piles at the end bents and on groups of six drilled shafts at each of the eight interior bents. The bridge foundations were designed using the 2010 AASHTO LRFD Bridge Design Specifications as modified by South Carolina Department of Transportation. The design involved a comprehensive appraisal of the seismic hazards at the project site, including the development of site specific acceleration response spectra and multiple sets of acceleration time histories that were used for analyses of the bridge superstructure and foundations for the Extreme Event Limit States. Based on the seismic hazards, the end bent foundations required ground improvement (earthquake drains) to prevent the development of excess pore water pressures in the soils underlying the bridge abutments. The interior bent foundations were designed to accommodate downdrag loads created by settlement of near surface soils under seismic ground shaking. The presentation will provide a broad overview of the complex design process, with emphasis on the seismic design aspects that were believed to be the controlling condition heading into design.

TECHNICAL SESSION III
MODERATOR: JAMES CHATAGNIER, LADOTD
PRESENTATION 8:
KENTUCKY CABLE RAIL

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ABSTRACT

This presentation describes the geotechnical investigation process for cable median barrier in Kentucky. In recent years, there has been an emphasis in Kentucky on installation of cable barrier in areas with high vehicle crash rates, or high crash potential. This type of barrier has been proven effective in reducing crash severity and fatalities resulting from cross-over collisions. Several cable barrier projects have been awarded each of the last several years for construction of cable barriers on interstates/parkways throughout the state.
After providing some basic information on the purpose and benefits of cable rail, the presentation will outline the process by which the Kentucky Transportation Cabinet addresses such projects from initiation to completion of construction. Other general provided will include typical cable barrier layout and placement guidelines, types of systems permitted in Kentucky, mowing strip details, typical types of posts and anchors for Kentucky projects, and material testing.

The majority of the presentation will focus on the geotechnical information obtained during the design phase prior to project letting. The Geotechnical Branch of the KY Transportation Cabinet obtains borings at anchor locations using Standard Penetration Tests and split-spoon sampling. The samples are tested for natural moisture content and soil classification (AASHTO and USC systems) and this information is provided to the contractor. The feedback received from Contractors, the Federal Highway Administration, Contractor's Geotechnical Subcontractors, and others have suggested this approach and the information provided have been helpful in both the bidding process, and in site-specific design of the cable systems. The discussion will also include some of the changes in the geotechnical investigation process over the years, and the reasons for those changes.

Continue on next page…

The presentation will briefly discuss anchor design for the cable barrier systems. This will be presented both in general terms, and based on typical Kentucky cable barrier details. Some possible construction issues will be outlined, and possible methods to avoid those will be presented.

Technical Session III

Moderator: James Chatagnier, LaDOTD

Presentation 9:

National Corvette Museum

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ABSTRACT

At 5:38 am on the morning of February 12, 2014, security cameras recorded the collapse of the display floor and development of a sizeable sinkhole inside the museum. Eight treasured and unique corvettes were “swallowed” by the cavity. Within 24 hours, a team had been assembled to stabilize the area, assess the short term risk, evaluate procedures to safely remove the automobiles, and develop a plan for exploration and permanent repair. Team members represented a wide range from construction, engineering, geology and environmental professionals, academic experts and state geotechnical and safety officials. Data acquisition included large diameter drilled holes, laser surveys, micro gravity study, physical cave exploration, borehole cameras and literature research. All of these aspects were executed amidst worldwide attention and media chaos. Live webcams were installed, hourly Facebook postings, YouTube videos and about every other avenue of communication known to man were employed. Every aspect of study and repair involves moderate to very high degrees of risk I all categories. The expertise and determination of the team conquered all of the obstacles in as timely a manner as possible attempting to maintain economical approaches whenever possible.

Technical Session IV
Moderator: Larry Jones, FDOT
Presentation 10:
Reverse Battered Piles Use to Stabilize a Landslide

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ABSTRACT

An innovative use of counterintuitive reversed battered of piles to arrest a large landslide in West Virginia. Reverse batter is where the top of the pile is angled with the direction of sliding instead of canted against the direction of sliding. Research and experience has shown that reversed batter sometimes allows smaller piles to resist more load than vertical or positively battered piles. This presentation will provide an overview of the use of reverse battered piles, discuss our design methodology, and give a case history of a completed project.

TECHNICAL SESSION IV
MODERATOR: LARRY JONES, FDOT
PRESENTATION 11:

Landslide Stabilization for a Large Slope on a Newly Constructed Interstate

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ABSTRACT

The human desire to build roadways through mountainous terrain is often burdened by nature's unpredictability. Such is the case of the I-22 Slope Stabilization project Alabama Department of Transportation (ALDOT) in Marion County, Alabama. The slide was located on westbound I-22 at milepost 17.4 just before the Hamilton exit. The slope was originally cut to a 3H:1V configuration and was reconfigured several times since its original construction due to slope failures. Remediation options such as benching, flattening the slope, riprap to key the slope's toe, and drainage improvements were attempted and unsuccessful. The continued surface sloughing and deeper seeded failure created heave at the toe of the slope adjacent to the road. ALDOT advertised an emergency design-build-warranty request for proposals to stabilize the slope before additional failures ensued. The stabilization system included a two-tiered soil nail wall measuring a distance of approximately 750 linear feet with individual wall heights up to 40 feet (over 25,000 SF of soil nail & shotcrete walls). This work included massive excavation and permanent soil nails capable of producing a global factor of safety greater than 1.3. Due to the emergency nature of the project, an aggressive schedule was established that included working through Northern Alabama's winter months that were plagued with heavy precipitation and cold temperatures. This presentation will cover all aspects of design and construction for this project.

Presentation 12:

Permanent Micropile Foundations for the NCDOT in Elizabeth City, NC

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ABSTRACT

In the spring of 2011, the North Carolina Department of Transportation let TIP U4438: The Rehabilitation of US158 (East Elizabeth St) to East of Pasquotank River in Elizabeth City, NC. Elizabeth City is in the northeast portion of North Carolina, roughly 3.5 hours east of Raleigh and 1 hour south of Norfolk, VA. It is situated on the west bank of the Pasquotank River and is the gateway to the Outer Banks. The overall work included, but was not limited to; the demolition and construction of the west bound bascule bridge and approach slab; the installation of a new bridge powerhouse; the installation of roadway micropiles and foamed concrete; installation of a new road surface, the redesign and installation of drainage including new overflow pumps; and the installation of new signal poles. Schnabel Foundation Company was contracted to design, furnish and install the micropile foundations for the signal poles, the roadway deck, the west bridge abutment, the powerhouse and the pump generator slab. The contracted scope included approximately 400 permanent production micropiles and 5 verification piles with permanent casing and continuous center reinforcement. These micropiles varied in length from 62ft. to 98ft. and in diameter from 7" to 10-3/4". The systems had to be designed in an area that had very weak soils overlaying gravel, alluvial sands and very stiff sandy clay. To date SFC has installed approximately, 288 micropiles totaling roughly 23,000 lf of drilling. This work was completed in multiple mobilizations despite the limited work area and equipment size, an accelerated schedule, and the inherent difficulties with installing work at the waterfront. This presentation will be case study of the challenges of design and construction of the permanent micropiles in this unique part of the country.

TECHNICAL SESSION IV
MODERATOR: LARRY JONES, FDOT
PRESENTATION 13:
Evaluation of pile setup using dynamic restrike analysis in the State of Alabama

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ABSTRACT

After piles are driven into the soil, significant variations of pile resistance typically occur with time. When pile capacity increases with time after installation, the increased amount of capacity is referred to as *setup*. Incorporating the amount of increased bearing capacity into the overall design of the driven pile foundation systems of structures can potentially reduce sizes of elements, ultimately reducing cost.

For over 25 years, the Alabama Department of Transportation (ALDOT) has been collecting pile installation and restrike data during the impact of a pile-driving hammer with Pile Driving Analyzers (PDA) to determine the capacity at the end of the driving process as well as at various time periods after EOD. The Alabama DOT is currently funding a project to organize and evaluate the dynamic testing data to aid in more efficient and cost-effective pile foundation designs. This research examines time-dependent changes in total, shaft, and toe resistances for more than 30 axially loaded driven test piles (concrete and H-piles) in Alabama soils using dynamic testing. Researchers filtered through this PDA data, and further analyzed the usable PDA data with an automatic signal matching program (iCAP) to improve the resistance estimates. This data is being utilized to estimate trends of setup in various locations throughout the state. An ArcMap of Alabama was created using GIS software to display and explore information, data, and results for each pile testing site. This presentation provides a summary of the process to analyze pile load tests, organize the data in a GIS system, and then utilize the information to produce trends and draw conclusions on improving the overall testing and regional design procedures.

Technical Session V

Moderator: Glen Foster, GDOT

Presentation 14:

Challenges and Solutions to the Implementation of LRFD for GDOT's Geotechnical Section

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ABSTRACT

The GEP Bureau started investigating the changes that would have to be made to implement the new AASHTO Load and Resistance Factor Design Bridge Specifications starting in 2008. At first only general ideas were known. Other than switching from factors of safety to resistance factors not much had been known at the start. The now retired Bureau Chief took it upon himself to come up with some minor specification changes that he thought would at least minimally suffice to get us started. A few meetings were held with contacts in academia on a semi quarterly basis to discuss the existing means and methods that were used, and what we could keep versus what new ways of analysis would be required due to the changes in specifications. Once it became apparent that the existing report format for bridge foundations would not facility the transfer of information appropriately to the bridge office, a new team of peers was formed to develop a new report format. It was also discovered that new pile loads and geotechnical analyses would be required. Currently we determine estimate tips for piles based on the actual factored loads need by the Office of Bridge Design, whereas before maximum pile loads were used to determine the estimated tips. This procedure required a new intermediate step that did not exist in the old work flow. Also, existing static analysis methods used by GDOT, that were created based on local info from years ago, could not be translated into LRFD since they did not conform to any of the existing methods presented in the code. It was decided that a method from LRFD would be chosen in lieu of trying to determine how to come up with a resistance factor for the existing data. This issue and many others, including how we solved them will be the essence of my presentation.

TECHNICAL SESSION V
MODERATOR: GLEN FOSTER, GDOT
PRESENTATION 15:
Kentucky Lake Pipe Pile Load Test Program

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ABSTRACT

This presentation describes a design-phase pile load test program performed to study the constructability and design parameters for large-diameter steel pipe piles for the proposed Kentucky Lake Bridge as part of the US68/KY 80 Bridge over Kentucky Lake project in Marshall and Trigg Counties, Kentucky.

The US 68/KY 80 bridges over Kentucky Lake and Lake Barkley were designed and built in the 1930s. The Kentucky Transportation Cabinet (KYTC) has embarked on a plan to build replacements widening them from two to four lanes and adding a pedestrian and bike path. Each bridge is approximately 4000 feet in length but also includes significant causeways and one smaller lagoon bridge.

A design-phase pile load test program has been performed to study the constructability and design parameters for large-diameter steel pipe piles for the proposed Kentucky Lake Bridge as part of the US68/KY 80 Bridge over Kentucky Lake project in Marshall and Trigg Counties, Kentucky. Extensive geotechnical field and laboratory testing programs were conducted to characterize soil and rock behavior under static and seismic loading cases.

The pile load test program included a 6000-kip static axial pile load test, 6000- and 8500-kip axial pseudo-static pile load tests, a 700-kip lateral pseudo-static pile load test and dynamic pile testing on six large-diameter pipe piles in difficult soil conditions. The pile load test program confirmed that the proposed 72- and 48-inch-diameter steel pipe piles with wall thicknesses ranging from 1.0 to 2.0 inches can be installed to the anticipated target nominal resistances and respective elevations at the site using a Menck MHU800S hydraulic hammer.

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The pile load test program indicated that the proposed steel constrictor plates should be installed within the pipe piles to increase the bearing resistance of the pipe piles, and helped the design team to gather information regarding viable design of the constrictor plates, how to locate the constrictor plates relative to the pile tip location, and in what soil strata the constrictor plates should bear within to mobilize additional bearing resistance in the pile design.

Axial static and pseudo-static pile load testing indicated that the skin resistance values used in the pile design phase were valid and likely somewhat conservative and indicated that the 48-inch-diameter piles were more likely to achieve a plugged condition while driving.

Technical Session V
Moderator: Glen Foster, GDOT
Presentation 16:
SEISMIC DESIGN – TIMES ARE CHANGING

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ABSTRACT

This presentation will review changes that are either currently being made or are anticipated being made within seismic design. New source models are being developed that can be used in the Central and Eastern United States (CEUS). Using these new source models the Next Generation Attenuation models for the eastern US (NGA-east) are being developed. SCDOT is developing new F-factor determination tools rather than relying on the F-factors currently available in AASHTO. UDOT is developing simplified liquefaction prediction models that will not require in depth analysis using SPT data. As part of this effort lateral displacement prediction models are also being included. Lastly, the National Research Council is attempting to develop the Next Generation Liquefaction models (NGL) similarly to the NGA development. The changes coming in seismic design are anticipated to have significant impact on the design of bridges in the future.

TECHNICAL SESSION VI
MODERATOR: SEAN FERGUSON, MDOT
PRESENTATION 17:

Accelerated roadway construction: Rigid Inclusions for Support of Embankments and MSE Walls in Soft Ground

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ABSTRACT

Rigid inclusions have been used as ground improvement for support of roadway embankments and MSE walls for a variety of reasons and have proven their worth in accelerated construction. This presentation will present three case histories from Virginia, Iowa and New Jersey to highlight solutions for short duration construction, soft ground, complicated alignments and limited right-of-way. Basic design approached will be discussed as well as the interface with rigid inclusion ground improvement with embankments as well as MSE walls. Application for projects in Southeast and for accelerated construction will be presented. The Virginia Ericson Avenue project illustrates a VE solution with rigid inclusions as an alternate to geofoam fill. The I-29 and US 275 interchange project in Iowa, presently under construction, will illustrate the application of rigid inclusions with limited right-of-way, restrictions from the Corps of Engineers do to proximity of river levees, and accelerated construction. Approximately 14,000 rigid inclusions are under construction at this Iowa project. The I-295 Direct Connect project in New Jersey illustrates similar issues as the Iowa work, with the additional challenges of difficult maintenance of traffic staging.

PRESENTATION 18:

Who's doing what? An Overview of Foundation Supports for Highway Signs, Luminaires, and Traffic Signals

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ABSTRACT

This presentation will provide an overview of differing procedures for the evaluation and review of foundations used by some of the various STGEC states as it relates to the Foundation Support for Highway Signs, Luminaires, and Traffic Signals. Structural design procedures have changed over the past few decades as the structures for highway signs, luminaires, and traffic signals continue to evolve, but are the standards keeping pace with procedures for the foundation requirements? The presentation will provide a review of the history on the foundation pole design and a review of AASHTO's current standards. In addition, the ability to perform complex analyses transformed by the growth of computers and programs, has allowed a rigorous, performance related standard which can and has been used by DOTs. The Alabama Department of Transportation's evaluation and review process will also be used as an example for the foundation review.

Technical Session VI
Moderator: Sean Ferguson, MDOT
Presentation 19:

ALDOT Birmingham Central Business District (CBD) Project – Subsurface Utility Engineering (SUE) Services

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ABSTRACT

The CBD is an ALDOT project to rehabilitate bridges, improve capacity on Interstate 20/59, and improve access to and from downtown Birmingham. This is a highly urbanized area with development that has occurred since 1880's through the present. There are a multitude of old abandoned utilities, new utilities, undocumented utilities and known and unknown subsurface structures. The inability to obtain reliable underground utility information has long been a troublesome problem for highway designers. ALDOT utilized SUE to identify and to acquire subsurface utility information needed for preparation of CBD plans.

The SUE process combines geophysics, civil engineering and surveying. We utilized several technologies, including surface geophysics and other devices to locate and identify these utilities and other features. In specific instances vacuum excavation was performed to expose utilities for further examination and documentation. Additionally, BHATE also scanned over 600 boring locations to identify underground utilities prior to commencing drilling to prevent damage to existing or unknown utilities.

The presentation will focus on how implementation of the SUE process at the CBD project assisted with identifying potential conflicts with existing underground utilities. The location of virtually all utilities will be determined and shown on the construction plans. This will help eliminate delays caused by redesign due to utility conflicts, potential construction delays caused by cutting, damaging, or discovering unidentified utilities and contractor claims for delays. The process also identified several potential environmental issues in the CBD construction area.

Technical Session VI
Moderator: Sean Ferguson, MDOT
Presentation 20:

MSE Wall and Ground Improvement in Karst Terrain – Birmingham Northern Bypass

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ABSTRACT

The first section of the Birmingham Northern Bypass (BNB) to receive final approval and go under construction extends from SR 79 to SR 75 northeast of Birmingham, Alabama. This section of the alignment passes through a gap in Sand Mountain and Red Mountain, which form the northwestern western flank of the Murphrees Valley anticline. Not surprisingly, a significant creek, Self Creek, which is a tributary of the Black Warrior River, also passes through this same gap in the mountains. The primary alignment stays to the southwest of the creek and floodplain; however, the ramps at SR 75 will encroach on the floodplain. As such, the design called for a retaining wall as much as 27 feet tall along the westbound on-ramp near the edge of the floodplain to reduce the environmental impact to the floodplain. This ramp is also underlain by highly weathered limestone and dolomite of Cambrian to Ordovician geologic age. Main line borings just uphill from the proposed wall location encountered firm to very stiff residual cherty clay over bedrock at a depth of 15 to 20 feet. However, the borings along the wall alignment encountered a mixture of clays, sands, and gravels, much of it very soft to very loose, to depths ranging from less than 10 feet to in excess of 50 feet. Major design considerations included not only the bearing capacity, sliding, etc., of the wall itself, but also the global stability of the wall and embankment. This paper presents the methods used to develop subsurface conditions in this and potentially other karst sites, foundation options considered, the final design approach, and preliminary results of the foundation construction. (Note, the foundation/ground improvement construction is just beginning as of August 2014.)

Technical Session VII

Moderator: Darrin Beckett, KY Transportation Cabinet

Presentation 21:

NCDOT's Recent Experience with Static Load Testing on Large Concrete Piles

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ABSTRACT

In the last two years, NCDOT has performed three full scale static load tests on two 30" square prestressed concrete piles and one 36" square prestressed concrete pile at separate bridge construction sites. The maximum target axial test load for both 30" test piles was 1,660 kips. The maximum target axial test load for the 36" pile was 3,000 kips. The 36" test pile was also subject to a lateral load test as jetting was used during pile installation.

Pile embedment below ground surface ranged between 84 and 93 feet. The two 30" test piles were constructed in waters less than 3-ft in depth. Increased testing difficulties were experienced at the 36" test pile site due to 33-ft water depth.

TECHNICAL SESSION VII
MODERATOR: DARRIN BECKETT, KY TRANSPORTATION CABINET
PRESENTATION 22:

Utilizing Driven Pile Installations to Predict Ground Vibration Propagation

John C. Cleary, Andrew S. Gillis, and Eric J. Steward

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ABSTRACT

Construction activities have the potential to create ground vibrations that could damage nearby structures. Research has been conducted on the effects of vibrations on structures, but the expected levels of vibrations are dependent on the soil conditions at the construction site. Therefore, site specific investigations are often required.

After concerns were raised by the Alabama Department of Transportation (ALDOT) about damage potential at a project site in South Alabama, a research project was initiated to investigate ground vibrations from pile driving at a project site near the Mobile River in Mobile, Alabama.

An investigation and vibration monitoring program was developed for pile sizes that are often used by the Alabama Department of Transportation (ALDOT). The piles were driven using typical installation techniques and the vibration levels at various distances from the piles were monitored.

The investigation found that the largest vibrations were observed while driving a thirty-six inch square concrete pile. The maximum vibrations observed had a magnitude of 0.82 inches per second at 50 feet from the pile. The vibrations at 150 feet from the pile had dissipated to 0.15 inches per second. A vibration prediction equation was developed based on the vibrations from the concrete pile.

Technical Session VIII
Moderator: Joe Carte, WVDOT
Presentation 23:
Large Diameter Open End Pipe Piles for Transportation Structures

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ABSTRACT

This presentation will highlight the current state of practice regarding the design and installation of large diameter open-end piles (LDOEPs) for transportation structures. LDOEPs provide advantages where large foundation loads may exist and/or the piles are subject to significant unsupported length due to scour, liquefaction, or very weak surficial soils. Marine construction conditions also favor the use of these piles, particularly where pile bents might be employed to eliminate footings. A soon to be published NCHRP synthesis report will provide a summary of the state of practice with regard to LDOEPs in the transportation industry. Some of the key issues and practices covered in the report are discussed in this presentation.

LDOEPs are cylinder-shaped piles driven open ended, that is with no plate or plug on the bottom of the pile, allowing soil to move up inside of the pile as it is driven into the ground. As the need to support larger lateral, seismic, and axial loads increases, designers and contractors are more often considering LDOEPs as one of the foundation types to resist these loads. LDOEPs can be preferred over similar size drilled shafts and/or pile groups to address constructability and/or environmental concerns in certain circumstances or conditions. The same advances in construction equipment that have benefitted the installation of large diameter drilled shafts have also allowed LDOEPs to be a cost-effective solution for some of the same loading conditions.

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A primary issue with LDOEP design is that the current Load and Resistance Factor Design (LRFD) static methods are based on small diameter piles, typically 24 inches or less. Design methods for LDOEPs need to account for factors not necessarily considered for small diameter piles such as the influence of diameter and pile wall thickness, the degree of soil plugging or internal skin friction that exists, non-linear vibration effects, scalability, and soil-pile-hammer effects. There is also uncertainty as to whether the resistance factors used for small diameter piles are also valid for LDOEPs.

In addition to uncertainties in static design methods, significant questions exist concerning drivability issues and the results of dynamic testing on LDOEPs. The potential for damage of LDOEPs driven to bear on rock is a concern, and such damage at the toe of the pile is often difficult to detect or recognize. On some recent projects, dynamic tests have reportedly indicated much lower resistance values than were anticipated; alternative static or rapid load tests have sometimes demonstrated resistance values significantly higher than indicated by the dynamic testing. On rare occasions with piles in deep cohesive soils, the opposite pattern has been reported. Because static load tests on LDOEPs are expensive and therefore relatively uncommon, dynamic testing of these piles is of great interest. The same questions concerning the influence on size, wall thickness, plugging, etc. need to be evaluated and accounted for in the analysis of dynamic testing results.

While not as common in the transportation sector, other industries currently use LDOEPs for foundation systems. The offshore petroleum industry has a long history of using LDOEPs, including a body of research on estimating pile capacity and improving installation methods. The U.S. Army Corps of Engineers has a long history of use of LDOEPs in flood control projects, most recently on several projects around New Orleans, Louisiana repairing and improving the flood protection system of the city and surrounding areas. One other industry is the energy sector, where LDOEPs are used for transmission structures and other applications. Although the practices developed by these other industries are based can be useful to further the understanding of LDOEPs for the transportation sector, limitations in adopting or using these methods need to be recognized due to the differences between transportation applications and those of the other industries.

Technical Session VIII
Moderator: Joe Carte, WVDOT
Presentation 24:

A “Greener” Approach – Examining FDR from a Geotech’s Point of View

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ABSTRACT

The advantages of Full Depth Reclamation (FDR) and other forms of pavement recycling are far reaching from a construction cost and time standpoint, but what is the impact from a geotechnical engineering perspective? More traditional pavement designs and even designs that involve remedial measures require a certain level of field exploration, laboratory analysis, design consideration, and associated construction materials testing. FDR and similar pavement reuse has dramatically altered the approach geotechnical engineers implement to develop appropriate design and construction recommendations. Laboratory replication of real-time construction activities presents challenges, especially when dealing with a variety of existing pavement sections and subgrade conditions. Materials testing during construction can often present challenges due to the unique characteristics of the recycled materials.

Local experience, knowledge of design specifications, and an understanding of construction practices are necessities when developing and implementing the best project approach. Illustrations of a variety of FDR projects completed by KSWA will be presented to highlight the need for varied approaches. These projects include the reconstruction of Runway 2L-20R at Nashville International Airport, taxiway rehabilitation at Shelbyville Municipal Airport, and pavement rehabilitation for a commercial parking lot in Middle TN. FDR is fast becoming a preferred alternative to the traditional pavement design process, and geotechnical engineers provide the “Base” for optimal design and construction as well as addressing environmental awareness.

Technical Session VIII
Moderator: Joe Carte, WVDOT
Presentation 25:

Scour Potential of Alabaman Hard Cohesive Soils if the Black Belt and Coastal Plain

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ABSTRACT

Determination of erosion parameters in order to predict scour depth is imperative to designing safe, economic, and efficient bridge foundations. Scour behavior of granular soils is generally understood, and design criteria have been established by the Federal Highway Administration. The same is not true for cohesive soils, and because of their complexity, a universal scour prediction method has not been established by the industry. The Erosion Function Apparatus (EFA) was created to determine the rate of scour of cohesive soils under known shear stresses, which can then be used to predict scour depths under similar conditions.

During this study, ten cohesive soil formations were sampled with the assistance of the Alabama Department of Transportation. Specimens from these formations were scour tested in an updated EFA featuring an ultrasonic sensor for quantitative erosion measurements. EFA tests were performed to determine erosion functions and whether any formations demonstrated scour resistance. Geotechnical index tests were also performed on these formations to correlate scour to geotechnical properties.

Results of testing verified the performance of the ultrasonic sensor and updated EFA. Three of the tested formations were scour resistant. Velocity and shear stress based erosion functions were generated for the scourable formations with scour rates upwards of 15 mm per hour. General correlations were established between scourability and basic geotechnical parameters.

Technical Session VIII
Moderator: Joe Carte, WVDOT
Presentation 26:

Geotechnical Considerations During Design and Construction of the ASPA Mobile Container Terminal at Choctaw Point in Mobile, AL

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ABSTRACT

The ASPA Mobile Container Terminal at Choctaw Point is a 135 acre facility located along the Mobile River at the head of Mobile Bay. The project was constructed over 21 acres of shallow water bottoms and 27 acres of deep water bottom. An approximately 2,000 ft long ship dock supported on prestressed concrete piles was constructed along the Mobile River Ship Channel. A sheetpile bulkhead wall was constructed adjacent the dock structure to retain soil fill placed within the River/Bay area that was reclaimed. Approximately 1,500,000 cubic yards of sand fill/backfill was placed within the reclaimed 27 acre Bay/River area over an average of 24 ft of very soft to soft marine clay and silt deposits. Stone columns, vibro compaction, geogrid reinforced soils and lightweight fill were used to strengthen the soils and reduce lateral pressures on the sheetpile wall and dock structure. Sand fill was placed over the very soft to soft bay bottom soils to above the water level, approximately 94,000 – 40 to 50 ft long wick drains were installed to accelerate the consolidation and settlement process, and additional fill soils and preload soils were placed to cause estimated settlement of up to 8 ft from consolidation of the very soft to soft river bottom soils. After consolidation of the very soft soils, the preload was removed to about elevation 14 ft, approximately 16 inches of roller compacted concrete was placed, and the facility was put into operation of supporting cargo containers. Soft compressible soils were found at shallow depths underneath the locations of the terminal operations buildings. Piles were driven to support two of the building structures and additional preloading was performed in some areas so that spread footings could be used as the foundation system in these building areas.

PAST STGEC SITES

1	1969	Atlanta, Georgia	31	1999	Asheville, North Carolina
2	1970	Jackson, Mississippi	32	2000	Little Rock, Arkansas
3	1971	New Orleans, Louisiana	33	2001	Roanoke, Virginia
4	1972	Montgomery, Alabama	34	2002	Baton Rouge, Louisiana
5	1973	Orlando, Florida	35	2003	Charleston, South Carolina
6	1974	Covington, Kentucky	36	2004	Biloxi, Mississippi
7	1975	Gatlinburg, Tennessee	37	2005	Lake Lanier Islands, Georgia
8	1976	Raleigh, North Carolina	38	2006	Florence, Alabama
9	1977	Hot Springs, Arkansas	39	2007	Bowling Green, Kentucky
10	1978	Wheeling, West Virginia	40	2008	Pigeon Forge, Tennessee
11	1979	Charleston, South Carolina	41	2009	Wilmington, North Carolina
12	1980	Atlanta, Georgia	42	2010	Charleston, West Virginia
13	1981	Virginia Beach, Virginia		2011	(No STGEC)
14	1982	Jackson, Mississippi	43	2012	Richmond, Virginia
15	1983	Montgomery, Alabama	44	2013	Baton Rouge, Louisiana
16	1984	Winter Park, Florida	45	2014	Mobile, Alabama
17	1985	Gatlinburg, Tennessee			
18	1986	Louisville, Kentucky			
19	1987	Hot Springs, Arkansas			
20	1988	Raleigh, North Carolina			
21	1989	Charleston, West Virginia			
22	1990	New Orleans, Louisiana			
23	1991	Charleston, South Carolina			
24	1992	Williamsburg, Virginia			
25	1993	Matches, Mississippi			
26	1994	Atlanta, Georgia			
27	1995	Huntsville, Alabama			
28	1996	Cocoa Beach, Florida			
29	1997	Chattanooga, Tennessee			
30	1998	Louisville, Kentucky			

NOTES:


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