SCHEDULE OF EVENTS

Monday, August 1, 2016

2:00 PM - 3:00 PM  Deep Foundations for Landslides & Slope Stabilization Committee Meeting | Cherry

3:00 PM - 4:00 PM  Tiebacks and Soil Nailing Committee Meeting | Cherry

4:15 PM - 4:15 PM  Meet-Up for Departure to WiDF Lecture & Reception | Westin Lobby

6:00 PM - 8:00 PM  WiDF Special Lecture and Networking Reception at HDR, Inc.
1670 Broadway, Suite 3400 | Denver, CO 80202-4824

4:00 PM - 8:00 PM  Exhibitor Set-Up | Alder I

Tuesday, August 2, 2016

7:00 AM - 8:00 AM  Registration | Grand Foyer

7:00 AM - 8:00 AM  Networking Breakfast and Exhibition | Alder I

7:00 AM - 8:00 AM  Speakers Preparation | Alder II

8:00 AM - 8:15 AM  Welcome and Introductions | Alder II
  Vern Schaefer, Ph.D., P.E.
  Moderator and DFI Deep Foundations for Landslides & Slope Stabilization Committee Chair
  Iowa State University
8:15 AM - 9:00 AM  
**Keynote Presentation**
Introduction to Landslide Stabilization Design & Construction

*Erik Loehr, Ph.D., P.E.*
*University of Missouri Columbia*

This presentation addresses design and use of deep foundations for slope stabilization and covers concepts of load transfer for deep foundations from moving soil, important failure modes and limit states that should be considered for design of deep foundations for slope stabilization, practical methods for prediction of foundation resistance, and consideration of structural resistance for deep foundations in slope stabilization applications. “Do’s and don’ts” for design of deep foundations for slope stabilization along with a brief case history comparing the predicted and measured resistance for drilled shafts are also included.

9:00 AM - 9:45 AM  
**Keynote Presentation**
Tieback & Soil Nail Design and Construction for Excavation Support & Landslide Stabilization

*Jesús Gómez, Ph.D., P.E., D.GE.*
*GEI Consultants*

This presentation depicts several scenarios where lack of attention to seemingly minor details during construction document development caused construction claims or stoppages. The presentation also discusses simple ways in which such problems could be avoided. The discussion is illustrated through actual case histories.

9:45 AM - 10:15 AM  
**Networking Break and Exhibition** | Alder I

10:15 AM - 10:30 AM  
**Introduction to Software Session Program** | Alder II

*Ed Laczynski, P.E.*
*Wagman, Inc.*

*Summary not available at this time*

10:30 AM - 11:00 AM  
**FHWA Program Activities on Earth Retention**

*Scott Anderson, Ph.D., P.E.*
*Federal Highway Administration*

*Summary not available at this time*

11:00 AM - 11:30 AM  
**Colorado DOT Geohazard Program**

*Ty Ortiz*  
*Colorado Department of Transportation*

*Summary not available at this time*
Widely Spaced Shear Walls Stabilize Landslide to Protect Trunk Highway 2 in Crookston, Minnesota

Rick Deschamps, Ph.D., P.E., D.GE.
Nicholson Construction

A landslide in Crookston, Minn., caused extensive damage to residences and jeopardized Trunk Highway 2. Deformations of several inches per year were occurring post-slide. The stabilization approach consisted of shear walls 100 feet in length, 3 feet in width, and spaced at approximately 100 feet center to center. A mixture of cement-bentonite was used to construct the walls by excavating 65 feet through the lake clays and penetrating 10 ft (3m) into the underlying glacial till. The presentation will include, design, construction and approximately one year of deformation data.

Landslide Stabilization with Anchored Solider Pile Walls in Central California

Ryan Turner, P.E., G.E.
California Department of Transportation

The topic of this presentation is anchored soldier pile walls (ASPW) for landslide stabilization. Varied geology, landslide characteristics and site conditions present challenges to the design and construction of ASPW’s on the Central Coast of California. Case histories will be presented with discussion of site characterization, wall design procedures, construction challenges and solutions, and lessons learned at each unique project site.

Networking Lunch and Exhibition | Alder I

Case Histories on the Selection, Design and Use of Secant Walls for the Excavation Support Systems in Boulder Colorado | Alder II

Todd Duncan, P.E.
Schnabel Foundation Company

Summary not available at this time.

Colorado State Highway 13 - Emergency Landslide Repair

Rick Walsh, P.E., G.E.
Hayward Baker Inc.
Ira Scott Long
Anderson Drilling

This presentation will outline the procurement and construction of an emergency landslide stabilization project that disrupted road travel on State Highway 13 between Meeker and Rifle, Colorado. The accelerated timeline from the time of landslide occurrence in April of 2015 with advertising for bid, bid submission, award and the start of construction all occurring within approximately 2 months illustrate the emergency nature of this project.
In addition to discussing the timeline of procurement and construction this presentation will address the geotechnical conditions that precipitated this failure and the construction at the site to stabilize this landslide and restore the roadway for vehicular travel.

2:30 PM - 3:00 PM  
Piscataway Drive Roadway and Slope Reinforcement  
Kwabena Ofori-Awuah, P.E., ENV-SP  
KCI Technologies, Inc.  
This presentation discusses the emergency safety measures, geotechnical investigations, remedial design and construction recommendations implemented to mitigate and stabilize the failed roadway and slopes. Temporary measures included minimizing water infiltration across the slopes to mitigate progressive ground movements. Forensic site investigations included geologic assessment, SPT test borings, Cone Penetrometer tests and Dilatometer tests to identify major subsurface strata including Marlboro Clays, and estimated depths of critical slope failures and ground movements. In addition, we implemented an instrumentation and monitoring program including in-place inclinometers and ground surface survey points to record and evaluate post-failure and progressive ground movements.

3:00 PM - 3:30 PM  
Networking Break and Exhibition | Alder I

3:30 PM - 4:00 PM  
Kane Brook Slope Failure and Repair | Alder II  
Randall States, P.E.  
Michael Baker International, LLC  
The presenter will review design and construction constraints, geotechnical material properties (contaminated urban fill overlying varved clay), probable failure mechanism, analysis methodology, corrective repairs, and lessons learned of a slope failure The project owner authorized installation of geotechnical monitoring, subsurface explorations, and laboratory testing, to support analysis of cause, and evaluation to develop corrective actions. The project owner, contractor, and designers contributed towards the presentation.

4:00 PM - 4:30 PM  
Review of Large-Scale Experiments Highlighting the Performance of Flexible Facings Used for Slope Stabilization and Temporary Shoring Applications  
Kevin McNeill, P.E. and Tim Shevlin, P.G  
Geobrugg North America, LLC  
The issues related to slope stability play a great role in geotechnical engineering. Within past decades, plenty of slope stabilization methods have been developed and used worldwide. Even though most of those methods proved to be effective and reliable, there is still room for their optimization. A great example for this can be the surficial slope stabilization method consisting of soil nailing and flexible facing system based on high-tensile steel wire mesh.
The use of high-tensile strength steel wire mesh has been used for nearly 15 years for stabilizing oversteepened slopes, shallow landslides, and sometimes as temporary shoring applications. Recently, this stabilization method was thoroughly investigated within a research project supported by Swiss Institute for Technology and Innovation (CTI). The project included creation of large-scale testing setup, preparation and calibration of measuring instrumentation, establishing appropriate testing procedure, and data acquisition method. A total of 31 large-scale field tests and several nail-mesh variations were examined providing a large amount of test data including tension forces and bending momentums in the nails and deformations of flexible facing protecting the slope surface. This paper presents observations, results, and analysis of large-scale field experiments and will present selected case studies highlighting the use of high-tensile strength mesh in temporary shoring applications for foundation construction.

4:30 PM - 5:00 PM

**Norristown High Speed Line Emergency Embankment Repair Project**

*Britain Materek, P.E.*  
*HNTB Corporation*

Following the heavy rains from Hurricane Irene in 2011, approximately 150 feet of embankment along the heavily traveled SEPTA Norristown High Speed Line, a commuter rail line in Delaware County, Pennsylvania, exhibited signs of excessive movement. As part of an on-call contract, HNTB worked closely with SEPTA to respond to this emergency situation, design a permanent slope repair that would minimize interruptions to rail service and provide construction support throughout the project. The use of in-situ instrumentation allowed HNTB to quickly assess the embankment, propose a design solution and expedite the design process. To temporarily stabilize the embankment and keep rail traffic operating during construction HNTB proposed the use of hollow bar soil nails and reinforced steel mesh along the upper 12 feet of the embankment. The permanent solution included a drilled shaft soldier pile and lagging wall near the toe of the embankment which was tied back with ground anchors. Additionally, much of the poor surficial material was replaced with a layered fill which acted to direct water away from the embankment and increase the overall strength of the embankment. Due to the emergency nature of the project the design was completed and put out to bid in less than 21 days, and construction to repair the embankment began 33 days after the failure occurred.

5:00 PM - 6:30 PM

**Networking Reception and Exhibition**  |  Alder I

**Wednesday, August 3, 2016**

7:30 AM - 8:30 AM  
**Registration**  |  Grand Foyer

7:30 AM - 8:30 AM  
**Speakers Preparation**  |  Alder II
7:30 AM - 8:30 AM  Networking Breakfast and Exhibition  |  Alder I

8:30 AM - 8:45 AM  Welcome and Introductions  |  Alder II
   
   Ed Laczynski, P.E.
   Moderator and DFI Tiebacks and Soil Nailing Chair
   Wagman, Inc.

8:45 AM - 9:30 AM  Stabilization of Hills of Rivermist Landslide, San Antonio, Texas
   Garry Gregory, Ph.D., P.E., D.GE
   Gregory Geotechnical and Oklahoma State University
   
   A massive landslide occurred at the Hills of Rivermist subdivision in San Antonio, Texas in January 2010. The landslide was reported as one of the largest in Texas history. Approximately 27 homes were damaged and 91 homeowners were forced to evacuate their homes. A comprehensive site exploration and laboratory testing program was conducted followed by extensive slope stability analyses and stabilization design. The project is situated in the Del Rio Clay formation, which in the weathered condition can exhibit very low shear strength. Stabilization of the landslide in the very weak soils and with space and access limitations presented a significant challenge to the design team. The stabilization scheme required drilled shafts below grade with embedded structural steel elements above grade to accommodate the retaining wall structural facing. Various locations along the project required a combination of drilled shafts with high capacity tiebacks and cantilevered drilled shafts. The drilled shafts ranged in diameter from 30-inches (760 mm) to 48-inches (1220 mm) with embedment depths up to 44 feet (13.4 m). The tieback anchors ranged in capacity up to 142 kips (632 kN). The analyses were not routine due to the very high capacity drilled shafts and tieback anchors in the weak soils. The slope stability analyses were performed with conventional limit equilibrium methods and the lateral capacities of the drilled shafts with embedded structural steel elements were analyzed using p-y methods. Approximately 3,000 linear feet (915 m) of retaining structures were required. Construction was completed in early 2011 and the landslide stabilization has performed well to date.

9:30 AM - 10:00 AM  The Use of Ballistic Soil Nails for Shallow Landslide Repair
   Cameron Lobato, P.E., P.Eng.
   GeoStabilization International
   
   Ballistic soil nails have been used in the United States to repair shallow roadway landslides for nearly 20 years. The U.S. Forest Service/Federal Highway Administration “Application Guide for Launched Soil Nails” is the principal design manual for designing with ballistic soil nails and employs a simplified sliding wedge analysis using limit equilibrium concepts to determine the factor of safety of a slope reinforced with soil nails. We will present case studies on projects in Colorado, Wyoming, Oregon and North Dakota. Numerous shallow landslides have been mitigated using launched soil nail technology along public highways.
This presentation will convey the appropriateness of selecting launched nails as well as the cost and time benefits of using launched nails in mitigating certain geohazards. The benefits of using launched soil nails will also be shown when used in environmentally sensitive areas of the Willamette River near Portland, Oregon. And finally, a case study will be presented showing the rapid installation benefits of using launched soil nails to minimize track time interference to mitigate a soft railway embankment near Harvey, ND.

10:00 AM - 10:30 AM

Mitigating Landslides in Wyoming Using Innovative Coupled Drilled Shaft Systems
Ben Arndt, P.E., P.G
Yeh and Associates, Inc.
The Wyoming Department of Transportation (WYDOT) recently completed two successful large-scale landslides mitigation projects. Yeh and Associates (YA) was the consultant selected to provide the professional design services and design support. The first slide known as the Narrows Landslide, is located along State Highway 220 south of Casper Wyoming had been active since 1965. The slide extended for more than 500 feet in length along the roadway above the North Platte River. YA and WYDOT collaborated on an innovative mitigation design known as the Coupled Shear Pile (CSP) system. This system uses the frame action of two drilled shafts that are connected at the top with a rigid pile cap. The coupled system transfers the maximum moments generated by the moving slide mass through the rigid pile cap rather than having the maximum moment at the slide plane as occurs with single row drilled shafts. Using this system, the size of the drilled shafts was reduced to 48 inches in diameter that is significantly smaller than single row drilled shaft stabilization systems. Additionally the project specified an oscillating drilled shaft construction method that was successfully completed ahead of schedule in the summer of 2013. The second landslide known as Hoback North was located in the Snake River Canyon south of Jackson Wyoming along Highway 191/89/287. The slide extended for more than 800 feet in length along the roadway above the Snake River. The same system was used to couple together two 60 inch diameter shafts to stabilize the landslide. The project also specified an oscillating drilled shaft construction method that was successfully completed ahead of schedule in the summer of 2015.

10:30 AM - 11:00 AM

Networking Break and Exhibition | Alder I

11:00 AM - 11:30 AM

Design Method for Slide-Stabilizing Micropile Walls | Alder II
John Turner, Ph.D., P.E., D.GE
Dan Brown and Associates, PC
A design method is presented for slope stabilization involving the use of micropiles extending through the sliding mass into more stable material.
This type of wall typically consists of a line of micropiles placed into the soil mass at alternating batter angles. The micropiles are fixed at the ground surface by means of a concrete cap beam running the length of the wall, effectively creating a structural 'A-frame' to resist landslide forces. Studies of instrumented micropile walls described in the literature indicate that the magnitude of sliding resistance contributed by micropiles depends more upon mobilization of axial resistance than it does upon their bending resistance. These observations suggest a simple design method in which the micropile wall is modeled and analyzed as a structural frame, and in which axial force mobilized in the micropiles controls the design of the structure and provides an approximate, but realistic representation of wall performance. Design parameters include size and location of the cap beam, micropile spacing, batter angles, lengths, diameters, and structural design.

11:30 AM - 12:00 PM

**Design of Landslide Stabilizing Piles By Numerical Methods**  
*Daniel Pradel, P.E., G.E., D.GE., FASCE*  
*Ohio State University*

Design of landslide stabilizing piles by numerical methods including the strength reduction method (SRM), kinematic method and comparison with traditional slope stability methods. Because of the large bending moments to which landslide stabilizing piles are subjected, drilled shafts in slopes are generally reinforced with massive steel I-beams and/or reinforcement cages, and their design often incorporates several rows of tiebacks. In the USA, a minimum static Factor of Safety of 1.5 is generally required for slope stabilization. The application of this Factor of Safety requirement is not as straightforward as it may appear, and often designs by various consultants can differ significantly for the same slope. To avoid this problem stabilizing piles can be designed from both a geotechnical and structural perspective by the strength reduction method using numerical programs such as FLAC or PLAXIS. Additionally, numerical results will be compared to various traditional methodologies often used by consultants.

12:00 PM - 12:30 PM

**New Method for Analysis of Lateral Loading of A-Walls**  
*Helen Robinson, P.E.*  
*Schnabel Engineering*

This presentation will summarize the findings of the Committee Project Fund research, “A New Method for Analysis of Lateral Loading of A-Walls”. The research was designed to develop a simplified approach to the analysis of lateral loading on A-Walls, as well as compare the strain wedge method to the beam over elastic foundation formulation that LPILE and GROUP are based on. A-Wall systems are a combination of deep foundations and, in some cases, tiebacks used to provide lateral support to an unstable ground mass. Determination of the lateral and vertical forces acting on an A-Wall system is a complex endeavor. To date, the design of A-Walls has necessitated multiple design steps, whether calculating by hand or using commercially available computer programs that allow determination of soil forces against a deep foundation element installed through a mass of moving soil.
At present, such analyses are often performed considering the individual elements, which require that assumptions be made regarding interaction among connected elements. Such analyses are extremely tedious and time consuming, requiring numerous iterations, and the assumptions required lead to questions regarding how well the predicted forces match with reality. The presentation will contain a summary of the analyses performed and the results of comparisons between instrumented data, hand calculations, and software output. The discussion will outline a modified series of steps streamlined and effective analysis of A-Walls subject to lateral loading.

12:30 PM - 1:30 PM  
**Networking Lunch and Exhibition | Alder I**

1:30 PM – 2:00 PM  
**Design of a Temporary Tieback-Supported Platform on an Existing Landslide | Alder II**  
*Eric Newman, Ph.D., P.E.*  
*AECOM*

The Calaveras Dam Replacement Project site, contains multiple secondary faults and numerous active, dormant, and inactive landslides. During construction, an unmapped ancient landslide complex was encountered underlying the left abutment of the new dam. The portion of the slide mass within the dam footprint was removed as part of the dam foundation preparation, but a portion had to be left in place upstream of the dam to avoid impacting construction activities. This slide remnant left in place had a maximum height of about 50 feet and was supported using multistrand tiebacks and shotcrete. An exploration program was conducted to identify the slide geometry and characterize material properties. Live loads considered in the stability analysis included a large crane used in construction of the new spillway. The approximately 280 tiebacks were installed over a period of about 2 months and the structure has performed well since.

2:00 PM - 2:30 PM  
**Landslide Remediation: Tools for Cost Estimates**  
*Sebastian Lobo-Guerrero, Ph.D., P.E.*  
*American Geotechnical and Environmental Services, Inc.*

This presentation explains the general design and advantages of landslide remediation using soil/rock nails. Several case studies are highlighted illustrating the design, construction, and testing of the main components of the system. Guidance is also provided for preliminary cost estimates.

2:30 PM - 3:00 PM  
**A Hybrid Retaining Wall to Conquer a Massive Slope**  
*Sixto Fernandez P.E.*  
*Schnabel Engineering*

A series of multi-tier hybrid soil nail and tieback retaining walls were designed and erected adjacent to new highway construction in Pinson, Alabama. A maximum retained height of approximately 150 feet was supported with four tiers, each supporting up to a vertical height of 40 feet of the slope. A long term design life of 75 years was used for this project.
Various issues arose during the design and construction process that challenged both the design team and the contractor. This presentation will discuss some of these issues and how they were resolved to bring the project to successful completion as well as the design methodology used.

3:00 PM - 3:30 PM  
**Networking Break and Exhibition** | Alder I

3:30 PM - 5:30 PM  
**Exhibitor Break-Down** | Alder I

3:30 PM - 4:15 PM  
**Great Wall of Haddam** | Alder II  
*Gary Fuerstenberg P.E.*  
Haley & Aldrich  
This unique project involves building a 35-foot-high retaining wall mid-slope of a 60-foot-high steep slope for expansion of an electric substation. The presentation discusses subsurface explorations, slope stability evaluation, design, and construction aspects of the project.

4:15 PM - 5:15 PM  
**Software Analysis for the Geotechnical Engineer: A Discussion** | Alder II  
*Chris Ramsey, P.E., Senior Geo-Structural Engineer*  
Amec Foster Wheeler Environment & Infrastructure, Inc.  
*Summary not available at this time.*

5:15 PM - 5:30 PM  
**Closing Remarks**  
*Vern Schaefer, Ph.D., P.E.*  
*Iowa State University*

*Program Subject to Change*
- Thank You to Our Event Underwriters -

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