September 2018 DVGI Dinner Meeting

**SPEAKER:** Silas C. Nichols, P.E.,
Principal Bridge Engineer - Geotechnical, FHWA

**TOPIC:** Addressing Issues with the Use of Large Diameter Foundation Elements

**DATE:** Tuesday, September 18th, 2018

**LOCATION:** Valley Forge Casino, Parkview Ballroom, 1160 First Avenue, King of Prussia, PA

**TIME:** 5:30 PM Social Hour, 6:30 PM Dinner and 7:15 PM Presentation

***Registration and Payment Online at www.dvgi.org***

Innovations in construction equipment over the last two decades, combined with increased load carrying demands for foundation elements have resulted in significantly larger and deeper foundation elements that have tested our abilities in many areas including equipment requirements, materials, and construction means and methods. The Federal Highway Administration (FHWA) is completing a series of research efforts, and policy changes related to design and construction issues, and acceptance standards to address advances occurring with driven pile and drilled shaft foundations. The presentation will address efforts to optimize drilled shaft design, evaluate design methodologies for large diameter open-ended pipe piles, and the update of guidance for acceptance of large diameter foundation elements.

**ABOUT THE SPEAKER:**

Silas Nichols is the Principal Geotechnical Engineer for the Federal Highway Administration’s Office of Infrastructure. Silas is responsible for providing leadership and direction for the FHWA National Geotechnical Team through policy development, technical guidance development, and coordination with industry and professional groups. Silas has been with the FHWA for 17 years both in Headquarters and with the Resource Center. Silas has a Bachelor’s Degree in Civil Engineering from Syracuse University, and a Master’s Degree in Geotechnical Engineering from Tuft’s University. Prior to employment with the FHWA, Silas served more than 10 years in private consulting in the Northeastern and Mid-Atlantic United States.

*One Professional Development Hour (PDH)*

*will be provided for this dinner meeting.*
The Lehigh Valley Section of ASCE and DVGI were both selected for the 2018 ASCE-GI Cross-USA lecture by Dr. Andrew J. Whittle of the Massachusetts Institute of Technology. LV-ASCE and DVGI held a joint meeting with Dr. Whittle on May 23rd, 2018, at the Holiday Inn of Lansdale-Hatfield in Kulpsville, PA.

ABOUT THE PRESENTATION:
There are many diverse geotechnical problems where reliable predictions of ground deformations are critical in design and only limited options are available to control these movements. This lecture compared and contrasted experiences in the application of advanced constitutive models in the prediction and control of ground movements in four distinct classes of problem: urban excavations, mechanized tunneling, seismic retrofit of waterfront structures, and long-term prediction of settlements on clay.

ABOUT THE SPEAKER:
Andrew Whittle is the Edmund K. Turner Professor in the Civil and Environmental Engineering Department at the Massachusetts Institute of Technology in Cambridge, MA. His primary research interests include the fundamental understanding and modeling of geo-material behavior, the development of analysis methods for predicting and/or interpreting soil-structure interactions, and new concepts for monitoring and controlling underground infrastructures. He has written over 75 research papers, published four books, and presented at over 100 conferences. Current research projects include developing constitutive models describing the hydro-mechanical and hydraulic fracturing behavior of shales, validating constitutive models for pile-soil interactions using the results of physical model tests at deep water sites in the Gulf of Mexico, and integrating recent advances in computational analyses (massive 3D FE models) and in the design of low cost wireless sensors, in order to develop a capability for ‘real-time’ data interpretation and prediction in the arena of temporary earth retention structures in the urban environment.
Upcoming Dates for 2018-2019 Dinner Meetings and events are as follows:

- October 15th Dinner Meeting: TBA
- November 15th Dinner Meeting: Rick Brinker, Pennoni Associates

One PDH will be awarded for most dinner meetings that you attend.

If you are interested in presenting at one of our monthly meetings or have ideas about potential speakers, please get in touch with a DVGI board member.

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Every child should Dream Big

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The acclaimed giant-screen documentary Dream Big: Engineering Our World has inspired and delighted audiences in museums around the world.

Now, ASCE with generous support from the United Engineering Foundation (UEF) has set an ambitious goal: to put a copy of the Dream Big film and educational toolkit in every public school in America.

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ANNOUNCEMENTS

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ANNOUNCEMENTS

Upcoming GSI Webinars for 2018
(1.5 PDH/each upon completion of exam)

11:30 AM—1:00 PM (Eastern Time)

Topics, Dates and Registration at www.geosynthetic-institute.org/webinar.htm

Cost: GSI Members $200; Nonmembers $250

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HAVE DVGI PUBLISH YOUR ARTICLE, ADVERTISEMENT, OR JOB POSTING

- Do you have an interesting article on a project or individual in your organization that you would like to have published in the DVGI newsletter?
- Would you like to get the word out about a job opening, new venture, etc. to our membership via the newsletter?

Please submit your articles or news items for consideration in the next edition of the newsletter or get in touch about our reasonably-priced advertising by contacting Theresa Loux (tloux@aeroaggregates.com).

DVGI Merchandise Available for Purchase

Coffee mugs ($8) and lapel pins with the DVGI logo ($5) are available for purchase. See Russ Preuss if you are interested in purchasing either of these items.

ASCE/G-I Members:
Read past and present issues of Geo-Strata magazine online at www.asce.org
MEMBER SPOTLIGHT

Melissa Logan Gillespie, P.E.
TRC Engineers

Melissa possesses 19 years of progressive experience in the field of geotechnical engineering which has involved her with a varied portfolio of public and private infrastructure projects throughout the country. She presently serves as Eastern Geotechnical Engineering Practice Lead for TRC Engineers’ Infrastructure Sector where she has been employed for the past 17 years. She routinely works a part of a multi-disciplinary team providing geotechnical design solutions for a wide range of private and public sector project applications, such as industrial processing facilities, airports, mooring structures, municipal wastewater treatment facilities, power generation and transmission projects, natural gas pipelines and associated facilities, low to high-rise residential developments, office complexes and mixed use buildings, multi-story parking facilities, highways, and bridges primarily located throughout the Northeast, Mid-Atlantic, Southeastern and New England states.

Melissa received her undergraduate Civil Engineering degree from Drexel University and her graduate Civil Engineering degree from the University of Texas at Austin, and is a registered Professional Engineer in nine (9) states. She was an active member of the Board of Directors of the Delaware Valley Geotechnical Institute of ASCE from 2005 through 2017, serving as At Large Director, Newsletter Editor, Secretary, Vice Chair, Sponsorship Chair, and as a member of the Scholarship Committee. Melissa also served as ASCE South Jersey Branch Chairperson for the Committee in Equal Opportunity Programs from 2005 through 2009, where she coordinated with an administrator from the Camden City Public School District for selection and sponsorship of two (2) high school students to attend the Engineering Summer Camp held annually at Widener University.

Melissa lives in Lower Bucks County with her husband Joe. They are in the process of planning an 8-day walking vacation through Spain to experience beautiful landscapes as well as local cuisine, wine, culture and people.

Q & A with Melissa:

Q: What got you first interested in the geo-world?
A: I started my college career at Drexel thinking that I wanted to be a structural engineer (specifically, to design bridges). However, after taking Engineering Geology and Soil Mechanics, I had a change of heart and knew that the geo-world was where I wanted to be.

Q: What is your favorite thing about your Alma Mater?
A: The professors in the Civil Engineering Department (especially those who taught the geo-related courses), as well as the network of Drexel Alum that I have developed working relationships and friendships with throughout the course of my education and career.

Continued on the following page...

We will continue to feature DVGI members in upcoming issues of the Newsletter. Please feel free to contact any of the board members with any general comments or member spotlight suggestions. Board member email addresses can be found on Page 4.
MEMBER SPOTLIGHT

Con’t
Melissa Logan Gillespie, P.E.
TRC Engineers

Q: What is something about yourself that would surprise us?
A: I’ve never eaten a piece of pizza or pasta involving red sauce or any tomato ingredient. This is despite that fact that both my parents are of full Italian descent.

Q: What are three career lessons you’ve learned thus far?
A: 1) The greatest growth, both personally and professionally, comes when you push yourself outside of your comfort level; 2) mistakes happen despite our greatest efforts to avoid them, they can create extremely difficult situations, but we often learn the most from them; and 3) work isn’t so much like work when you enjoy what you do and the people that you do it with.

Q: What is your favorite thing to do in Philadelphia?
A: If I had to pick just one, I’d say exploring the restaurants in various Philadelphia neighborhoods. I also enjoy taking advantage of the diverse live music offerings at various venues throughout the City and going to Phillies games (Joe and I are not nationals fans despite the photo!)

Q: What aspect of your job do you enjoy the most?
A: Having the opportunity to work collaboratively on projects involving unique geotechnical challenges and solutions.

Q: What is the most challenging aspect of your job?
A: Successfully managing personalities and expectations.

Q: What do you like most about TRC?
A: The people I work with as well as the diversity of project types and locations. In addition to supporting our own external Client base, our Geotechnical Engineering group has the opportunity to support various practices within TRC’s Infrastructure, Environmental, Power and Oil & Gas sectors. In doing this, we routinely work with an amazing group of engineers on diverse project types across the U.S.

Melissa and her husband, Joe

We will continue to feature DVGI members in upcoming issues of the Newsletter. Please feel free to contact any of the board members with any general comments or member spotlight suggestions. Board member email addresses can be found on Page 4.
A lone drilling rig hammered away on a muddy, puddle-laden King of Prussia, Pa. construction site on an unseasonably cold April morning. Future residents of the 5-story, 248-unit suburban Philadelphia apartment complex would someday shuttle back and forth to the various amenities in this bustling community, but no structure could rise from the ground until Compaction Grouting Services, Inc. (CGS) performed its namesake service to tame the poor subsurface conditions.

Media, Pa.-based CGS was retained by local engineering firm Earth Engineering, Inc. (EEI) and worked as a subcontractor to Western New York-based LECESSE Construction Services. CGS, a DBE-certified ground improvement contractor with a 20-year track record of geotechnical construction experience in Pennsylvania, New Jersey, Delaware, and Maryland, has extensive experience correcting the precarious subsurface conditions that plague the King of Prussia area.

**Why Compaction Grouting?**

“This whole town is basically a big sinkhole,” quipped CGS Supervisor Steve Oxendine. His experience has been that addressing subsurface issues during pre-construction is far more cost-effective than doing so post-construction.

EEI confirmed that this site was a candidate for compaction grouting following test bores in 2004 and 2016. This sinkhole-prone parcel is underlain by dolomite, a type of carbonate rock prevalent in King of Prussia’s geology.

The compaction grouting process consists of injecting a low-slump, low-mobility, soil-cement grout at high pressures to compact loose, coarse-grained soils and densify and/or displace soft fine-grained soils. A grid-like pattern – pre-determined by a geotechnical engineer – is positioned across the site. Grout columns are then injected into the hole locations within the pattern. Compaction grouting is ideally suited for sinkhole remediation, foundation settlement reduction, and soil preparation pre-construction by strengthening soil to withstand higher bearing pressures. It offers a cost-effective alternative to deep foundation systems and underpinning methods.
The apartment building complex will have a 65,000-square-foot footprint founded on spread footings with a partially underground parking garage. CGS drilled 18,061 linear feet at more than 626 hole locations and pumped in 820 cubic yards of grout in total. Some areas of the footing will rest directly on bedrock. When rock was 6 feet or less below the surface, it was dug out and backfilled with lean concrete. CGS helped to prevent excessive excavation by test drilling in zones where it was suspected that 8-plus feet of digging would be required because of a rock drop-off. In those cases, compaction grouting was a better choice.

Determined the location of additional holes was a fluid process that involved ongoing test drilling and coordination with EEI, according to Senior Project Manager Justin Terry. “It wasn’t hard set,” he explained. “We were working closely with and feeding the engineers a lot of drilling information to help determine if additional areas needed to be grouted.”

Navigating Crowded, Muddy Site Conditions
The nature of compaction grouting means that CGS crews are accustomed to muddy jobsites, but an unseasonably cold start to Spring in Pennsylvania with multiple Nor’easters turned the site into a mud basin. Further complicating matters was that CGS crews were frequently working in areas of low relief, causing them to deal with most of the site’s surface water runoff including rain, snow, and a tire wash.

CGS Vice President Mike Miluski uses words like lake, pond, and swamp to describe site conditions. He recalled one of the firm’s trucks halfway immersed in one such body of water. CGS relied on dewatering equipment to dry out the puddles and air compressors to blow off the snow. “We always deal with mud,” Steve Oxendine said.” With compaction grouting you never have ideal sites.”

A large excavator dug a trench in one corner, an idling articulated hauler had its tires blasted with a pressure washer, and oversized truckloads with corrugated pipe rumbled down the road as members of the CGS crew made their way back to the drill rig. While the foundation work was unable to start until CGS finished compaction grouting, the project site was crowded with various other trades trying to get a head start where they could.

A Multitude of Tightly Spaced Holes
The site was crowded by more than workers and equipment. The sheer volume of holes in such a tightly packed area meant that CGS crews would not be able to address every other hole. No hole within 8 feet could be touched within 12 hours so they were required to grout every third hole. Most of the grout ports were clustered on the southern and northeastern quadrants of the site.

Steve Oxendine, whom supervised the project from the front lines, considered managing the quantity of holes in the condensed area the greatest challenge. “The paperwork was daunting,” he recalled, noting that it was critical to cross-check the plans and survey stakes to stay organized. Keeping the stakes in place and undamaged was also difficult as the various trades on site navigated the obstacle course on foot and in machinery.

Drilling into Bedrock and Casing Holes
CGS subcontracted the lion’s share of drilling to East Earl, Pa.-based Brubacher Excavating, which supplied a manned Atlas Copco ROC D7 Drilling Rig. The rig was constantly pounding away to pre-drill the holes and install temporary steel casing.
The first step was to drill 3.5-inch-diameter holes. The next step was to drive in 2-inch inside diameter temporary casing with a bullet point on the bottom. The tip was then intentionally knocked out by yanking a rope from ground level to avoid clogging the hose with grout. It remains in the ground indefinitely. The casing was then pulled out, cleaned, and reused repeatedly.

The original spec required CGS to drill 3 feet into bedrock, which lied at varying depths from 15 to 60 feet. Drilling was cut off at 50 feet if no rock was encountered. Excavation on one corner of the site turned up 5- to 6-foot boulders, some of which jutted out from stockpiles and embankments around the site. CGS had to bore an extra 2 feet in this zone to ensure the drill was hitting bedrock.

**Mixing and Pumping Grout**

“It’s (grout) tightening up the soils as we pump,” Steve Oxendine hollered over the machine gun-like hammering of a nearby drill. “The pressure surge (maximum injection pressure), on this job is 500 psi. That’s a lot of pressure pumping all that grout down in there and compacting that soil.”

The site contained a mix of dense clay soils and softer karst conditions. Mike Miluski noted that a normal soil profile would typically increase in strength with depth. With karst conditions, the dense clays are up top and the weaker soils are just above bedrock because of water flowing above the rock formation.

There is no surefire way to determine exactly how much material a hole will take. The variables include depth to bedrock, soil conditions, and groundwater level. The refusal criteria on the site required CGS to pump grout ranging from 54 cubic feet per foot at 50 psi or below, 27 cubic feet per foot at pressures between 50 and 150 psi, and 5 cubic feet per foot at pressures from 150 to 500 psi.

CGS crews pumped the grout in from 100 to 500 psi, although the average was 300. More challenging locations took 5 cubic feet on average while locations that encountered the unvarying terrain required about 2 cubic feet per foot.

“The higher psi tells you that the soils are pretty good or you’re in rock,” Mike Miluski explained, adding that a significant number of holes took less grout since the rock was higher than anticipated. “The soil has been relatively good and that helped our schedule.”

CGS generally pumped 20 to 50 cubic yards of grout per day while utilizing 2 to 3 crews. The grout was produced using a mobile mixer with sand and cement in the hopper and a 500-gallon water tank hooked up to a Putzmeister grout pump. This pump is specifically designed for injecting grout at high pressure. “We were averaging between 15 and 20 holes a day.” Oxendine recalled. “At one point we had 3 pumps and 2 mobile mixing trucks going at the same time because some of these holes were 50 to 60 feet deep.”

The mix of water, cement, and sand is crucial in compaction grouting, according to Mike Miluski. The specification called for a 300-psi compressive strength and 8 to 10 percent cement, a relatively standard specification. Due to
CGS’ experience he stressed that the gradation of the mix is what really counts. “The more cement you have, the more it travels in the ground,” he said of the grout. “You want it to be like a growing mass.” #8 crushed stone (3/8- to 1/2-inch) was added to prevent the viscous grout from seeping into rock fissures.

**Bidding Lump Sum to Mitigate the GC’s Risk**

“This isn't a unit job,” Mike Miluski said, looking out over the site. “There’s serious risk involved in giving a hard number.”

It was initially a unit price project until CGS offered to bid it lump sum as the company does on many compaction grouting projects. This helped to mitigate risk and instill assurance and confidence for its western New York-based general contractor LECESSE.

Justin Terry agreed. He believes there are other subcontractors that could have done the work, but doubts that they understand compaction grouting well enough to bid the project lump sum.

“It’s really a crapshoot,” he explained. “How deep are we going to have to drill? How much volume (of grout) are the holes going to take? As an owner who’s not as familiar with it, it’s scary for a lot of them to think that they have the exposure of a possible $100,000 swing.”

It is not uncommon for compaction grouting projects to have 10 to 20 percent swings when comparing estimated drilling and grout volume quantities to actual quantities. Spread over a large magnitude (600-plus grout locations), the associated additions and deductions associated with unit costs can kill a project budget or sink a contractor. By providing a lump sum, CGS eliminated the risk for the owner while betting on its own knowledge, experience, and production.

**Finishing Ahead of Schedule**

Project delays up front put CGS on the site in February at the tail end of a cold winter that would bleed into a chilly spring. The crew geared up, working through snow, rain, and chilly temperatures amidst knee-deep puddles, mud, and the occasional snow mound.

In addition to schedule adjustments, tight working quarters, and excessively muddy conditions, a sinkhole opened where foundations were founded on rock in an area where grouting had not been performed. Due to experience and CGS’ onsite mobile mixing grout trucks, they were able to immediately mitigate this sinkhole by adjusting the grout mix to pump in high-mobility grout. There was no need to wait for cement delivery or a neat cement mixing truck to arrive onsite.

The pressure stayed on as the contractor that would be constructing the footers bore down on the CGS crews. Despite the challenges, CGS delivered the job a day earlier than expected. This was meaningful on a 40-day project with the aforementioned variables. Not to mention, CGS took on an additional 13 holes at the engineer’s request and improved upon its track record of completing a job on time.

“It’s a big job, but we try to do it as fast as we can,” Steve Oxendine said of the 12 workers that make up his crew. “We work long hours and we get it done.”

*Backpressure from the soil forced the grout out of the pipe.*

This Article was submitted by CGS, a DVGI Corporate Sponsor. Does your firm have an article to share? Submit articles for consideration to the Newsletter Editor.
5th Annual DVGI Golf Outing

On June 22nd, 45+ DVGI members and friends participated in the 5th Annual DVGI Golf Outing at Jeffersonville Golf Club. The weather was par for the course of this past summer, but with cold refreshments and warm company, a fun afternoon was had by all. After the round of golf, participants gathered for dinner, drinks, and prizes. It was a great event to get to socialize with DVGI members and friends at a more informal gathering! Many thanks to Russ Preuss, DVGI Vice-Chair, for all of his efforts to make this event a resounding success!

Also, we extend special thanks to our corporate golf sponsors...

We raised over $4,000 for the DVGI Scholarship fund, our largest total to date!
EVENTS AND CONFERENCES

Deep Foundations Institute
43rd Annual Conference
Hilton Anaheim | California | October 24-27, 2018

IFAI Geosynthetics Conference
Feb. 10-13, 2019 | Houston, TX USA
Marriott Marquis Houston
GeosyntheticsConference.com

Geo-Congress 2019
Philadelphia, Pennsylvania | March 24–27, 2019
EVENTS AND CONFERENCES

October Dinner Meeting -
Lessons Learned on Vine Expressway Project (1 PDH)

Join us to learn about PennDOT’s $65 million Vine Expressway Bridge Replacement Project that’s nearing completion and a year ahead of schedule. Pennoni’s James Pezzotti, PE will share his design and construction experience, including accelerated schedules, accommodating large public events, and the maintenance and protection of traffic through the heart of Philadelphia.

Questions:
Please feel free to contact Kazi M. Hassan (215-254-7720 or kazihassan@pennoni.com) for any general questions.

Speakers: James J. Pezzotti, PE (Pennonni)

Date/Time: Thursday, October 11, 2018
Social 5:30 PM; Dinner 6:30 PM; Presentation 7:30 PM

Location: Maggiano’s Philadelphia 1201 Filbert Street Philadelphia, PA 19107

Fees: Members $40; Govt Employees and Students $20; $50 after RSVP Deadline.

RSVP: RSVP: By Thursday, October 4, 2018 at 5:00 pm

SEI Presents - Nonlinear Time History Analysis in RFEM with Machine Induced Vibrations (1 PDH)

This presentation will apply a nonlinear time history analysis on an industrial steel structure with consideration of machine induced vibrations.

Questions:
Please feel free to contact Niki Eno (610-594-2460, Extension 3028 or neno@figgbridge.com) for any general questions.

Speakers: Amy Heilig, P.E. (Dlubal Software, Inc.)

Date/Time: Thursday, September 27, 2018 - 5:30 pm

Location: Valley Forge Casino, 1160 First Avenue, King of Prussia, PA - Parkview

Fees: General Admission $50; Government $35; Students $35

RSVP: RSVP: By September 21, 2018 at 5:00 pm,
Website: www.sei-philly.org, Link For Online Registration: https://www.picatic.com/event15344175327991