Geo-mélange

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DATA FORENSICS
The Tragically Misunderstood Rigid Inclusion

Mary C. Nodine, PE, A.M.ASCE, is a geotechnical poet and a project engineer with GEI Consultants, Inc. in Woburn, MA. She can be reached at mnodine@geiconsultants.com

They tell me of their troubles, Foundation friends of mine. The footings speak of poor compaction As though it is a crime.

The piers complain their skin friction Is underestimated, While piles claim that driving noise Complaints are overrated.

Patiently I listen To them all – I can relate To some or other aspect Of each element’s fate.

But the truth is, sharing qualities With each one of my peers Won’t foster trust like you would think – Instead, it brings on fear.

My concept is quite simple: Deep in soft ground I go, Thereby reducing settlement As I bear part of the load.

But engineering sometimes seems An all-or-nothing game. The freely-flowing questions Are impossible to tame:

If we’re improving soil, How then do we measure The capacity for bearing Of the clay and grout together?

And no code has been written That acknowledges there are Legitimate deep foundations Without casing, cage, or bar.

Alone, I don’t conform, But as a ground improvement system, My concepts of design hold true To engineering wisdom.

Because I’m rather stiff Compared to clay (to put it lightly), When aided by dense aggregate Above, compacted tightly,

I attract most of the load And bring it deep to better ground, Using skin friction and arching concepts: Verified and sound.

I can only dream that one day I’ll adorn the hallowed pages Of ACI and AASHTO, To live on through the ages.

Until then, I hope good folks Find flexibility - Open minds to innovation but Maintain integrity.
CELL CRETE
I do not think there could be a better representation of the Coefficient of Consolidation than Mary Nodine’s poem. I have been involved with vertical drain solutions for over 45 years, and the discussions over determining the Coefficient of Consolidation have remained the same with the exception of an increasing number and complication of testing (which I am convinced are not much better than using the liquid limits to determine the Coefficient from conversion graphs found in the NAVFAC manual that was published before I finished graduate school (it has been revised since then, but not the graph).

The great thing about geotechnical engineering is that it is not yet an exact science, and that was the reason I chose to concentrate more on soil mechanics (that is the term used when I was in school) courses in graduate school. Listening to lectures by Arthur Casagrande and discussing projects with his brother Leo and a younger Chuck Ladd, I found that knowledge and experience were as important as formulas and test results.

M. James Warren (Jim)
HB Wick Drains
Melbourne, FL 32940

Author’s note: I am really glad you enjoyed the poem. My first wick drain design was what inspired this poem several months ago, and I’m currently doing my second. It’s a great way to flex my settlement calculation muscles that have been out of commission since graduate school. The fact that geotechnical engineering/soil mechanics is not an exact science is a big part of what drew me to it as well. Soil and rock will always remain somewhat mysterious. I think it also makes for good poetic material.

Just a note to tell you that I have just finished a cover-to-cover read of the latest Geo-Strata (July/August), and this magazine seems to get better and better with each issue. You and your Editorial Board are ferreting out most interesting new stuff and presenting it clearly, interestingly, and in well-illustrated form. All of us readers owe you a big vote of thanks and appreciation. It is a real added value to my Geo-Institute membership.

University Distinguished Professor, Emeritus
Blacksburg, VA 24061
BENTLEY
The Last Word

The G-I currently has about 12,000 members and thousands of you may be wondering, “Who is this Camp guy?” To introduce myself, I thought I’d steal a segment from a fellow South Carolinian, Stephen Colbert – “Better Know Your President: Billy Camp.”

I am the youngest of four and the only son of a horse farmer and a nurse. I was raised in Franklin, VA, a town of about 7,000 in the Tidewater region. I received my undergraduate civil degree from the University of Virginia (UVA) in Charlottesville, VA and then entered the geotechnical engineering program at the University of Texas at Austin for my master’s. This was quite the juxtaposition. There were as many faculty members in the Texas geotechnical program as there were in the entire Civil Department at UVA. And, while my 1986 civil engineering graduating class at UVA numbered about 25, there were more than 60 students in just the geotechnical program alone at Texas. The small-then-large programs were a great combination for me and both Charlottesville and Austin were ideal places for a college student.

From Texas, I moved to a barrier island near Charleston, SC for my first professional job. Twenty-five years later, I am still at the same regional geotechnical firm S&ME. The seismic hazard and abundant soft ground sites make Charleston an interesting place to practice, and its historic charm, beautiful environs, and exceptional restaurants substantially add to our quality of life. My wife and I have raised our three sons here and have no plans to leave (except during a busy hurricane season when our barrier-island-lot elevation of +9-ft MSL seems precarious).

On to G-I business. I’d first like to thank our out-going President, Craig Benson, and out-going Past-President, Phil King. These two have a combined tenure of more than 14 years on the Geo-Institute Board of Governors and their service to our Institute has been exceptional. We will continue to benefit from Craig’s leadership, since he will remain as past president this year, but Phil is officially Governor Emeritus.

Another G-I member that deserves special thanks is Jean-Louis Briaud. Jean-Louis just completed his four-year term as president of the ISSMGE. Jean-Louis is a past-president of the G-I and his ISSMGE presidency actually began immediately following the six years that he served on the G-I Board. The G-I and ISSMGE are critically important to the geo-profession and his impact on both organizations has been monumental.

Thanks to the efforts of all those who have proceeded me, the G-I is in excellent shape (and I trust that the Board will not let me mess it up). Our publications and conference content are some of the best available in the geo-professional world. In the last five years, our student involvement has increased dramatically and the number of local G-I chapters, (now up to 34), is steadily growing. By the time this message is published, the G-I Board will have completed its strategic planning effort and the implementation of steps for improvement and maintenance will have begun. As always, we welcome your comments or suggestions and I look forward to hearing from many of you during the next year.

William M. Camp, III, PE, D.GE, M.ASCE, Geo-Institute President
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Wikipedia defines a mélange as “a large-scale breccia, a mappable body of rock characterized by a lack of bedding and the inclusion of fragments of rock of all sizes, contained in a fine-grained, deformed matrix. Mélanges typically consist of a jumble of large blocks of varied lithologies.” So then what’s Geo-mélange? Well, like a geologic mélange, Geo-mélange refers to an issue of Geo-Strata that has a mix of geo-articles with no single theme. We used the same theme for a similar issue about 10 years ago after the first G-I Director and geologist, Carol Bowers, coined the term.

Based on his 25 years as a forensic geotechnical engineer, Pat Lucia, author of this issue’s guest editorial “Geotechnical Forensic Engineering in Defense of Geotechnical Engineers,” states that the most important factors contributing to failures are the lack of process in conducting geotechnical engineering studies and understanding the Standard of Care. He concludes saying that engineers of the future must learn the technical details of our profession and how to convey the exercising of judgment in a way that quantifies the geotechnical practice of engineering.

When catastrophic events affect the infrastructure, geotechnical triage, like its medical equivalent, can be used to apply limited professional resources to sites where timely intercession can make the biggest difference. In “Geotechnical Triage,” Don Dwyer describes the process used by the New York State Department of Transportation and examples of its use following Hurricane Irene and Tropical Storm Lee.

The design of a rock cut slope can present many unique and challenging opportunities to manage risk. “Innovative Protection for a Railroad Slope” by Walter Kutschke describes how design, construction, and performance monitoring were integrated for a new freight railroad alignment traversing a geologic unit that is particularly troublesome and susceptible to landsliding.

Safety is critically important, but can safety in the workplace be emphasized so much it loses its punch? In his article “A Culture of Unconditional Dedication to Safety,” Randy Neuhaus describes how a tragic event made safety an unqualified, uncompromising, unconditional element of his firm’s culture.

In 2011, the G-I Board of Governors created a focused initiative to enhance diversity within the G-I membership and within the community of geoprofessionals. The G-I’s Diversity and Inclusion Committee was kicked off in 2012, and its first major program was held at the 2013 Geo-Congress. The Committee highlights what they’re doing and why diversity is important in “Diversity in Geo-Engineering.”

In his second article about the business of geotechnics, “Categories and Characteristics of E&C firms Employing Geoengineers,” Rudy Bonaparte describes how firms can be differentiated based on their size and practice model in terms of technological approach, business culture, and practice and client focus.

This issue presents some other interesting content. For example, the GeoCurmudgeon offers his perspective on what makes a real good sales person in “Sell. Sell. Sell.” And our GeoPoet, Mary Nodine authors an ode about “The Tragically Misunderstood Rigid Inclusion.”

Transition

After eight years, Cathy Bazan-Arias, PhD, PE, FASCE, has decided to hang up her Geo-Strata editor responsibilities. We thank you Cathy for your dedication and friendship and wish you much success in your future pursuits.

The authors and editors are pleased to bring this issue to you. Please send us your comments to Geo-Strata@asce.org or post your comments on the Geo-Institute’s Facebook page at www.facebook.com/GeoInstitute.
Based on his 25 years as a forensic geotechnical engineer, Pat Lucia, author of this issue’s guest editorial “The Practice of Forensic Engineer,” states that the most important factors contributing to failures are the lack of process in conducting geotechnical engineering studies and understanding the Standard of Care.

The Borehole Shear™ test is the definitive test for evaluating slope stability, landslide repair methods, foundation bearing capacity, and soil strength behind existing retaining walls. It is the fastest and most effective way to measure soil cohesion and friction angle on an effective stress basis, providing $c'$ and $\Phi'$ measurements in minutes instead of hours.

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Meet the New Geo-Institute 2013-2014 Board of Governors

It is with pleasure that the Geo-Institute announces its latest updates to its 2013-2014 Board of Governors roster. The following changes officially took place at the end of the October 18, 2013 Board meeting in Reston, VA.

**President**
William M. Camp III, PE, D.GE, M.ASCE
S&ME, Mt. Pleasant, SC

**New Governor**
Gary H. Gregory, PhD, PE, D.GE, M.ASCE
Gregory Geotechnical, Stillwater, OK

**Immediate Past President**
Craig H. Benson, PhD, PE, D.GE, NAE, FASCE
University of Wisconsin, Madison

**Existing Governors**
Barbara Luke, PhD, PE, D.GE, M.ASCE
University of Nevada, Las Vegas, NV

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Allen Cadden, PE, D.GE, M.ASCE
Schnabel Engineering, West Chester, PA

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Patricia J. Culligan, PhD, M.ASCE
Columbia University, New York, NY

Kord Wissmann, PhD, PE, D.GE
Geopier Foundation, Inc., Davidson, NC

Philip G. King, PE, D.GE, FASCE completed his term on the Board, most recently serving as immediate past president. We thank him for his numerous years of service to the Board, the Geo-Institute and its membership.
BRAYMAN
As I See It: Geotechnical Forensic Engineering in Defense of Geotechnical Engineers

I have been involved in forensic engineering for over 25 years of my more than 40 years as a geoprofessional, investigating over 50 geotechnical failures, typically as an expert in defense of geotechnical engineers. Evaluating the cause of a geotechnical failure has always been exciting, at least at the beginning. Delving into the technical aspects of a failure is often like solving a murder mystery. Unfortunately, at the end of the mystery, the autopsy is far too often being conducted on the geotechnical engineer. Geotechnical forensic investigations are seldom intended just to advance professional knowledge; rather, they are, unfortunately, typically intended to assign responsibility for damages caused by the failure. For the geotechnical engineer, this is always an evaluation of their compliance with the “Standard of Care” (SOC) and ultimately the degree to which they may be negligent.

In developing insights into the factors contributing to geotechnical failures, I realize that 50 data points is a small percentage of the projects built over the past 25 years. However, certain factors consistently contribute to a failure, allowing an opportunity for insight that will contribute to improving the professional practice of geotechnical engineering. In my experience, the single most important factor contributing to failures is lack of process in conducting the geotechnical engineering studies. Almost universally, I find a lack of documentation and a lack of formal peer review of all aspects of the work.

The second major factor is a lack of understanding by geotechnical engineers on what constitutes the SOC. Often, the engineer learns the concept of SOC when it’s explained to them by their lawyer or, almost equally as bad, they define the SOC as what they do without regard to their peers. Nearly every geotechnical report includes a disclaimer that work described in the report was done within the SOC without the author understanding what that term means or somehow believing that including that statement makes it true and absolves them from liability.

In geotechnical engineering, the definition of SOC is more subjective than in other engineering disciplines due to the nature of working in the subsurface. Every geotechnical engineer relies on their judgment on every project. When a failure occurs, the engineer’s judgment is questioned on every facet of the work. Too often, in my experience, the engineer’s explanation of the application of their judgment comes across as arbitrary and after the fact, particularly when the explanation is given to a lay jury or judge without the supporting documentation in the files.

Geotechnical engineers’ decisions are seldom arbitrary; they are typically backed by years of experience, knowledge of local geologic conditions, past performance of similar structures in similar conditions, and other factors. The problem lies in the lack of documenting that experience at the time an assumption is made in the project. Why are three borings okay when the plaintiff’s expert defines the SOC as 10 borings? As a defense expert on behalf of the engineer, I can argue the reasons why three borings are within the SOC, an argument that sounds better to a lay jury or judge when the assumption behind it was included in the report or in the files at the time the judgment was applied.

The problems I see in geotechnical engineering don’t lie in our ability to get samples, test them, and perform analyses. When we have problems in geotechnical engineering, they are typically the result of the decisions we make about where to sample, what to test for, what parameters to use in analyses, and how to interpret the results—in other words, the application of our judgment. Too often, problems occur as a result of judgment exercised in a vacuum without the vetting that occurs in the process of peer review and documentation.

No amount of documentation will prevent all claims from occurring, but when the process of engineering is properly done and properly documented, it will far reduce the number of claims and make the defense of those claims much easier. Engineers learn the technical details of engineering at universities quite well, but not the practice of engineering; teaching that has always been considered to be the responsibility of business. The engineer of the future must not only learn the technical details of our profession but also how to convey the exercise of judgment in a way that quantifies the geotechnical practice of engineering.

Patrick C. Lucia, PhD, PE, GE, recently retired from consulting, where he served as the Chairman of the Board for 12 years, and now Chairman Emeritus, of Geosyntec Consultants. He can be reached at plucia@ucdavis.edu
MONOTUBE
In medicine, triage is the process of determining the priority of patients’ treatments based on the severity of their conditions. Triage rations patient treatment efficiently when resources are insufficient for all to be treated immediately. When catastrophic events affect the infrastructure, geotechnical triage can be used to apply limited resources, in this case geotechnical expertise, to those sites where timely intercession can make the biggest difference. Because decisions need to be made quickly and there’s often no time to refer a problem to headquarters, having experts in the field to address the problem is important. The New York State Department of Transportation (NYSDOT) has geotechnical experts based throughout New York who can mobilize quickly to address geotechnical problems resulting from floods and storms.

As emergency responders have developed protocols to handle various types of trauma, NYSDOT geotechnical engineers have developed generic approaches to common failures that occur during storm, flood, and abrupt spring melt events—washouts, slope erosion, rockfalls, landslides, mudslides, and scour. These generic strategies are flexible enough to be modified in the field to suit actual conditions that can vary considerably from site to site. This approach has been used for decades but has gained renewed attention following Hurricane Irene, Tropical Storm Lee, and Hurricane Sandy.

**A Different Mindset is Required**

Geotechnical design engineers are tasked with developing effective design solutions at the least cost. This requires site investigation, subsurface explorations, testing, and analysis. Geotechnical triage requires a different mindset for a designer to produce decisions quickly and requires knowledge of “field soil mechanics.” Geotechnical engineers need to know how different granular materials behave and when to use, and when
not to use, geotextiles. They need to recognize the difference between distress that just appears to be serious and distress that indicates more serious issues.

For example, a shallow landslide can cover the road with debris but it can be cleaned up quickly. After the slope is regraded and protected with a blanket of slope protection, the road can be reopened. Alternately, cracks emerging at the top of a slope and bulging past the slope’s toe may not look important to the untrained eye but may indicate a deep-seated failure that could move suddenly during or after the event and create a dangerous situation.

**Gather Information**

Knowledge, experience, and training are crucial attributes for the field geotechnical engineer. In NYSDOT’s Geotechnical Engineering Bureau (GEB), before geotechnical engineers can perform geotechnical triage they must have years of experience in designing retaining wall and bridge foundations, analyzing settlement and stability of embankment foundations, performing forensic investigations, and designing slope remediation treatments.

The geotechnical engineer must gather facts and site information first upon arriving on site beyond the geotechnical features because there’s always more to a solution than just the geotechnical aspects. Other people on site, such as bystanders and first responders, can provide valuable input. They should be consulted about what they have observed. In addition:

- All conditions should be surveyed regarding what is happening at the moment and what is likely to happen soon as the event progresses.
- Conditions must be examined safely from different angles because geotechnical triage requires more attention and effort than a “windshield survey.”
- Remedial options depend on what materials and equipment are available. Repair timing must be met to restore an acceptable level of service. This includes answers to questions such as “Where are the gravel and stone sources?”, “What areas can be used to waste excavated material?”, and “Are there any environmental restrictions?”
Assess Priorities

Geotechnical triage means the engineer may need to settle for a quick fix and identify approximately how long a treatment might last. Sometimes it is acceptable, or even desirable, to implement a short-term fix and to plan for a more permanent fix in a later contract. This strategy may open up options that would not otherwise be available; for example, temporarily filling in an abandoned historical canal to act as a berm for a slope above it until a permanent solution can be designed and constructed. At other times, the immediate fix also can serve as the long-term solution. Suggestions for the geotechnical engineer include:

Focus on the major problems at important sites first. The geotechnical engineer should not spend a lot of time on minor problems at important sites or on major problems at unimportant sites. The engineer should find out how essential the feature is. Ask if it must be repaired right away or if it can be partially or fully closed for a time.

Balance speed versus risk. The experienced geotechnical engineer will know when a quick and effective solution can be implemented with reasonable risk, cost, and time, and when a more detailed and considered approach is necessary.

Determine what is needed. Different roads and bridges have different values. Some can be closed without major repercussions. Others may need to remain at least partially open at all costs, using alternating one-way traffic. Some facilities must be opened as soon as possible. The geotechnical engineer should work with the maintenance engineer to deliver the resources to the right place at the right time.

Analysis and Recommendation

With geotechnical construction and repair work, the order of operations is important. For example:

- Remove the failed material.
- Re-establish drainage.
- Cut in slope trenches from the bottom up to keep from working in water all the time.

In wet conditions, the engineer should use stone wherever possible, as compaction of granular material will be impractical. The engineer also should try to use what is available and on hand wherever possible. The ideal materials may not be readily available, so decide if accessible materials can work. Often, inelegant and conservative solutions are preferable due to easier and speedier implementation. The brute-force approach may offend designers accustomed to optimizing designs, but easily implemented solutions are preferable in an emergency situation.

Geotechnical engineers sometimes are asked to make an assessment of risk, such as when to close a road and when to keep it open. This is a classic risk/reward evaluation, but in the geotechnical arena. For example, engineers may be asked to look at an actively failing slope and be able to estimate how long the road can remain open.

The geotechnical engineer needs to trust the maintenance people because they have the best sense of available resources and of the Department’s requirements. If they suggest closing the road, that’s probably the right decision. They have a finely honed sense of what they can and can’t do. Once they decide that a particular problem is beyond their current resources, help them determine what else needs to be done to close and to monitor the facility. When this is done, move on to the next site.

When recommendations are needed eventually, it is important to be decisive. Ultimately, the geotechnical engineer may be the most qualified person in the field to make a judgment. Be conservative when appropriate but not overly so. The geotechnical engineer should make the decision quickly and then move on. It is good to be accurate, but it is at least as important to be fast.

Establish Monitoring

An ongoing failure or changing site condition will call for monitoring. Monitoring should be implemented quickly and simply so that specialized training is not required to make measurements. There is rarely time to reap the benefit of sophisticated instrumentation because it requires time to install, to establish an initial reading, and to produce successive readings to show a trend. Simple, temporary monitoring schemes that employ simple features as trigger points, such as spray paint, PK nails in pavement, line of sight, etc., as references are more useful. Also consider using existing features that can be easily measured or observed, such as existing cracks or trees. A protocol is needed to describe how often measurements are taken and how often, and to whom and in what format results are to be reported.
Monitoring is useless without a corresponding action plan. Make the decision points easy and the resulting action clear. Some examples might be: “If that tree with the red ribbon tied around it falls over, close the road” or “Measure the width of the crack marked with paint every six hours. If it exceeds three inches, close this lane and call.” Plans to follow up should be formulated as needed.

**Geotechnical Triage for Hurricane Irene and Tropical Storm Lee**

Hurricane Irene slammed into New York on August 28, 2011. Of all the places affected by Irene, East Durham, NY, had the seventh-highest rainfall at 13.3 inches, and Sayville, NY, had the fourth-highest wind gusts at 91 mph. Tropical Storm Lee struck soon after, hitting New York on September 4, 2011. Lee’s heavy rain was compounded because Irene’s floodwaters had not fully receded and the ground was saturated. Some roads and bridges that were damaged by Irene, including newly completed repairs, were knocked out from the one-two punch of the storms.

NYSDOT’s geotechnical engineers and technicians were prepared for both storms. The GEB’s lab generated a list of granular material suppliers from which it previously received samples to test. This list could be used by maintenance and construction personnel to obtain granular material for anticipated repairs. Contact information for geotechnical engineers was shared with executive management; the engineers were assigned days and times to be on call. All geotechnical engineers kept their cell phones charged and their personal protective gear with them at all times.

Engineers also were ready to take personal cars as needed because their assigned state vehicles are powered by compressed natural gas (CNG) and there was a possibility that the CNG fueling stations could be knocked out. They had paper maps in case GPS was not available everywhere, phone numbers for and locations of maintenance facilities in each county, regional contacts, and other resource information. They were instructed to call in to the main office twice a day to provide status updates. The GEB provided expertise to towns and counties as well and, by knowing locations of field personnel, was able to reroute engineers to trouble spots in response to information received from the local municipalities.

Up-to-date information on road and bridge closures was provided by the Statewide Transportation Information and Coordination Center (STICC). The online versions of local newspapers and local news networks helped in tracking the changing status of roads and bridges. The geotechnical engineers worked closely with maintenance staff in each affected area because they had the best knowledge of which roads were closed and they knew alternate routes to get around washouts and blocked roads.

In many cases, the short-term repair was to become part of the long-term solution, so it was important to think past addressing the initial failure. As an example, emergency workers had to transition from a temporary repair to SR 103 over the Mohawk River at Lock 9 to a permanent fix that was under design. A berm of stone and gravel was pushed out into the river to divert the flow away from the slope supporting SR 103. Later, this berm was incorporated into permanent fill that permanently cut off the river flow around the canal lock.

**SR 103 over the Mohawk River at Lock #9.**
Examples of Geotechnical Triage

Recommendations were delivered via e-mail several times a day. The terse style of communication delivered just the right amount of information while still providing evidence of establishing monitoring, interviewing on-site personnel and using materials that are readily available.

- Rt. 9 RM 2101 – “Road is open. Approximate 6-ft-deep washout at end of existing retaining wall affecting the shoulder. I recommend digging a key at the toe of slope (3 ft deep x bucket width wide [2 ft]). Place a layer of 50/50 mix of size 1 and 2 stone to cover underdrain pipe. Place medium stone at toe and in key. Slope back with light stone. Chink in light and medium stone with gravel and shoulder backup.”

- Rt. 73 RM 1439 – “Stone has been placed. A 40-ft-long, 6-in.-deep crack has developed east of the stone fill. We have spray painted the end of the crack to monitor the length. Crack existing at guide rail.”

When recommendations are needed…it is important to be decisive. Ultimately, the geotechnical engineer may be the most qualified person in the field to make a judgment.
The Important Role of the Geotechnical Engineer

The geotechnical engineer’s role in the overall triage scheme is adjunct. Maintenance forces see their roles in emergency response as the triage experts, and they are. The geotechnical engineer can be an important resource but the maintenance engineer bears the ultimate responsibility for the safety and function of the roads and bridges. If geotechnical engineers use their expertise to help the maintenance forces do their job quickly, effectively, and safely, they will have fulfilled their roles. Having an experienced and knowledgeable in-house geotechnical engineering staff is vital to responding quickly and safely to emergencies using geotechnical triage.

In many cases, the short-term repair was to become part of the long-term solution, so it was important to think past addressing the initial failure.

Don Dwyer, PE, is an associate soils engineer for the Geotechnical Engineering Bureau of the New York State Department of Transportation in Albany, NY. Mr. Dwyer is head of the Highway Design and Construction Section, which provides geotechnical support and quality assurance for all Department projects, from scoping through design and construction. He can be contacted at Don.Dwyer@dot.ny.gov

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Design with community in mind
Risk and Performance of a Rock Cut Slope

By Walter G. Kutschke, PhD, PE, M.ASCE

Rock cut slope design can present many unique and challenging opportunities to manage risk. Landslide-prone and moisture-sensitive strata undoubtedly heighten the awareness of risk management. The Keystone Buildout project, completed within the rural and mountainous terrain of southwestern Pennsylvania, provides an excellent example of potential risks related to rock cut slope design. A proposed 5.4-mile new freight railroad alignment would traverse a geologic unit that is particularly troublesome to this region and has been credited with several thousand recent and historic landslides. Events leading up to the project’s completion presented an opportunity to implement geotechnical risk management approaches and provided valuable lessons regarding risk management in projects with challenging geology.

The new alignment connects two existing rail lines in order to provide a more efficient route for delivering coal to an electrical power generating facility. Earthwork involved approximately 1.5 million cubic yards of excavation, with cut slopes as high as 150 ft and fill slopes as high as 45 ft. A unique aspect of the project was the use of a shotcrete slope protection system (SSPS), an extension of the soil nail wall construction technique. This system was used to protect moisture-sensitive mudrocks exposed in the cut slopes, allowing the use of steeper slopes. The Keystone Buildout is perhaps the largest known application of this particular slope treatment, involving roughly 2,800 cy of shotcrete, 2,340 individual rock anchors, and 134 subhorizontal drains.

Redbeds

Soil conditions along the alignment consist of residual and colluvial deposits that vary in thickness from 1.5 ft to 28 ft. Beneath the overburden, the project exposed the horizontally bedded Pennsylvanian-aged sedimentary rock units of the Conemaugh Group. Strata consist of a cyclic series of strong and weak rocks composed of sandstone, siltstone, limestone, coal, and mudrocks (i.e., shale and claystone). These strata exhibit considerable horizontal and vertical variation in strength and deformability, but tend to exhibit vertical repetition of behavioral characteristics.

A classic feature of the Conemaugh Group is the presence of mudrocks, particularly massive claystone layers known locally as “Pittsburgh Redbeds.” The claystone units are generally soft, weak, and highly erodible. Rudimentary slake durability testing indicated that these strata would disintegrate rapidly to form red-brown sandy, silty clay of medium plasticity when soaked in water, often completely disintegrating to a soil matrix within a matter of minutes.

Aside from their moisture-sensitive characteristics, the claystone units were also penetrated by a myriad of randomly oriented, closely spaced fractures, often with slickensided surfaces. These can be characteristic features associated with small relative...
movements attributed to lateral stress relief from valley downcutting associated with glacial activity. To further complicate matters, the subsurface exploration program also encountered laterally erratic stratigraphy between adjacent borings and existing topography that revealed abrupt changes in slope angle. The combination of slickensided surfaces, discontinuous strata, and unusual topographic features suggested that one of the most extensive and deep proposed cut sections may be located within a historic landslide having very significant dimensions.

Design Approach

The geologic environment presented several design challenges. Excavation would expose rock strata that exhibit highly variable rates of weathering both vertically and horizontally due to discontinuous strata. This condition made it impractical to consider employing different cut slope angles as a function of rock type. The issue of potentially reactivating a historic landslide by removing mass from the toe also needed to be addressed. The client sought design alternatives to evaluate risk-tolerance. Three levels of risk were defined:

- The lowest project risk involved purchasing additional right-of-way to accommodate traditional cut-slope design practices used in this region (3H:1V or flatter in claystone). However, acquisition of additional right-of-way would present political challenges with landowners and would significantly increase schedule and construction cost.
- Intermediate project risk entailed performing a more detailed site characterization program to better ascertain the potential for landslides and to further characterize discontinuous strata. However, it was recognized that such an effort would likely not be entirely conclusive despite the large costs involved.
- The greatest project risk involved designing the proposed cut slopes to fit within the available project right-of-way. Differential weathering would be addressed with the SSPS, which would seal the moisture-sensitive strata and protect against weathering and erosion. An instrumentation program would be implemented to monitor the slopes during and after construction. The design would also include contingency plans to address the possible occurrence of unacceptable slope movements. This option obviously presented significant financial risk, but could result in significant schedule and cost savings.

The design process moved forward using the greatest project risk alternative, the approach which was strongly favored by the owner. The intent of the SSPS was to minimize weathering of mudrocks so that a single cut slope template could be used throughout an entire cut section, regardless of the variation in rock type encountered. The SSPS made both the acquisition of additional right-of-way and the excavation of hundreds of thousands, if not millions, of cubic yards of additional material unnecessary, resulting in significantly reduced construction time and cost. However, because the SSPS did not alleviate concerns regarding the potential presence of a historic landslide, monitoring movements during excavation became of utmost importance.

Instrumentation Program

As a means to manage risk, the designers developed an instrumentation program that consisted of six inclinometers and seven standpipe piezometers, installed prior to construction. The program was developed to monitor three significant cut slopes along the proposed alignment. One of these cut slopes, the southwest cut, would extend as much as 102 ft below existing ground to the proposed track subgrade. Site characterization data suggested that this area had the greatest potential to encounter and/or reactivate a historic landslide, concerns which would prove to be well-founded.

All instrumentation was located 10 ft beyond the proposed cut slope crest, with casing depths ranging from about 95 ft to 165 ft. Inherent in the use of such a program is the necessity for deciding, in advance, of a positive means for solving the problems that the instrumentation data might reveal. For this project, the specific objectives of the instrumentation program were to monitor for:

- effectiveness of the subhorizontal drainage system, allowing this data to be used to direct the installation of subsequent drains;
• movement of cut slopes with respect to observed groundwater levels in order to guide subsequent drain installation, and;
• movement of cut slopes with respect to excavation activities to evaluate possible alternative grading or structural elements required to arrest any such movement.

The instrumentation program was considered critical for the early detection of any movements that might be associated with the reactivation of historic landslides.

**Construction Highlights**

Construction began in the spring of 2005. During excavation, the installation and testing for the SSPS followed general soil nail wall construction procedures. Although contract drawings revealed anticipated limits of SSPS application, field personnel guided the SSPS contractor based on the actual field conditions exposed by the excavation. System flexibility, one of the many benefits of SSPS, was essential as the challenging geologic environment began to reveal itself in the early stages of excavation.

Laterally discontinuous strata were exposed in the cut slope, requiring field decisions regarding SSPS application. Figure 1a shows the just-completed southwest cut, where the laterally discontinuous stratum was discovered. The available subsurface information had suggested only the presence of sandstone at this location, thus the slope was originally designed entirely as a rock cut slope. However, a large area in the center of the cut was found to be comprised of soil, and this area had to be flattened as much as possible during construction.

The project also required the installation of 134 subhorizontal drains in an effort to lower the groundwater level and thereby improve slope stability. The drain holes were drilled with the same equipment used to install the SSPS. Drains were installed at predetermined locations and as directed in the field. Flow rates for completed drains varied along the alignment from 0 to 80 gal/hr. The subhorizontal drains were generally most effective when installed at the base of fractured shale or sandstone stratum which was underlain by relatively impervious claystone.

Three inclinometers were located at the southwest cut, all of which were placed above the high side of the 102-ft-deep cut. The inclinometers indicated that the excavation was responsible for cumulative displacements of about 1 in. at ground surface. Two of these inclinometers indicated distinct movement at approximately 65 ft below original ground surface, corresponding to the elevation of the slickensided claystone in the test borings. The potential for reactivating a historic slide seemed to be an increasingly likely scenario and heightened risk management.

Deformation and groundwater pressure are the primary parameters that assist in the evaluation of stability during excavation. Time rate of movement is a particularly important parameter regarding inclinometer data. Plots of the inclinometer data from the southwest cut showed that the rates of slope movement asymptotically approached zero following completion of the blasting and excavation operations, with total displacements in the range of 0.25 to 0.50 in. As the movements slowed down and ultimately stabilized, it was decided that additional stabilization measures would not be required. Since the completion of excavation, these inclinometers have shown several cycles of minor movement and subsequent stabilization at relatively shallow depth within the soil overburden. These periods of movement are believed to be related to the buildup of perched groundwater following precipitation events. Monitoring concluded in the summer of 2006 when the new rail line went into service.

**Post-Construction Conditions**

Not all owners are willing to take significant financial risk and use an observational approach. However, such an approach proved to be very rewarding for this project. With the project...
complete and now nearly seven years into service, how are the slopes performing? As suspected, the southwest cut slope proved to be problematic. A soil slide involving approximately 8,000 cy of material occurred approximately eight months after construction of the slope. The slide occurred in front of and downslope from two of the inclinometers (Figure 1b). Although the inclinometers were installed as close as practical to the crest of slope, the slide scarp formed entirely in front of the inclinometer casings, so no early movement was detected.

Regrading operations in the slide area encountered only soil and resulted in the destruction of one inclinometer casing. Further site reconnaissance revealed tension cracks extending laterally (parallel to the cut slope) which rendered another inclinometer inoperable by kinking the

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casing at a depth of 22 ft. The regrading operations and new trench drain system are shown in Figure 1c.

At the southwest cut, recent data revealed an additional 0.11-in. cumulative displacement at the presumed soil slide plane elevation and 0.27-in. horizontal displacement at the ground surface. Total cumulative movement since the first reading is 0.72 in. at the presumed slide plane and 1.2 in. at the ground surface for this 102-ft-deep cut slope. The slope continues to exhibit creep, but the design provided a toe bench that provides sufficient storage for any sloughed material. Figure 1d presents the current slide condition. The head scarp has raveled upslope and seepage is noticeable. Although this slope has experienced slide activity, railroad operations are not impacted and the risk-based approach proved to be successful.

Besides the inclinometers at the southwest cut, the remaining three inclinometers were distributed along the alignment in cut slopes ranging in height from 140 ft to 150 ft. In response to the deep adjacent excavations, these inclinometers all indicated the development of slope movements occurring at distinct zones. Because these movements stabilized following the completion of the respective cut, they have been attributed to lateral stress relief. These distinct zones have subsequently undergone movements of approximately 0.1 in. over the six-year period following excavation, with total cumulative movements on the order of 0.25 in. This movement has not had any detrimental impact on overall stability.

The SSPS system proved to be necessary for the long-term performance of the project. The SSPS was not applied to all moisture-sensitive strata; rather, it was only applied to slopes in which undermining of more resistant strata would create significant risk. The lower-risk slopes did not receive SSPS. Slopes that did not receive SSPS have undergone significant weathering and undermining of more resistant strata with talus developing at the toe of slopes from just 8 months of exposure (Figure 2).

Post-construction, the slopes that received the SSPS are performing satisfactorily. Figure 3 shows the SSPS at the base and mid-height of the deepest cut slope, which is located at the northeast limit of the project area. Had these zones been excavated at flatter slopes in order to protect the overlying sandstone from becoming undermined, the quantity of excavation would have increased at least 100 percent. Had the SSPS not been installed along high risk slopes, undermining of more resistant stratum would have undoubtedly occurred. The subhorizontal drains also continue to perform well with observed drainage rates up to 80 gal/hr. Water flow from the subhorizontal drains remains clear and their performance continues to keep water levels within the slopes at acceptable levels.

The SSPS made both the acquisition of additional right-of-way and the excavation of hundreds of thousands, if not millions, of cubic yards of additional material unnecessary.
Lessons Learned

This project provided a unique opportunity to apply the techniques of stabilizing and monitoring cut slopes through weak rock on a large scale. Recent site reconnaissance indicates the continued acceptable performance of these slopes with regard to owner expectations. Looking back at the many ups and downs of this project, there are several lessons learned, including:

- Instrumentation and the observational approach can be powerful tools to help the engineer and owner manage risk. However, both parties must understand and agree upon a solution beforehand should the data indicate potential problems.

Figure 1d. Present slope face conditions in the laterally discontinuous strata of the southwest cut slope.

Figure 2. Claystone slope without shotcrete slope protection after 8 months of exposure.
It is very important to communicate levels of risk to the owner. There is no substitute for sound engineering principles, and non-traditional approaches should be thoroughly investigated and properly understood – they are non-traditional for a reason. However, these approaches can provide significant benefits as long as everyone is aware of the project risks.

It is essential to understand construction methods and assign experienced representatives to observe critical aspects of the work. Project success often revolves around one simple decision made in the field.

These three concepts helped advance and complete this project in a safe and cost efficient manner.

Figure 3. The deepest cut slope along the alignment at 150 ft. The shotcrete slope protection system is situated at the base of the cut slope and also at mid-height.

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TENCATE
Most of us have a true respect for the word *safety* and its critical importance to our professions and industries. In these enlightened times, the word *safety* has become an icon, an ideal, and we understand, don’t we, that safety is critical to the well-being of our people and our businesses.

Yet, I guess one could ask, can safety in the workplace be emphasized so much it loses its punch – begins to seem dull or boring?

I suppose it could, but then safety becomes quite real and personal when you look a nine-year-old in the face as he tries to understand why he will never see his father again. It’s real as you talk to the boy’s mother – who just lost her husband – and try to explain what happened. And you feel your presence in this home may not be entirely welcomed.

Safety becomes quite real and personal when a family is struggling because a poor decision was made, an accident occurred, and the family breadwinner is not there to support his family. Well, it was his decision wasn’t it? Yes…but was there more we could have done to help his awareness? Or to help his supervisor or his co-workers assist him in making a better choice?

I never thought I’d write an article about safety. Well I’m, not…exactly. I’ll often be using that word, *safety*, but this article is not so much about safety as it is changing my firm, S&ME’s, *attitude* about safety. It’s about changing our corporate culture, actually; about demonstrating through our beliefs, efforts, and results that safety is an unqualified, uncompromising, unconditional element of our culture.

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Keeping the End in Mind

As Stephen Covey so aptly wrote in his book about highly effective people, “start with the end in mind.” The goal at S&ME is very simple: *Everyone arrives home safely every day*. Simple, but getting there – not so easy. And adapting the right attitude is vital. But some will say, wait, accidents are going to happen, you know. Well, not necessarily. Accidents or incidents are not required.

So why change a company’s attitude? Our industry has changed, and that in itself may be reason enough. If your company fails to attain a certain safety level, you may see many opportunities slipping by; S&ME certainly experienced this first hand. But that doesn’t answer the *why change* question. We can acknowledge our company was once built around the conceptual vision: *Do whatever it takes to get the job done*.

Now that was a worthy enough, positive-sounding ideal, depending on what was meant by “whatever.” And really, it didn’t mean working unsafely was a swell idea. But lurking around this
ideal was the idea that taking some risks could be overlooked to get the project completed. I don’t think S&ME was alone in having notions of that sort and being okay with it. Our industry or our profession has changed.

Earlier I asked, was there anything more we could have done to help our employee, their coworkers or their supervisors arrive at better decisions to assist in avoiding an injury or incident. As employers, we have the responsibility to do everything we can to assure a safe work environment, to provide the training, and to educate every employee so they have the opportunity to arrive home safely every day.

**When Safety Sinks In**

So, do I take safety personally? You bet I do. But I didn’t always. I needed convincing, and that didn’t come easy to me. I remember one evening at a company function I was really being challenged by a one of our employees who “got safety,” truly understood the concept, long before many of us did. It was early in my term as president, and he challenged my position on safety. I must not have replied very well because his reaction clearly told me he was not impressed. I am one who sometimes has to process constructive criticism or, as in this case, maybe constructive insults.

But I did process it and soon came to realize that if we were going to achieve safety within our firm (and to be honest the initial goal may have been more company-focused than individual-focused), something needed to change. Change, now there is where the rubber meets the road. It’s the moment of truth. Who likes change? Just bring up the subject and people get nervous. How will it affect me? Who is going to be responsible? How much will it cost? And on it goes.

The real change at S&ME began when we were honest enough with ourselves to admit a change in our safety program was absolutely necessary. And here was the first change: It would not be a safety program. A program has a beginning and an end. This was not to have an “end.” We needed a safety initiative, a process; anything but a program. We hired a consultant and that, for me, began a journey of change. This journey was launched with the understanding that what needed to change was our culture.

**Learning and Leadership**

We learned much about ourselves working with our consultant. The “Big Picture” recommendations included: 1) Building Corporate Character (Developing Culture), 2) Reflect, Learn and Continually Improve, and 3) Execute with Excellence. Each recommendation identified ways to accomplish these changes.

We learned what it means to have an “actively caring culture.” It’s a culture in which individuals care enough about the health and safety of others to act accordingly. For example, by continually being on the lookout for unsafe work practices, pointing them out to others, and taking appropriate corrective actions.

It became easy to see that leadership in changing safety culture must come from the top down. The biggest challenge was convincing our leadership that safety was the top priority. Now don’t get me wrong, it was always a priority, well, at least, none of us wished anybody to get injured, but a wish is not the same as a priority. And making safety the “Top Priority” is not the same as making it “one of our priorities.”

Cost is not a question you ask about or want to be asked about when talking about “The Top Priority.” Some won’t be on board with this culture change as it hits their bottom lines, and your job as the leader, or one of the leaders, is to clearly demonstrate you are serious that this change is imperative. Still, some may not be convinced, and they, or you, may need to make decisions about their futures, because their futures will directly impact your company’s future.

**A Decisive Emphasis on Saying No**

One of our biggest changes was empowering every single employee to say no. We make it clear if an employee believes he or she is being asked to perform an at-risk procedure or to work in an unsafe environment, that employee is authorized to decline the request. It doesn’t matter if the request comes from a supervisor or a client. Concerns over that can be worked out later. But the employee’s right to refuse an unsafe assignment must be honored immediately.
At first this took some convincing in a culture that had embraced “just get it done.” Yet several years later, it is now a matter of ownership and pride. Even as president, I am reminded about where to stand and what personal protective equipment (PPE) is required when visiting project sites. Empower your staff at every level to say no to unsafe or at-risk behavior.

**Understanding at All Levels**

Knowledge is power, and a very important part of changing culture is manager training. When the leadership “gets it” and conveys it to all staff levels, amazing things can happen. It is satisfying to watch the evolution of trust develop as your staff begins to understand you actively care about their safety.

Sometimes there was mistrust; some thought employee safety related only to the bottom line. Now the company does benefit from a safety culture, but the benefit is a result of everyone arriving home safely. A leadership challenge is convincing your staff, especially those in the trenches, that the motives behind safety requirements are for their benefit, not to improve company safety statistics.

Once your leadership accepts the benefit of an actively caring culture, how you continue to develop it becomes a little more mechanical. When you put passionate people together for a cause, amazing things can happen. We see this in our nation and communities time after time when man-made or natural disasters occur.

S&ME has a passionate safety staff and one of the necessary steps was to convince all staff that safety was everyone’s responsibility and not just that of the safety professionals. We developed a Safety Leadership Team (SLT) in which the safety professionals participated but did not lead. This team was given a clean sheet of paper and their marching orders were to help us change the S&ME safety culture; not design a program, but change the culture. Representatives were selected from across the company at every staff level. This group still exists today.

**Transformation**

The elements of a safety transformation evolved through safety education. Not just “check-the-box” education but meaningful instruction. For example, we had held safety meetings for years prior to this time. It was good information and employees attended, if they could, and were able to “check the box” that they’d attended a safety meeting.

But the enthusiasm changed, and attendance increased, as the content and expectation of the meeting brought value to each employee. This was interesting to me because we didn’t have to change that much to go from a “check-the-box” mental-
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ity to a “desire to participate” by simply changing the value, content, and expectation of the meeting.

There was and continues to be a great deal of activity around the how of changing our culture at S&ME, and that may be content for another article. Briefly, our safety initiative is designed around three major areas; training, practices, and policies.

Training is critical for specific tasks encountered by all employees, many of whom often work unobserved on their own. How they perform when no one is watching tells you something about your culture. Examples of site-specific training include confined space, scaffolding, trench excavation, and the list goes on. Our training includes defensive driving, first aid, and CPR, and we invite family members to attend these sessions. There is nothing better than to see a teenage driver from one of our families attend the defensive driver training.

**BBS**

The largest training component for us was the Behavior-Based Safety (BBS) Training. BBS creates the opportunity for each employee to observe another employee performing a particular task. The observer notes safe and at-risk behavior. The employee observed remains anonymous because the purpose is not to “catch” anyone working unsafely. The purpose is to observe both safe activities and areas where we need improvement. This improvement could be in methods and procedures or it could include anything from large equipment operation to wearing appropriate PPE. BBS results are also used as part of ongoing training. We have many other training sessions, including 10-hour OSHA training for our managers.

**Practices and Policies**

Implementing the safety initiative are our safety practices. The authority to say no is a very important practice. Another is that we put a great deal of energy into promoting near misses. We encourage all employees to report a near miss if they experience a situation where they “nearly missed” involvement in an accident. Identifying near misses can be a major help for all to avoid similar perils. Caring enough to help save someone else from a dangerous situation is a key support to an actively caring culture. Other practices include our Tool Box Meetings, Job Safety Analysis (for each task we performed), and the First Move Forward practice.

It would be nice to achieve our goal without policies; i.e., wielding a heavy-hand, but the reality is policies are required. Two very important policies are the “Run Over/Struck By” policy and the “Distracted Driving Policy.” Briefly, the Run Over/Struck By policy provides very stringent procedures for field personnel to set up to do their work in a safe manner. We are very serious about this policy and for good reason. It relates to the family I mentioned earlier. Staff working alone may often find themselves in harm’s way. We want every policy necessary in place to give them a safe work environment.

The policy that created the most robust debate was the Distracted Driving Policy. S&ME implemented a Distracted Driving Policy on March 1, 2011. The data about the risks and hazards of distracted driving is very clear and powerful. If you have any hesitation about such a policy, visit the National Safety Council web site on distracted driving, and if you’re still not convinced let me ask you one question. Is there any phone call worth an accident, injury, or even someone’s life? I am sure not. We’ve found that business can survive without the risk of distracted driving. S&ME and many other companies are proof of that today.

**An Expectation**

I have great pride in our employees as I experience S&ME’s transformation to an actively caring culture and making safety a top priority. I’m far from alone now among S&ME staff who believe an incident- and injury-free workplace is not only possible but should be an expectation. As we strive for this achievement, we realize the finish line is ever moving, our initiative is for continuous improvement, and our goal is to just keep getting closer to it. There are many benefits to an actively caring culture and the beneficiaries include our company and our clients. But remember, the most important significant beneficiaries are our employees: *Everyone arrives home safely every day.*

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To attract and retain highly qualified employees as well as to create a cooperative, creative, and productive work environment for an ever-growing diverse workforce, employers are promoting measures to be more inclusive in their business operations. Likewise, the Geo-Institute and ASCE have created and supported initiatives to promote and enhance diversity and inclusion in their memberships. Here’s a glimpse of what’s underway.

G-I Commitment to Diversity

The Board of Governors of the Geo-Institute made a strategic decision in 2011 to create a focused initiative to enhance diversity within the Geo-Institute (G-I) membership and within the community of geo-professionals. A Board-level committee was created and charged with “developing a robust diversity and inclusion program within the Institute that provides leadership and raises awareness in all matters of diversity and inclusion within the geotechnical engineering community.” In 2012, the Diversity and Inclusion Committee (D&IC) was formed, and its first major program was held in March at Geo-Congress 2012 in Oakland, CA.

While the G-I’s membership is more diverse than the Soil Mechanics and Foundations Division of 50 years ago, the majority of the G-I membership still consists of white, middle-aged men from the U.S. Creation of the D&IC was a conscious effort by the Board of Governors to change the face of the profession. Most diversity initiatives are developed to promote equal opportunity and equity. In contrast, the G-I’s D&IC was created to promote innovation.

G-I Past President Craig Benson described the goals of the D&IC:

“The objective is to see the G-I become a diverse organization that is comprised of members that look more like the composition of our general population. This is driven by a need for a broader set of ideas that come from a more diverse group of participants, and not by a need for racial, gender, or ethnic equity. The belief is that we (engineers) will make better decisions and innovate more when we are immersed in a greater diversity of ideas, which can come from others that have had different experiences from ourselves. I think this is essential for our future, and if we don’t focus on it our profession will wither.”

Innovation is critical to the future of a technical profession. Examples of innovation, and the benefits that come from it, are evident every day. Smartphones and tablet devices are perhaps the most prominent examples today. But why is diversity important, and how does diversity promote innovation? The rationale is simple—innovation is often the product of a collision of ideas from different perspectives. Groups with effective dynamics that struggle to coalesce and build consensus around a collision of ideas frequently create unique and exciting solutions.

Diversity promotes this collision of ideas because people with different backgrounds and personal experiences see the world through different lenses, have different visions, and can create unique solutions. Combining these unique perspectives, and harvesting the best ideas from them, promotes innovation. Through the D&IC initiative, the Board of Governors plans to work towards attracting different groups to our profession—engineers from different countries,
ethnic origin, gender, and race—and to encourage the unique perspectives they bring to geotechnical problems.

In 2012, members of the D&IC conducted a Diversity Landscape Assessment. The purpose of the Assessment was to survey the current demographics of geotechnical graduate programs, and to then use that information to project the likely gender, racial and ethnic makeup of the G-I over the next 5 years. Moving forward, the Assessment can be used as a baseline for comparison with similar surveys in the future.

Though the D&IC was formed in 2012, G-I’s diversity efforts have been underway for many years prior. Specific events have included:

- 2013 Geo-Congress, San Diego, CA - Diversity and Inclusion Program and Luncheon
- 2012 Geo-Congress, Oakland, CA - Diversity and Inclusion Program and Luncheon
- 2011 Geo-Frontiers, Dallas, TX - Diversity Program and Reception
- 2010 Geo-Florida, West Palm Beach, FL - Women Geo-Professionals Program and Reception
- 2009 IFCEE, Lake Buena Vista, FL - Women Geo-Professionals Program and Reception
- 2008 Geo-Congress, New Orleans - Women Geo-Professionals Program and Reception
- 2007 Geo-Denver, CO, Women Geo-Professionals Networking Reception

...we (engineers) will make better decisions and innovate more when we are immersed in a greater diversity of ideas...
• 2006 Geo-Congress, Atlanta, GA - Women geo-professionals networking luncheon and media training

Based on feedback from the G-I membership at these events, the D&I has developed a four-phased approach to encourage diversity and innovation within the G-I membership:

1. highlight and celebrate diversity within the current G-I populace;
2. improve diversity for “now” – actively and aggressively promote diversity initiatives and collaborations among current G-I membership;
3. improve diversity for the future – develop initiatives at the college level; and
4. increase exposure of geo-professionals and the G-I through community-focused initiatives.

Specific action items have been developed for each of these four “phases,” and work on the action items is ongoing.

**ASCE’s CDI Activities and Direction**

ASCE’s Committee on Diversity & Inclusion (CDI), formerly the Committee on Diversity and Women in Civil Engineering (CDWCE), was established to provide ASCE with leadership in all matters of diversity within the civil engineering community.

The Geo-Institute has had a strong presence in ASCE’s diversity activities, with G-I Past President Priscilla Nelson, a former member of ASCE’s CDWCE, and Sandra Houston, the current chair of ASCE’s CDI, taking on leadership roles. With its long-standing history of having members committed to diversity in the geo-profession, the G-I is the first Institute to form a Committee on Diversity and Inclusion.

In May 2011, the CDI took a proactive and bold step to reinvigorate the Diversity Program by creating a new five-year strategic plan that aligns with ASCE’s organizational priorities. A schematic of the plan is shown in Figure 1. The CDI plan includes a new emphasis on the retention of underrepresented groups in the civil engineering workforce and post-secondary pipeline. The strategic plan was completed in February 2012 and is designed to be a “living document” for maximum flexibility in an ever-changing diversity environment. In October 2012, the charge for CDI was updated to state “The Committee on Diversity and Inclusion shall provide leadership for diversity and inclusion as the standard for ASCE and the engineering community through its programs, products and services.”

The vision developed by the CDI membership is that Diversity & Inclusion (D&I) is a way of doing business in ASCE and the civil engineering profession. When this vision

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**The Case for Diversity, Accessibility, and Inclusion – A Minority Perspective**

**Kofi Acheampong, PhD, PE**

*Changing the Conversation.* Who are our most important constituents, and how do we engage them from the beginning? How do we attract, develop, and maintain them in our profession? My experiences in both small and large business environments have convinced me that we need to redefine the concept or perception about Diversity and Inclusion (D&I). This changing of the conversation is an attempt to engage and challenge everyone. In my opinion, diversity is not about shades of color, gender, orientation, quotas, or mere “minority” representation. D&I is about engaging and taking advantage of the greater resource potential, in terms of people and their talents and skills, and of the broader community, and should focus on several guiding principles:

- Trust – Does my employer strive to create an inclusive environment where people seek different viewpoints to improve their teams and results?
- Diversity and variety of thoughts – Does my employer accept and take other views into consideration in the context of decision-making and problem-solving?
- Value Systems – Is my employer aware of and sensitive to different value systems about what’s relevant and what’s not important within our own value systems?
- Socio-Cultural Backgrounds – Does my employer understand what shapes and influences others?
- Opportunities – Does my employer recruit and place importance on developing a team with diverse members to create an environment for growth and development?
- Expectations – Does my employer maintain a basic level of competence and high standards?
- Relationships – Does my employer use effective communication, education, and awareness to build relationships within communities?

As a profession, global interactions and trades, changing domestic demographics with its associated multi-cultural influences, and federal, state, and local agencies’ contractual requirements for inclusion and utilization of disadvantaged-owned business enterprises demand an urgent strategic framework to position our industry for opportunities, growth, and influence. The geo-profession has to make inclusiveness a priority. By making diversity a competitive advantage, we will not only survive and thrive, but also make our institutions and companies better places to work, better understand and communicate our diverse clients’ needs, provide outstanding service, and deliver more value.

*Imagine an Environment Where Differences are Resources for Success.* In short, it’s about mobilizing and trusting everybody to play a vital part in achieving solutions -- each idea given an opportunity to grow and thrive. In addition, our approach to D&I should be based on maintaining or advancing standards via education and training, qualifications, competence, and professionalism, thus fostering an expectation of achievement.
With its long-standing history of having members committed to diversity in the geo-profession, the Geo-Institute is the first Institute to form a Committee on Diversity and Inclusion.

is achieved, there will no longer be a need for CDI. The CDI’s Strategic Priorities for the next five years include:

• advance recruitment and retention of a diverse ASCE membership,
• expand perceived value, visibility, and presence of diversity and inclusion,
• advance civil engineering as an inclusive and people-serving profession, and
• increase the positive perception and sustainability of the civil engineering profession and ASCE.

The CDI plans to meet these priorities by:

• creating a data archive and information resource,
• cataloguing, developing, and promoting tools and materials,
• integrating inclusion into recruitment as well as retention-focused partnerships,
• creating a web- and social media-based communications strategy, and
• collaborating to advocate for diversity and inclusion across ASCE.

Designing excavations and open pit mines requires you to manage groundwater, ensure stability, and consider deformations due to unloading or even an earthquake. Using GeoStudio software can help you understand these issues and find the best solution for your excavation design.

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Categories and Characteristics of E&C Firms Employing Geoengineers

By Rudolph Bonaparte, PhD, PE, D.GE, NAE, M.ASCE

This second article in my “Business of Geotechnics” series addresses categories and characteristics of U.S. private-sector engineering and consulting (E&C) firms that employ geoengineers and other geoprofessionals. These firms can be differentiated based on a number of criteria, including size, practice model, ownership model, and legal structure. I briefly discuss size and practice model here. A discussion of ownership model and legal structure can be found in my GSP No. 226 paper from which this Geo-Strata article is derived.

Firm Size Influences Firm Characteristics

It’s interesting to see how firms of differing size that employ geoengineers exhibit different characteristics. For this evaluation, I used data from the Engineering News Record (ENR) 2010 Top 500 Design Firm list.

Very Large Firms. This category includes the 50 largest firms from the ENR list, all with revenues of $250 million or more. The 10 largest are listed in Table 1. None of these firms self-categorize by the category defined by ENR as geotechnical engineer (GE). Instead, they self-categorize as engineer (E), engineer/architect (EA), engineer/contractor (EC), or engineer/architect/contractor (EAC). These 10 firms are all “full service” with a focus on some of the largest infrastructure, industrial, commercial, and institutional projects and programs. They have been characterized by some as “mega-firms.”

These mega-firms are often organized around market sectors such as transportation or water/wastewater; client sectors such as oil and gas, or mining and minerals; or client types such as private, municipal, or federal. Their organizations are not centered around practice disciplines, although “technical practice groups” may exist in the firms. These very large firms typically have different people responsible for managing the business, selling work, managing projects, and executing the work. Notably, each has “in-house” geoengineers and these in-house personnel perform much of the geotechnical evaluation, analysis, and design needed for each of the firm’s projects. Table 1 shows that for a number of these firms, in-house geoengineering capacity was built through acquisition.

Of the very large firms in the 2010 ENR list, only one, Fugro (ENR rank #26), self-categorizes as GE. In fact, Fugro is the only firm in the top 100 of the ENR list that self-categorizes as GE. By way of contrast, in the 1975 ENR Top Firms list, Dames & Moore (#6), Woodward-Clyde (#16), Law Engineering (#50), McClelland Engineers (#58), D’Appolonia (#86), Fugro (#91), and Soil Testing Services (#99) were all in the top 100 and all self-categorized as GE.

Compared to 30 or 40 years ago, few very large U.S. engineering firms are today self-categorizing as GE. There are a number of reasons for this, perhaps the most significant being that the engineering marketplace as a whole has grown more rapidly than the geoengineering business sector and large projects are much more multi-disciplinary than 30 to 40 years ago. Consequently, the geoengineering component of many projects represents a decreased percentage of the total project scope. A second significant reason is the rise of the full-service “mega-firms,” the in-housing of substantial geoengineering resources in these firms, and the concomitant reduction in subcontracting by these firms to firms focused on geoprofessional services. A third reason relates to the rapid growth of small geoprofessional firms and sole proprietorships.

Large Firms. Table 2 presents representative large firms whose revenues fall between $50 million and $250 million with ENR ranks from 200 to 50, that either self-categorize as GE or who today self-categorize differently but started as geoengineering firms. In contrast to the very large firms, these large firms are still dominated by traditional individual-practitioner-led consulting practices. Most senior personnel in these firms continue to operate as sellers/managers/doers (practitioner model). A number of these firms maintain...
in-house geotechnical testing capabilities, but only one maintains in-house field drilling and sampling capabilities. Firms in this size category have typically expanded beyond their geoengineering practice roots to provide services in selected other areas such as environmental, water resource, and structural engineering. In this regard, these firms may be considered “multi-service.” These firms are also of a size that, to one degree or another, they incorporate organizational elements focused on specific market sectors, client sectors, and/or client types.

Medium Firms. Table 3 presents representative firms from the 2010 ENR list that are classified as medium in size, with revenues between $10 and $50 million and an ENR rank from 500 to 200. These firms share similarities with the large firms, they are just smaller and typically do not have the breadth of practice capabilities or geographic coverage of the large firms. In this classification, a higher percentage of firms categorize themselves as GE. Inspection of Tables 2 and 3 could be interpreted to indicate that, with the exception of Fugro, firms that self-categorize as GE have revenues of about $50 million

Table 1. Representative Sample of Very Large Firms from the 2010 ENR Top 500 Design Firm List.

<table>
<thead>
<tr>
<th>ENR Rank (#)</th>
<th>Company Name</th>
<th>Self-Selected ENR Category*</th>
<th>2010 Design Revenue ($ Million)</th>
<th>Representative Geotechnical/Geoenvironmental Acquisitions (Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#3 Jacobs</td>
<td>EAC</td>
<td>4,748</td>
<td>Jordan, Jones &amp; Goulding (2010)</td>
<td></td>
</tr>
<tr>
<td>#4 CH2M Hill</td>
<td>EA</td>
<td>3,603</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#6 AMEC</td>
<td>EC</td>
<td>2,456</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#8 Bechtel</td>
<td>EC</td>
<td>2,170</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#9 KBR</td>
<td>EC</td>
<td>2,010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#10 Parsons Brinkerhoff</td>
<td>EA</td>
<td>1,561</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* GE = geotechnical engineer  | E = engineer  | EA = engineer/architect  | EC = engineer/contractor  | EAC = engineer/architect/contractor
or less. As the GE firms in Tables 2 and 3 grow larger in the coming years, it will be interesting to see if they continue to self-identify as GE or if they change to E or some other ENR category.

**Small Firms and Sole Proprietorships.** There are many small firms with revenue less than $10 million and sole proprietorships in private-sector geoengineering practice. One estimate places the total number of such firms in the U.S. at about 1,500, with the majority of these having less than 10 employees. A few are highly specialized, considered subject matter experts. Others focus on their local presence with local clients. Some have a significant part of their business involved in the observation of construction activities and testing of construction materials. Many small special status (e.g., WBE, MBE, SDVBE) geoengineering firms have been established over the past three decades in response to federal, state, and municipal procurement goals. In my GSP No. 226 paper, I provide several reasons for why the geoengineering discipline has been fertile for the development of these special-status businesses. I also observe that the number of geoengineers choosing to operate as sole proprietorships appears to have steadily increased over the past several decades.

**Practice Model Further Influences Firm Characteristics**

I define a firm’s geoengineering practice model in terms of three interrelated factors: (1) technological approach; (2) business culture; and (3) practice and client focus. Discussion of each factor is based on my personal observations and is most reflective of E&C businesses in the medium to large size category.

**Technological Approach.** The status of the technology applied by a firm in the marketplace influences the types of projects the firm performs, the technical practice tools it uses in its projects, and the processes it uses to staff and manage the projects. I use a categorization approach adapted from Coxe, et al. (1986) to explain three technological approaches common to geoengineering firms.

- **Brains** – The technical knowledge and practice experience used on projects is at the forefront of the profession. The technology application requires creativity, innovation, and pioneering of new approaches. The project delivery process is driven by senior subject matter experts. Due to the very specialized nature of the work, delegation from senior to junior staff is more limited than in the other categories. The generation of new and innovative engineering tools and solutions is a hallmark of a brains-based practice.

- **Grey Hair** – The technical knowledge and practice experience used on projects is at the forefront of the profession. The technology application requires creativity, innovation, and pioneering of new approaches. The project delivery process is driven by senior subject matter experts. Due to the very specialized nature of the work, delegation from senior to junior staff is more limited than in the other categories. The generation of new and innovative engineering tools and solutions is a hallmark of a brains-based practice.

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<table>
<thead>
<tr>
<th>ENR Rank (#)</th>
<th>Company Name</th>
<th>Self-Selected ENR Category*</th>
<th>2010 Design Revenue ($ Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#58</td>
<td>Golder Associates</td>
<td>EC</td>
<td>201</td>
</tr>
<tr>
<td>#74</td>
<td>Geosyntec Consultants</td>
<td>E</td>
<td>163</td>
</tr>
<tr>
<td>#97</td>
<td>S&amp;ME</td>
<td>E</td>
<td>110</td>
</tr>
<tr>
<td>#114</td>
<td>Langan</td>
<td>E</td>
<td>95</td>
</tr>
<tr>
<td>#119</td>
<td>GZA Geoenvironmental</td>
<td>EC</td>
<td>92</td>
</tr>
<tr>
<td>#144</td>
<td>GEI Consultants</td>
<td>E</td>
<td>75</td>
</tr>
<tr>
<td>#148</td>
<td>Haley &amp; Aldrich</td>
<td>E</td>
<td>74</td>
</tr>
<tr>
<td>#177</td>
<td>Shannon &amp; Wilson</td>
<td>E</td>
<td>57</td>
</tr>
<tr>
<td>#187</td>
<td>Ninyo &amp; Moore</td>
<td>GE</td>
<td>53</td>
</tr>
<tr>
<td>#190</td>
<td>Schnabel Engineering</td>
<td>GE</td>
<td>51</td>
</tr>
</tbody>
</table>

* GE = geotechnical engineer | E = engineer
EA = engineer/architect | EC = engineer/contractor
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Table 2. Representative Sample of Large Firms from the 2010 ENR Top 500 Design Firm List.

...a firm’s geoengineering practice model [can be defined] in terms of… technological approach; business culture, and practice and client focus.
to the “brains” approach. The project delivery process is driven by senior practitioners having deep experience and strong project management skills. Project teams are more structured and include a higher proportion of junior practitioners than in the “brains” approach.

- **Procedures** – The technical knowledge and practice experience applied to projects is well recognized and familiar, and the steps necessary to complete the projects are straightforward and well defined. The procedures for some parts of the work may be prescriptive, such as ASTM procedures, the project scope has been conducted many times previously, and much of the work can be delegated. The project delivery process is designed to achieve efficiency and cost effectiveness. Project managers are highly experienced in the practice and are evaluated by their ability to meet project delivery goals.

Most firms practicing geoengineering do not neatly fit into any single category. Instead, most exhibit attributes of several of the categories, with perhaps one being dominant in the firm. Notwithstanding, I believe this categorization scheme provides a useful framework for defining the technological style of a firm’s practice.

How does the technological approach drive the style of a firm’s practice? As an example, a firm performing mostly projects using the “brains” approach will be highly dependent on the specialized expertise of its senior staff and may enjoy the advantage of having a limited number of qualified competitors. It may be able to command relatively high billing rates given the level of technical expertise embedded in its practice, but its opportunities to grow are limited and its staff leverage, the ratio of junior staff to senior staff working on a project, will likely be low. It may also struggle to win work outside of its well-defined practice specialties. In contrast, a firm using mostly a procedures approach may be able to compete for a broader range of projects while achieving a higher level of staff leverage. It may also have more growth opportunity and staff recruiting may be easier because less technical specialization is required. The business will be more scalable and replicable than a brains-approach-based business. However, a procedures-approach firm may face substantial competition from others because the technological barriers to market entry are not that high. Low cost may often be a primary selection factor for clients procuring procedures-approach-based services.

**Business Culture.** Most firms publish a list of company values and other attributes that help to define the firm’s business culture. These typically include important principles such as honesty, integrity, work quality, employee safety, client service, lifelong professional development, and equal opportunity, among others. Another attribute, not often stated, relates to whether the management and staff in the firm place more emphasis on the practice attributes of the company or on the company’s business performance. Are most professionals “practice-centered,” seeing their calling as exercising their practice skills and producing technical work products for their clients? Or are they mostly “business-centered,” seeing their practice more as a means of livelihood? Or are they somewhere in between?

Where a company falls in the spectrum from a purely

<table>
<thead>
<tr>
<th>ENR Rank (#)</th>
<th>Company Name</th>
<th>Self-Selected ENR Category*</th>
<th>2010 Design Revenue ($ Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#219</td>
<td>Geoengineers</td>
<td>E</td>
<td>44</td>
</tr>
<tr>
<td>#220</td>
<td>Raba Kistner</td>
<td>GE</td>
<td>44</td>
</tr>
<tr>
<td>#292</td>
<td>Froehling &amp; Robertson</td>
<td>GE</td>
<td>34</td>
</tr>
<tr>
<td>#295</td>
<td>Paul C. Rizzo</td>
<td>E</td>
<td>33</td>
</tr>
<tr>
<td>#326</td>
<td>Mueser Rutledge</td>
<td>GE</td>
<td>31</td>
</tr>
<tr>
<td>#340</td>
<td>Engineering &amp; Testing Services</td>
<td>GE</td>
<td>29</td>
</tr>
<tr>
<td>#395</td>
<td>Soil &amp; Material Engineers</td>
<td>E</td>
<td>24</td>
</tr>
<tr>
<td>#404</td>
<td>Leighton Group</td>
<td>GE</td>
<td>23</td>
</tr>
<tr>
<td>#408</td>
<td>Earth Systems</td>
<td>GE</td>
<td>22</td>
</tr>
<tr>
<td>#435</td>
<td>Jacobs Associates</td>
<td>E</td>
<td>21</td>
</tr>
</tbody>
</table>

* GE = geotechnical engineer | E = engineer | EA = engineer/architect
EC = engineer/contractor | EAC = engineer/architect/contractor
practice-based culture to a purely business-based culture is mostly dependent on the attitudes, focus, and demands of the firm’s senior managers. Figure 1 defines four types of professional service firms based on business culture. It’s my observation that as firms grow, they tend to move from a more practice-centered culture to a more business-centered one, although the extent of this shift in business culture varies significantly between firms and there are exceptions to the observation. This cultural shift occurs slowly in many cases. The shift can happen more quickly if a firm is acquired by another company or undergoes a change in management.

**Practice and Client Focus.** The third factor to consider in the geotechnical practice model is practice and client focus (Table 4). The lists in Table 4 are not meant to be exhaustive. Each type of client and area of practice in Table 4 is somewhat different with respect to how work is procured, the relative role of the geoprofessional on the project team, pricing and contracting practices, and other factors. Thus, the practice and client focus of a firm has a large influence in defining the firm’s characteristics.

### Defining Your Firm and Making Choices for Your Future

You can use this business framework, along with the discussion of ownership models and legal structures in my GSP No. 226 paper, to define the attributes of the firm you work for and others you encounter. Perhaps more importantly, you can use this framework to help develop your firm’s next strategic plan and define your aspirations for your firm’s future.

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**Figure 1.** Practice-centered and business-centered firm cultures (arrow denotes typical direction of cultural evolution).

**Table 4**

<table>
<thead>
<tr>
<th>Practice-Centered Practice</th>
<th>Business-Centered Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>A practice-centered practice has a primary focus on the enjoyment and challenges of the projects it performs. As long as the firm does well enough, business performance is not a significant management focus. Senior managers are practitioners and spend little time on firm management.</td>
<td>A business-centered practice is primarily concerned with the business performance but also devotes considerable time and energy to building an attractive practice for its employees and clients. Senior manager decisions are driven by the business first and the practice second.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Practice-Centered Business</th>
<th>Business-Centered Business</th>
</tr>
</thead>
<tbody>
<tr>
<td>A practice-centered business is primarily concerned about the enjoyment of its projects but also devotes considerable time and energy to its business performance. Senior managers are practitioners who accept that they must spend necessary time managing the firm.</td>
<td>A business-centered business is a firm where the business performance of the firm is the dominant management focus and drives management decisions. Senior managers are largely divorced from the practice.</td>
</tr>
</tbody>
</table>

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STRATA SOLUTIONS
Over a billion cubic yards of sediments in rivers, lakes, and oceans have been contaminated by pollutants that have been released for decades, starting with early industrialization and continuing until recent regulations were established to control the disposal of contaminants into water bodies. Today, urban runoff containing polycyclic aromatic hydrocarbons (PAHs), oil, grease and heavy metals, as well as agricultural runoff contaminated with nutrients and pesticides, can deliver chemicals that sink to the bottom of water bodies and mix with the fresh sediments near the mudline. These processes have resulted in elevated contaminant levels in industrialized and urbanized coastal areas and river beds, leading to unacceptable human health and ecological risks. With such a significant volume of contaminated sediment in U.S. waterways, there is a need to develop economic and sustainable solutions to reduce/eliminate these risks.

**Current Remediation Practices**

Managing contaminated sediments can be very costly. Some sediment site investigations cost tens of millions of dollars and remediation projects can have budgets on the order of hundreds of millions of dollars. For example, the cost to remove approximately 46,000 m$^3$ of contaminated soil and 18,000 m$^3$ of sediments containing polychlorinated biphenyls (PCBs) and metals adjacent to a former harbor on the Hudson River is estimated at $250 million. While dredging has historically been the method most commonly used to remediate contaminated sediments, this technique has proved costly. It would be economically infeasible to remove all contaminated sediments and unnecessary, in many cases, to reduce environmental effects to acceptable levels. In addition to dredging or excavating the contaminants, the sediments may be remedi-ated using in-situ methods that rely on natural processes or
the use of subaqueous barriers, such as caps, to arrest/block exposures.

**Dredging.** In this process, contaminated sediments are mechanically removed using either buckets (Figure 1) or a hydraulic cutter head connected to a hydraulic pump. Dredging removes the contaminated sediments without draining, dewatering, or diverting water. The dredged material usually has a high water content, particularly when using a hydraulic cutter head and pumping, and requires dewatering. The water from the dredged material is contaminated and typically needs to be treated before being discharged back into a water body or disposed. The removed sediments may require treatment to meet disposal site and management requirements. Disposal options are selected based on environmental and economical considerations and can be classified as open-water disposal, confined disposal, or beneficial use. While the dredging process can release contaminants into the water body due to the disturbance of the sediments, the permanent removal of the contaminated sediments is a major advantage for dredging as compared to in-situ methods.

**Excavating.** This process is similar to dredging in that the contaminated sediments are removed. Before removing the sediments, however, the water overlying the sediments is removed by temporarily diverting the water from its natural flow channel or constructing a cofferdam around the contaminated site and pumping the water out. After dewatering, conventional construction equipment can be used to excavate the contaminated sediments. While this method has a higher construction cost, it produces far less water for treatment compared to dredging. Additionally, during the whole excavation process, the excavated material is never in contact with an overlying water body, which significantly reduces the chances of resuspension of contaminants during sediment disturbance.

**Monitored Natural Recovery (MNR).** This technology relies on the naturally occurring physical, chemical, and biological processes to contain or destroy the toxicity of contaminants in sediments. Where applicable, MNR is often a preferred remediation method because of its relatively low implementation cost and non-invasive nature. Because it doesn’t require sediment removal or other construction, the majority of the costs associated with this method are for long-term monitoring to ensure the reduction of contamination risks over time. However, MNR is not applicable to all contaminated sites; it requires long remediation times because it relies on natural recovery. The contaminants, or at least some of the contaminants, remain in the sediment layer, leading to a risk of contaminant migration in the event of sediment disturbance or excess hydraulic flow.

**In-situ Capping.** In-situ capping refers to the mechanical placement of a new layer of soil, or cap, on top of contaminated sediments. A cap is designed with multiple layers of mostly granular material with different particle sizes to provide an erosion-resistant barrier that isolates the sediments. In-situ caps can be grouped in two major categories: passive caps and active caps. Passive caps consist of adding a chemically inert soil layer on top of the contaminated sediment for containment. Active caps incorporate an additional layer, mostly in the form of thin composite geotextile mats containing one or more layers of reactive/absorptive materials, such as activated carbon, apatite, or organo-clay, that can provide chemical isolation of the contaminated sediments from the water body on top of the cap.

In-situ capping has become popular in recent years due to its efficiency, lower implementation cost, and minimal impact on the ecosystem and public health. The efficiency of in-situ capping is a result of physical isolation, and chemical isolation in case of active caps, of contaminated sediments from the overlying water. In contrast to MNR, in-situ capping provides protections against erosion of sediments and mobilization of contaminants.

**Physical Properties of Contaminated Sediments**

With the size and complexity of site-specific ecological and health impacts at contaminated sediment sites, it can be challenging to select the most appropriate remediation method for a given site. The decision process should consider the physical, chemical, and biological properties of the sediments and overlying water body. With respect to physical properties, EPA recommends that site characterizations consider:

- sediment particle size/distribution and mineralogy in cores;
- in situ porosity/bulk density;
• bearing strength;
• specific gravity;
• salinity profile of sediment cores;
• geometry/bathymetry of water body;
• turbidity;
• temperature;
• sediment resuspension and deposition rates;
• depth of mixing layer/degree and depth of bioturbation;
• geophysical survey results;
• flood frequencies, annual and event driven hydrographs, and current velocities;
• tidal regime;
• groundwater flow regime and surface water/groundwater interaction;
• ice cover and breakup patterns; and
• water uses causing physical disturbance of sediment.

Most of these factors focus on evaluating the risks of resuspension of contaminants into the water body above the contaminated sediments. Bearing strength is the only listed geotechnical consideration. However, the consolidation properties of the contaminated sediments are also important as they can play a significant role in deciding the best remediation technique, particularly in case of in-situ capping. Soft sediments will undergo significant consolidation under the weight of in-situ caps. Understanding the consolidation properties and the nature of the effluent can be the decisive factor in selecting the remediation method.

Laboratory Testing to Simulate In-Situ Cap Consolidation

The effectiveness of in-situ capping as a remediation technique comes from the isolation of the contaminated sediment and the protection of the overlying water body from contaminants transported from the sediments. The potential for the mobilization of non-aqueous phase liquids (NAPLs) from sediments under the weight of an in-situ cap was investigated through a testing program conducted at the University of Texas at Austin. When a sand cap is placed on top of a soft sediment, even in stages, the sediment will undergo consolidation and expel some of its pore fluids. The purpose of the tests was to determine whether the effluent will be NAPL or water under the different cap thicknesses.

To simulate the mobilization of pore fluid within contaminated sediments, consolidation tests were designed to model the in-situ capping process. The tests used a modified triaxial frame to perform consolidation tests under conditions of no lateral strain (K0-consolidation); the vertical actuator of the triaxial setup was replaced by a high-precision air piston to allow for accurate control of small changes in vertical stresses. The drainage lines were fitted with bladder accumulators to collect the effluent fluid for post-consolidation analysis. A hybrid-specimen preparation method combining the methods used for cohesionless soils and cohesive soils was developed to accommodate very soft sediments.

Reconstituted specimens were prepared so that essentially identical specimens could be tested. Georgia kaolinite type Hydrite-R, Soltrol 130, and tap water were used to simulate the solid, NAPL, and water phases of contaminated sediments, respectively. Sediment specimens were mixed in a bowl by hand with the appropriate percentages of solids, water, and NAPL to achieve various NAPL saturation percentages, the percentage of NAPL to the total pore fluids. The mixtures were then molded into the triaxial specimens at a high bulk void ratio (2.34) to simulate the soft sediments approximately 1m below the mudline (Figure 2).

The specimens were first consolidated to the in-situ conditions before increasing the vertical stress to simulate the incremental placement of the cap in total thickness stages of 0.5
In-situ capping has become popular in recent years due to its efficiency, lower implementation cost, and minimal impact on the ecosystem and public health.

m, 0.9 m, 1.8 m, and 3.0 m. The staged placement method was used to reduce the risk of bearing capacity and slope failure, but still resulted in the same amount of consolidation. For all tests, a K value of 0.7 was used for all consolidation stages representing lateral stresses during initial sedimentation and cap placement.

The testing was performed on specimens with initial NAPL saturation ranging from 15 to 70 percent. Figure 3 shows the change in void ratio with increasing vertical effective stresses for the different specimens. The compression index (Cv) values varied between 0.31 and 0.75. The plots identify the effluent fluid as either water or NAPL. The results show a transition of the effluent from NAPL to water when going from the high initial NAPL saturation specimens to the lower saturation specimens. Specimens with 33 percent and 29 percent initial NAPL saturation expelled oil initially under the first stage of capping and then water for the remaining stages.
For the same tests shown in Figure 3, the weight of NAPL remaining in the specimen, normalized by the weight of kaolinite, is plotted as a function of the vertical effective stress in Figure 4. The plots illustrate that the kaolinite has a capacity to retain about 0.08 to 0.1 grams of NAPL per gram of solids. These results indicate that if a kaolinite sediment had NAPL contamination higher than 10 percent by dry weight, some of the NAPL will be expelled when a cap is placed on top of it. The NAPL will be mobilized into the sand cap, increasing the risk for contaminants resuspension and migration into the overlying water body. In such cases, an active cap could be used to capture the expelled NAPL and isolate it from the water body.

A second series of similar tests was performed, with the exception of introducing organoclay to capture the expelled NAPL. During specimen preparation, a thin layer of organoclay was placed on top of the specimen under the top porous stone and filter paper. The $K_c$-consolidation tests were performed in an identical matter to the earlier tests. Figure 5 shows the weight of expelled NAPL, after applying all the stages of the capping system, per weight of dry kaolinite for different initial NAPL saturation percentages. The weight of expelled NAPL increased with the increase of the initial NAPL saturation with and without organoclay. However, the expelled NAPL in the presence of organoclay is reduced, implying that the active capping can trap the contaminated effluent, or at least reduce the expelled amount.

**Final Thoughts**

Geotechnical and geoenvironmental engineers must play a much larger role in the remediation of contaminated sediments. This observation was very evident at the 7th International Conference on Remediation of Contaminated Sediments held in Dallas in February 2013, where only one of 50 technical sessions discussed the geotechnical engineering aspects of contaminated sediments. Many of the challenges facing proper characterization of the mechanical properties of these sediments, as well as the by-products from treated and untreated dredged materials, represent areas where geotechnical and geoenvironmental engineers can provide important contributions.

The effectiveness of in-situ capping as a remediation technique comes from the isolation of the contaminated sediment and the protection of the overlying water body from contaminants transported from the sediments.
HOUSE AD?
Response of soft sediments to a capping load is a simple geotechnical problem that geotechnical engineers have dealt with for decades. The presence of contaminants in these sediments, particularly liquid phase contaminants, adds complexity to the analysis of sediments with multi-phase pore fluids. The physiochemical interaction between the multi-phase pore fluid and the soil particles is an interesting field of study where geotechnical and geoenviromental engineers can provide significant insight that can help with decision making when it comes to contaminated sediment remediation.

Chadi S. El Mohtar, PhD, A.M.ASCE, is an assistant professor of Civil, Architectural and Environmental Engineering at The University of Texas at Austin in Austin, TX. His research focuses on geotechnical engineering, with an emphasis on pore fluid engineering, multi-phase flow through porous media, ground improvement, liquefaction, fatigue life and performance of asphalt concrete, and experimental methods for characterization of geomaterials. He can be reached at ElMohtar@mail.utexas.edu

Figure 5. Expelled NAPL using passive and active caps.
Looking Out for You from the G-I Organizational Member Council

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The G-I Organizational Member Council (OMC) welcomes Tensar International to its prestigious group of Organizational Members.

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Save Money on Your Geo-Congress Registration.
Each OM’s contact person has received the special 4-digit code to use on your registration to the 2014 Geo-Congress in Atlanta, GA on February 23-26, 2014. The code, which saves hundreds of dollars off your full registration, can only be used by one person of an OM firm.

OM Activities at the 2014 Geo-Congress
Organizational Member Dinner Workshop
Monday, February 24, 2014
6:30–8:00 pm
Westin Peachtree Plaza Hotel
Atlanta, GA

Each OM’s contact person is cordially invited to attend this special Dinner Workshop prior to the OM/Student Career Fair. Last year’s Executive Workshop highlighted the need for additional “elbow rubbing” and conversation time with attendees. Come share your ideas how we can best address your needs. Watch for your personal invitation.

Organizational Member/Student Career Fair – By invitation only
Monday, February 24, 2014
8:00–9:00 pm
Westin Peachtree Plaza Hotel
Atlanta, GA

This special reception for Organizational Member student stipend winners brings together future employers and employees for the chance to relax and learn about the profession and each other.

Organizational Members/Student Reception
Monday, February 24, 2014
9:00–10:30 pm
Westin Peachtree Plaza Hotel
Atlanta, GA

Organizational Member executives, members of the Organizational Member Council, newly-inducted and current D.GEs, and fellow students join together for this special career networking opportunity. Students are encouraged to bring cards and/or resumes.

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From l to r: Scott Mackiewicz, PE, D.GE, M.ASCE, Kleinfelder; Michelle Bolding, PE, LEED AP, M.ASCE, Schnabel Engineering; Howard Thomas, P.Eng., PE, F.ASCE, CH2M Hill Canada Ltd; Kord Wisemann, PhD, PE, D.GE, M.ASCE, Geopier Foundation, Inc.; John Bischoff, PE, M.ASCE, URS; Jay Beech, PhD, PE, M.ASCE, Geosyntec Consultants; James D. Husan, PE, M.ASCE, Hayward Baker
Free Publicity for Your Organization

Did you know that one of your OM benefits is the publicizing of your company’s non-sales-related information in these pages of Geo-Strata? Send award news, new staff member notices, company project news, upcoming meetings, etc., plus high-resolution photos (300 dpi or more) to lbayer@asce.org.

Things You Should Know as an OM

1. Let the G-I know about your recent Facebook and Twitter business posts so we can help you publicize your information. “Like” us on the G-I Facebook page at facebook.com/GeoInstitute and follow us on Twitter at twitter.com/GeoInstitute.

2. OMs receive a 5 percent discount for advertising in Geo-Strata magazine. Be sure to mention this to your advertising representative.

3. Each year during the annual Geo-Congress, the OMC hosts its OM Career Fair/Reception. Two OM members from each OM firm are invited to participate along with 45-50 students who are carefully chosen by the OMC. Forty percent of OM annual dues directly fund participation of the students and the reception.

4. Is your company’s logo posted on the G-I website at www.asce.org/geo/About-GeoInstitute/Organizational-Members/Organizational-Members-of-the-Geo-Institute/ If not, send your logo in a png, jpg, or gif format to lbayer@asce.org.

5. Maximize your professional commitment to the Geo-Institute by displaying the G-I logo on your website and on printed materials. Request a logo and preferred format at lbayer@asce.org.

6. Exhibiting at a trade show? Contact lbayer@asce.org to receive your G-I Organizational Member placard to display at your booth.

Organizational Members: Make Sure We are Following You

The G-I not only follows its Organizational Members on Twitter, but retweets news and lists it at @GeoInstitute/GIOrgMembers. We also follow OMs who are on Facebook. E-mail us at ecuscino@asce.org when you join Facebook and Twitter so we can follow you and add your name to our list.

Terracon Adds to Its Staff

William J. Brickey, Senior Vice President

William J. Brickey, P.E., M.ASCE, joined Terracon as senior vice president. He is based in Terracon’s Phoenix office, where he is responsible for companywide strategic development of the facilities and materials services.

Brickey has more than 34 years of experience in directing operations, strategy, and business development across the consultancy, engineering, construction, and program management business lines. He also has extensive construction and materials engineering experience with an emphasis in pavement engineering, concrete evaluations, rehabilitation of concrete infrastructure, and the design, evaluation, and repair of industrial slabs-on-ground.

He is a registered professional engineer in AZ, NM, NV, NC, and SC. He is an active member of American Concrete Institute (ACI Committee 360 Design of Slabs-on Ground), American Society for Testing and Materials, American Public Works Association, American Council of Engineering Companies Society of American Military Engineers, and City of Phoenix Village Planning Committee (past member). He earned a BS in civil engineering from North Carolina State University.
Terracon Establishes Presence in New Jersey

Terracon Consultants, Inc. opened its New Jersey North office in South Plainfield, N.J., which expands and enhances the company’s service offerings throughout the state and Northeast region. Clients in NJ, NY, eastern PA, and DE can now access additional Terracon resources based even closer to their facilities. The office, with 15 current employees and managed by Steven Thorne, PE, D.GE, M.ASCE, provides environmental, facilities, geotechnical, and materials services to private and public sector clients.

“This is a tremendous move for Terracon in the Northeast,” said David R. Gaboury, PE, M.ASCE, president and CEO of Terracon. “By establishing our presence in New Jersey, in the heart of the tri-state metropolitan area, we are better positioned than ever to help our valued clients here meet their goals locally and regionally.”

Derr Selected for ARTBA Board

John A. Derr, PE, a senior vice president and director of the West Region of Gannett Fleming, based in the Phoenix, AZ, office, was elected for another three-year term to the board of directors of the American Road and Transportation Builders Association (ARTBA). In this role, he will continue to represent Gannett Fleming’s sustained investment in the nation’s transportation infrastructure through 2016.

With more than 26 years of experience in the transportation industry, Derr has led multiple project improvements on the National Highway System. His project experience includes numerous environmental evaluations, conceptual and preliminary engineering, final design for design-bid-build and alternative delivery projects, and construction oversight for several departments of transportation and national transit agencies.

Derr holds a BS in civil and environmental engineering from The University of Wisconsin-Madison. He is a licensed professional engineer in AZ, FL, ME, PA, and TX. Additionally, he is an active member of the American Society of Highway Engineers (ASHE), the Institute of Transportation Engineers, and the International Bridge, Tunnel, and Turnpike Association. His awards include the national 2011 ASHE National Member of the Year award and the ARTBA 2010 Guy Kelcey Award.

Fugro Secures New Contract for Offshore Geotechnical Investigation in Mexico

Fugro was awarded a contract of around $90 million by Mexico’s national oil company PEMEX for ultra-deep water geotechnical and pilot hole (drilling and logging) services associated with the de-risking of drilling locations and field developments planned off the shore of Mexico. The overall duration of geotechnical and drilling activity is expected to be 14 months.

This contract award represents a further strengthening of Fugro’s long and successful history in working with PEMEX and reinforces Fugro’s market leadership internationally as the preferred service provider for deep and ultra-deep water geotechnical data gathering, interpretation, and consulting services. Fugro utilizes ultra-deep water vessels such as the Fugro Synergy for work of this nature.

The firm is the largest global supplier of offshore geotechnical services.

Geosyntec Welcomes New Employees

Glenn J. Rix, PhD, M.ASCE, joined Geosyntec Consultants as a principal geotechnical engineer based in Georgia, where he will focus on solving challenging problems for public and private sector clients.

Lucy C. Jen, PhD, PE, M.ASCE, joined Geosyntec Consultants as a senior geotechnical engineer based in MA. Jen brings more than 16 years of experience in geotechnical engineering, foundation engineering, numerical methods in geotechnical engineering, and forensic geotechnical engineering. Her experience includes geotechnical site investigation, site characterization, site history research, and field instrumentation.

Jen specializes in the design and performance of deep excavations in soft clay; prediction of excavation-induced ground movements; deep and shallow foundation design and construction monitoring; settlement analyses; retaining wall analyses; and slope stability. Her project experience as a design engineer includes design and construction monitoring of a deep excavation in soft clay for a subway station and tunnel; construction monitoring for the

Lucy Jen
construction of foundations for a new airport terminal; site investigation for a proposed combined sewer overflow tunnel; and design and construction of shallow and deep foundations for buildings.

Jen also has experience in litigation support for projects involving the performance of mechanically stabilized earth (MSE) walls; the performance of vinyl sheet pile walls; and the impacts of adjacent construction. For the past 12 years, Jen has been a part-time lecturer at the Massachusetts Institute of Technology, where she teaches undergraduate and graduate courses in soil mechanics, foundation engineering, and geotechnical engineering design. Jen is a registered professional engineer in MA, NH, RI and NJ.

**TenCate Mirafi Geosynthetic Reinforcement Used for Soil to Build Bridges**

The Utah Department of Transportation (UDOT) is using an innovative method to replace the interstate highway I-84 overpass bridge near Echo Junction in northern Utah to save construction time and government money. Bridges will be supported on a mechanically stabilized earth system utilizing TenCate Mirafi geosynthetic reinforcement.

This is the first structure of its kind to be used on an interstate highway. Typically, bridge abutments are constructed using steel piles and large cast-in-place concrete structures that require specialized labor as well as large equipment and takes longer to build. The MSE system allows for rapid construction and significant construction savings. This system also allows for flexibility in the appearance of the abutments by having various colors and textures of segmental retaining wall (SRW) blocks to select for a nice appearance.

UDOT said this innovative technique will save $200,000 on the $3.2 million price tag because concrete is more expensive and time-consuming. There is also ease of construction and shorter construction time.

**Minks Joins Terracon’s St. Louis Office as Geotechnical Department Manager**

Allen G. Minks, PE, FASCE, joined Terracon as geotechnical department manager in the St. Louis office where he will promote services to new and existing clients, provide project and deliverables management, lead and supervise the department and local drilling operations, review of laboratory testing and drilling, preparation of geotechnical engineering reports and proposals, and business development activities.

Minks brings 30 years of experience to his new position from a wide variety of geotechnical studies ranging from home foundation distress investigations to foundation analysis, design, and construction monitoring of multi-million-dollar projects. He has authored geotechnical reports about various geologic and subsurface conditions and worked on U.S. and international projects.

He is a past president of ASCE’s St. Louis Section and recipient of the Professional Recognition Award from the St. Louis section in 2012. Minks is also the recipient of this year’s ASCE Edmund Friedman Professional Recognition Award, which is presented to a member of the society who is judged to have contributed substantially to the status of the engineering profession by establishing a reputation for professional services.

Minks is a registered professional engineer in MO, IL, IA, and OK. He earned an MS in geotechnical engineering and a BS in civil engineering from the Missouri University of Science and Technology, formerly University of Missouri-Rolla.

**Thermal Integrity Profiler Wins 2013 Innovation Award**

The Thermal Integrity Profiler (TIP) is the winner of DFI’s 2013 C. William Bermingham Award for Innovation. The award was created in 2012 to recognize the innovative spirit of Bill Bermingham, DFI past president, and encourages and recognizes innovative contributions to deep foundation technology.

The innovative aspect of the TIP consists of the utilization of the heat generated by curing cement to evaluate the integrity of cast-in-place concrete foundations such as drilled shafts, bored piles, augered cast-in-place, continuous flight auger piles, and drilled displacement piles. The technology may also be used to evaluate the shape of jet grouting columns and diaphragm or slurry walls, or other concrete structures. Regions that are colder than expected
are indicative of necks or inclusions; regions that are warmer than usual indicate bulges. It is also possible to identify misalignments of the shaft reinforcing cage and estimate the concrete cover along the entire length of the shaft.

Researchers at the University of South Florida (USF) initially developed the thermal integrity profiling technology. A joint effort undertaken by Foundation & Geotechnical Engineering, LLC (FGE) and Pile Dynamics, Inc. (PDI) incorporated that technology into the TIP.

Kleinfelder’s Struzziery Receives ASCE Citizen Engineer Award

Kleinfelder recently announced that John Struzziery, PE, M.ASCE, a distinguished civil and environmental engineer with over 37 years of experience, received the Citizen Engineer Award from the Boston Society of Civil Engineers Section (BSCES) and the American Council of Engineering Companies (ACEC) on September 23 during the 165th BSCES Annual Award Dinner at the EMC Club in Boston’s Fenway Park.

Struzziery was recognized for his 32-year tenure as the chair of the Town of Hull Permanent Sewer Commission. Under his leadership, the commission sets policy for the wastewater treatment and collection system, establishes sewer user rates, and works with Town officials and contract operators to develop emergency response plans, and address odor complaints. In addition, Struzziery uses his engineering expertise to provide the Town with additional technical assistance and direction on the wastewater collection and treatment system.

Bentley Systems, Incorporated, recently announced that it has acquired the MOSES software business from Ultramarine, Inc. With worldwide use, MOSES is the premier analysis and simulation software for complex projects involving the transportation and installation of offshore structures, including the launch of jackets and floatover of topsides.

Bentley further strengthens its leadership in the accelerating offshore energy industry following its acquisition in March 2011 of SACS, flagship software for the structural design of fixed offshore structures. The integration of MOSES and SACS enables unprecedented comprehensiveness in offshore engineering, in particular for the analysis and design of floating production, storage, and offloading (FPSO) structures.

Phil Christensen, Bentley vice president, offshore, said, “Our next step is to leverage the Bentley technology platform to enhance MOSES’ modeling and graphical visualization capabilities, as well as its ease of use. This will improve the user experience and extend the application of MOSES for more interactive design decisions. In addition, full integration between SACS and MOSES will allow a cohesive model to be used for all structural and naval architectural analyses.”

Geocon: Sharing Its Love of Geology at the Gem-o-Rama

Mike Conkle and Gerry Kasman of Geocon’s Burbank, CA office led a group of more than two dozen Cub Scouts and Boy Scouts to the annual Gem-o-Rama in Trona, CA. Trona is an unincorporated community in San Bernardino County located about 30 minutes east of Ridgecrest. The same collection of geologic forces which created the Searles Valley where Trona sits also created the natural resources of Searles Dry Lake, which contains rich deposits of chemicals, including dozens of minerals. The weekend trip included field trips out onto Searles Lake where the scouts could collect rare hanksite minerals from the mud, pink halite (salt) from the brine pools, and many more specimens. The purpose of the trip was to show scouts the fun (and dirty) side of geology. For information: www.geoconinc.com/news/#sthash.kJ8ozoHr.dpuf

Stantec Assists WI City in Successful Bid for a National Brownfield Award

The City of Wausau, WI’s successful revitalization of a 31-acre downtown waterfront site, was recognized with a national award by Brownfield Renewal magazine.

The award recognizes a brownfield site development that best demonstrates positive economic impacts including
job creation. Wausau’s transformation of its Wisconsin River waterfront was selected from more than a dozen submissions across the U.S. and Canada.

This is the second year in a row that a Wisconsin city has been selected for Brownfield Renewal’s Economic Impact Award, and the second time Stantec has been involved in supporting the revitalization efforts completed by the award recipient. For the City of Wausau, Stantec assisted with securing several important US EPA and State brownfield grants totaling $750,000 for the final segment.

“My vision is that our Wausau waterfront redevelopment becomes a world-class example of brownfield remediation into a vibrant area that attracts not only residents, but visitors from all over the globe,” says Wausau Mayor James Tipple.

Lingard Named President of URS Corporation

URS Corporation announced on October 1, 2013 that W.J. (Bill) Lingard, the company’s chief operating officer, was named to the additional position of president, effective immediately. Lingard will continue to report to Martin M. Koffel, URS’ chairman and chief executive officer, who previously also held the position of president.

With Lingard’s appointment as president, each of URS’ four divisions – Federal Services, Infrastructure & Environment, Energy & Construction, and Oil & Gas – will report to him directly.

Koffel said: “I am pleased to announce Bill’s new appointment as president, which was approved by the URS Board of Directors. Bill is an exceptional leader, with a proven track record of delivering growth and value for investors, building client relationships and leading a highly successful, multi-faceted engineering and construction company. As a professional engineer… Bill is ideally suited for the additional responsibilities he will undertake as URS’ President. He will continue to work closely with the leadership team to achieve the Company’s operational and strategic goals.”

Woods Named Vice-President of Densification, Inc.

The nation’s leading dynamic compaction firm, Densification, Inc., announced the promotion of Chris Woods, PE, LEED® BD+C, M. ASCE, to the role of vice-president of the firm. Woods is based in the corporate office in Paeonian Springs, VA.

Since joining the firm in the role of chief engineer in 2012, Woods and president Joe Drumheller, Aff. M. ASCE, have continued to expand the company’s client base, as reflected by the consistent workload that has continued nationwide throughout 2013. Woods has been involved in the geotechnical/construction industry since the late 1990’s, primarily working along the east coast. He began his career as a consulting engineer after earning a bachelor’s in civil engineering from Purdue and a master’s in geotechnical engineering from Virginia Tech.

Prior to joining Densification, Inc., Woods spent close to 15 years working as a consulting geotechnical engineer with Langan Engineering and Environmental Services in NJ, NY, and CT, as well as obtaining project experience in Southern Asia. He has also worked as a department manager for a geotechnical consulting firm in the Washington, D.C. area.

Sanborn Head Oversees Remedial Work at Beede $50M Superfund Site

The startup of the groundwater remediation system at the Beede Waste Oil Site in Plaistow, NH is planned for November. Sanborn Head has worked on the Beede site for the New Hampshire Department of Environmental Services (NHDES) since 1995 providing pre-remedial investigation site and waste characterization; oversight of waste removals; and RI/FS (including a Human Health and Ecological Risk Assessments) services. The site was listed as a USEPA Superfund site in 1996. The ongoing remedial work is being performed by the Beede Site Group while Sanborn Head is currently serving as the oversight consultant for NHDES and the U.S. Environmental Protection Agency. For more information: www.sanbornhead.com/sites/default/files/20130919%20Concord%20Monitor.pdf
Moustafa Gouda is a principal and director of the Geotechnical/Environmental Services at Maser Consulting P.A. of Red Bank, NJ. He has been practicing geotechnical and environmental engineering in the U.S. since 1970. As director, he is responsible for all geotechnical and environmental engineering work from the preliminary planning phase through consultation, during construction of foundations and earth work for structures, and the remediation of environmentally-impacted sites. With 50 years of experience, Gouda has been in charge of design, preparation of reports, and consultation on a variety of geotechnical and environmental projects in the Northeastern U.S., Egypt, Nigeria, Panama, and Algeria.

He is noted for pioneering brownfields redevelopment and for promoting the beneficial use of landfills. Gouda is known for his expertise in the beneficial use of amended dredge materials (ADM). He also has managed numerous dam safety and dam rehabilitation projects, as well national accounts and numerous projects in various states for several fortune 500 companies.

In addition to Gouda’s 50 years of professional experience, he has dedicated 35 years to various levels of involvement on the state, local, and national levels of the American Society of Civil Engineers (ASCE), serving as president of two sections and one branch; serving three years as the national District 1 Director; and two years as national treasurer. In recognition of Gouda’s services to the engineering community, the U.S. Congress declared May 14, 1999 as “Moustafa A. Gouda Day” in NJ’s first congressional district.

What was your most fun class while in school?
Industrial engineering where the professor taught us how to observe defects and recognize problems.

What was the most fun project you worked on?
I have done many projects ranging from a McDonald’s restaurant to high-rise buildings; however, a challenging and exciting project was the Caesar’s Palace Hotel and Casino renovation and expansion of the casino and the new 40-story tower in Atlantic City, NJ.

When did you know that you wanted to study civil engineering? What were the key factors in your decision to be a civil engineer?
The decision came after the first year of college, which was called the preparatory year. Specialization occurs during the second year of the five-year program. I felt that a civil engineer does things that can be felt and touched.

What is your message to professional engineers out there regarding specialty certification?
I have been a supporter of specialty certification from the mid-1980’s when it was first discussed at ASCE. To be a master builder, one should specialize and master his or her trade. Master builders are the planners and designers of society’s economic and social engine; the stewards of the natural environment and resources; and the innovators and integrators of new ideas and technology. How can one do all this without specializing?

Why are you certified as a D.GE and what made you choose to become a Diplomate in the Academy?
My firm believes in specialty certification and this was the main reason I became a D.GE in the first Academy class. Being a D.GE gives me a sense of belonging to a selected group of civil engineers who choose the exciting career of geotechnical engineering. It is also recognition of achievements and recognition of competency in a specific branch of civil engineering. The Academy must push hard to get more recognition by the public agencies and by the general public of the value of utilizing the services of a D.GE since awareness of the importance of such a distinguished designation need to be heightened.

How do you feel about the state of civil engineering and the profession as it is today?
I feel the same way I have felt all along. Civil engineers create comfort in life; however, I am glad that more of the public today knows what civil engineers do and about their contribution to society. ASCE continues to work in raising the public and government’s awareness of civil engineers’ contributions. It has come long a long way since I started my affiliation with ASCE in the late 1970s.

What do you feel are the biggest challenges on the horizon for the profession?
Meeting the complexity of the future problems and projects and the need for better education for the future civil engineers. I agree with ASCE’s Policy 465 of requiring a master’s or bachelor’s degree plus 30 credits as the first professional degree. Today, graduate engineers are taking fewer credits than we took 30 or 40 years ago. This is taking place while the complexity of the projects and challenges of environmental concerns and sustainability is increasing. Many professions that are less complex than engineering only require six to seven years of education before their members are allowed to practice; however, engineers are allowed to practice with only four years of education.

Read the complete article at www.geoprofessionals.org.
SCHNABEL
T he first thing really good salespeople sell is themselves. That’s why they’re able to convince their clients and customers to buy more than they originally had in mind and, generally speaking, their clients and customers wind up delighted with their purchase. Really good salespeople do this by exhibiting self-confidence without arrogance, an unwavering belief in their products or services, and a genuine desire to help. Those attitudes help convince their customers and clients to trust them – to “buy” their point of view – an outcome strengthened through technique; by talking less about cost and more about benefit, like the lower cost of construction derived from more comprehensive design-phase services.

Really bad salespeople seem to lack confidence in their interpersonal capabilities and so are intimidated by the thought of selling themselves in order to earn trust. So they don’t. They simply offer the lowest price they can live with, believing (not incorrectly) that low price can make the sale for them. When most salespeople in a given marketplace take this approach, the marketplace cannot help but become a hotbed of price competition, underlain by pitches like “We all have the same licenses and meet the same standards. It’s just that I can do it for less.” If the pitch is made often enough, customers and clients will come to believe that all those who provide a given product or service are just about the same. Keep that up for a generation or two and customers and clients will regard what’s being sold as a commodity.

So, what are things like in your marketplace? In most areas, for many geoprofessional services, the focus is low price rather than high quality and the lasting value it provides. I submit that one of the major causes of this is unsupported reliance on the “seller/doer” model of project management: “Bring in the business and then provide the service.” That’s great as long as seller/doers possess not only outstanding technical/managerial skills, but also the innate ability to sell themselves to anyone. But face it: Few geoprofessional project managers are self-confident individuals who know how to sell themselves. Instead, most are technically focused individuals whose decision to pursue a geoprofessional career was influenced at least in part by a strong desire to avoid certain responsibilities, like having to sell. Is it any wonder, then, that they let low fee do the talking for them? “But what else should you expect? I don’t know how to sell,” they might comment. But that isn’t true. Just about all geoprofessionals have jobs they had to sell themselves to get, and most are or have been married, another outcome for which selling themselves was a prerequisite. Those were BIG sales. How’d they do it?

First of all, they probably told themselves, “This isn’t selling.” Second, they put themselves in the right place at the right time and, third, they simply exhibited who they were, and that’s all they needed to build the trust needed to make the sale.

If you believe conditions in your markets have caused you and other geoprofessionals there to be regarded as commodities, you’ve got to do a better job of selling. Your firm can help by providing sales training (ASFE/GBA’s “Hassle-Free Selling for Project Managers” BackYard Seminar could help) and developing at least a rudimentary sales organization; e.g., appointing a sales manager who gives each seller/doer monthly targets. But you can help yourself most by doing what you’ve done before to make a big sale: Put yourself in the right place at the right time.

One easy way of doing that is through involvement in a meaningful professional society or trade association that would put you into comfortable contact with client-organization representatives. Just being a member is not enough, though: You need to be actively involved, something that’s achieved by joining a committee whose members work as a team to achieve
In most areas, for many geoprofessional services, the focus is low price rather than high quality and the lasting value it provides.

mutual aspirations. That kind of involvement builds bonds of friendship and trust. It allows others to see you as someone who cares; someone who is knowledgeable and passionate (even if tacitly) about getting the job done. That breeds respect and exactly the kind of trust that makes others willing to listen to you and so learn why all geoprofessionals are not the same; why those who, like you, are at the top of their game are in a position to add the kind of value that can make a project more enjoyable and far more cost-effective.

Over time, if enough geoprofessionals took this approach, the entire marketplace would change, and geoprofessionals would finally be able to do something meaningful about the commoditization caused by their erroneous assumptions about selling and their inability to do it. Frankly, I don’t know if that change will ever be realized, but one thing’s sure: It can happen to you. Just do it!

John P. Bachner is the executive vice president of ASFE/The Geoprofessional Business Association (GBA), a not-for-profit association of geoprofessional firms; i.e., firms that provide geotechnical, geologic, environmental, construction-materials engineering and testing (CoMET), and related professional services (en.wikipedia.org/wiki/Geoprofessions). GBA develops programs, services, and materials to help its members and their clients confront risk and optimize performance. Contact john@asfe.org

**Statement of Ownership**

Geo-Strata is published by the American Society of Civil Engineers (ASCE), with general business offices at 1801 Alexander Bell Drive, Reston, VA 20191-4382. The Managing Director of ASCE’s Member and Corporate Communications Division is Stefan Jaeger. The magazine is wholly owned by the American Society of Civil Engineers, a nonprofit educational and professional organization with more than 140,000 members. There are no individual owners or stockholders.

I certify that the above statements made by me are correct and complete.

Stefan Jaeger, CAE
Managing Director of Member and Corporate Communications
Check these sources for breaking G-I news:

- The G-I webpage at [www.asce.org/geo](http://www.asce.org/geo)
- The G-I monthly eUpdate newsletters.
- Twitter at [http://twitter.com/GeoInstitute](http://twitter.com/GeoInstitute)
- Facebook at [www.facebook.com/GeoInstitute](http://www.facebook.com/GeoInstitute)
- G-I LinkedIn at [http://www.linkedin.com](http://www.linkedin.com)

According to LinkedIn’s Geotechnical Engineering Experts: Here’s What’s Been on People’s Minds

- Undrained Triaxial Model in Plaxis2d BGE.
- Can geotechnical engineering help to reduce effects of climate change?
- Projecto e construção de 900 PCHs no Brasil nos próximos anos.
- Limit analysis vs. limit equilibrium in analysis of slopes.
- Post-improvement shear wave velocity testing of ground improvement.
- Strike to dip direction conversion sheet.
- Who knows the thickness of a sheet pile “Larsson 64”? The profile is probably not fabricated anymore.
- Helical pile load test data.
- For slope stability analysis, what is the best analysis to use? FEM or LEM?
- Bridge foundation on boulder in matrix.

**G-I NEWS**

**Gregory Elected as New G-I Governor**

Garry H. Gregory, PhD, D.GE, PE, M.ASCE, secured the most votes in the Geo-Institute’s governor election to become the eighth member of the 2013-2014 Board of Governors.

“Garry possesses that rare balance between practitioner and academician,” stated G-I Past President Stephen G. Wright, PhD, PE, M.ASCE. “His technical knowledge is outstanding and he has extensive experience in practice. In fact, he currently works both as a professor and a consultant.” Jean-Louis Briaud, PhD, PE, D.GE, FASCE, and also a G-I past president, commented that Gregory is “…very technically competent and very dedicated to his profession by his words and by his deeds. While he has been a practitioner for most of his career, he has a keen interest in teaching and the discovery process. This gives him the excellent balance to represent a broad spectrum of our members.

**2014 Geo-Congress**

February 23-26, 2014
Westin Peachtree Plaza Hotel
Atlanta, GA
[www.asce.org/geocongress](http://www.asce.org/geocongress)

Are you registered for the Geo-Institute’s 2014 Geo-Congress? Have you considered additional learning in one of 6 full-day Short Courses, or 2 half-day courses? The 2014 annual Congress “Geo-Characterization and Modeling for Sustainability” will take you through extremely useful technical and career information covering the broad spectrum of the geo-profession.

Come listen to what the experts have to say about relevant topics such as:

- Can you readily adapt to the innovative approaches now being required for projects?
- How will sustainable designs impact the future of the geo-profession?
- What does sustainability in geotechnical engineering really mean?

You can choose between 38 technical sessions divided into 4 tracks: Geo-Characterization; Innovation, Standardization, and Regulation; Numerical and Resilience Modeling; and Sustainable Design, Visualization, and Communication.

Be a part of the dozens of business and social activities that make the Geo-Congress THE annual conference for geo-professionals whether you’re a practitioner, a student, an academic, or a vendor. Visit the new Geo-Video YouTube site at [www.youtube.com/user/GeoInstituteASCE](http://www.youtube.com/user/GeoInstituteASCE) to watch some Congress highlights from the past. See you in Atlanta.

**G-I and Kazakhstan Geotechnical Society Sign Agreement**

On September 2, 2013, the Geo-Institute and the Kazakhstan Geotechnical Society signed an Agreement of Cooperation in Paris, France in conjunction with the ISSMGE’s 18th International Conference. The purpose of the agreement is to promote and enlarge the exchange of technical, scientific, professional, and organizational knowledge to better serve the interests and welfare of members, the engineering profession, and the public in both countries.

Delegations from both societies attended the signing and discussed ideas for future collaboration. While hosting seminars in each other’s country was suggested, the goal of the agreement is significantly broader and includes:

- international collaboration,
- geotechnical information exchange,
- publication lists exchange,
- encouragement of a diversity of joint events, and
- exchange of information about technical events.

**Have You Visited G-I’s New YouTube Site?**

The new Geo-Channel at [www.youtube.com/user/GeoInstituteASCE](http://www.youtube.com/user/GeoInstituteASCE) features the never-before-available-online 2013
GEO HOUSE AD
Peck and Seed Lectures and 2013 Geo-Congress Highlights, the 2012 Terzaghi Lecture and Student Professional Development Workshop, and more. Additional full-length lectures and workshops are coming soon. Select lectures and workshops will be added following the 2014 Geo-Congress. Subscribe now to be notified when new material is posted. More than 350 people have already subscribed as this issue went to press!

While you’re there, enter the Video Contest by December 4, 2013 to be eligible to win full registration to the 2014 Geo-Congress; one of two $100 Amazon.com gift cards, or one of 6 $25 iTunes gift cards.

**Help Students with Your Voluntary Contribution**

ASCE/G-I Members: when renewing your 2014 membership, please include a voluntary contribution which goes directly into a restricted fund for G-I 2014 student activities.

Last year’s contributions helped to partially fund MSE Wall team travel to 2013 Geo-Congress, Geo-Prediction and Poster Competitions, grants to Graduate Student Organizations, travel grants, and more.

**G-I CO-SPONSORED CONFERENCES**

**Anchored Earth Retention/ Micopile Design and Construction Seminar & Exhibits**

March 21-22, 2014
Hilton Salt Lake City Center
Salt Lake City, UT

The Geo-Institute’s Utah Chapter is one of the cooperating organizations of this ADSC/DFI Seminar. The program covers aspects of micropile foundation support and anchored earth retention with an emphasis on design, QA/QC, testing, installation methodology, and case histories.

**Presentations**

Presentations are given by experts from all sectors of the geotechnical engineering and construction industry. This practice-oriented seminar is valuable to owners, engineers, architects, general contractors and others to understand the fundamentals, applications, design, construction, testing, and QA/QC procedure of micropiles and anchored earth retention systems. There are opportunities for networking and individual discussion with presenters and panelists throughout this two-day event.

**ICTI 2014**

3rd International Conference on Transportation Infrastructure
April 22-25, 2014
University of Pisa
Pisa, Italy
www.iciti2014.org

The Department of Civil and Industrial Engineering at the University of Pisa announces ICTI 2014 which will be held under the auspices of the International Society for Maintenance and Rehabilitation of Transportation Infrastructures (iSMARITi). This conference is the third in a highly successful series that began in China, followed by the second conference in Brazil. It has occurred at four-year intervals. The ICTI series aims to promote and discuss efficient planning, design, construction, and maintenance of transportation facilities and infrastructure assets by addressing important issues related to roads, railways, airports, intermodal, and mass transit systems.

**27th Central Pennsylvania Geotechnical Conference**

April 23-25, 2014
Hershey, PA
www.central-pa-asce-geotech.org/

This conference, sponsored by ASCE’s Central Pennsylvania Section, has already scheduled a wide variety of interesting speakers from academia and practitioners. To register, exhibit, and information: http://www.central-pa-asce-geotech.org/papers.php

**Registration questions: Jason Gardner, PE, M.ASCE, at: jgardner@gfnet.com**

Exhibit questions: Bruce Stegman, PE, M.ASCE, at: bruce.stegman@verizon.net

The program is currently being developed so please check the website to register, reserve an exhibit booth, and check program speakers.

**GeoShanghai 2014**

May 26-28, 2014
Shanghai, China
www.geoshanghai2014.org

GeoShanghai is a series of international conferences about geotechnical engineering held in Shanghai every four years. Since the successes of the first International Conference in 2006 and the second in 2010 that gathered 400 and 350 colleagues from all over the world, the geotechnical communities have witnessed many advances in soil and rock mechanics technology and engineering practices. To showcase the latest developments and promote international collaborations in geotechnical engineering and related areas, the organizers of the GeoShanghai International Conference 2014 invite geotechnical researchers, practitioners, and educators from all over the world to participate.

**GeoHubei International Conference**

July 20-22, 2014
Hubei, China
www.geoconf.org

The goal for this emerging technique conference, titled “Sustainable Civil Infrastructures: Innovative Technologies and Materials,” is to provide safe transportation facilities for effective and efficient movement of people and goods. The conference will provide a showcase for recent developments and advancements in design, construction, and safety inspections of transportation infrastructures and offers a forum to discuss and debate future directions for the 21st century. Conference topics cover a broad array of contemporary
GEO HOUSE AD
issues for professionals involved in bridge, pavement, geotechnical, tunnel, railway, and emerging techniques for safety inspections.

Shale Energy Engineering Conference
July 21-23, 2014
Pittsburgh Convention Center and Westin Hotel
Pittsburgh, PA
www.geosynthetica.net
This conference, titled “Technical Challenges, Environmental Issues and Public Policy,” will provide a forum for discussing the technical challenges associated with shale oil and gas development, exploring the critical environmental issues that exist in this area, and presenting balanced public policy solutions that can be used to safely develop our shale oil and gas resources. The conference will focus on the challenges that lie ahead with developing the means and methods to carefully monitor all aspects of shale oil and gas production, and will encourage and promote the development of technologies that allow for cost-effective shale oil and gas exploration while minimizing the impact on water resources, geological stability of impacted areas, air quality, and infrastructure assets such as roads, pipelines, water, and wastewater networks.

IFCEE 2015
March 17-21, 2015
JW Marriott
San Antonio, TX
www.ifcee2015.com
IFCEE is the “must-attend” event for professionals in the foundation industry. The Congress, sponsored by ADSC, DFI, G-I, and PDCA, will include presentations of reviewed technical papers, panel discussions and debates, indoor exhibits, an outdoor equipment exposition, educational short courses, technical committee meetings, networking with industry leaders, and so much more. 4 leading organizations. 4 dynamic days. 4 times the industry influence. Exhibit sales open January 2014.

GBA President Fraese Sees Bright Future Ahead for Geoprofessionals
“As has always been a hallmark of this organization, we are responding to the future, not the past, so that when the future arrives, we’ll all be there to greet it. We intend to be a continuing, long-term asset of service to you by staying out front, not just by responding to change, but also by helping shape what that change looks like.” So stated ASFE President Kurt R. Fraese, L.G., in his President’s Report delivered to the membership assembled in Boston for ASFE/GBA’s 2013 Fall Conference. “And what does the future hold in store? Opportunity for geoprofessionals, in the form of infrastructure repair, replacement, and expansion; creation of protective barriers for major coastal cities; energy production, transmission, distribution, and conversion; alternative energy development; and the new smart electrical grid.”

Professional Development Corner

ASCE/G-I Co-Sponsored Online Webinars
LRFD Best Practices in Subsurface Investigations and Soil and Rock Testing
11:30 AM-1:00 PM ET
December 20, 2013
Load & Resistance Factor Design (LRFD) for Geotechnical Engineering Features, Complete Two-Part Series
12:00 PM-1:30 PM ET
Design of Geomembranes for Surface Impoundments (Ponds, Reservoirs, Etc.)
11:30 AM-1:00 PM ET
January 14, 2014
Energy Piles: Background and Geotechnical Engineering Concepts
11:30 AM-1:00 PM ET
February 11, 2014
LRFD Design of Ground Anchors and Anchored Wall Systems
12:00 PM-1:30 PM ET
February 20, 2014
Geosynthetics Used in Unpaved and Paved Roads
11:30 AM-1:00 PM ET
February 26, 2014
For more webinar information: www.asce.org/Continuing-Education/Webinars/Live-Webinars/

ASCE/G-I In-Person Seminars
Finite Elements in Geotechnical Engineering
January 16-17, 2014
St. Louis, MO
Instrumentation and Monitoring Boot Camp: Planning, Execution, and Measurement Uncertainty for Structural and Geotechnical Construction Projects
February 13-14, 2014
New York Metro Area
For more seminar information: www.asce.org/Continuing-Education/Seminars/Face-to-Face-Seminars/

On-Demand Videos
- An Overview of Geosynthetics and Their Major Applications
- Analysis and Design of Veneer Cover Soils for Landfills and Related Waste Containment Systems
- Coal Combustion Products in Geotechnical Applications – Part II of VI
For more on demand information: http://mylearning.asce.org/diweb/catalog/t/2135/t/2108/c/79
14th Annual DICEP Conference
October 23, 2013
Houston, TX
www.piledrivers.org
The PDCA 14th Annual Design and Installation of Cost-Efficient Piles (DICEP) conference is co-sponsored by the Geo-Institute and is designed for geotechnical, structural, and civil engineers; contractors; and other firms or individuals who support, conduct business, or are associated with the deep foundations, earth retention, and/or the driven pile industry. Licensed PEs needing Professional Development Hours (PDHs) can obtain 6 PDHs from this conference.

The DICEP conference will present modern approaches to maximize efficiency, effectiveness, and economy (E³) of driven piles through a series of presentations including energy efficient piles, efficient pile design utilizing setup, rebound, pile constructability, pile driving noise reduction, software, case histories, and more.

For information: contact PDCA at 888.317.322 or e-mail Jessica Fasanella at jessica@piledrivers.org.

Moustafa Gouda
Former Geo-Institute Governor Moustafa Gouda, PE, D.GE, FASCE, celebrates 50 years in the civil engineering profession as of January 2014. He is proud to share his story with readers and thanks everyone for their support and encouragements which have, as he says, “...kept him going” all the years. Read his and 17 other civil engineers stories in ASCE’s eBook, All in the Family, Civil Engineering Legacy Stories. The book celebrates civil engineers’ accomplishments and can be read at www.asce.org/Foundation/CELegacyBook/.

Gouda is currently the principal and director of the Geotechnical/Environmental Services at Maser Consulting of Red Bank, NJ. He was recently named Central Jersey Civil Engineer of the Year by ASCE’s Central Jersey Branch in recognition of his contributions to innovative engineering solutions for difficult soils conditions. He has dedicated 35 years to various levels of involvement on the state, local, and national levels of ASCE, serving three years as the national District 1 director and two years as national treasurer.

Joseph P. Welsh, PE, FASCE, was selected as one of the five finalists to receive the 2014 Outstanding Civil Engineering Achievement award for construction at next year’s OPAL Awards. The OPAL is presented annually in each of the five categories to a civil engineer who “represents a model of achievement to which future generations of engineers aspire to match or exceed.”

Seth L. Pearlman, PE, D.GE, M.ASCE, is the recipient of ASCE’s 2014 Michel Award. The award is presented annually to an individual who is a recognized and acknowledged leader "of the design and construction industry, whose dedication and aggressive vision have provided cornerstones for improving the quality of people’s lives around the world through research in the design and construction industry." The award was established in 1996 in honor of Henry L. Michel, past chairman of the board of directors of the former Civil Engineering Research Foundation.

Byle Kicks Off DVGI Season
Michael Byle, PE, D.GE, FASCE, the civil/geotechnical engineering discipline lead at Tetra Tech, Inc., kicked off this season’s Delaware Valley Geo-Institute Chapter's dinner talks with a detailed discussion about aerial characterization of karst regions for wind development. The presentation demonstrated the use of aerial imagery and digital modeling to identify surface depressions. It also included the methodology and verification measures used to assess a proposed wind energy site of more than 8 square miles. Byle showed how ground truth was established by visual reconnaissance on foot using GPS location and showed the aerial mapping to be accurate to within fractions of a meter. This work demonstrated that aerial and digital tools are an economical and highly accurate method for assessing the presence of karst features and is a useful tool for characterization of large areas.
October marked the 40th anniversary of John P. Bachner’s affiliation with ASFE/The Geoprosessional Business Association (GBA). His vision and engagement have helped to advance careers, businesses, and the geoprofession.

Over the years, Bachner has led the change in helping geoprofessionals and their clients confront risk and optimize performance. Under his leadership, ASFE/GBA has enhanced geoprofessionals’ writing skills, improved contracts, developed the concept of limitation of liability, and coached geoprofessionals in the business aspects of selling and practicing their profession. He has helped to provide the tools and resources many firms depend on to improve their businesses such as backyard seminars, the Fundamentals of Professional Practice (FOPP) Course, peer reviews, and the publication of more than 750 business-oriented materials—including more than 100 case studies.

ASFE/GBA celebrated Bachner’s 40-year milestone with an evening of recognition on October 11 during the 2013 ASFE/GBA Fall Conference in Boston. Past ASFE/GBA presidents David E. “Dave” Thompson, PE, FASCE; Richard T. “Dick” Reynolds, PE, D.GE, M.ASCE; and Gerald J. “Gerry” Salontai, PE, spoke on behalf of the many members who have been influenced by Bachner’s work. James L. “Jim” Withiam, PhD, PE, D.GE, M.ASCE, speaking on behalf of Terra Insurance, introduced a humorous and warm video from David L. J. “Dave” Coduto and Hal S. Arditti of Terra Insurance expressing their thanks. Current ASFE/GBA President, Kurt R. Fraese, L.G., wrapped up the celebration with a reflection of other icons who have served their craft for 40 years and are still going strong.

**Mooney Named Endowed Chair at Colorado School of Mines**

Michael A. Mooney, PE, M.ASCE, was appointed as the Grewcock University Endowed Chair in Underground Construction & Tunneling (UC&T) at Colorado School of Mines. He will lead the university-wide Center of Excellence in Underground Construction & Tunneling.

Mooney brings 18 years of academic and consulting experience in heavy civil engineering and construction to this position. He received a BS in civil engineering from Washington University in St. Louis, an MS in civil-structural engineering from the University of California-Irvine, and a PhD in civil-geotechnical engineering from Northwestern University. His expertise lies in soft ground tunnel design and construction, ground improvement, instrumentation/monitoring of construction systems, nondestructive imaging techniques, and intelligent geosystems. He advises numerous graduate and undergraduate students pursuing industry-applied research projects in UC&T.

He is excited about the future of UC&T education and research at the school. “Mines is a natural fit for a Center of Excellence in UC&T given the collective strength of the civil, geological, and mining engineering departments, the industry-focused nature of Mines, and a university mission that is strongly tied to earth engineering.”

**Yazdani Wins DFI 2013 Student Paper Competition**

Hessam Yazdani, PhD, S.M.ASCE, University of Oklahoma, is the winner of the DFI Educational Trust 2013 Student Paper Competition. His winning paper is titled, “Optimization of Piled-Raft Foundations Considering Soil-Pile Raft Interaction.”

Yazdani received his bachelor’s and master’s degrees in civil engineering from the University of Kerman, Iran, and moved to the U.S. for his Ph.D. in 2011. He was then offered a research assistant position by his advisor, Dr. Kianoosh Hatami. His main research interests include simulations of random heterogeneous materials and the application of innovative materials as well as probabilistic, optimization, and data mining methods in geotechnical engineering. He is the author of more than 25 papers published in accredited journals and international conference proceedings.

The first runner-up for the Student Paper Competition is Fawad Niazi, S.M.ASCE, graduate research assistant, Georgia Institute of Technology. His paper is titled, “A Review of the Design Formulations for Static Axial Response of Deep Foundations from CPT Data.” The two papers will be published in a future volume of the DFI Journal.
Ng is First Runner-Up in DFI Young Professor Paper Competition

Kam Ng, PhD, EIT, A.M.ASCE, assistant professor in the Department of Civil and Architectural Engineering at the University of Wyoming, was the first-runner-up winner of the DFI’s Educational Trust Young Professor Paper Competition. His paper is titled “Towards a Performance-Based Design of Drilled Shafts.”

The winner of the competition was Armin Stuedlin, PhD, PE, of Oregon State University. His paper, “Factors Affecting Reliability-Based Serviceability Limit State Design of Augered Cast-in-Place Piles in Cohesionless Soil,” will be published in the DFI Journal. He was assisted with the paper by graduate student Seth Reddy.

STUDENT NEWS

2014 Geo-Congress Student Travel Grant Information

Travel grants are available to student members of the G-I through the G-I Organizational Member Council and for competitors in the GeoChallenge competitions. Only one travel grant will be awarded to an applicant. Check the 2014 Geo-Congress Student page at http://content.asce.org/conferences/geo-congress2014/student-info.html for information.

5th Annual Student/Organizational Member Career Fair

Monday, February 24, 2014
8:00-9:00 PM (Stipend winners & Organizational Members only)
9:00-10:30 PM (Open to all registered students)

Due to the success of last year’s student travel grant winners’ Career Fair/Reception, the event will again be held in 2014. Forty-five travel grant winners will have a unique opportunity to participate in the Organizational Member/OM Career Fair “speed-dating” style, during which students can spend a brief time with any of the OMs they want prior to the general reception. This exclusive time brings together future employers and employees for the chance to learn about the profession and each other. Students graduating in 2014 will be given preference for the grants.

All students registered for the Congress will then have the chance to network with OMs during the 9:00-10:30 PM portion of the event. This free event, organized by the G-I Organizational Member Council, was funded by the generosity of the G-I Organizational Members.

To be considered for one of the 45 $275 stipends, students must have first registered for the Congress then completed the Student Travel Grant Questionnaire from the Registration or Student pages of the Geo-Congress website at www.geocongress.org by January 22, 2014. Student winners must attend the entire Organizational Member/Student Reception on Monday, February 24, 2014 and be willing to work as a volunteer, if requested, during one Congress event. Successful grant winners will be notified via email by February 4, 2014.

Contact Linda Bayer at lbayer@asce.org with questions about the reception and travel grants.

Host Sites Sought for 2014-2015 Cross Country Lecture Tour

The Geo-Institute provides the Cross-USA G-I Lecture Tour as a service to Geo-Institute-affiliated groups and members as an ongoing program to enhance the prestige of the geoprofession. The Cross-USA G-I lecturer will be a distinguished geoprofessional nominated by members and selected by the G-I Board of Governors in early March of 2014.

Only G-I Chapters and G-I Graduate Student Organizations (GSOs) may apply to host. You may submit an application if you are in the process of becoming a Chapter or GSO, but your Chapter or GSO must be approved by April 15, 2014 for your application to be considered.

If a GSO is selected as a host, it shall invite area professionals to attend. The host groups will be selected based on a range of criteria, including past selection as a host group, population base, geographic location, and application presentation. The application deadline for hosting is April 15, 2014.

An honorarium of $1,000 per lecture will be provided to the lecturer by the G-I. In addition, the lecturer’s travel expenses for the tour will be reimbursed by the G-I in accordance with current ASCE travel guidelines. The local host group will provide local lodging, local transportation, and meal expenses. For information: www.asce.org/gi/Member-Benefits/Cross-USA-Lecture-Tour/

Vermont and Hawaii Become GSOs

The G-I welcomes its 20th and 21st Graduate Student Organizations (GSOs) – The University of Vermont and the University of Hawaii, Manoa.

Vermont’s Mission Statement is that the GSO “will be a student-led body that functions to enhance the educational and professional experience of students in geotechnical engineering at the University of Vermont. One of the main commitments of the organization will be to increase student awareness of the geotechnical engineering profession at UVM. Also, the organization will work to engage the undergraduate civil engineering population at UVM by promoting participation in student activities organized by the Geo-Institute.” The GSO chair is Mandar Dewoolkar at mandar.dewoolkar@uvm.edu.

Hawaii’s Mission Statement states that “the graduate students at the Department of Civil and Environmental Engineering-Geotechnical Engineering group feel the need of increasing the student knowledge of geotechnical engineering at University of Hawaii at Manoa. This will come true only through activities that will be organized by Geo-Institute.” The GSO’s chair is Constantinos Papacostas at csp@hawaii.edu

Student Internship Opportunities

Looking for an internship opportunity? Then explore the positions listed on the...
**G-I CHAPTER NEWS**

**Professionals Benefit by Short Course on Sustainability**

A one-day short course titled “Life Cycle Assessment and Sustainable Geoengineering” was held at the University of Illinois at Chicago (UIC) on September 9, 2013. The course was presented through the cooperation of ASCE Illinois Section Geo-Institute Chapter and UIC. The instructors were Krishna R. Reddy, PhD, PE, D.GE, F.ASCE, a professor of Civil Engineering at UIC, and Jeffrey A. Adams, PhD, P.E., M.ASCE, an associate of San Ramon, CA-based ENGEO Incorporated. The course presented a range of sustainability concepts and tools that could be applied to the design, construction, and operation of civil engineering projects. Over 20 attendees representing a cross-section of academia, consulting, and government agency organizations attended.

The course featured several sustainability-related topics, including an overview of the basic sustainability concepts, a discussion of various environmental, social, and economic concerns, a discussion of the “Triple bottom line” concept, metrics used to measure sustainability, and several sustainability measurement frameworks and tools, including carbon footprint analysis, life cycle assessment (LCA), and streamlined LCA. In addition, sustainability software programs were demonstrated, and several case studies and related quantitative sustainability assessments were presented covering a range of civil engineering-related applications.

Through their participation, attendees learned about the growing interest and attention development of sustainable geo-systems have had and how sustainability principles can be increasingly incorporated into projects. The case studies provided specific examples of how these concepts may be introduced to critically assess project alternatives among a range of technically appropriate options.

The post-course feedback from the attendees was overwhelmingly positive. One attendee commented, “The content improved my understanding of sustainability. I liked the detailed explanations. The means for measuring the degree of sustainability was extremely interesting.” A second attendee added, “I was interested in the case histories. These made me think about project designs in a new light.”

Reddy and Adams plan to offer the short course at different locations in the future.

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**Attendees of UIC Short Course**

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**Become a Geo-Institute Chapter. No $$ is Involved.**

Looking for a more extensive way to get your section and/or branch message out to prospective and existing members? Then become a Geo-Institute Chapter. ASCE encourages this effort. There are no fees or chapter dues required by the G-I. There is just one short Memorandum of Understanding (MOU) that is needed. You can increase your membership recruitment efforts and event marketing by converting your ASCE Geotechnical Group to a G-I Chapter or by forming a new G-I Chapter. Download the MOU from the G-I web site at [http://content.geoinstitute.org/groups/index.html](http://content.geoinstitute.org/groups/index.html). Discover the benefits of affiliation.

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**Invite a Friend or Colleague to Your Local Meeting**

Do you faithfully attend your local geotechnical group’s monthly meetings but wonder why you always see the same people there? Have you ever invited anyone new to attend? How about the new, young engineer your company just hired (or whom you are possibly mentoring)? What about inviting a client? Or, maybe you have recently changed positions and could ask a few of your new co-workers to attend. Based on survey information received from local groups during the G-I Geo-Summits, it’s clear that the success of many local...
G-I chapters and geotechnical groups is a direct result of the marketing actions of their members. Help your local group succeed. Invite someone new to your next meeting.

**ISSMGE NEWS**

Frank Becomes ISSMGE President

The Geo-Institute congratulates Professor Roger Frank, the new president of ISSMGE for the 2013-2017 term. Professor Frank will guide ISSMGE’s 88 member societies, consisting of nearly 20,000 individual members.

Frank has been an active participant in ISSMGE during the past 35 years, as well as being involved in numerous international activities. He was the vice-president for Europe of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) from 2005 to 2009 and an appointed member on the Board of ISSMGE from 2009 to 2013. He was also the chairman of the Strategic Advisory Committee for the 18th ICSMGE held in Paris, September 2-6, 2013.

ISSMGE Bulletin Available Online

The September 2013 ISSMGE Bulletin is now available. This issue includes background information about the society following the many regional presentations celebrating ISSMGE’s 75th anniversary. Read the Bulletin online at www.issmge.org/en/resources/issmge-bulletin/622-vol-7-issue-5-september-2013.

**ALLIED ORGANIZATION NEWS**

**ADSC Announces 2013 Safety Award Winners**

From left: ADSC President Tom Tuozzolo; Robert Carnevale and Christie Weinstein, Hayward Baker; and Michael Moore, ADSC CEO

The ADSC: The International Association of Foundation Drilling is widely acknowledged for its focus on promoting safety in the workplace. One of the ways the ADSC highlights this emphasis is by presenting annual awards to companies that demonstrate a strong commitment to providing their most valuable asset, their personnel, a safe working environment.

This year there were 19 winners representing U.S. contractor companies, with three Canadian firms taking home special honors as well. In addition, five manufacturer and supplier firms were recognized for their outstanding safety records.

At the top of the list is Hayward Baker, Odenton, MD. Hayward Baker achieved the association’s highest honor, winning the “Rick Marshall Commitment to Excellence in Safety Award.” Case Atlantic, Co., Clearwater, FL, is the recipient of the “Dave White, Most Improved Safety Program” award.

These top awards are named in honor of two of the ADSC’s leading safety professionals, Rick Marshall, Safety Director at Richard Goettle, Inc. in Cincinnati, OH, and nationally-prominent safety consultant Dave White, now deceased. For a list of winners, contact: Katie Nephew at knephew@adsc-iafd.com

**In Memoriam**

DFI Trustee Arturo L. Ressi di Cervia


Ressi became a member of DFI in 1990 and a trustee in 2010. As a trustee, he offered his experience and intellect in the Institute’s governance. He was recently named the recipient of DFI’s highest award to an individual, the Distinguished Service Award. The annual honor recognizes “individuals who have made exceptionally valuable contributions to the advancement of the deep foundations industry.”

As a young engineer, relatively new to the U.S., he was involved in the design and construction of the innovative slurry wall foundation for the World Trade Center in New York City. That seminal structure withstood the 9/11 disaster and most likely prevented the Hudson River from flooding lower Manhattan.

Ressi’s roots were in Italy, where he graduated from Bologna University in civil engineering, specializing in soil mechanics. After university, he joined ICOS, an international specialty foundation company, where he was frequently promoted and given increasing responsibility. He became president and owner of ICOS’ international operations, with companies in Hong Kong, Chile, Venezuela, Korea, Singapore, and Canada. When Trevicos was established the U.S., he served as president. Since 2007, Ressi served as special projects executive with the Eastern District of Kiewit and was an independent foundation and geotechnical consultant. His career...
came full circle when he returned to the World Trade Center to work on the slurry wall extension of the new deep basement to the east.

A preeminent constructor of slurry walls worldwide, he was involved in many landmark projects including the deep cut-offs in Manicouagan, Wolf Creek, the New World Center in Hong Kong and other slurry wall projects for subways in the U.S., Hong Kong, Korea, and Singapore. He authored several technical papers, frequently lectured at technical seminars and conferences, and held six U.S. patents.

He was a Life Member of the United States Committee of Large Dams; a member of the American Society of Military Engineers; the American Society of Civil Engineers (ASCE); The Moles; a board member of the Deep Foundations Institute; and a member of ADSC.

Ressi was nominated by Engineering News Record for the ENR Man of the Year Award in 1977 and featured in the ENR cover story of April 5, 1979. He was also Recipient of ASCE’s A. P. Greensfelder Construction Prize in 1980, the ASCE Kapp Foundation Engineering Award in 2012, and the DFI’s Distinguished Service Award in 2013.

**INDUSTRY NEWS**

**Geothermal Drilling Research**

Last year, a partnership between Sandia National Laboratories and Atlas Copco Secoroc was awarded a $3.4 million Department of Energy (DOE) grant to develop a down-the-hole hammer capable of low-cost, high-production drilling in the extreme heat of deep geothermal wells. The overall DOE goal is to increase the feasibility of geothermal energy production by lowering the cost and financial risk associated with it.

The two firms were recently awarded continuation of the project after successfully displaying the results of Phase 1 to an industry and government review panel. The remainder of the project will demonstrate that percussive drilling with compressed air is capable of consistently drilling to 1000 ft, at temperatures up to 570°F, and at rates exceeding conventional methods.

**Caltrans on Target to Complete Repairs on Bay Bridge Bolts**

A permanent fix for the failed bolts on the San Francisco-Oakland Bay Bridge in California is on track to be finished by the end of autumn, according to Caltrans. The repair work involves the installation and tensioning of steel saddles. “All the pieces of the steel saddles themselves are in place. The steel saddles are going to carry these steel tendons,” said Andrew Gordon, a Caltrans spokesman. “When the steel tendons are tensioned, that will provide the same clamping force that those bolts were supposed to provide.”

**$162M in Federal Funds Provided to Repair East Coast Storm-Protection Projects**

The federal government will provide $162 million toward 45 projects to help reduce the impact of Atlantic Coast storms that caused an estimated $65 billion in damage. Hurricane Sandy was the second-costliest hurricane in U.S. history, behind Katrina. Projects include the restoration of shorelines, wetlands, and marshes. “What we witnessed during Hurricane Sandy was that our public lands and other natural areas are often the best defense against Mother Nature,” said Interior Secretary Sally Jewell.

To submit information for Geo-Strata magazine, send your brief news about your recent honors, awards, special appointments, promotions, etc. to geo-strata@asce.org. High resolution photos must be sent as separate files. Refer to production guidelines on the Geo-Institute website at www.asce.org/geo. Sales-oriented copy should be directed to Dianne Vance, Director of Advertising at dvance@asce.org.
HAYWARD BAKER