

Docket S030
Ex. 39-18

AUGUST 2003

Sculpted Soil Nail Wall
Beautifies
Provo Canyon

Anomalies Revisited

New Drilled Shaft
Concrete Research

Vacuum
Consolidation
Technology

FOUNDATION DRILLING

Dr. Michael W. O'Neill
1940 - 2003

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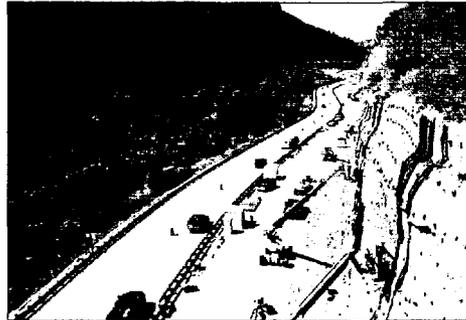
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Reader Service #0604

FEATURE ARTICLES

14 Soil Nails, Rock Dowels, and Unique Architectural Treatment Beautifies Provo Canyon

A slope stabilization project for SR-169 near Provo, Utah called for soil nails, rock dowels, and an environmentally acceptable wall finish. DBM Contractors reached deep into their idea-bank to solve all of the problems.



Provo Canyon gets special treatment. See feature page 14.

18 What Do You Do With an Anomaly?

A research team from the Civil Engineering Department at the University of Washington in Seattle is working on an in-field finite elements program that will address the issue of drilled shaft rejection based on CSL and like testing in real time. The question to be addressed is "What is the real impact of a defect in the performance of a constructed drilled shaft?"



Self Consolidating Concrete tests at Auburn University. See feature page 24.

24 Self Consolidating Concrete Research Shows Promise for Drilled Shafts

Dr. Dan Brown at Auburn University, Auburn, Alabama has completed the first phase of his research into the behavior of self consolidating concrete (SCC) in drilled shaft construction. The results, while still preliminary in nature, indicate the increased workability provided by SCC may solve a number of problems associated with traditional drilled shaft concrete mixes.



New Euro-Technologies provide stimulus for U.S. construction innovations. See feature page 28.

28 Vacuum Consolidation Technology: Another Innovative European Technology

This is the fourth in a series of articles that resulted from the 2002 AASHTO/FHWA-sponsored European Geotechnology Scanning Tour, the purpose of which was to investigate state-of-the-art practices that could accelerate the construction of embankments in the U.S. Transportation Industry.

ADSC

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ON THE COVER

DBM Contractors, Federal Way, Washington, installs soil nails and creates an architectural finish that satisfies the staunchest environmentalists for Utah's Provo Canyon slope stabilization project. See feature page 14.

In Memoriam

Dr. Michael O'Neill Passes Away, We Are Not Ready

by S. Scot Litke

Where were you when you got the news that Dr. Michael O'Neill had died? For me that question ranks right up there with the very same that has been asked about John F. Kennedy and Martin Luther King. It is even more profound for me, for while I admired both legendary figures in this nation's history, I did not have a personal relationship with either. I did with "Dr. O," as we at the ADSC headquarters called him. My "call" came from ADSC Past President and current President of the Geo-Institute, Alan Macnab. It was 7:30 am on Monday, August 4th. I was in Whistler, British Columbia having just completed the ADSC's 2003 Summer Meeting and getting ready to leave for the Vancouver airport. The message was very simple. "Scot have you been in touch with your office this morning", Alan asked. "No" I replied. "Mike O'Neill died of an apparent heart attack in his home on Saturday." That was all I needed to hear, and all I can remember of that dreaded phone call. My reaction was thorough shock, followed immediately by feelings of deep, deep sorrow, and an overwhelming sense of loss. It couldn't be, but nonetheless it was so. All of us who knew Mike knew his health had been an issue for many years, but somehow we just never thought that he would succumb, after all he was only 63.

This is not the Editor's Note col-



Dr. Michael O'Neill
1940 - 2003

umn I had written for this issue of *Foundation Drilling* magazine. The August issue had been "put to bed" weeks ago. This is not a column I relish writing. I would much prefer to be reporting on yet another mutually successful research or training venture the ADSC had just completed in conjunction with "Dr. O", for during the 21 years of my tenure in this seat there have been many. All of that changed on that sun-filled morning in the magnificent mountains of British Columbia. Dr. Michael O'Neill had died and the professional world in which I/we live would never be the same.

I returned to the ADSC office on Tuesday morning, August 5th. The email, phone, and fax wires were already buzzing with notices of Mike's passing. His vast engineering credits were being recounted from a variety of noted sources. Rather than reiterating Mike's illustrious career, I prefer to focus on what he meant to

(continued on page 5)

FOUNDATION DRILLING

Serving Geo-Construction Professionals
Throughout The World

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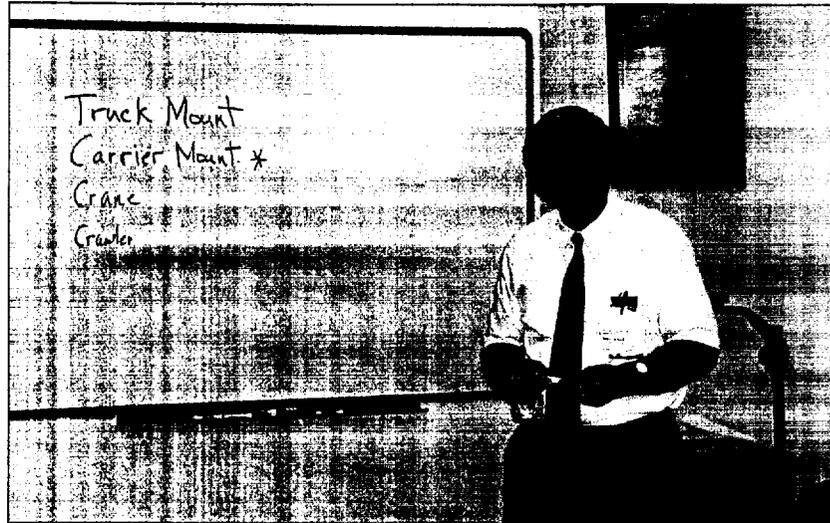
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the ADSC, to the drilled shaft industry, to all that had the privilege and a privilege it was, to have worked with him, to have known him as a colleague, and as a friend. The ultimate irony is while I was away, Mike had sent me several emails on a variety of subjects in which we were currently engaged. He was to participate in an ADSC South Central Chapter meeting with the Texas DOT in a few weeks and was clearing his calendar to be able to attend. The last message I received from him mentioned that he was scheduled for an "outpatient procedure on August 5th". Perhaps if he had been able to make it through that terrible weekend-event they would have been able to intervene in what was his final bout with a weakened heart. That is too troubling for me to deal with right now as I lost my own father in a similar fashion.

So let's talk about Mike. He was a prolific writer whose many monographs, research reports, and manuals on the subject of Drilled Shaft design, construction, and testing, forms the core of the ADSC's Technical Library in that subject area. He was an indefatigable traveler literally covering the globe sharing his considerable wisdom. Mike was the backbone of many of the ADSC's educational efforts being a featured presenter at over 100 drilled shaft design and construction seminars under the ADSC umbrella, and in conjunction with the FHWA's National Highway Institute. I personally traveled with Mike all over the United States, and in Canada. He bounded from Europe to Asia influencing geotechnical engineering thinking on every continent in between. As his health began to fail, he continued on without respite. Perhaps he knew better than all of us that he didn't have much time. And as we all knew, he had so much to share.

Mike was equally at home presenting the prestigious Terzaghi Lecture to an auditorium full of geotechnical engineers as he was teaching the subtleties of slurry construction to



Dr. Michael O'Neill teaches an NHI Drilled Shaft Design and Construction Seminar this past spring. (Photo by Bill Isenhower).

ADSC member firm field personnel. He was one of my personal mentors. I sat in on every one of his lectures at ADSC drilled shaft design seminars. I really started to worry when I realized that I understood everything he was saying (almost...). While you don't want to be traveling over any bridge whose drilled foundations I designed, you can rest assured that my comprehension of axial and lateral load, the performance of mineral and polymer slurries, soil-structure interaction, finite elements analysis, and similar engineering fundamentals is soundly based in good part on what I gleaned from "Dr. O."

Mike was someone who could never say "No." Anytime I flashed off an email to him asking for his brief opinion on a subject, I received an expanded response almost immediately. Every time the ADSC needed help in a research area, and educational program, or support for a regional Chapter's initiative with a particular State Department of Transportation, Dr. O'Neill was there to assist. I particularly enjoyed his phone calls. Even after our working closely together for nearly 20 years he would introduce himself by saying, "Hello Scot, this is Dr. Michael O'Neill from the University of Houston," (as if I didn't know), I know that you are busy, but I wanted to

talk to you about something that may be relevant." Then he would launch into a concise discussion on some topic of definite importance to the drilled shaft industry.

Mike was a wonderful partner for the drilled shaft industry. His seminal research in drilled shaft design and performance moved the industry forward dramatically as has had the work of his mentor Dr. Lymon Reese before him. Mike did his undergraduate, Masters, and PhD work under Dr. Reese at the University of Texas, yet Mike is most closely associated with the University of Houston, which was clearly, "his school." The ADSC and its members supported much of Dr. O'Neill's research work at the University of Houston's geotechnical engineering testing site. His work there led to the site being selected as one of the first National Geotechnical Experimentation Sites initially funded by the National Science Foundation and the FHWA and now under the direction of the Geo Council. Unfortunately, University expansion pressures caused the site to be closed. The value of his work there in studying drilled shaft performance as it relates to slurries, non-destructive evaluation, soil-structure interaction in expansive soil, and much, much more, lives on as does

(continued on page 6)

his research work conducted throughout the U.S.

Those of us who knew Mike knew that below that most amenable manner lived a man who knew where he stood on every issue. Serving with Mike on a number of Geo-Institute, Geo-Council, and FHWA research committees, provided me with a first hand understanding of Mike's commitment to his personal craft and to his profession. As a dedicated professional he never shied away of being critical of geotechnical engineers when it came to a tendency to rely on theory rather than field experience. He was equally at home in a laboratory or climbing around a construction site...at times getting too close to the action. But, that's another story. He often apologized to construction site field personnel and to ADSC company leaders for being "just a professor." Just a professor, my steel toed boots! Although I must say, the first time I observed "Dr. O" showing up at a field site in loafers I did have to wonder. I remarked about this one time while sitting under the shade of a load test H-beam...Mike responded, "that's OK, I always wear these in the field." I should have known. And while Mike took his work very seriously, he was never above making fun of himself. His dry wit often caught those around him off guard, another engaging part of his complex personality. He willingly shared the spotlight with all those who worked with him and gave credit where credit was due. Mike was genuinely appreciative of everything that was done for him. He was profuse in his praise when praise was due. The ADSC staff adored him. ADSC members truly *liked*, as well as respected him. One could not help but become a better professional by being part of his world.

At the ADSC and ASCE's Geo-Institute mega conference to be held in Orlando, Florida, in February of next year, Dr. O'Neill was to be honored as the geo-engineering and geo-construction industry's "Hero." In that capacity he was to join industry giants Dr. Ralph Peck, Dr. Jim Mitchell, and



In 1990, Dr. O'Neill received the ADSC's Outstanding Service Award from then President, Alan Macnab.

John Focht. We kept this from Mike in a desire to try to surprise him at that event. Now I am sorry that we did not share this with him in advance. He should have known how he was revered by his colleagues. Mike was a deep thinker, an innovator, an educator, a consummate professional.

I could go on and on about "Dr. O," listing his many contributions to geotechnical engineering research, deep foundation design, his extensive professional honors, his 200 published papers, and his contributions to geotechnical engineering education as the list is a long one indeed. Suffice to say, Dr. Michael O'Neill, Cullen Distinguished Professor of Civil and Environmental Engineering at the University of Houston, Houston, Texas, is one of the most important and influential individuals in the history of the drilled shaft foundation industry.

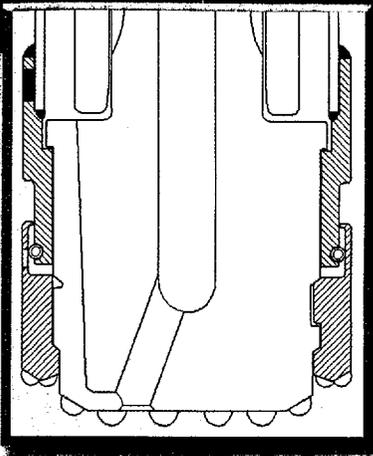
On my drive back to Vancouver I was struck by the majestic mountains alive with their powerful glaciers slowly and profoundly changing the region's geologic features, a place where mountain peak meets the sky. An apt metaphor for where our "Dr. O" now resides.

He is gone far too soon. We are not ready.

Michael Wayne O'Neill, Ph.D., 63, passed away Saturday, August 2, 2003. He was born February 17, 1940 in San Antonio, Texas to Wayne and Hazel O'Neill and is survived by his wife Jerilyne, son Ron, and other extended family members. He will be missed by many colleagues and friends.

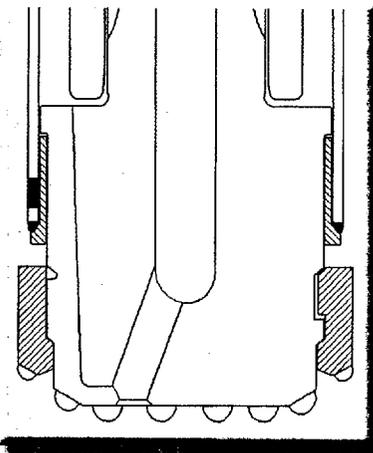
Mike was a Civil Engineering Professor at The University of Houston for 29 years. Among his many awards and accolades, he was a John and Rebecca Mores Scholar Program Professor and a Cullen Distinguished Professor. In 1990, he received ADSC's Outstanding Service Award, and in 1998 he was awarded the Karl Terzaghi Lectureship.

Funeral services were held on August 6, 2003 at Holy Cross Lutheran Church, Houston, Texas. Graveside services took place at Sunset Memorial Park in San Antonio, Texas. The family requests memorial contributions be made to Holy Cross Lutheran Church or The University of Houston Graduate School of Civil Engineering Scholarship Fund.



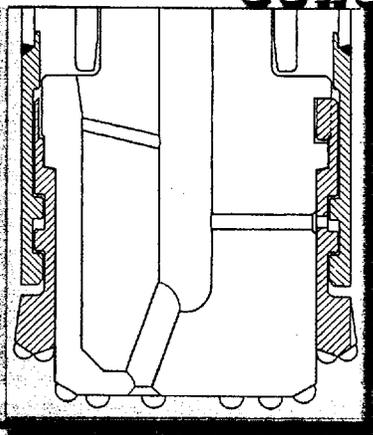
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- Easy retrieval of the casing and ring bit is left in the hole
- Intended for shallow holes and/or where the casing is retrieved from the hole



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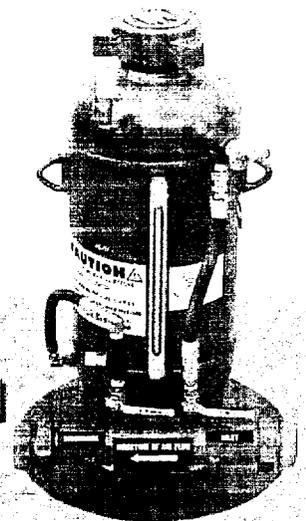
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The Gas Detector Challenge

The following request from an ADSC Contractor Member and the response from ADSC's Safety Hotline Provider could be of use to all of our members. Greg Strudwick can be contacted at 800/426-8920. (Editor)

Good morning Greg,

My company has had problems for years with gas detectors. We will find a brand that all the crews will like for a short time, then it seems that the detectors will start to have problems. The money we have spent on repairs is mounting. Is there a brand of detector that the ADSC recommends that is reliable and fairly maintenance free? Please let me know if you can help.

Thanks and have a great day.

Dean Frohling
Vice President
Blackhawk Foundation Co., Inc.

... and the response

Dear Dean:

Gas detectors are a challenge!!! The best way to approach the issue is to find a local dealer that is very customer conscious. I have owned several different brands i.e.: Dynamation, Lumidor and En-Met. All were good detectors but all had to be serviced on a regular basis. The vendor made a difference in that they would provide a loaner during the service period. There is a new brand on the market that is popular at the moment, B-W. I don't have any details but I think that United Rental handles it in our area. The other challenge that confronts contractors who use gas detectors is that they are electronic and will not withstand constant abuse. Employee training is a must if the equipment has any hope of a long service life. They have a tendency to drown easily!!! I wish I had all the answers but I don't, all gas detectors tend to be expensive and temperamental. The best seem to be simple to operate and easy to service. Find a good Vendor!!! I hope that

I provided some help.

Regards,

Greg Strudwick
Greg Strudwick & Associates
ADSC Safety Hotline Provider

The Discussion Continues on the Work of the Specialty Subcontractor

A Letter to the Editor in the March/April 2003 issue of Foundation Drilling entitled "Long-Time Subcontractor, Now General Contractor, Takes Issue with ADSC Position on GC's Self-Performing Specialty Work" resulted in a follow-up rebuttal in the May issue called "Specialty Subcontractors Are Best Suited to Do Our Work!" Two more points of view are included in this issue for your consideration and response. Keep those cards and letters coming. (Editor)

Specialty Contractors vs. General Contractors

Dear Editor,

I've been following the recent letters regarding General Contractors self-performing caisson work and find the discussions very amusing, but do not understand all the surprise.

Some GC's have been installing their own deep foundations since I started in this industry twenty years ago. This is especially true for the highway contractors self-performing driven bearing piles and sheet pile earth retention work. Most of these GC's do a great job self-performing this work. Some may experience difficulties; however, this is the exception and not the rule.

I think that we as an industry must be smart, particularly smarter than the GC's we hope to work with. It is not uncommon for some in the caisson, piling and earth retention business to furnish prices to GC's who are known to dabble in our industry. And we have all heard the excuses from these particular GC's; this job is too big for us; all of our equipment is

busy on other jobs; if you beat our cost, we'll award the work to you; etc. And some specialty contractors actually believe these stories and quote the work. Others will compromise and provide a "drill only" price, where the GC will furnish and place casing, reinforcing steel, concrete, etc. Even more exasperating, a few specialty contractors will offer to provide the superintendent/lead man for the GC to perform the work!

What we need to do is unite and boycott these self-destructive practices. The GC's who perform our work should not be provided our pricing or expertise either during or after the bidding process. We should seek out and help the reputable GC's who will subcontract the work to the appropriate specialty contractor. And, we should be intelligent enough to anticipate what that GC needs and provide not what he *thinks* he needs, but what we *know* he needs to perform the work on schedule, within budget and according to the project specifications.

Our own practices have led us to our current dilemma. Only by changing our ways can we hope to cease this unwanted trend. If we seek to perpetuate our industry, we must first sell our services, complete and unadulterated. But we must also learn to sell smart.

Doug Keller
Executive Vice President
Richard Goettle, Inc.

Subject: Specialty contractors are best suited to do our work

Dear Editor:

I read with interest Kevin Sharp's letter in the May 2003 issue of *Foundation Drilling*. As a consulting engineer with no axe to grind, I wholly agree with him that the construction of drilled shafts should better be left to specialty contractors. Nevertheless, economic constraints may sometimes lead to a different outcome. The Israeli experience may well illuminate this

(continued on page 10)

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point in five simple steps:

a. Imagine a large drilled shaft contractor (DSC) with an excellent track record who has just finished a large piling job. Since the Client still has no General Contractor, DSC is asked to cast the grade beam, which he does.

b. On the next job DSC has enough self-confidence to undertake, in addition to the piles, also culverts and retaining walls.

c. The next logical step for DSC is to bid on the construction of residential and office buildings. Because of oversupply, this is clearly a buyer's market in which it is almost impossible to make any profit.

d. DSC, now turned into a full-fledged GC, has only one more direction in which to expand – development. He borrows money from the banks, buys real estate and builds residential neighborhoods.

e. During all this time the GCs, who used to provide jobs to DSC, watch how their former subcontractor has turned into an aggressive

competitor. Since they refuse to turn the other cheek, they will buy some small-league specialty contractor and start to produce their own drilled shafts.

f. At the end of the day, the GCs end up by producing inferior foundations, while DSC goes bankrupt.

The writing is on the wall – just give it a hard look.

Sincerely,

Dr. Joram M. Amir, CE
ADSC Technical Affiliate Member

**Cover Feature
Receives Kudos**

The following letter to Foundation Drilling magazine's Managing Editor is greatly appreciated. To learn how your company can be featured on the cover of the magazine, contact Teri Dres at the ADSC office (214/343-2091). (Editor)

Dear Teri,

I would like to take this opportunity to thank you for the time you put into producing the July 2003, *Foundation Drilling* magazine cover feature: *Building a Castle on the Moon – Largest SCDOT Infrastructure Project Ever! Drilled Shaft Installations in Extreme Environments*, by Nigel Osborn.

Having a layout process that allows us to follow-up with additional edits makes a lot of difference. Case Atlantic Company greatly appreciates having a cover feature published in a magazine that communicates so effectively with the engineering community.

I look forward to receiving the issue (which I am sure will be stunningly well-produced), and possibly developing future articles for *Foundation Drilling* magazine.

Best Regards,

Todd Pierce, Technical Writer
Keller Foundations Inc./Case Atlantic

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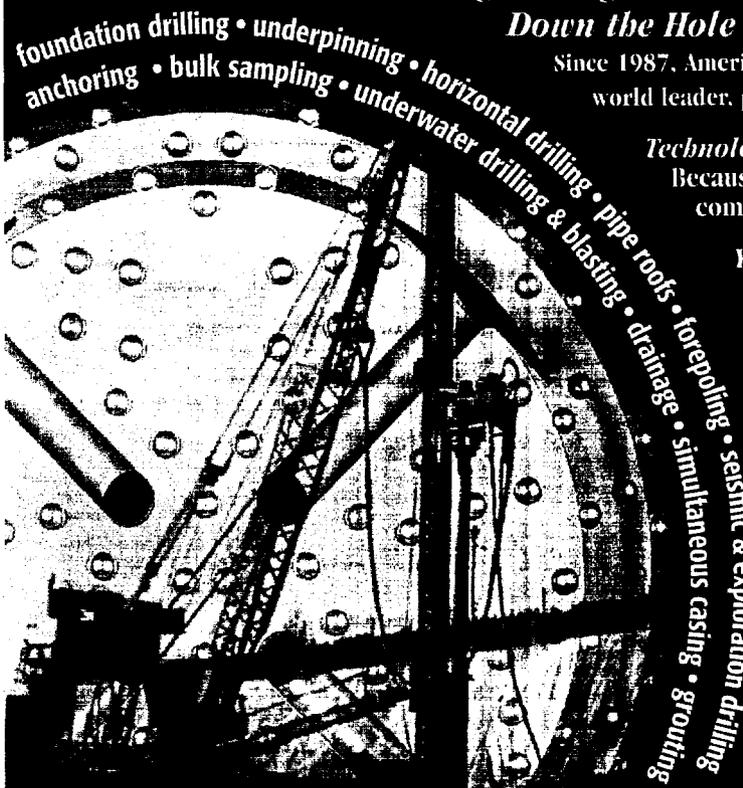
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THE THIRD ANNUAL ADSC ANCHOR AND MICROPILE INSTALLATION SCHOOL

November 2 - 8, 2003



In an effort to continually advance the industries in which we work, ADSC proudly presents our **Anchor and Micropile Installation School (AMPIS)** - again. This course will take place in Greensboro, North Carolina at **Gulford Technical Community College, November 2 - 8, 2003.**

WHO SHOULD ATTEND?

The AMPIS program is designed for the employee who shows promise and has some experience in the field working with earth and rock anchors, or other types of soil retention construction.

Why should your employee attend? Just listen to their comments . . .

"All classes were of value, who knows when you will need such information throughout your career."

"It was exciting learning new techniques not only from the speakers, but our peers. It was extremely positive."

"As I started to evaluate all of your speakers, it came to me that everyone involved did a great job. Everyone was willing to answer anything asked. It was a great experience and I hope to see this class offered again."



**One (1) attendee per company!
Additional company attendees may be considered
for registration after Friday, October 3, 2003.**

WHAT WILL THEY LEARN?

AMPIS attendees are instructed on the use of four to five different drills and tooling set-ups over a six day period. Daily quizzes will be given on each day's course curriculum.

POTENTIAL CLASS TOPICS:

On Site Safety ♦ History and Applications for Anchors ♦ Grout Plants, Set-up, Mixing, Cleaning ♦ Setting Up and Maintenance ♦ Drilling Systems - Single, Duplex, DHH, Augers ♦ Anchor and Micropile Drilling ♦ Hydraulic Systems and Troubleshooting ♦ Anchor and Micropile Set-up for Testing ♦ Anchors, Soil Nails, and Micropiles ♦ Using Air, Water, Foam, and Drill Fluids ♦ Reading and Recording Test Results ♦ Soils and Job Site Math ♦ Actual Testing of Installed Anchors to Failure ♦ Understanding the Driller's Role ♦ Project Planning and Drawing Review ♦ Drilling - Including Hands on Applications, Techniques, and Systems ♦ Job Planning

SCHEDULE:

Sunday, November 2, 2003 - 6:00 p.m. - 8:30 p.m., kick off. *Please plan on arriving at the hotel Sunday, November 2, 2003, registration will begin promptly at 5:00 p.m.*

Monday, November 3 - Friday, November 7, 2003 - Class time begins at 7:00 a.m. continuing through 5:30 p.m. *Breakfast will begin serving at 6:00 a.m.*

Saturday, November 8, 2003 - Class time begins at 7:00 a.m. and will conclude at 4:30 p.m.

Saturday evening Awards Dinner, 6:00 p.m. - 8:00 p.m.

Check out: Sunday morning, November 9, 2003.



A M P I S

**Registration is
Limited to Only
20 Attendees!**

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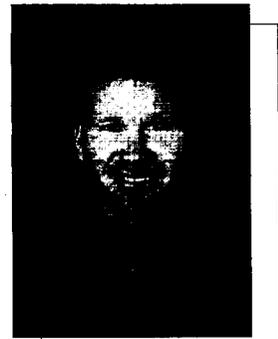
The Ship is Sailing, Come on Board

by Mike Hayes

Are you taking advantage of one of the most valuable resources that the ADSC has to offer? And no, I'm not talking about the Associate members hospitality suites or the hats, coffee mugs and other assorted goodies that are given away at our meetings. Although I would have to admit that without these perks attendance at our meetings might suffer. If you can't visit a hospitality suite until the late hours of the night and get a free hat, what is the point of going to a meeting! But seriously, the resource I am referring to is one that will be a long-term benefit that will pay dividends for years to come for our member companies and their employees.

Most of you by now are familiar

with our different internal educational schools and institutes conducted on a regular basis. Many of our members have been taking advantage of these programs in the past but I have the feeling that some of you may be missing the boat. For those of you not familiar with these schools they are; Anchor and Micro-pile Installation School (AMPIS), Drill Rig Operator School (DROS), Management Personnel Training Institute (MPTI), Supervisory Personnel Training Institute (SPTI) and the Slurry School. Each of these programs have been developed over the years and tailored to meet the individual needs of each participant. Every one of these schools began with an idea by a member in one of our committee meetings to develop a training program that wasn't avail-



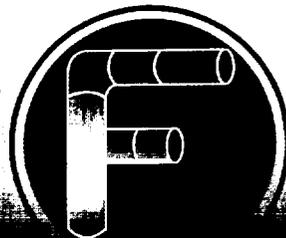
able anywhere else. In the beginning many of these ideas were met with much skepticism. With a few visionary members leading the way, and a lot of support from staff and member Contractors and Associates, we have progressed to where we are today.

While we are pleased with the results of these past schools, the ADSC is never one to rest on its laurels. In our quest for perfection, we recently formed a task force to examine different aspects of each school in an effort to better serve our membership. Under the able guidance of Education Committee Chairman, Bill Maher, we met recently to discuss various issues that might have been perceived as needing updating or modification. I can report that it was a very productive session. New schedules have been established for the schools so that they all don't occur during the same time frame. Curriculums are being developed for not only the classroom sessions, but for the field portions of the training. Different locations for the schools are being examined to allow easy travel access for all of our members around the country. Sites that allow adequate space for equipment and provide varying drilling conditions are being examined.

For those of you who have participated in one of these schools, either as a student or as an instructor, you know what an enormous undertaking they are. Each school relies on

(continued on page 13)

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a member coordinator working with the staff and the many member volunteers to make it a success. One of the most important aspects of this is the coordination between staff and school coordinator and the delineation of responsibilities. I believe that through dialogue that took place at our meeting, we are making real progress in this area that will pay dividends in the future.

I want to acknowledge all of our staff and members who have spent countless hours and donated thousands of dollars in services and/or equipment usage to these schools. For those of you who haven't been involved, it's time to step up to the plate. The stage is set to expand on our successes of the past. The boat is leaving port and the only question is whether you're on board! ■

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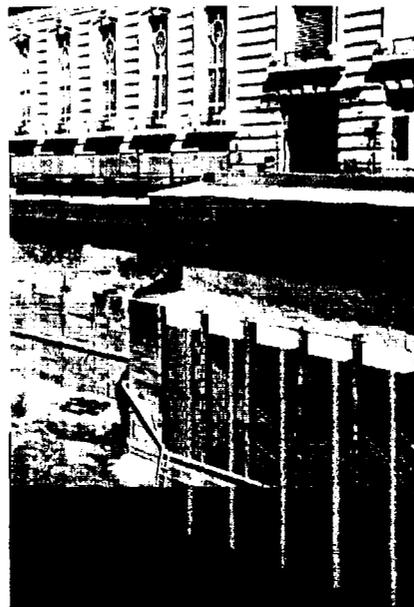
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SEPT/OCTOBER FEATURE ARTICLES

Soil Nails and Rock Dowels Support 1.5 Mile Stretch of SR-189

by John Bickford, P.E.
Engineering Manager
DBM Contractors, Inc.



Working high above SR-189 in Provo Canyon.

Project Background

In 1995, construction began on a slope stabilization project along a 1.5-mile stretch of SR-189 in Provo Canyon, Utah. A portion of the scope of work included the construction of approximately 170,000 square feet of permanent soil nails and rock dow-

UDOT's main goal included the requirement of aesthetic slope stabilization structures that are responsive to public concerns and compatible with the existing geological features of Provo Canyon.

els. The project plans also detailed a reinforced concrete cast-in-place form lined finish wall facing for these structures.

Upon completion of the rock stabilization system, construction began on the concrete facing. Almost immediately, residents of Provo Canyon began to voice concern and displeasure regarding the aesthetics of the concrete facing. This concern, coupled with other contractual

issues terminated the project in 1997.

In July 2001, Utah Department of Transportation (UDOT) issued a Request For Proposal (RFP) to select a Design/Build Team to design and construct the continuation of the rock stabilization required from Vivian Park to the Wasatch County Line on SR-189.

The two phase technical cost proposal included the procurement of the "best value" contractor to design and construct the safe, efficient, cost conscious, environmentally sensitive and compatible soil nail stabilization, wall drainage, and cast-in-place, pre-cast or structural shotcrete slope face treatments.

UDOT's main goal included the requirement of aesthetic slope stabilization structures that are responsive to public concerns and compatible with the existing geological features of Provo Canyon. Secondary goals included reasonable cost and a project completion within the construction period from April 2002 to October 2002.

Included as part of the \$6.5 million project were two interesting features. These two features included a contractor proposed Warranty Bond for

the permanent wall drainage system where the proposing contractor specified the warranty duration, warranty criteria with measurable standards and remedial work plan. The second feature included a \$200,000 Performance Incentive Fee awarded only if the contractor exceeded the minimum requirements specified for the aesthetic treatment of the slope faces. These requirements included blending the retaining structures into the

The second feature included a \$200,000 Performance Incentive Fee awarded only if the contractor exceeded the minimum requirements specified for the aesthetic treatment of the slope faces.

natural canyon environment including color, texture, natural vegetation, relief, shadowing and pleasing transitions that match or enhance the sur-

(continued on page 15)

rounding physical features of the canyon. Award of the Contractor Performance Incentive was to be determined by the Provo Canyon Aesthetics Team. The team was composed of the UDOT Project Manager,

The objective of the sculpted shotcrete treatment proposed by DBM was to "raise the bar" as it related to the quality associated with simulated rock slope stabilization for UDOT and their stakeholders.

three members of the public and three UDOT staff members, all appointed by the UDOT Project Manager.

In December 2001, DBM Contractors, Inc. was awarded the Design/Build Contract. Included on DBM's Provo Canyon Project Team were Golder Associates (Design Engineer) and CemRock Landscapes, inc. (Shotcrete Subcontractor). Together the DBM team presented a detailed technical cost proposal that included a high quality simulated rock treatment to the slope faces. The objective of the sculpted shotcrete treatment proposed by DBM was to "raise the bar" as it related to the quality associated with simulated rock slope stabilization for UDOT and their stakeholders.

Design Considerations

Based on the various existing conditions, three different slope treatment types were designed.

In areas of competent rock with no shotcrete, minimal treatment was used. Treatment included scaling and installing additional rock dowels as required for stability of the rock face.

New and existing rock dowels were trimmed and painted to preserve the aesthetics of the existing rock.

In areas of soil nails and shotcrete, treatment consisted of a new six inch structural shotcrete facing with a 2-inch layer of sculpted shotcrete. Based on the RFP, the existing soil nail walls were analyzed at selected locations to determine that adequate static and dynamic factors of safety were present for a design life of 75 years.

In areas of weak rock with existing rock dowels, treatment was the same as the soil nailed areas previously described.

Permanent drainage considerations, where new shotcrete had been applied, were based on data collected from the previous design team and field observations. One foot wide geocomposite drain boards were used and covered between 20% to 60% of the treated surface. Water collected in the composite drain boards was released at the base of each wall through a standard 1.5" diameter weep pipe.

Besides providing for drainage behind the new shotcrete, the RFP specified that waterproofing be considered. DBM's design team worked with the local concrete supplier to develop a concrete mix that included waterproofing additives to reduce

the permeability of the shotcrete and help "seal" potential small hairline cracks that might develop.

This additive was used for both the structural concrete as well as the sculptured concrete.

For freeze/thaw durability of the sculpted shotcrete, consideration was given to the wide range of temperature differences that Provo Canyon experiences. DBM's design team worked with UDOT to develop a concrete mix that included air entrainment and synthetic fiber reinforcement. These synthetic fibers were used to control shrinkage and temperature cracking and provide additional durability and toughness in the shotcrete mix.

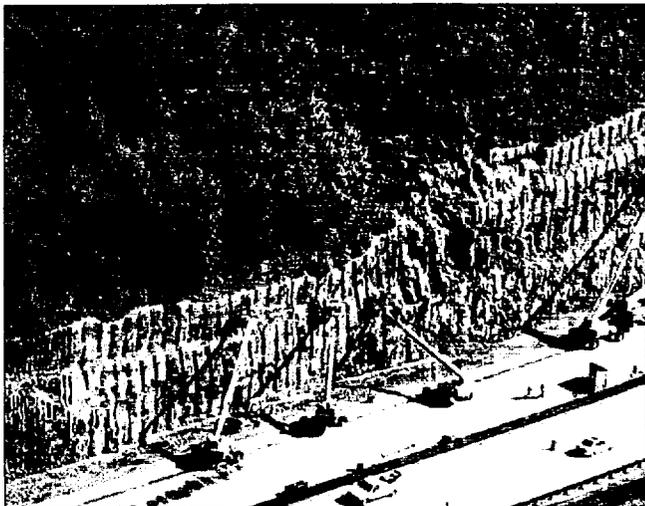
Other projects with similar characteristics were studied to determine the weight of fiber reinforcement necessary per cubic yard of shotcrete on this project. Consideration regarding the quantity of fiber reinforcement was also given to the application process (e.g. shotcrete).

Every simulated rock project has its own unique set of requirements and constraints. The Provo Canyon rockwork is a very large project relative to most artificial rockwork jobs. The natural setting is spectacular; its particular ecological nature stems from the singularity of its vegetation,

(continued on page 16)



"Natural Rock Face" begins to take shape.



It took considerable coordination of DBM's resources to meet project goals.

elevation, topography, hydrology and wildlife. The canyon is a popular and notable recreation site. The aesthetic roadside rockwork treatments that DBM proposed had to be executed with an awareness of the environmental importance of the project. Within the constraint of a fixed bud-

Within the constraint of a fixed budget, it was DBM's responsibility to produce a level of realism that maximized the aesthetic appeal of the finished product while minimizing its impact on the local ecology.

get, it was DBM's responsibility to produce a level of realism that maximized the aesthetic appeal of the finished product while minimizing its impact on the local ecology. In other words, the work had to be as "transparent" as possible.

To accomplish the above goal, the DBM team had to develop a work strategy that balanced fixed cost with the different stakeholder demands

for naturalistic realism. It was our opinion that the great majority of recreationalists will generally experience the project either from the window of a moving automobile or from the streamside opposite the treated slopes, and that the rel-

ative differences of viewing distances between the tops of the slopes and the bottom are minimal. This meant that if the rockwork we proposed had any variation in its level of realism, the changes would be very subtle with the level of realism decreasing only slightly for the work at the highest elevations (>60' above the roadway).

Efflorescence, or the buildup of white stains caused by leached calcium salts from the shotcrete, would

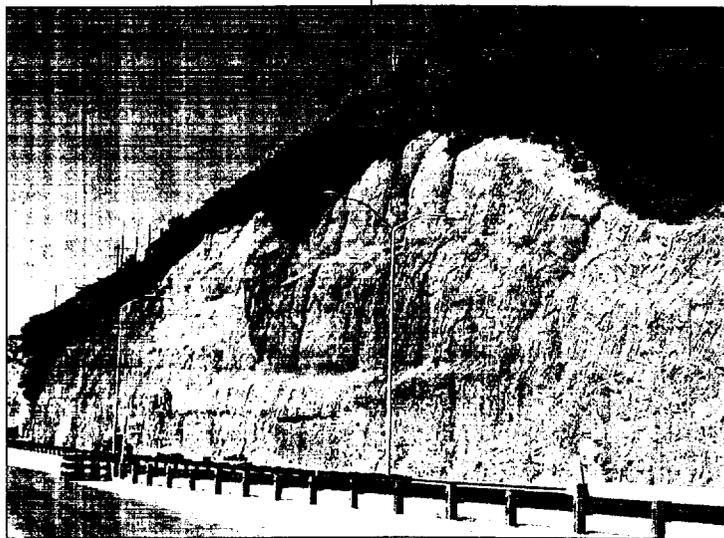
be minimized through the use of admixtures in the concrete that both waterproofed the shotcrete structure and lowered the production of calcium hydroxide during the hydration and curing of the concrete. Efflorescence cannot always be eliminated entirely, but through the use of these admixtures it can be reduced to an acceptable level.

The aesthetic appeal of the many rockscapes on this project would also be enhanced greatly by the judicious use of vegetation. Most of the natural slopes in Provo Canyon are too steep to afford areas where plants can grow. Planter pockets would be placed in the slope faces, but presented difficulties related to drainage and naturalistic realism. For this reason planting within the rock faces would be minimal. Most vegetation designed for the project was placed either above or below the rock face with indigenous species of small form.

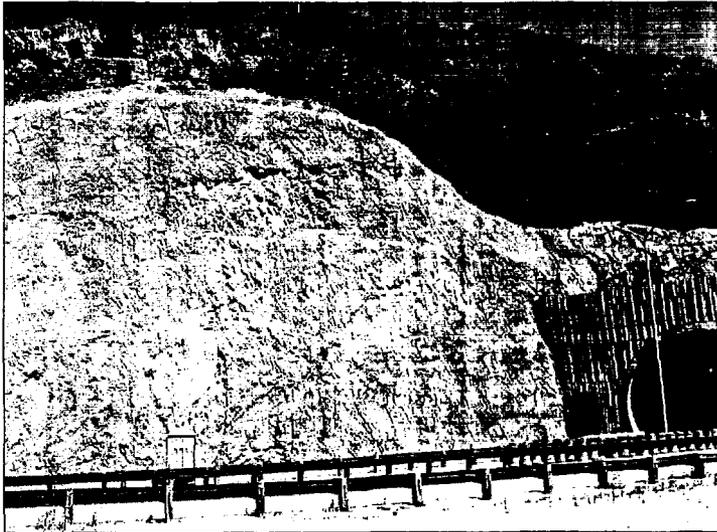
Construction

Construction started in April 2002 and consisted of approximately 170,000 square feet of permanent

(continued on page 17)



The "finished" product.



The stabilized wall blends into the canyon's character.

sculpted shotcrete soil nailed and rock doweled slope treatment. Slopes varied in vertical height up to 110' above the roadway surface. The westbound lanes of SR-189 were closed to allow access to the different slope faces. The project was divided into seven different wall locations (Wall A through Wall G) and included treatment to the existing tunnel portals and construction of an equipment enclosure that also had to blend with the Provo Canyon environment.

For connectivity between the existing rock dowels/anchors, soil nails and the new shotcrete surface, steel plates with headed studs were installed at each anchor location.

Performance and Conclusions

Construction was successfully completed in October 2002 on

Included with the successful project completion was the payment of the full amount of the \$200,000 Performance Incentive Fee.

schedule and under budget. Included with the successful project completion was the payment of the full amount of the \$200,000 Performance Incentive Fee. This acknowledged the full satisfaction of all of the project stakeholders regarding the aesthetic treatment of the Canyon Walls.

As of the writing of this article, the project is endured its first winter season. Hopefully at a future presentation we will be able to illustrate the successful performance of the permanent drainage system and the wall facing treatment through its first spring thaw.

UDOT awarded DBM Contractors, Inc. and Golder Associates* with its 2002 *Engineering and Construction Award of Excellence* for their efforts on the beautification of Provo Canyon SR-189 from Vivian Park to the Wasatch County Line.

*Indicates ADSC Technical Affiliate Member.■

Project Team

Project:

SR-189 Vivian Park to Wasatch County Line Slope Stabilization

Project Location:

Provo Canyon, Utah

Owner:

Utah Department of Transportation (UDOT)

General Contractor:

DBM Contractors, Inc.

Paul Groneck - Project Principal
Jim Sexton - Project Manager
John Bickford, Engineering Mgr.
Jim Porterfield - QA/QC Manager
Ed Boyer - Project Superintendent

DBM Project Partners:

CemRock Landscapes
Shotcrete Subcontractor

Golder Associates
Slope Stability Design
Engineer

Blake McCutchan Design
Landscape Architect

JM Williams & Associates
Structural Design Engineer

Hubble Engineering
Surveyor

American Civil Contractors
Landscape Subcontractor

United Rentals Highway
Technologies
Traffic Control Subcontractor

What Do You Do with an Anomaly?

by Conrad W. Felice, Ph.D., P.E.
Kathryn Petek, Graduate Student
and R. D. Holtz, Ph.D., P.E.

Introduction

With seed funding from the ADSC's West Coast Chapter under the leadership of Tom Armour and Alan Macnab, The University of Washington and ADSC Technical Affiliate Member, C. Felice & Company, have initiated a joint three phase research project to develop a validated computation tool that will permit the direct assessment of the load carrying capacity and performance of large diameter drilled shafts that have been rejected or declared unacceptable due to the detection of anomalies or defects by nondestructive evaluation methods during construction. The FHWA Turner Fairbanks Highway Research Center and the ADSC Industry Advancement Fund have provided subsequent sponsorship for the research effort. The research program is a phased effort which includes the following activities.

- Phase I: Literature review, data collection and the numerical analysis of defects in two dimensions under axial loading
- Phase II: A complete three-dimensional analysis of a shaft with defects to quantify performance under combined axial and lateral loading
- Phase III: Extension of Phase II work to include earthquake loading

Phase I of the effort has been completed and the purpose of this article is to present the findings of the activities from this phase of the program.

In addition, Phase II activities will be described and an outline for Phase III presented.

Background

The concept for this effort was developed through discussions with ASDC members that have faced construction delays and cost overruns following the identification of an anomaly in a constructed drilled shaft by nondestructive testing (NDT) techniques such as gamma-gamma logging or cross-hole sonic logging. The common concern was that once an apparent anomaly had been detected, there is no currently accepted procedure to objectively show the effect of the anomaly on the ability of the drilled shaft to carry its design load and perform satisfactorily. Without a validated and accepted procedure, construction can be halted, a process of coring and testing may be implemented and possibly repairs to the shaft required when repairs may be unnecessary.

Application to Practice

The end product of this research is to develop a rational approach that can be used to answer the question of, "What is the real impact of a defect on the performance of a constructed shaft?" Once an apparent anomaly is detected, there is an

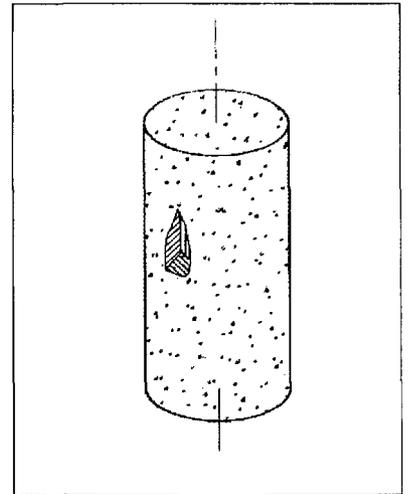


Figure 1: Idealize defect.

implicit assumption that its presence will seriously affect the shaft's performance and its ability to carry the design load. (see Figure 1). This assumption has substantial cost and schedule impacts to both owners and contractors. The goal of this research is to develop a rapid field assessment protocol that will quantitatively determine the impact of the apparent anomaly thereby creating a defensible basis agreeable to the owner, the contractor, and will satisfy the designer for deciding if repairs are needed. The concept is to integrate existing site and design performance data with NDT results to model the

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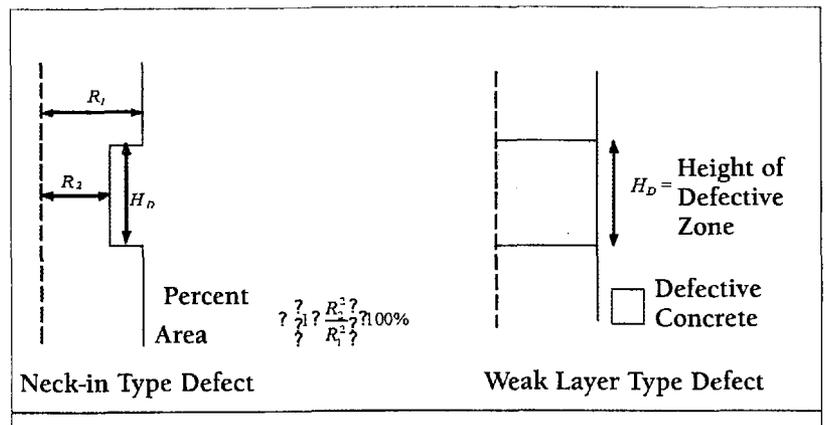


Figure 2: Idealized defects.

anomaly(s) in three-dimensions at the specific location it was detected with appropriate material strength and compressibility properties. Comparing analysis results with either actual load test data and/or design criteria will quantitatively determine the impact of the anomaly on shaft performance and provide an objective basis whereby down time can be minimized and the need for expensive or unneeded remediation avoided. How the protocol might be fielded is described below.

Following the detection of an apparent anomaly, instead of directly implementing an expensive process of coring and additional testing, a licensed engineer will be engaged to quantitatively determine the importance the defect (e.g., based on its size location, etc) on the load carry-

The end product of this research is to develop a rational approach that can be used to answer the question of, "What is the real impact of a defect on the performance of a constructed shaft?"

ing capacity of the shaft. The engineer will be provided the geotechnical and structural data and following the validated protocol will make an assessment of the importance of the defect and issue a decision. It is anticipated that no more than two to three days will be required to complete the assessment and issue a decision. Each case will be recorded and a database of decisions developed that will assist in refining the procedure and be available to owners and contractors. It will still be the responsibility of the owner to make the final decision on what action will be taken. However, through the analysis by an independent party following an agreed upon protocol, cost

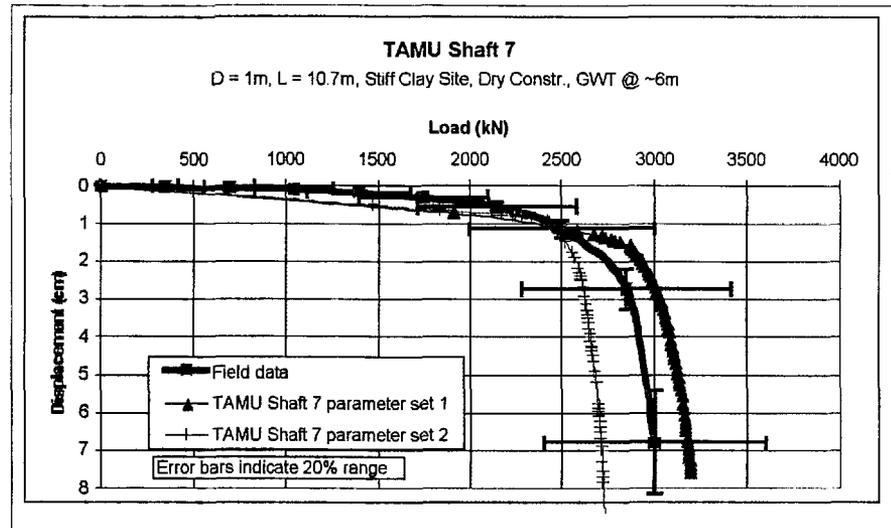


Figure 3: PLAXIS results of a "near perfect" shaft in cohesive soil, data from Baker et al, 1993.

and schedule delays can be better managed and hopefully avoided.

Phase I Program

The primary tasks that were part of the Phase I effort included the following.

- A two-dimensional model was developed for analyzing drilled shafts using the commercial finite element program PLAXIS and calibrated against existing 'near-perfect' drilled shaft load-test data.
- Weak layer and neck-in type defects were selected for analysis.
- A series of numerical load tests were performed to assess the performance of drilled shafts with weak layer and neck-in type defects at specific locations and specific sizes along the length of the drilled shaft.

The results of the Phase I program is summarized below. For additional details the reader is referred to Petek (2001) and Petek et al (2002).

Model Development

In Phase I we evaluated current and historical industry practices for considering defects and examining weak layer and neck-in type defects in terms of shape, size, and location

along a drilled shaft. These types of defects were selected based on our literature review, discussions with industry experts, and model limitations. For the neck-in type defect, we assumed a single height of 1m with various area reductions to determine the critical size for each soil profile. For the weak layer type defect, layer heights of 0.6 and 1m were considered with two defective concrete zone strengths. These defects were idealized as shown in Figure 2. Heights of both defect types were based upon those thought to most commonly occur in the field.

PLAXIS, a commercially available finite element program, was selected to model the drilled shaft behavior. Although PLAXIS has been validated for many geotechnical applications, a series of numerical load tests of 'near-perfect' shafts were modeled and compared with full-scale field load test data (see Figure 3). This analysis allowed us to validate the use of PLAXIS for our application as well as to calibrate material models and other model parameters. As shown in Figure 3, reproducible results could be achieved.

Drilled Shafts With Defects

The validated model was then used

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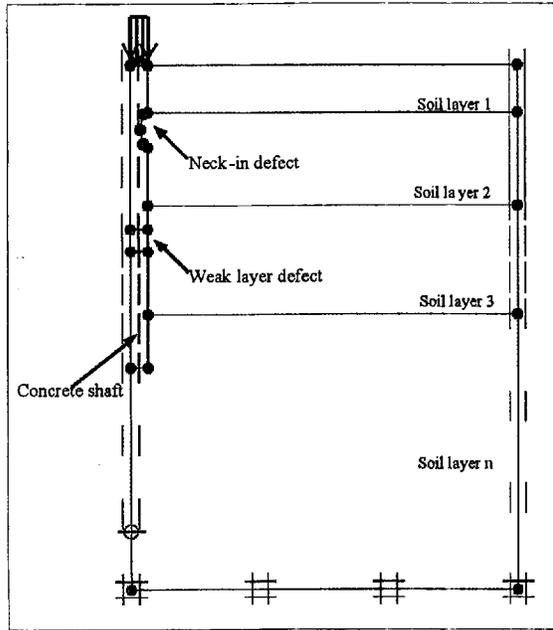


Figure 4. Analysis model.

to analyze weak layer and neck-in type defects in three cohesive soil profiles. Three different soil profiles were considered in order to observe the effect of a defect with variations in geotechnical capacity. A parametric study of the size, strength, and position of the defects was performed and their affect on the load carrying capacity of an idealized shaft was assessed. The idealized shaft was 1m in diameter and 15m long. Figure 4 shows the model with defects.

The two defect types were considered separately in each of the three soil profiles. Because only axial loading was considered in this analysis, the critical position for all defects is the top of the shaft. As a shaft is loaded and displacement occurs, the shaft side shear resistance is mobilized. As load is taken up by the side shear, beginning at the top and then continuing down the length of the shaft, there is a dissipation of load with depth. The highest stress concentrations therefore occur at the top of the shaft and a defect at this location will have the greatest effect on shaft capacity. In this analysis, all defects were consid-

ered with their mid-point at a depth of 2m, which is near enough to the top of the shaft to be considered critical. Defects occurring above this height are very unlikely as they would likely be discovered and repaired during shaft construction. The defect position was then shifted to the mid-depth and toe of the shaft for analysis. The primary means of determining the effect of the defect on shaft capacity was by examining the shift

in the point of maximum curvature and the change in stiffness of the load displacement curve.

For the neck-in type defect, the cross-sectional area of the defect was increased until an observable effect (> 20% change in capacity) was seen in the load-displacement curve. The "significant size" defect was then considered at the mid-depth and toe of the shaft to compare the effect of its various positions. We also exam-

ined two heights of the weak layer defect such that $H_d = 0.6m$ and $1.0m$. Two strengths of defective concrete, based on test results of cores from defective shafts were considered in each of the three soil profiles at the top, mid-depth, and base of the shaft.

Figure 5 shows sample output from a 1m high, weak layer type defect located at 2m from the top of the shaft. In this figure, relative shear stress plots are compared for the defective and perfect shafts in the three soil profiles at the defective shaft failure load. The relative shear stress plot gives an indication of the proximity of a stress point to the failure envelope. Figure 5 demonstrated that the geotechnical capacity controls the amount of load in the shaft and the resulting effect of the defect on the shaft capacity. In the soft soil profile, very little load is applied to the shaft because of the low geotechnical capacity and the concrete in the defective zone is not near failure. However in the very stiff soil profile, the shaft experiences greater loads because of the increased soil strength and the defective concrete reaches failure, and then transfers load to the adjacent soil. Similar behaviors were

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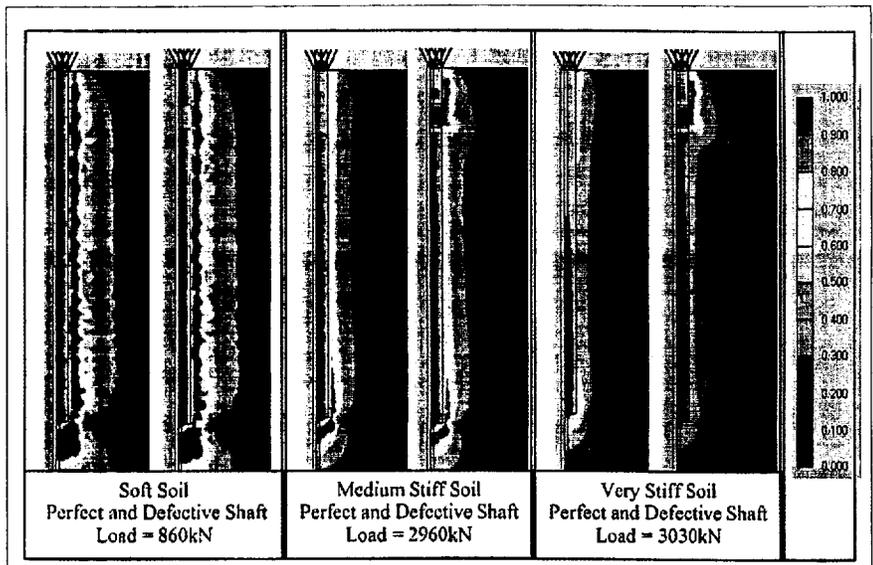


Figure 5: Relative shear stress plot at failure load for a $H_d = 1m$ weak layer at 2m..

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found for the neck-in type defect. The effect of the defects significantly reduced when they were located at the midpoint or toe of the shaft.

The results from the Phase I effort are:

- Under axial loading, the effect of a defect is highly dependent upon the geotechnical capacity of a drilled shaft. A shaft in stronger soil will experience greater loads and will therefore be more affected by presence of a defect than a shaft in weaker soil.
- In many cases, a defect will not have a significant effect on shaft capacity because the reduced structural capacity remains greater than the geotechnical capacity.
- The position of a defect is critical in evaluating its effect on shaft capacity. Under axial loading, defects located at the top of the shaft have the greatest effect on shaft capacity, while defects at the midpoint or toe of shaft

have a minimal or reduced effect on shaft capacity due to the dissipation of load with depth.

Phase II and III

With funding from FHWA and the ADSC Industry Advancement Fund, Phase II of the project is currently underway to consider drilled shafts with construction defects under combined axial and lateral loading in three dimensions (see Figure 6) using the recently developed finite element computing framework OpenSees, developed by the Pacific Earthquake Engineering Research (PEER) Center. In this work, a similar approach to the Phase I will be taken for model development, where models of near-perfect drilled shafts are calibrated to field load test data. Models of drilled shafts with defects will then be generated

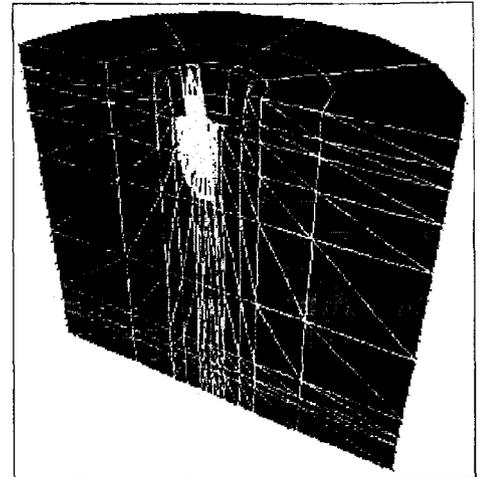
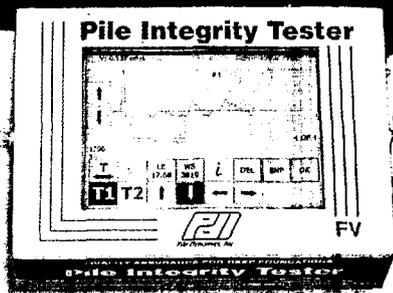


Figure 6: Three-dimensional model.

and validated to existing load test data of shafts constructed with intentional defects. In this work, an approach will be developed to quantify the strength and compressibility properties of material defects for use in constitutive models. Phase III of the project will then consider drilled shafts with defects under dynamic loads.

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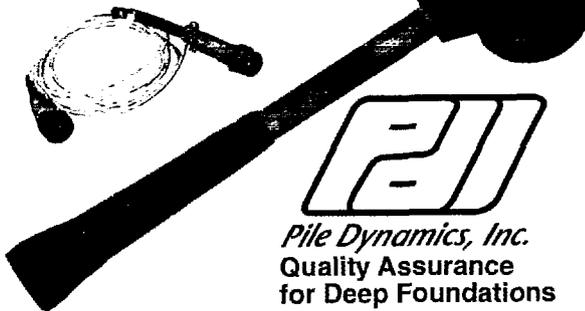


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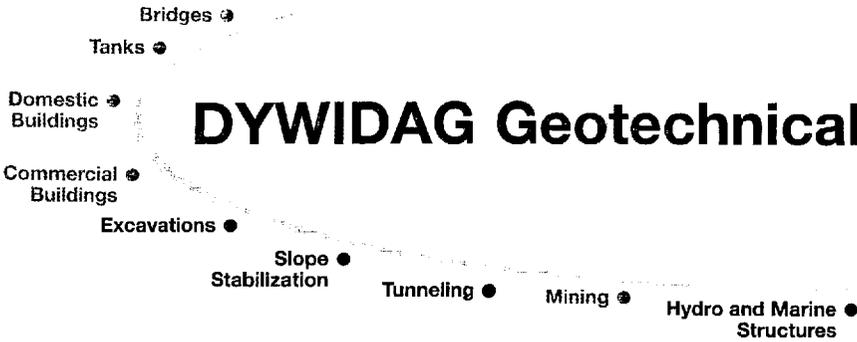
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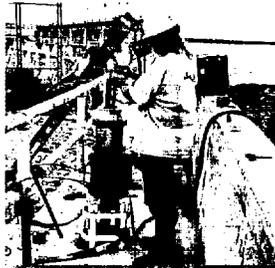
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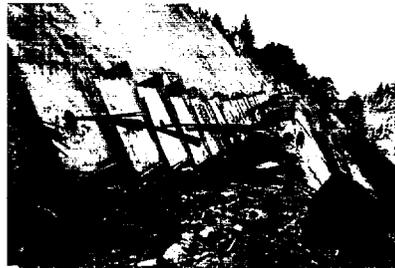
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Self Consolidating Concrete

Research Shows Promise for Drilled Shafts

by Dr. Dan Brown, P.E.
Auburn University

If you have been reading *Foundation Drilling* magazine on a regular basis, you are no doubt aware of the ADSC and FHWA interest in the potential for the application of Self Consolidating Concrete (SCC) in drilled shaft foundation construction. (See *Foundation Drilling* magazine, June/July 2002 page 17.) In a nutshell, it is possible that SCC, which has been used fairly widely for above ground structures, could find application in drilled shaft construction. The key aspect of this material that is of interest is its "workability." This is critical in the ability of drilled shaft concrete to flow through the increasingly tight spacing of reinforcing cages being designed for drilled shafts that will carry very high loads, especially in seismically sensitive areas. This phenomenon is most prevalent in the transportation industry where drilled shafts are being used with increased frequency for highway bridge foundations.

Dr. Dan Brown, Auburn University, Auburn, Alabama has been conducting research in this realm. The early findings are very encouraging. The FHWA and the ADSC, along with the State of South Carolina DOT, are planning to support the expansion of Dr. Brown's research. Dr. Brown recently made a presentation on his research to ADSC members at the ADSC's 2003 Summer Meeting held in Whistler, British Columbia, Canada. The following is a progress report provided by Dr. Brown. (Editor)

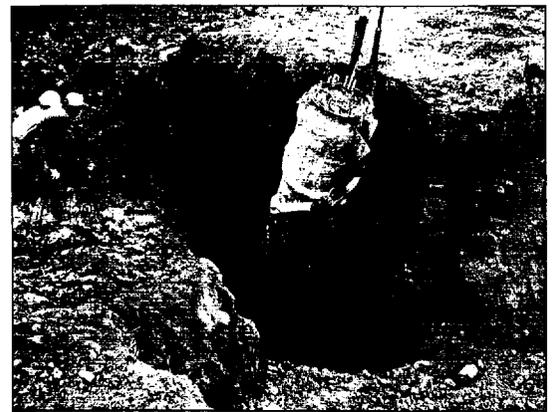
Five drilled shaft foundations 3.5' diameter by 25' deep were constructed using various differing concrete mixes. Two of the shafts were constructed using self consolidating concrete (SCC), two with a conventional mix using #57 stone (3/4" max, typical ALDOT mix), one with a conventional mix which used pea gravel aggregate. The concrete placement was made using a tremie and videotaped using a downhole camera. The SCC exhibited excellent workability in this application compared to the conventional concrete mix; the differences were noted in the flow of the concrete through the rebar cage and

The SCC exhibited excellent workability in this application compared to the conventional concrete mix; the differences were noted in the flow of the concrete through the rebar cage and the flow through the tremie pipe.

the flow through the tremie pipe. For the conventional mix, a difference in head of one to two feet was

present between the concrete within the cage and the concrete in the annular space outside the cage. The SCC head difference in this respect was negligible. It is noteworthy that the pea gravel mix performed very well with respect to workability.

The shafts have been subsequently exhumed and have been cored from the side and also sliced into 4 pieces using a concrete wire saw (like a giant salami!). Tests are now underway in the lab to evaluate differences in concrete properties within the shaft cross section and from top to bottom along the shafts. Visually, the more workable mixes (SCC and the

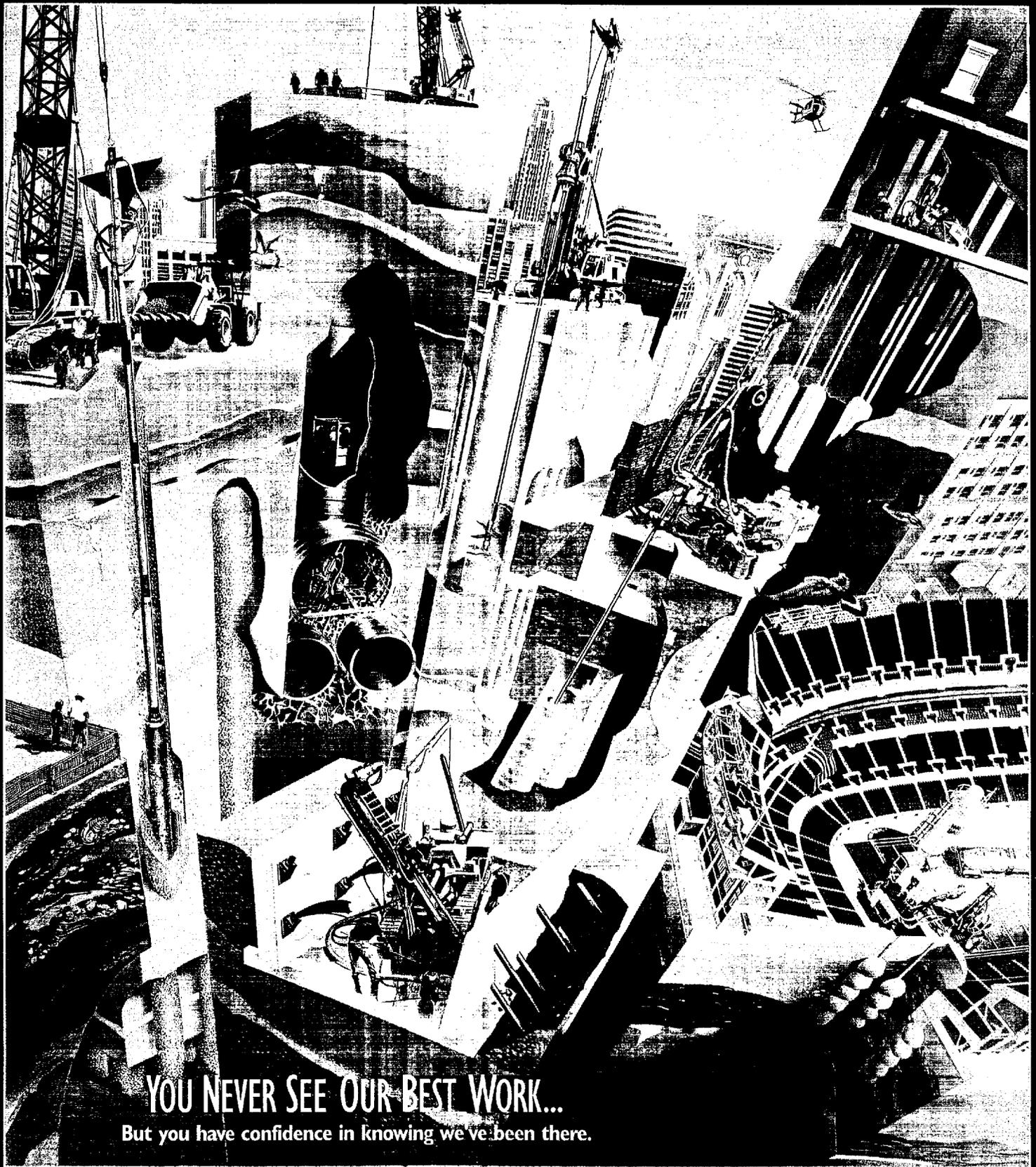


SCC shaft exhumed for analysis.

pea gravel mix) are clearly seen to provide a more dense concrete outside the cage than the conventional mix. The latter appears to provide a more porous texture outside the cage as seen in the attached photo. The porosity of the concrete has implications for corrosion protection of the rebar.

A noteworthy observation about the SCC. We added admixtures at the job site to aid workability but also tended to increase the entrained air content significantly. The result was a mix which had lower strength and higher porosity due to the large amount of entrained air. This is not thought to be an inherent characteristic of SCC, but reveals that we have some things to learn about using admixtures properly and considering

(continued on page 26)



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Drop box used to measure SCC characteristics.

all aspects of the mix design.

Everybody has been impressed with the increased workability and excellent resulting concrete which was obtained by simply changing the aggregate to a pea gravel instead of somewhat larger crushed stone aggregate. This mix had good workability, although not as good as the SCC. It also provided a dense mix

with good coverage over the rebar and high strengths.

Tests are still underway to map the aggregate distribution and the spatial variability of the concrete modulus (measured using wave velocities). The variations will be mapped across the cross section and compared for cross sections from the top, middle, and lower portions of the shaft. Permeability tests are also underway.

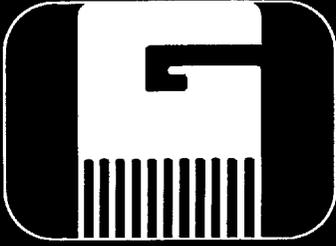
Dr. Anton Schindler of Auburn University is directing the concrete testing and Dr. Gray Mullins of the University of South Florida is performing permeability tests. ADSC member Russo Corp. of Birmingham, Alabama, constructed the shafts, and Dave Horhota of Florida

DOT performed the videotaping of the concrete placement. Dr. Dan Brown of Auburn University was the evil genius who contrived this whole affair and then tricked many other people into doing all the hard work. ■



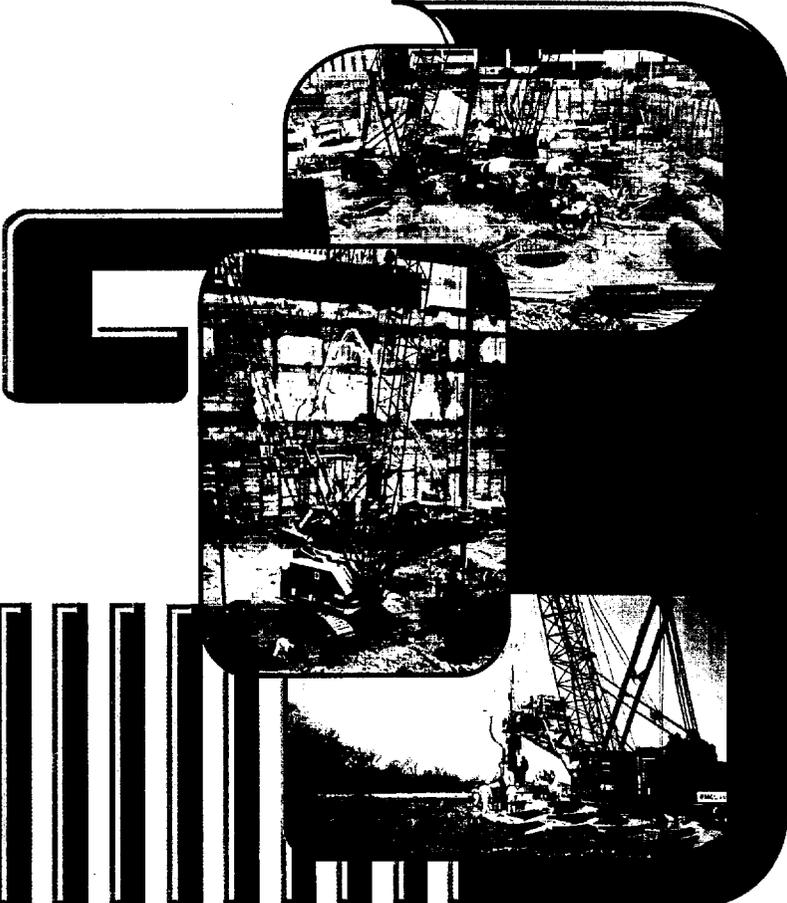
SCC performed exceptionally well as evidenced in excavated drilled shafts.

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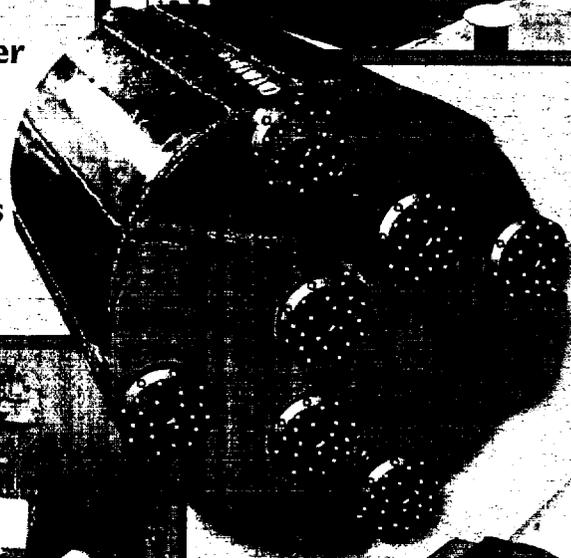
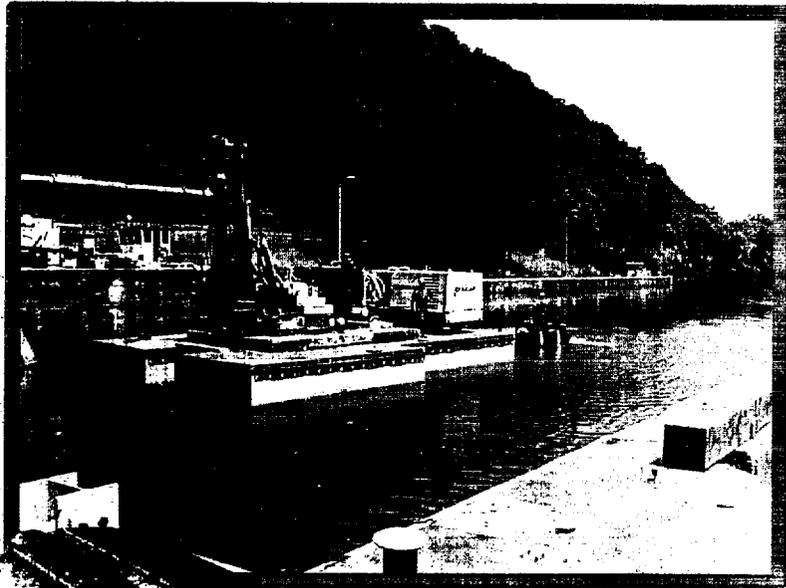


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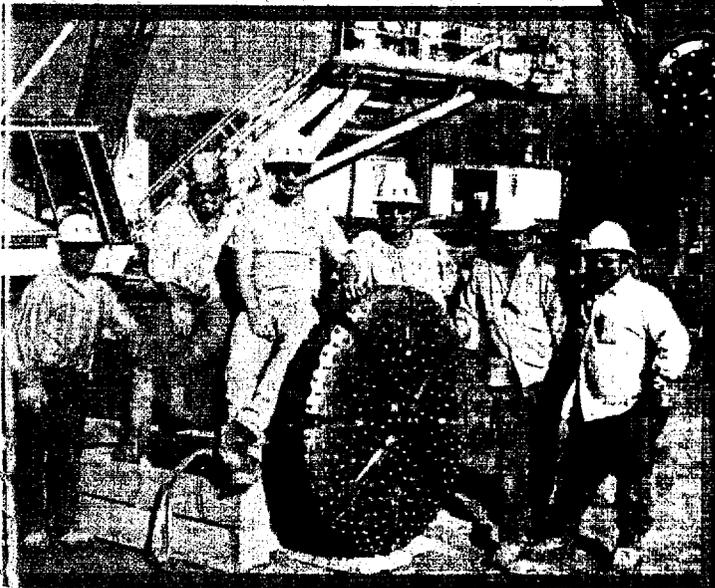
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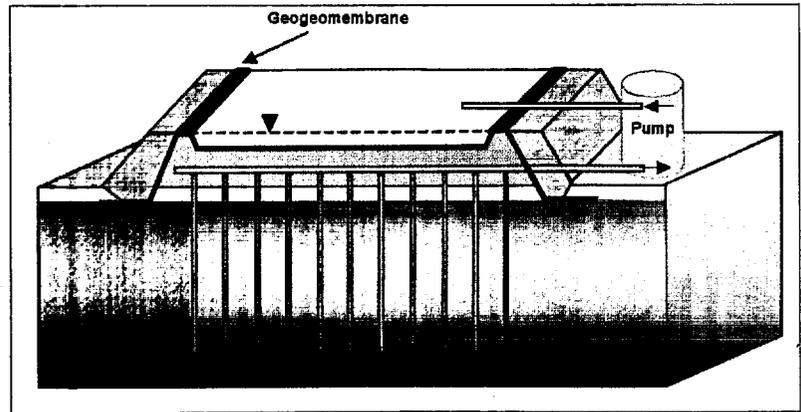
Innovative European Technologies to Accelerate Construction of Embankment Foundations

Part IV: Vacuum Consolidation Technology

by Ali Porbaha, Research & Innovation, Caltrans & Alan Macnab, Condon-Johnson & Associates, Inc.

The following article is the fourth in a series that will focus on the findings of an AASHTO/FHWA sponsored European Technology Scanning Tour conducted in 2002. The ADSC has been represented on these kinds of fact-finding activities since they were initiated by the FHWA several years ago. This article addresses Vacuum Consolidation Technology. Even though several of the technologies that will be described in the series do not currently fall under the purview of the ADSC, it is important that those in the drilled foundation and anchored geo-support industries become aware of the international construction trends that are being considered by engineers in the U.S. Transportation industry. (Editor)

Vacuum consolidation accelerates construction on soft ground by combining vertical drainage and pumped pore water pressure. As an alternative to the conventional preloading (physical surcharge), vacuum assisted consolidation can be used to consolidate soft alluvial soils, to improve bearing capacities prior to construction, and to reduce post-construction settlements to acceptable values. The



Concept of vacuum consolidation.

Swedish Geotechnical Institute claims first introduction of the principle of vacuum consolidation.

Conventional surcharge methods apply total stress loading to the soil to create an excess pore water pressure, which dissipates with time as the soil consolidates. When a vacuum is applied to a soil mass, it draws the soil pore water pressure. When the total stress remains unchanged, the decrease in the pore pressure results in an increase in the effective stress in the soil and consolidation.

The working platform consists of sand layer through which vertical drains are placed in the soil. A layer of geotextile may be placed under the sand to improve bearing capacity for construction equipment. Vertical drains are installed in a closely spaced grid pattern through the sand blanket into the soft soils. The improved area is sealed by a flexible geomembrane which is keyed into an anchor trench surrounding the area. A perforated pipe system is placed beneath the liner to collect water. Vacuum pumps with sufficient capacity are connected to the collection system in order to generate a vacuum in the soil. The pumps must be capable of pumping water and air.

Water flows from the compressible soil into the vertical drains due to excess pore water pressure and is drawn out of the vertical drains by the vacuum pump. The drainage increases effective stress in the soil and thus improves soil properties. The vacuum is typically applied for

several months to achieve a requisite degree of consolidation.

For conventional surcharging, the start of the project may be delayed when adequate fill material is not available. However, vacuum-accelerated systems can allow additional

The drainage increases effective stress in the soil and thus improves soil properties. The vacuum is typically applied for several months to achieve a requisite degree of consolidation.

flexibility in timely delivery of construction projects. Since it does not require large volume of fill, the ground improvement work can be started during the early stages of the project. Moreover, the load produced by the vacuum preloading does not raise any stability concern (i.e., undrained bearing capacity failure). Thus, there is no need to control the rate of load increment. In fact, the required load can be imposed rapidly to accelerate the consolidation of the compressible soil and shorten the duration required for such consolidation. Hence, vacuum consolidation is particularly applicable for very soft soils and the soft ground adjacent to

(continued on page 29)

critical slopes.

Some practical issues should be considered to ensure that vacuum system performs effectively. To avoid air leaks into the system, the geomembrane should be handled carefully to avoid any puncture during construction, and the joints should be sealed with great care. Disposing the pumped water on top of the geomembrane allows small leaks to be exposed and adds a small sur-

Hence, vacuum consolidation is particularly applicable for very soft soils and the soft ground adjacent to critical slopes.

charge load in addition to vacuum. The fill must also be free from stones or sharp objects to minimize the risk of punching holes in the geomembrane.

When the water table is not near the surface the air may leak through the unsaturated zone beneath the key bench. In this situation a cut-off system, such as deep soil mixing or slurry trench wall penetrating down to the water table, may be necessary to avoid air losses in the system.

An efficient system can achieve and maintain a vacuum of up to 80 kPa (12 psi) below atmospheric pres-

sure, which is equivalent to a physical surcharge of 4 to 5 m (13 to 16 ft) of fill.

Project Example

The site of a sewage treatment plant project, built on a rice field, is located in Kimhae, West of Pusan city in South Korea. Located alongside the banks of a river, the site covers a surface area of some 80,000 square meter (861,000 square feet) on highly compressible marine clay deposit layers with varying depth of 25 to 43 m (82 to 141 ft) in the flood plain zone.

Foundation depth was up to 7 m (23 ft) from final ground elevation. The sewage treatment plant was designed on a gravity process, which excluded any pumping sewage from one part of the plant to another.

The installation procedure of the vacuum consolidation is divided into several phases:

- Placing a woven geotextile (10 t/m²) to improve stability of the working platform.
- Laying down a sand blanket of 1m (3.3 ft) in thickness to serve as the working platform and drainage layer.
- Installing vacuum transmission pipes (VTP) to transmit vacuum to



Horizontal drains.

the soil.

- Connecting horizontal drains inside the sand blanket longitudinally and transversally towards the VTP.
- Installing an impervious slurry wall, 9 m (30 ft) deep outside the perimeter to maintain tightness (air and water) through the sandy silt.
- Installing peripheral trench system to provide air tightness at the boundary and to maintain tightness around the geomembrane.
- Placing a 1.5 m (5 ft) fill layer (primary fill) above sand layer prior to placement of geomembrane to increase stability of the system
- Welding the geomembrane and exit of horizontal drains through geomembrane towards vacuum pumping stations.

The recorded settlement was over 3 m (10 ft) for a surcharge of 6.5 m (20 ft) and vacuum pumping duration of 9 months. As soon as the vacuum was off and additional surcharge was removed, settlement stopped and a slight rebound was recorded.

In summary, the efficiency of the vacuum consolidation technology has been demonstrated under different site conditions to substantially accelerate the construction process. Vacuum systems do not apply undrained loadings, so the full vacuum can be applied quickly, allowing

(continued on page 30)



Pumping station unit.



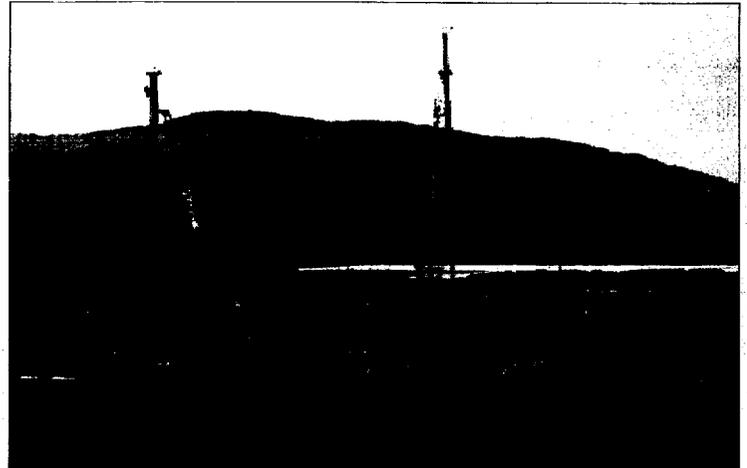
Air and water collectors.

a rapid start to consolidation. It is essential that the project site is to be securely sealed and isolated from any surrounding permeable soils in order

to avoid leaks in the geomembrane and loss of the vacuum. When the required preloading pressure is higher than the capacity of the vacuum pumps, a surcharge fill may be used in conjunction with the vacuum method.

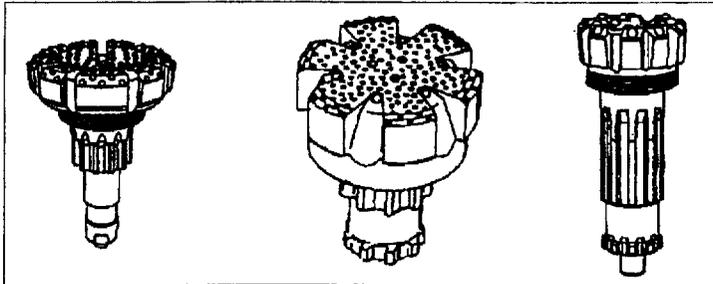
Acknowledgement

The authors are grateful to C. Spaulding, M. Preene, and M. Tang. The photos are the courtesy of Menard Soiltreatment.

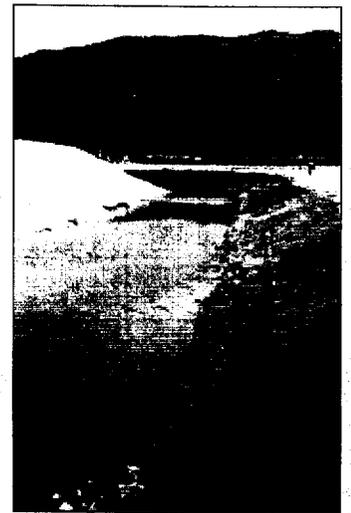


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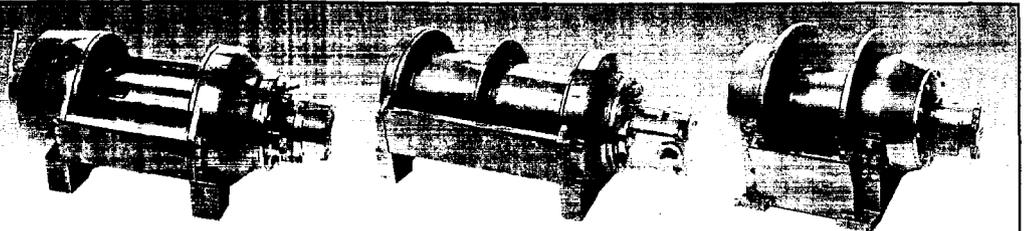
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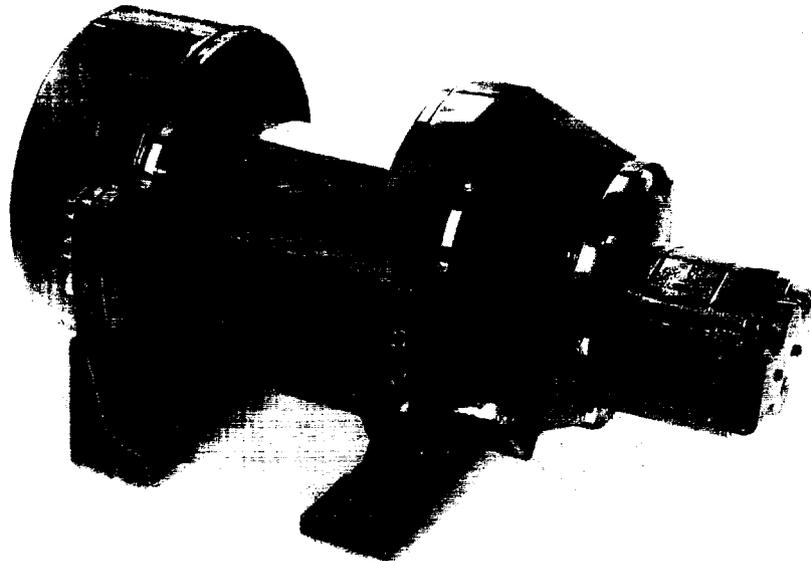
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Safety & Health Committee

by Teri Dres

This department continues this issue highlighting the ADSC's Safety Committee. Articles outlining the work of the Geo-Support, Education, Drilled Shaft, Micropile and Category III and IV Contractor Members have appeared during 2003. All ADSC members are encouraged to become actively involved in the work of our committees. (Editor)

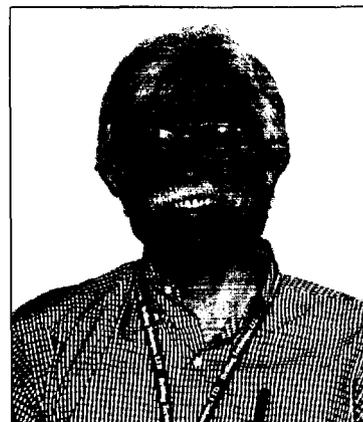
What came first – the chicken or the egg? This same allegory could be used when talking about the beginning of the National ADSC back in the 1970s. What came first – the National ADSC or OSHA-related safety concerns? Quoting from the History of the ADSC written by former ADSC Executive Director, Bill Pruitt

(now deceased), he said:

“About this time (1970) Congress passed a controversial bill called the Occupational Safety and Health Act (OSHA) which would affect every worker in the United States. The construction industry appeared to be more susceptible to discipline and fines by the Federal Government than any other segment of the economy. This new bill ‘aroused’ the out-of-Texas drillers, who in turn began asking the Texas ADSC members what its plans were for complying with these new and undefined safety regulations. This fear of the unknown consequences of the OSHA Act brought drillers nationwide together in Dallas for a summit meeting to decide how to approach the new Federal ‘monster’.”

In the later expanded version of the ADSC's history prepared by Gus Beck of A. H. Beck Foundation Company in San Antonio, Texas, it was stated:

“We can credit two principal forces



Chairman, Rick Marshall, Richard Goettle, Inc., Cincinnati, Ohio.

for the formation of the Association as we know it today. First, there was the Texas ADSC, and the second was the implementation of the Occupational Safety and Health Act.”

All of the ADSC's pioneers will agree that if it had not been for the

(continued on page 33)

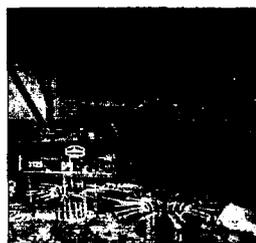
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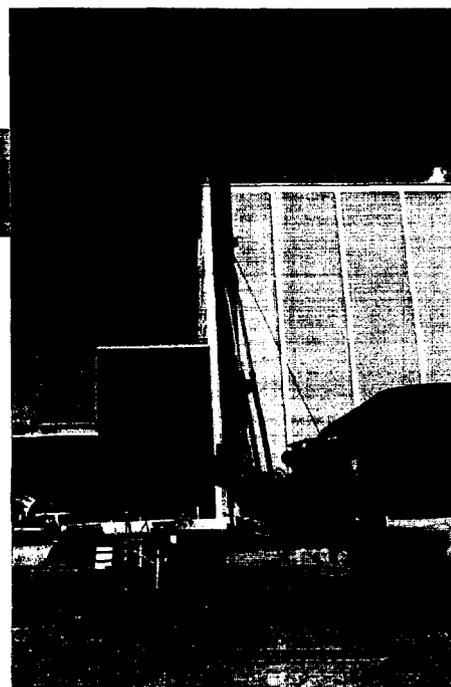
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OSHA Act of 1970, the growth of the ADSC would have at least been delayed several years. The perceived threat of OSHA was the rallying point. Since there is always more strength in numbers, a concerted group effort was needed. At the very first meeting of the National ADSC, April 7, 1972 at the Muehleback Hotel in Kansas City, Missouri, one of the first committees appointed by then ADSC President, **Jack Watson**, Watson, Inc., Fort Worth, Texas, was a Safety Committee. The first chairman was **Bob Long**, then with McDowell Contractors, now Long Foundation Drilling, Hermitage, Tennessee.

OSHA and all types of safety issues was the catalyst to get the association to spread its wings and that continues even today. Safety is #1, as it should be.

From those early days there has been a proverbial "Who's Who" of ADSC leadership that has chaired the Safety and OSHA Committees. These included **Wayne Riethmiller**, Tri-State Drilling, Inc., Hamel, Minnesota; **John Voss**, then with Martin & Martin Foundation, Fort Worth, Texas (now with Voss Parts & Supply, Euless, Texas); **Marshall Frye**, McKinney Drilling, Fort Worth, Texas; **Paul Wilson**, Russo Corporation, Birmingham, Alabama; **Chris Merillat**, Midwest Foundations, Topeka, Kansas; **George Cloud**, McKinney Drilling Company, Lithia Springs, Georgia; **Bruce Long**, Long Foundation Drilling, Hermitage, Tennessee; **Clayton Stephens**, N. L. Schutte Foundation, Dallas, Texas; **Bill Starke**, Deep Foundations Contractors, Thornhill, Ontario, Canada; **Harris Wilson**, Russo Corporation, Birmingham, Alabama, and the current chairman, **Rick Marshall**, Richard Goettle, Inc., Cincinnati, Ohio.

Other outstanding personalities that have had an impact on the success of our efforts with OSHA include **Dave White**, now deceased. Dave was ADSC's Safety Consultant until his death on March 3, 1996. He set the

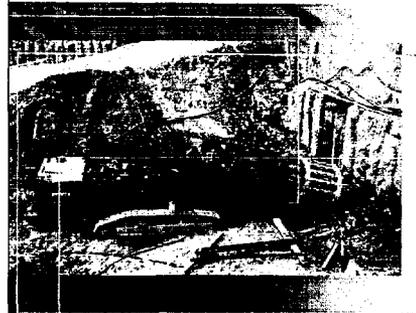
bar very high for future ADSC Safety Consultants and OSHA Hot Line Providers. These have included **Joe Shepherd** from Advanced Safety Consulting Services in Fort Worth, Texas; **Bill Atheson** from Safety Always, Maple Valley, Washington, and currently **Greg Strudwick** of Greg Strudwick & Associates, Coppel, Texas. As with all ADSC Hot Lines (ADSC also provides Construction Law, Employment Law, and Insurance/Bonding Hot Lines), one of the benefits of ADSC membership is the availability of an expert that can answer your questions about any given issue in their area of expertise. The first call on any given issue is free of charge to ADSC members.

Safety Committee projects over the years have been extensive. They include:

- Promotion of Annual Safety Award program
- Publication of OSHA Alerts to the membership
- Active promotion of company safety programs
- Tackled safety issues such as noise abatement, trenching and excavation, crane operations, seat belt regulations, utilization of boatswain's chairs, roll-over protection and gas detection.
- Provided model Substance Abuse Programs
- Adopted a policy to take a proactive stance in all OSHA matters
- Provided training programs for ADSC members on Competent Person Certification/Training, Crane Operations, the 10-Hour OSHA Construction and Safety Programs and the addition to our SPTI curriculum to instruct participants on how to handle OSHA inspections.
- OSHA 10 and 30 hour Construction Safety and Health Training
- Fall protection, rigging, as well as OSHA Inspections are also covered in the ADSC's DROS and AMPIS

(continued on page 34)

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The ADSC's Technical Library Catalog lists many publications for which the Safety Committee can take credit for implementing. These include:

- ADSC's Safety Handbook
- Crane Safety Manual
- Down-Hole Entry Manual (Recommended Procedures for the Entry of Drilled Shaft Foundation Excavations)
- Recommended Procedures for Fall Protection in Shaft Excavation Operations
- Drill Rig Operator's Safety Manual prepared by the Drill Rig Hoisting Task Force

An important video production has also been prepared:

- Safety in Foundation Drilling: A

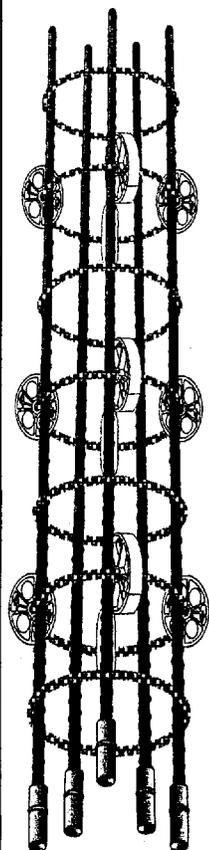


Attendees at a recent meeting included from left: Bob Birdsall, DBM Contractors; Rebecca Fisher, Allied Drilling; Mike Kemery, Longfellow Drilling; Harris Wilson, Russo Corporation; Tony Kraut, Bay Shore Systems; Rick Marshall, Richard Goettle, Inc.; Bill Maher, McKinney Drilling; Eric Reuther, Illini Drilled Foundations; and Kevin Sharp, Sharp's Construction Services.

video specifically developed for the drilled shaft industry (updated in July 2003)

Note: All of the above items are available through the Technical

(continued on page 35)



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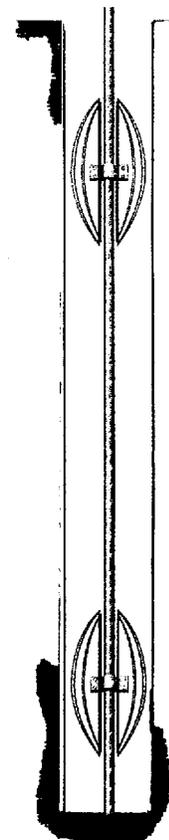
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Library by calling the ADSC office (214/343-2091).

In addition to these tangible items, the committee has also made information available to the membership on the following:

- Safety Guidelines for Utility Line Contact
- Safety Procedures for Drilled Shaft Construction in Caving Soils
- The availability of a compilation of OSHA citations which will be helpful to our members in working with OSHA.
- A Machine Safety Guide
- ADSC Safety decals

Each issue of *Foundation Drilling*

magazine carries either a Safety Record or OSHA Alert Department. Most of these are provided, or written by Rick Marshall, Safety Committee Chairman or by other Safety Committee members. All ADSC members are encouraged to always read this department and submit articles on their experiences with OSHA, particularly related to citations and the final outcome. Keeping abreast of current rulings is a must.

If we go back to the original question, what came first – the chicken or the egg – the ADSC or safety, I would suggest it is a tie. Thanks to the ADSC's pioneers for seeing the importance of safety issues, and thanks to all those members that continue to keep safety as the first priority in their business operations. ■

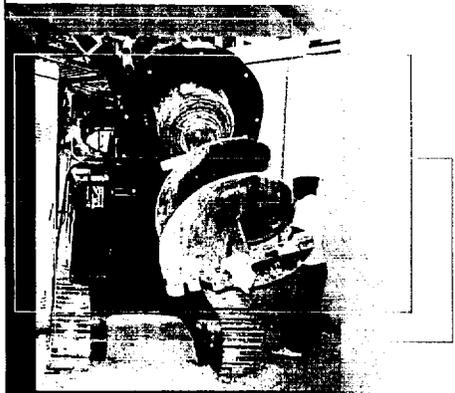
Safety Committee Members

Rick Marshall, Chairman	Richard Goettle, Inc.	Cincinnati, OH
Bob Birdsall	DBM Contractors	Federal Way, WA
Rebecca Fisher	Allied Drilling	Fort Worth, TX
Rich Hall	Schnabel Foundation	Sterling, VA
Mike Kemery	Longfellow Drilling	Clearfield, IA
Tony Kraut	Bay Shore Systems	Rathdrum, ID
Tom Myers	Davey Kent, Inc.	Kent, OH
Eric Reuther	Illini Drilled Fdn.	Danville, IL
John Roma	New England Fdn.	Quincy, MA
Kevin Sharp	Sharp's Construction Srv.	Edmonton, Alberta
Harris Wilson	Russo Corporation	Birmingham, AL
Tom Witherspoon	S&W Foundation Ctrs.	Richardson, TX



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It's Impossible to Get Hurt on That Machine

by Mary Jac Witherspoon
S&W Foundation Contractors

I will never forget the day of the accident. It was December 29, 1999 and we were trying to complete holes at the Broken Arrow Turnpike project in Tulsa, Oklahoma, before the New Years Holiday. We had decided to work until noon and then break for the holiday. The job was nothing out of the ordinary, other than our Superintendent with just a grunt labor force. The objective was to drill through 5 feet of clay and then penetrate 3 feet into hard shale. We then had to install 1" diameter Dywidag resin tie-down anchors that would be stressed to a 40 kip pullout force. The process was simple. Drill through the soft clay with a hand held little beaver auger and then complete the shale penetration with a hand held pneumatic rock drill. We would then place the Dywidag bar and grout with a specially prepared resin that was activated by impact at the bottom of the hole. The general contractor we were working for would then cast this bar in a concrete footing that was the base for a bridge retaining wall. Is that simple or what?

Just look at the equipment required for this job. The attached picture shows the small one-man machine that was only required to drill a 2" hole. This is the same machine we have used in limited access conditions to drill 12" to 16" holes for the past 18 years. It is a hydraulic fence post drilling machine that has been used by the foundation repair and fence business for over 40 years. While the speed of rotation is rated at 150 rpm, its torque capacity is only 1,000 foot-pounds with a very sturdy torque bar

to prevent backlash to the operator. It is considered safe and has withstood the test of time with little change in basic design.

Therefore, with the supervision of a superintendent who has been with us since our inception, the chance for injury was remote at best. We even had the weekly safety meetings and participated in the Oklahoma Turnpike Authority meetings to make sure no accidents would occur. Hey, this was the last day of the year and in two hours we would be able to again post a zero accidents and zero lost time record to receive another ADSC Safety Award plaque. Besides, no one had ever been hurt on this machine!

As you can tell from the photo, we were using a continuous auger with factory pins that recede back to the shape of the auger shaft. On the day of the accident the workman told our superintendent that he was running short of pins. After giving a short lecture to not jerry-rig the connections, the superintendent went to the rental store to purchase more pins. While he was gone the operator made a connection and lost both the pin in use and the spare. As he stated later, he was embarrassed to lose the pin so he found a 6" bolt to make the connection, so he could keep working until replacement pins were available. This sounds simple and hey, no



S&W's hydraulic fence post drilling machine drills 12" to 16" holes.

one has ever been hurt on this machine!

Even this might have been okay if the operator was not tired and decided to lay on the machine for the last two feet of harder material. When he got tired of lying on the machine, he attempted to lift his torso by grabbing the torque bar but his hand slipped and the connection bolt caught his loose coat. Since he was lying on the machine he was also laying on the drive button so there was no stop in rotation until the temporary bolt had twisted his arm around the augers. In fact the rotation was not stopped until the clothing and arm brought the auger to a stop.

This was about the time that our superintendent arrived back on the job in time to rush our driller to the hospital. The result was an arm that was broken in three places and dislocated at the elbow. This required two surgeries that day to repair the dam-

(continued on page 37)

age and reset bones.

Well, we know that when tragedy strikes we must address the situation and take positive steps. First and foremost, is we must make sure our employee is properly cared for. Secondly, we must get him back to work as quickly as possible.

Our superintendent stayed with the injured employee through the surgeries and took him home two days later. Luckily this happened on the final day before the

New Year so recovery was during a paid holiday. Another lucky thing was that the employee had a good attitude and wanted to get back to work as soon as possible without diminished wages. Therefore, we were able to get him back on the job on the following Monday, only five days after the injury, and because of the holiday with only the one lost day. He couldn't do much but we had him helping our mechanic and painting some of the parts after they were installed. We also told him to sit down when he was tired and work as many hours as he felt like. And we provided transportation to and from the doctor's office for any follow-up exams. With the obvious standard of care for this employee, we were able to make the best of a bad situation and build loyalty between employee and company.

Next came the physical therapy to restore full flexibility to the injured arm. The initial schedule set by the physician's office was for an early afternoon appointment. We called the doctor and found out his office was near the employee's home and he could see the man at 4:30 pm, which was after our normal work hours. By being proactive in this stage of recover, we were able to prevent lost time for therapy and keep

this employee actively engaged in our operations.

Now remember that this injury required two surgeries and two months of therapy but that the total charge to Texas Workman's Compensation was \$16,878.00. This was in no small part the result of our proactive participation in the total process and having the employee back on the job, even in his limited condition, quickly and

maintaining as much continuity of work as possible.

The second lesson from this experience is that no tool or piece of equipment is so simple and seemingly so safe that someone cannot be injured on it. We have called the manufacturer and they know of no such injuries on this piece of equipment. We have also talked with other contractors in this industry and they know of no injuries on this equipment. Therefore, just because no one has ever been hurt on this machine does not mean that they can't.

Foundation Drilling magazine and the ADSC Safety Committee encourage ADSC members to submit safety-related job histories. Email to: adsc@adsc-iafd.com or fax to: 214/343-2384. ■

The second lesson from this experience is that no tool or piece of equipment is so simple and seemingly so safe that someone cannot be injured on it.

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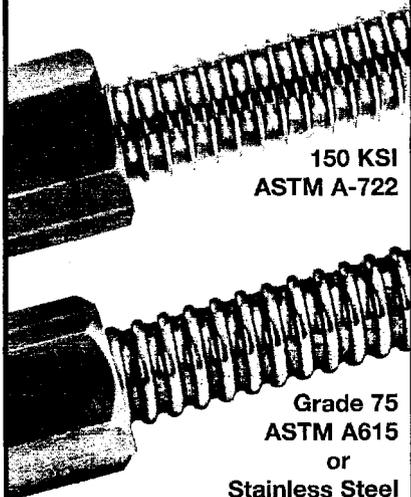
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MUD ON YOUR BOOTS

New Department Debuts for Category III & IV Contractors

by Kevin Sharp



As you might have read in *Focus On Committees* in the June/July issue of *Foundation Drilling* magazine, page 40, the Category III and IV Contractor Members Committee has launched a new Department that will appear in all future issues of our magazine. *Mud On Your Boots* will be written BY and FOR our smaller contractor members. This is your invitation to send in your article of special interest. It can be sent to either Kevin Sharp, committee chairman (780/473-4310) or ADSC's liaison to the committee, Cindy Colao (214/343-2091) email: ccolao@adsc-iafd.com. (Editor)

Our company, Sharp's Construction Services, has been a member of the ADSC since 1987. As a member, we try to participate at whatever level we can. Although we are a Canadian Category III Contractor, I have been very fortunate that my partners and my company have allowed me the flexibility to become involved.

Since becoming a member, I have attended various ADSC functions. At every event I have noticed a lack of participation by the smaller contractors. I have heard many reasons for this, some are valid and some are not. The excuse that continually pops its head is that the ADSC is geared for the larger companies and there is no value for the smaller contractor. That is not true! Did you know that the current ADSC Board of Directors has four Category III and IV Contractors out of the eighteen elected officials? Our voice is being heard!

We have just recently formed a Category III and IV Committee which was unanimously ratified by the Board. This committee will

attempt to meet at every board meeting to address matters pertaining to the smaller contractors. We will try and provide value added services for the smaller contractor to make our membership a little more attractive and let the general membership know that we are an important part of the ADSC. As we get closer to the big Geo-Support EXPO 2004 in Orlando next February, you will notice quite a few programs that are planned specifically for us. Please participate.

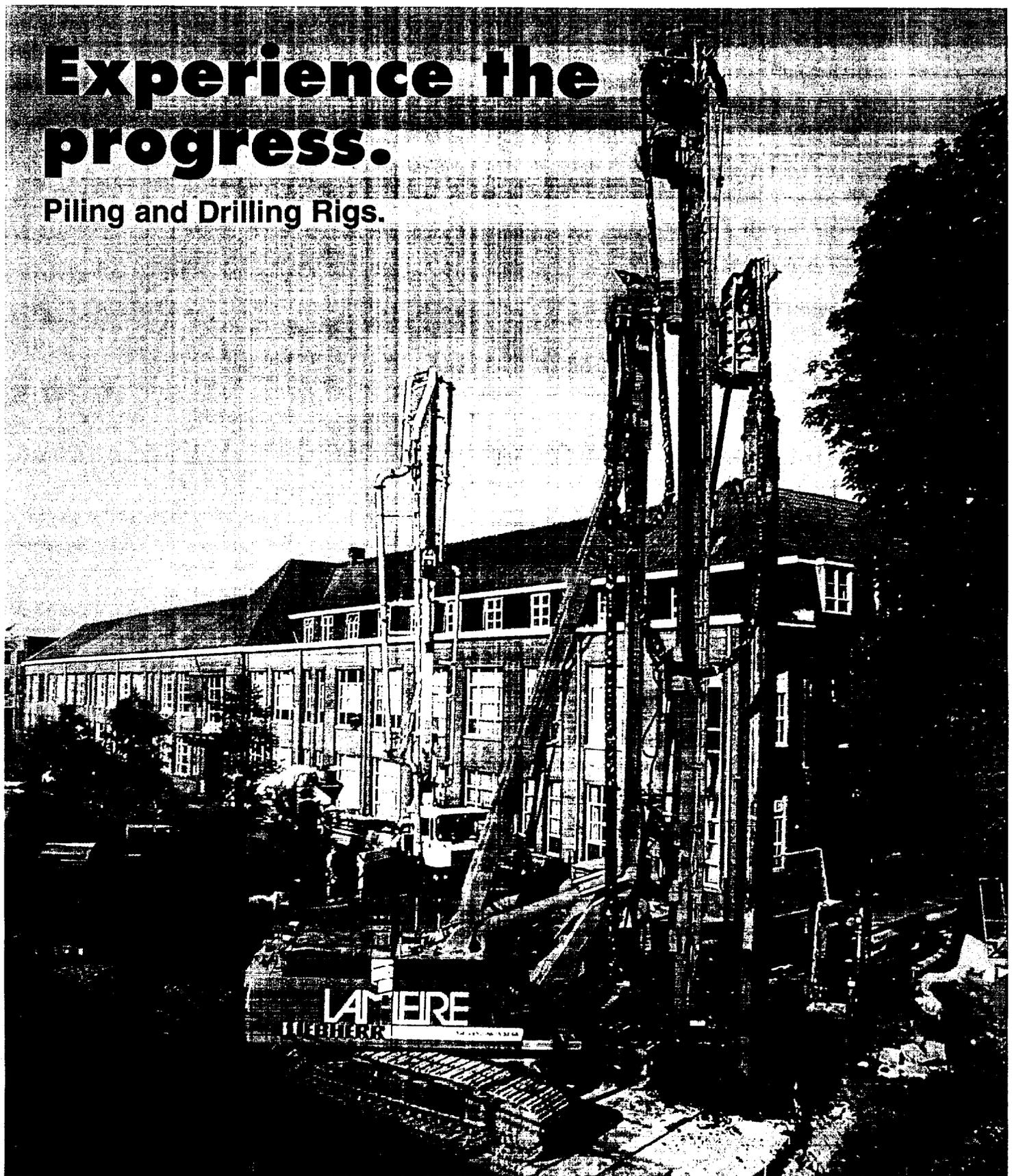
One of our committee's goals is to publish an article in each issue of *Foundation Drilling* magazine under the new Department *Mud On Your Boots*. This is a Category III and IV Contractor initiative and its success will depend greatly on the existing membership to provide articles of interest.

Our voice can and will be heard if we chose it to be so. The only way that this committee will be successful will be through active participation. It is time for us to be heard. I look forward to meeting all of you at a future ADSC event, or visit by telephone.

Kevin Sharp, Chairman
Category III and IV
Contractor Committee

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Locked Out of a Retirement Savings Plan Because You Own or Work for a Small Business?

Now, You Can Have All the Retirement Savings Advantages the Big Companies Do!

by Carl Sanger

Serenity Wealth Management, LLC

Carl Sanger is the owner of Serenity Wealth Management, LLC in New York. Carl is a Registered Investment Advisor and has been managing investment-capital for over eleven years. (Editor)

There was a time when only the very large firms could offer a formal retirement plan for their owners, officers and employees. In fact, giving up the opportunity to partake in a retirement plan was one of the big sacrifices you made if you wanted to work for yourself or own your own small business. Well, thanks to the Economic Growth and Tax Relief Reconciliation Act of 2001, and more tax legislation passed in 2002, this situation has completely reversed itself. The fact is that, even in these turbulent times, there are things you can do, regardless of the size of your business or workplace, that can ensure you have a prosperous retirement.

What Has Changed?

Where you once had to rely on making paltry contributions to your IRA as your only tax-advantaged vehicle to save for retirement, you now have a number of bona-fide investment plan choices that will let you retire in style. Under the new rules, you can:

- Create your own tax-advantaged retirement fund and contribute generously.
- Offer a comprehensive retirement plan when recruiting new employees.

- Retain your better employees. They'll no longer have reason to leave your company for another company just for the sake of getting a retirement plan.

- Reap the same tax advantages as the larger firms get when making retirement plan contributions.

What Retirement Plan Choices Do I Have?

In this article, let's take a look at some of the pros and cons of three of the more popular types of plans. If either of these plans interest you and you would like additional information about how to set up, maintain, and manage one of these plans or one of the other plans available, I recommend that you seek an investment advisor skilled in this specialized financial field. He or she will be able to work with you on setting up a plan for you and/or your employees that will not only meet your retirement goals but maximize your tax benefits, as well.

The Solo 401(k) Plan: This is, by far the hottest new retirement strategy being used by businesses where the owner or owners are the only employees. The solo 401(k) plan is ideal for sole-practitioner professionals, small retail business owners, freelance writers, and consultants, among others. This plan can even be contributed solely from part-time income. (Of course, if you work for another company full-time and contribute to their 401(k) plan, you cannot exceed the maximum allowable annual contribution between the two plans).

Boasting one of the more generous contribution limits, this plan allows you to contribute on your own plus have your own company match a percentage of your personal contribution up to an annual total of \$40,000 or 100% of your income, whichever is less. So, if you earn \$160,000, for example, you could contribute the legal limit of \$11,000 personally and your company can contribute the difference up to 25% of your earnings, making a total annual contribution of up to \$40,000. And, just as with all

401(k) plans, the contribution you make is deducted from your gross income, lowering your tax burden. If you are age 50 or older, you also are even allowed to contribute an extra \$2,000 above the annual limit as a "catch-up" provision.

The major drawback to the solo 401(k) plan comes into play if you decide to hire an employee who is not an owner of your company. In other words, if you have a small business and you one day plan to expand and hire more employees, you could open a can of worms. If you have a 401(k) plan already in place, and you decide to hire a non-owner employee, you now have new administrative, fiduciary, and financial responsibilities that extend to your employee. In most cases, you would have to start making contributions to your employees' 401(k) accounts, not just your own. If you fail to contribute to your employees' 401(k) accounts, yet continue to contribute to your own, you would most likely not pass the "non-discrimination test." This test exists to ensure all employees are treated evenly and fairly. With a 401(k) plan, if you contribute for one, you must contribute for all.

Simplified Employee Pensions (SEPs): The second very popular plan lets you set up a generous IRA for you and your employees. With this scenario, however, employees do not make any contributions on their own behalf. The plan is funded entirely by employer contributions. You, as the employer, however, have wide flexibility in deciding how much to contribute and when to contribute. In fact, you can vary what you decide to contribute from year to year and do not even have to make contributions at all in any given year. This eases your responsibilities if your business is cyclical or experiences some hard times. Maximum contribution limits are, like the solo 401(k), the lesser of 25% of earned income or \$40,000 annually. (This limit is linked to the rate of inflation and will increase over the coming years). A big advantage to

(continued on page 42)

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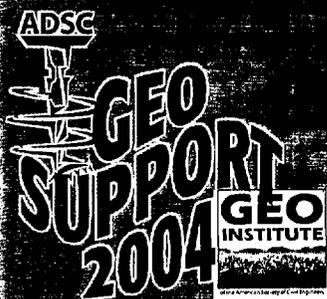
Technical Program Snapshot

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Dr. Fred Kulhawy, Cornell University
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For detailed information or to register visit the conference website:
www.Geo-Support2004.com or call Jan Hall at 214-343-2091.

SEP's is that administrative requirements are minimal when setting up and maintaining this type of plan.

SIMPLE IRA Plan: Unlike the SEP plan, the SIMPLE IRA allows employees to contribute a percentage of their income each paycheck and requires you, as the employer, to contribute a percentage, as well. Employees can decide how much they want to contribute up to a maximum of \$8,000 per year (going up each year by \$1,000 until the limit becomes \$10,000 in 2005). As with the other plans, an additional \$500 can be contributed as a "catch-up" if you are over age 40. Employee contributions are made by payroll deductions. You, as their employer, have to match employee contributions dollar for dollar up to 3% of the employee's compensation. Or, instead, you can opt to make a fixed contribution of 2% of compensation for all eligible employees.

In Summary

Please keep in mind that room does not allow me to describe all the advantages and disadvantages of each type of plan mentioned nor does it allow me to cover the whole spectrum of plan choices that now exist for you. In a later article, however, I will delve into the other types of plans that are available for you, such as Profit-Sharing Plans, Defined Benefit Plans, Defined Contribution Plans, Money Purchase Plans, and more. Certainly, in the meantime, you can feel free to contact me with questions of any kind.

These investment plans may seem, on the surface, like a long overdue way for small business owners to save for retirement. Perhaps, though, government is also hinting that we should take the notion of preparing for our own retirements seriously. Considering the rumored uncertainty of our social security system, we

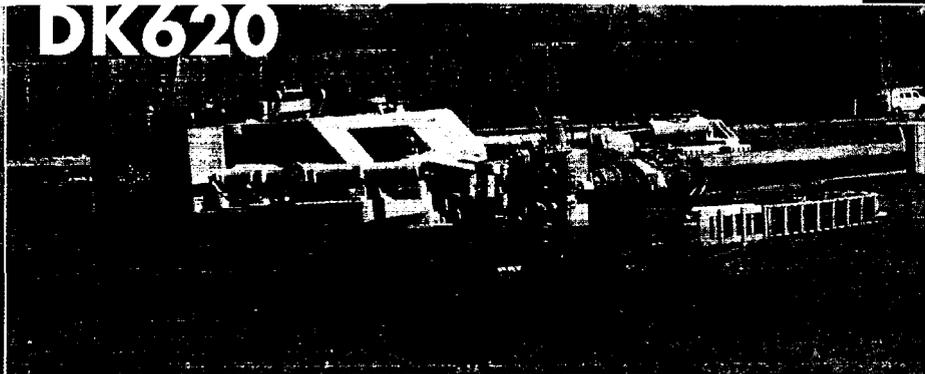
should heed this message being sent. Perhaps more than a half-century after Franklin D. Roosevelt's days, our elected officials are still recognizing his wisdom. Roosevelt once said, "True individual freedom cannot exist without economic security and independence." A modern interpretation of this might be, "Plan for your financial security now. Don't limit your personal freedoms in your golden years to whatever financial help government programs or your loved ones can afford to supply you with."

More retirement, tax savings, and other investment strategies can be found at www.serenitywealth.com or www.carlsanger.com. Carl welcomes your investment questions and can be reached directly at (516) 541-5985 or toll-free at (866) 958-4626, or by email at carl@carlsanger.com. ■

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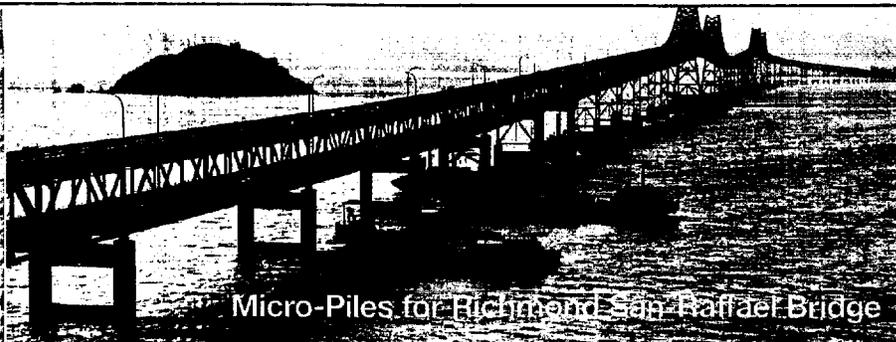
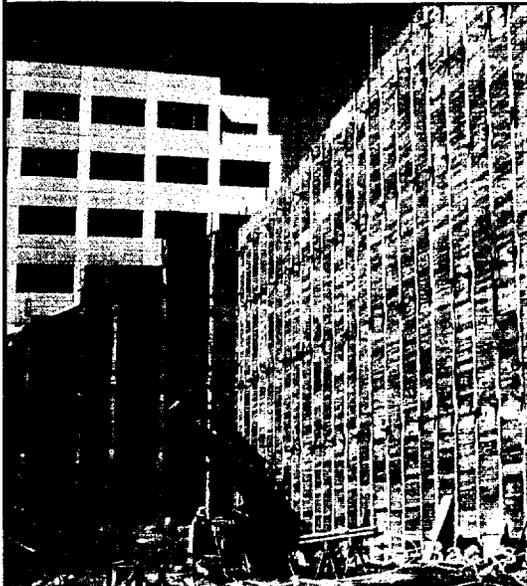
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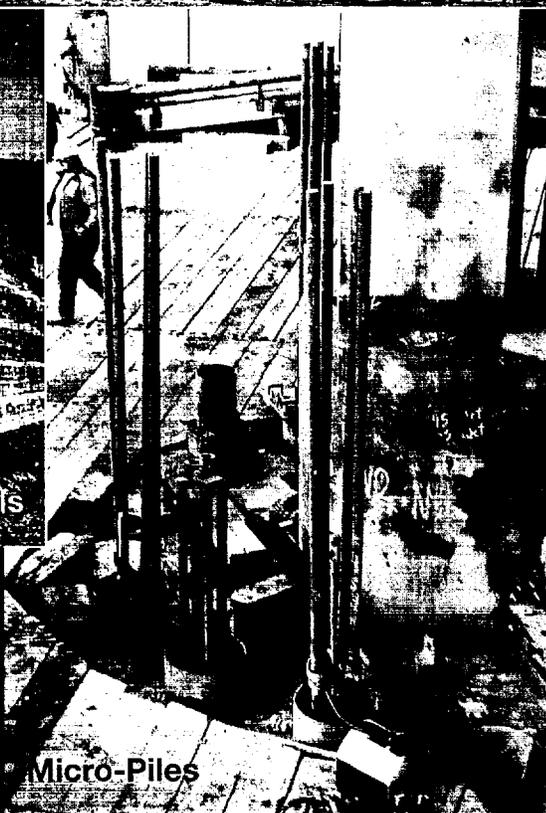


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Calibrating Hydraulic Jacks Re-visited

by John Dunncliff

Geotechnical Instrumentation
Consultant, Devon, England
and

Bengt H. Fellenius
Bengt Fellenius Consultants Inc.

In the section "Associate's Viewpoint" in the March/April 2003 issue of *Foundation Drilling*, Horst Aschenbroich of Con-Tech Systems Ltd. provided useful information relating to the use of calibrated hydraulic jacks and pressure gages during static loading tests of piles and anchors. However, some readers may interpret the text to mean that jacks and pressure gages can be used for measurement of load, and we want to explain why this is not good practice.

A jack is a tool for generating load, but a poor load-measuring device. While Mr. Aschenbroich is correct in saying that jacks and pressure gages show consistent calibrations over time, and therefore frequent re-calibrations may indeed be unnecessary, the pressure gage reading is sensitive to non-aligned and off-center loading. Calibration of a jack in a testing lab is performed with well-aligned, well-centered loading that delivers repeatable results over time. However, in the field, even with the best set-up, the load is never equally well aligned with the pile or anchor, and the load/reaction center is sometimes not even close to the geometric center of the set-up. When the jack pressure is changed and the piston moves, friction acts at the seals. For outward movement, therefore, some of the pressure indicated by the pressure gage is lost in overcoming the friction, creating a measurement error — the load is overestimated (i.e. on the unsafe side). The overestimation is typically as much as 10 % and sometimes nearly 20%. For inward movement (pressure is released), some of the load is carried by the friction — the load is underestimated. The effect of the friction depends on the degree of misalignment and load eccentricity, and it cannot be determined by calibration, only by a separate load measurement.

Confidence in the jacking system should not lead the user to believe that a separate device for measuring the

load is unnecessary. Always use a good load cell for separate determination of the applied loads.

By "good" load cell we mean that the height should be at least four times the cylinder wall thickness, and that the cell should be gaged for eccentric loading, with a minimum of four gages at 90 degrees. A substantial difference between the outside diameter of the load cell and the diameter of the end of the jack that is adjacent to the cell should be avoided, as this causes "barreling-out" (or the opposite) of the load cell cylinder. In any event, appropriately thick bearing plates should be used above and below the cell, ground flat, smooth, and parallel. Typical thicknesses should be 1.5 inches for 75 ton capacity, 2.2 inches for 200 ton, and 3 inches for 250 ton. Vibrating wire load cells are preferred because they are less prone to errors caused by differences in diameters because they are gaged on the neutral axis of the cylinder wall, whereas electrical resistance types are gaged on the outside wall of the cylinder. It is also important that the load cell must be insensitive to temperature changes. Note also that some high precision load cells claimed to be excellent may well be such in the lab, but the test is in the field where the environment is far from well controlled.

As a practical hint, use the jack pressure gage to run the test and the load cell as a passive device to record the load. And, very important, don't let the person reading the pressure gage read, or even see, the load cell readout.

After we wrote this letter, we saw the advertisement by Con-Tech Systems Ltd. on page 61 of the May 2003 issue of *Foundation Drilling*. It shows a superb set-up at an anchor head, with a load cell, very thick bearing plates, and essentially identical diameters of jack piston, load cell, and bearing plate — an excellent example of how to do it right! Now for the punch line — Horst Aschenbroich is the President of Con-Tech Systems Ltd., so clearly he doesn't need our letter. But perhaps it may be useful to other colleagues.

Foundation Drilling magazine encourages its readers to provide op'ed articles. Let our readers know "what's on your mind." Email to: adsc@adsc-iafd.com. or fax to 214/343-2384. (Editor)■

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Hayes Drilling Gets Credit for Successful Project

In a recent article in the June 23, 2003 issue of *Heavy Equipment News*, ADSC Contractor Member, **Hayes Drilling, Inc.**, Kansas City, Missouri, was recognized as being a key sub-contractor in the construction of the reconstruction of the Grandview Triangle Interchange in Jackson County, Missouri.

The Grandview Triangle forms the intersections of I-435, I-470 and U.S. Highway 71. Approximately 240,000 vehicles pass through the Triangle daily. Over the years, traffic patterns developed differently than the original design envisioned, and the interchange became a source of extreme congestion. So Missouri DOT (MoDOT) embarked on a four-phase construction program to streamline the Triangle. Clarkson Construction Company, Kansas City, Missouri completed phase one, a \$49-million

project, ten months ahead of schedule. Clarkson also has won the second phase, a \$65-million project that the contractor hopes to complete three months early.

According to Rich Markey, Clarkson's project manager, drilled shafts were used as foundations under the three longest bridges. The shafts, drilled by Hayes Drilling, measured 4.5, 5 and 5.5 feet in diameter. Hayes used two Soilmec track-mounted drills and one truck-mounted rig. Hayes drilled the holes an average of 45 feet deep, including a 10-foot-deep socket into bedrock. Casing was placed as drilling proceeded. Next, the holes were dewatered and cleaned; a man was lowered into the holes to clean them manually, using a 5-gallon bucket. Reinforcing cages were set, the holes were dewatered again and tremie concrete was used. Cross-hole sonic logging tested the structural integrity of the shafts.

Markey says drilled shafts can be less expensive to build than pile

foundations, depending on the situation. "There is renewed interest in drilled shafts at the federal level," he says. "For years we used drilled shafts on river bridges, but in recent years MoDOT has started using them on conventional bridges over land."

South Central Chapter Holds Safety Seminar

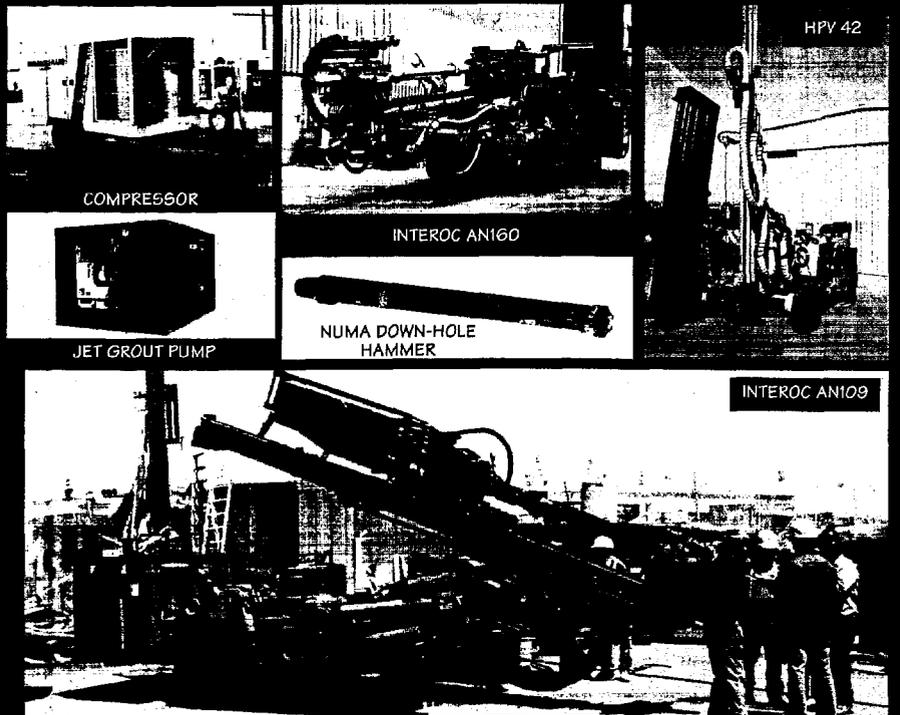
On Saturday, May 10, 2003, the South Central Chapter of the ADSC held a safety training seminar for the employees of chapter members. Instructors were David Decker, Double Eagle Drilling; Frank Taylor, Allied Drilling; and Gary Savage, Texas Shafts, Inc. A session on proper inspection of nylon web, chain and wire rope slings was given by George Suarez of American Sling, Inc.

The topics covered by the instructors

(continued on page 48)

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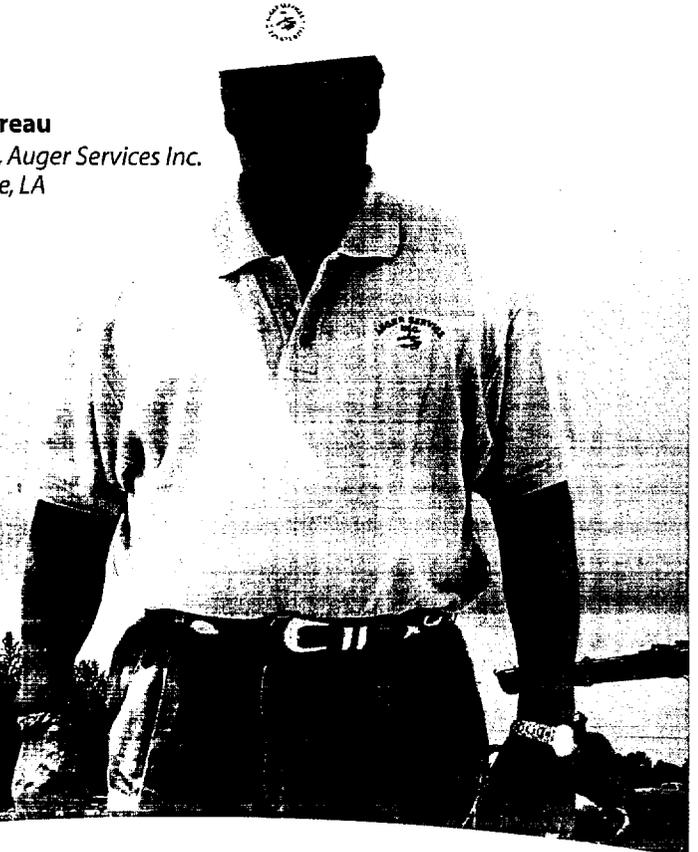
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The South Central Chapter of the ADSC held a safety training seminar for the employees of chapter members. Instructors were David Decker, Double Eagle Drilling; Frank Taylor, Allied Drilling; and Gary Savage, Texas Shafts, Inc.

during this session ranged from proper personal protection equipment to hole guards and driving safety.

Thanks to Watson, Inc. of Fort Worth for providing the facilities needed for this meeting. A tour of

their plant was given by John Monroe and Virgil Taylor to show the procedures taken while building a drilling machine.

These sessions are held on a quarterly basis, free of charge, as a benefit of Chapter membership. For more

information about these sessions, contact David Decker with Double Eagle Drilling in Azle, Texas at 817/444-3018.

\$700M to Cities for Homeland Security

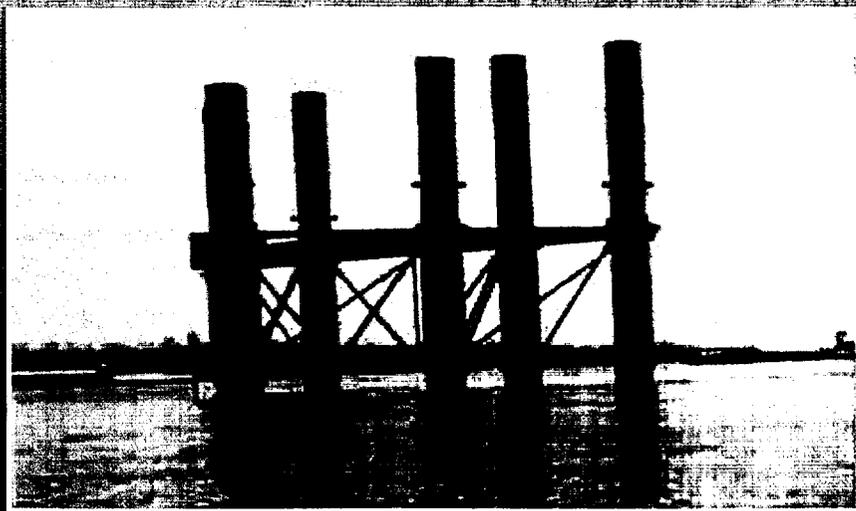
After months of discussion about insufficient federal financial support for meeting growing security demands, state and local officials will soon get some relief. The Department of Homeland Security announced it would allocate \$700 million from the 2003 supplemental budget to help protect urban areas and critical infrastructure.

Based on a formula that takes into account threat information, critical infrastructure and population density, most of that money – \$500 million

(continued on page 54)



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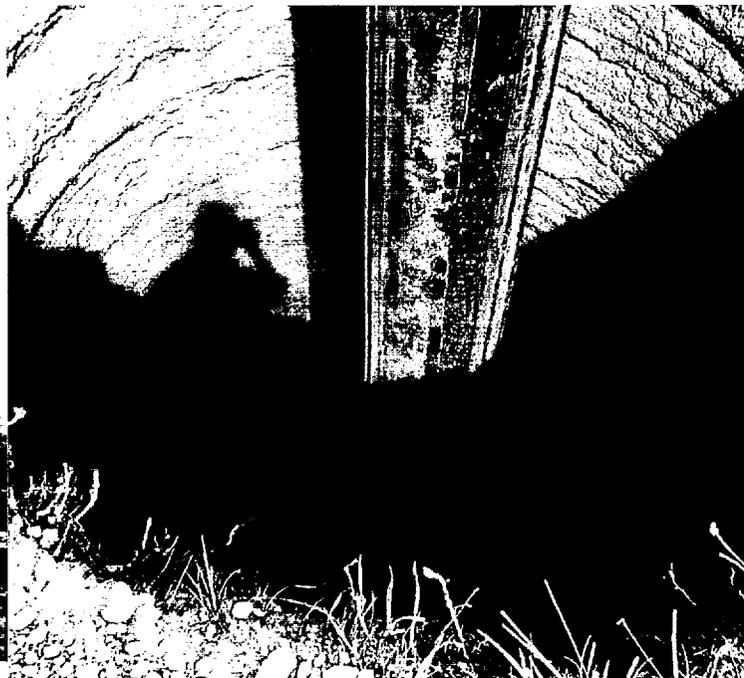
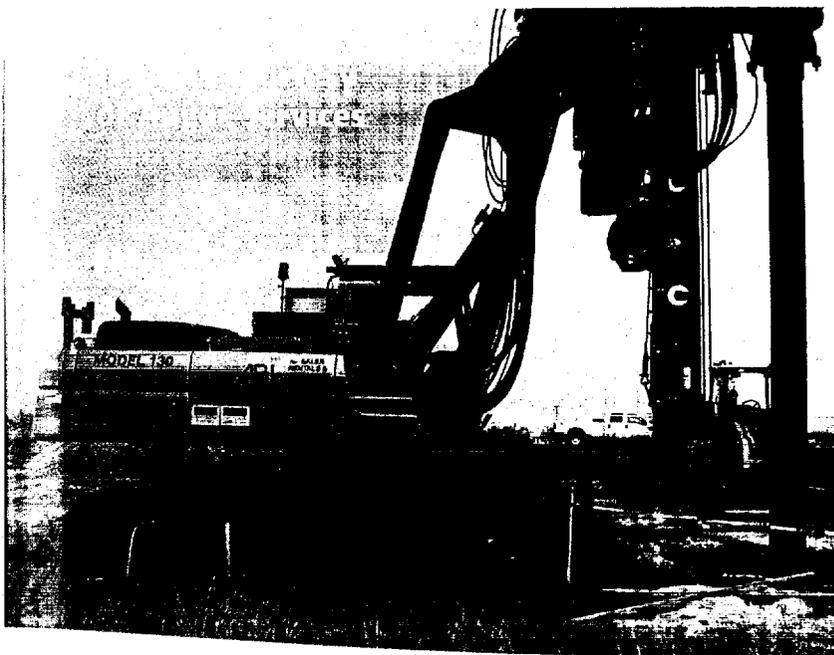
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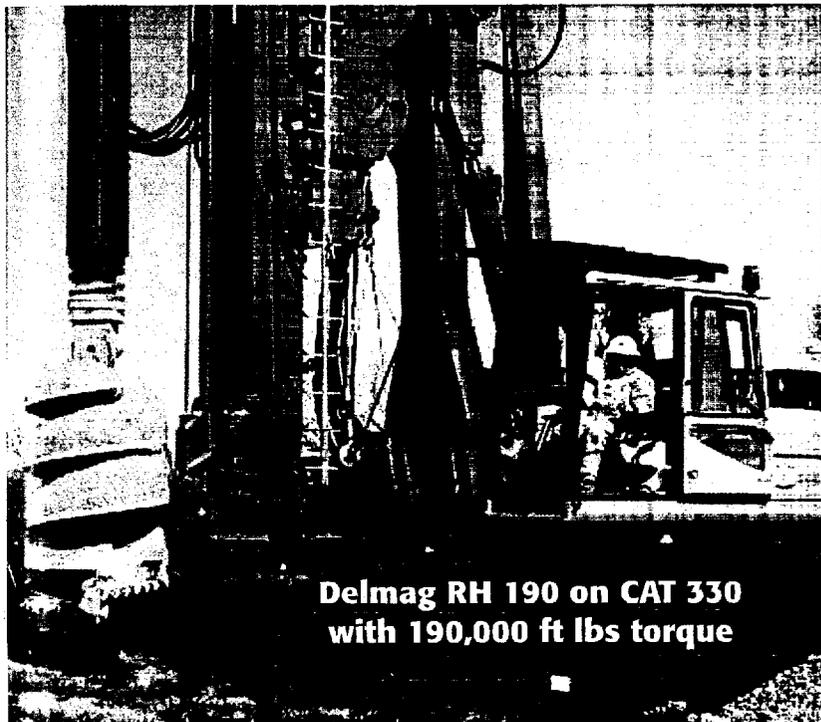
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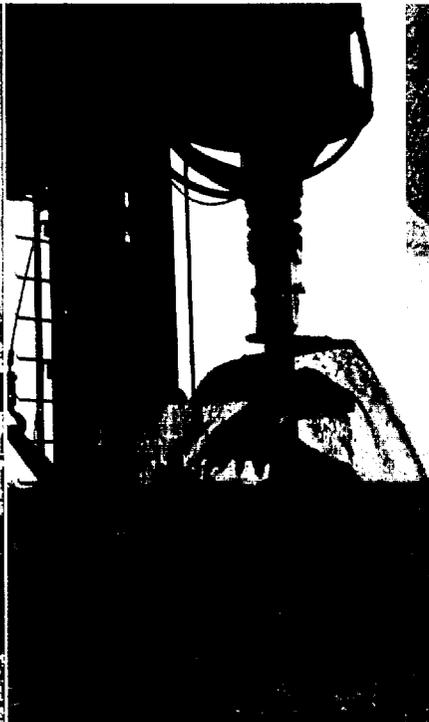
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– will be provided to states in the form of grants to boost security in 30 metropolitan areas. Not surprising, New York and its contiguous counties will see the biggest chunk of that money - \$125 million. Washington, Chicago and Houston will receive about \$42 million, \$30 million and \$24 million, respectively, Los Angeles, San Francisco and Seattle each will receive about \$18 million. Grants ranging from \$17 million to \$6 million will be made to 22 other cities as well.

“These grants demonstrate our strong commitment to provide assistance to the men and women on the front lines of the war against terrorism,” said Homeland Security Secretary Tom Ridge in a statement.

The information above was provided courtesy of TISP Newsletter.

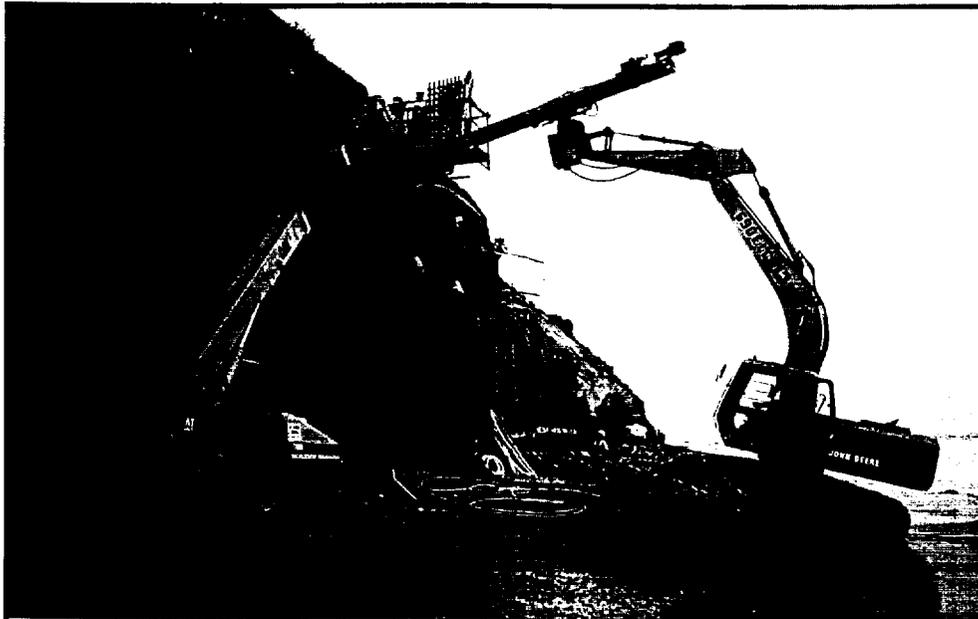


**Anti-Corrosion Times
Features I-70 Rehab**

The Spring 2003 issue of *Anti-Corrosion Times* features one of the

largest reconstruction projects in Illinois. Located in Clark County, this \$74 million reconstruction of ten miles of Interstate 70 was the first

(continued on page 51)



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segment in a 21-mile, \$135 million project. This same issue has an interesting story about the collapsed bridge on I-40 in Oklahoma which was reconstructed in a record time – 65 days from disaster to reopening.

The Concrete Steel Reinforcing Institute (CRSI) publishes their newsletter twice yearly for industry use, produced to keep manufacturers, consultants, engineers, owners, state agency personnel and others up-to-date on the newest information about epoxy-coated rebar. For your free copy, contact: John Prentice, CRSI at 847/517-1200, or email at jprentice@crsi.org.

**ASCE Makes Available
“Excavation Safety Video”**

ASCE's Continuing Education Department has made available a 7-

hour seminar on video entitled *Excavation Safety*. Other video productions are available on a variety of subjects including, Construction Project Administration, Cashing in on Design/Build, Concrete Basics: Slab on Grade, Project Management Online Course, and OSHA Regulations.

To receive more information about ordering some of these videos, contact ASCE at 1/800-548-2723.

**NUCA Achieves Success
with Tax Cut Bill**

The \$350 billion tax cut package signed by President Bush on May 28, 2003 included two provisions of particular importance to geo-construction specialty contractors. The tax package extends the temporary 30 percent depreciation bonus to 50

percent through FY 2005 and raises the expensing limit for small business from \$25,000 to \$100,000 through FY 2007.

The National Utility Contractors Association (NUCA) and the Associated Equipment Distributors (AED) surveyed NUCA's membership on how the 2002 “economic stimulus” packaged affected purchasing habits in the utility construction industry, and whether expansion of these provisions in the president's “economic growth” package would encourage further equipment investment. Results from the survey were overwhelmingly positive, and the study was delivered to members of the House Ways & Means Committee and the Senate Finance Committee during the concluding days of the tax debate. NUCA is pleased that these provisions were included in the

(continued on page 52)



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final bill.

Almost 70 percent of survey respondents who were aware of the depreciation bonus enacted as part of the 2002 Job Creation and Worker Assistance Act invested in new equipment as a result. Additionally, 90 percent of respondents said that further expansion of the depreciation bonus from 30 percent to 50 percent would prompt their companies to at least consider purchasing new equipment. Seventy-two percent of respondents said they would at least consider purchasing new equipment if the expensing limits were raised.

"The depreciation bonus and expressing expansion are common sense provisions that will stimulate economic activity," said Bill Hillman, NUCA CEO. "You don't get the bonus unless you buy. The NUCA/AED surveys shows that these provisions entice our contractors to buy, and we're pleased that we were able to demonstrate that."

FMI Schedules Excellent Seminars & Workshops

ADSC National Associate Members, FMI headquartered in Raleigh, North Carolina, offers a wide range of programs for the construction industry. The twenty-three courses described in their latest brochure have been carefully crafted to meet the needs of today's construction leaders, managers, and supervisors. To receive a copy of their Seminar and Workshop Calendar, contact FMI at 800/877-1364.

ADSC was very fortunate to have FMI Consultants, Ben Brahinsky and Timothy Spiker out of their Denver, Colorado office, as educational session presenters at the Summer Meeting in Whistler. Ben's topic was "Consolidation, Acquisition, and Ownership Trends and Issues." Timothy presented a three-hour Leadership Workshop. Both received high marks from attendees.

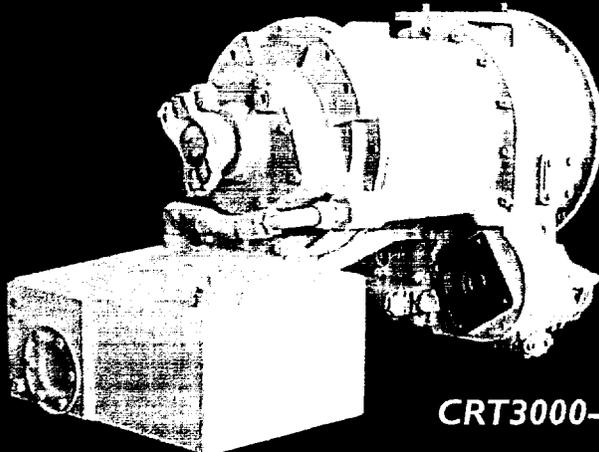
New Drilled Shaft Design Title Added to ADSC's Technical Library Catalog

Structural Design Issues for Drilled Shafts, a new sixteen-page report prepared by Dr. Michael O'Neill, University of Houston; Dr. S.W. Tabsh, American University of Sharjah, UAE; Dr. H.A. Sarhan, Bethel, Inc.; and Dr. M.S. Nam, University of Houston is now available for sale.

According to the Abstract,

"Drilled shafts are often designed using code requirements for structural beam-columns. However, the method of construction, particularly the use of drilling slurry, can lead to flaws not present in beam-columns that can affect the structural capacity of drilled shaft. Major flaws can be detected with modern NDE methods. Test results should be evaluated and the shafts repaired if warranted; however, minor flaws may not be

(continued on page 54)



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KEEPING UP Contd.

detected. The possibility that such undetected flaws may exist should therefore be reflected in design codes. This paper summarizes experimental and analytical research that considers effects of voids, mispositioned rebar, weak concrete, rebar corrosion and the probability of occurrence of such flaws on the axial, bending and shear capacities of drilled shafts. New structural resistance factors for consideration for structural LRFD design codes are also proposed."

To order, contact the ADSC's Technical Library at 214/343-2091 or via email at adsc-adsc-iafd.com. The price is \$4 for ADSC members, \$6.50 for non-members plus postage and handling.

GEO-SUPPORT 2004 UPDATE

The Joint Equipment Exposition and Technical Conference GEO-SUPPORT 2004, to be held February 4-7, 2004 at the Hyatt Orlando, in Orlando, Florida, gathers momentum as the technical program is filled in and the exhibit spaces for the wide variety of geotechnical oriented products and services are over 70% sold.

The Indoor Exhibit Area will highlight a variety of Member companies from the several co-sponsoring organizations including AEG, ASFE, DFI, FHWA, NDA and PTI. Exhibiting their products and services, manufacturers, specialty sub-contractors, geotechnical consulting firms, materials testing labs, soil investigation, estimating and design software developers, NDE providers will be eager to show their wares.

The Outdoor Area will be focused on large construction equipment including drill rigs, cranes, vibratory drivers, winches, geo-support drilling equipment, down-hole drills and bits and a wide variety of ancillary equipment will be there for you to inspect.

An outstanding selection of Plenary

and Technical Sessions have been planned to peak the interest of members of the engineering and construction communities. The guest lecturers include:

- Professor William Van Impe, ISSME President
- Professor Dan Brown, Auburn University
- Professor Fred Kulhawy, Cornell University
- Professor Harry Poulos, Sr. Principal, Coffey Geosciences
- William M. Camp III, P.E., S&ME
- Jerry Porter, P.E., Vice President, Design-Build, Peter Kiewit Sons', Inc.

Six Short Courses will be presented by the Geo-Institute of ASCE:

- *Estimation of Soil Properties for Foundation Design* - Instructor: Dr. Fred Kulhawy, Cornell University
- *Design, Construction and Verification For Drilled Foundations* - Instructors: Professor Michael McVay, Clyde Baker, P.E., Frank Rausche, P.E., and Mohamad Hussein, P.E.
- *Deep Mixing Technology For Construction of Infrastructure Systems; The State of the Practice* - Instructors: Members of the National Deep Mixing Program
- *Micropiles - Developments in Design & Construction* - Instructors: Tom Armour, DBM Contractors; Donald Bruce, Geosystems; Tom Richardson, Nicholson Construction; Tom Tuozzolo; and John Wolosick, Hayward Baker
- *Essentials of Risk Management, Client Relations and Profitability for Project Managers* - Instructor: John Bachner, President, Bachner Communications
- *Ten Ways to Stay Out of Financial Business Trouble* - Instructor: Lee James, CPA, formerly Treasurer of the Foundation for Professional Practices

Special Educational Programs for ADSC Members include:

(continued on page 56)

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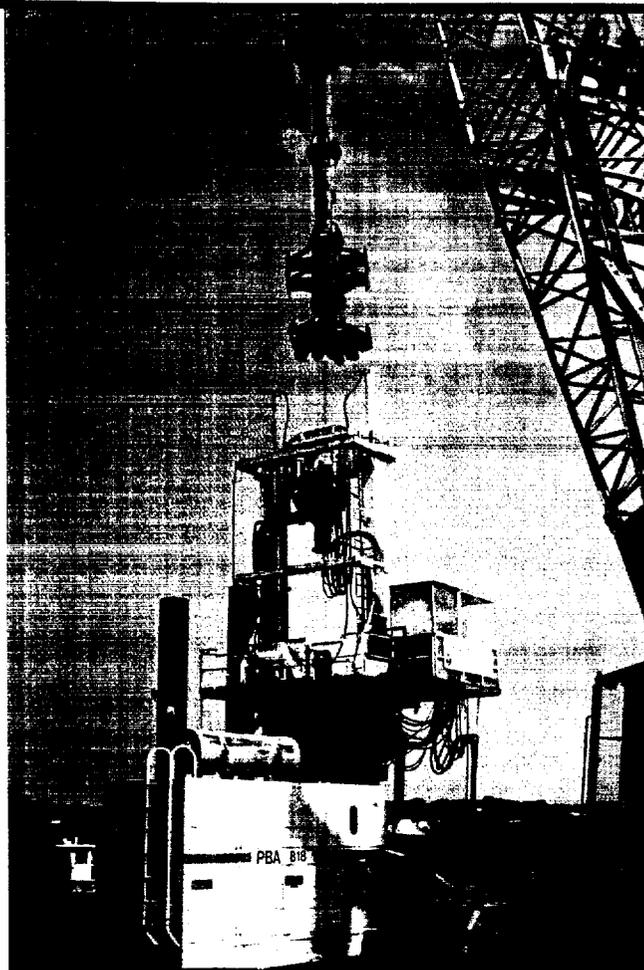
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- Safety Requirements Workshop
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- Panel Discussion: *Future Drilling Technology and Its Effect on Geotechnical Foundation Construction Methods and Design* - To be presented by a group of ADSC Associate Members.
- Special Development Session
Created for Category III and IV Contractor Members

ADSC will be making their annual Graduate Civil Engineer Scholarship Awards along with the Hall of Fame, Contractor of the Year, Associate of The Year, and Outstanding Service Awards, as well as presentations by ADSC and G-I of the Industry Hero Award.

In addition, the usual and unusual mix of social events over the four days will keep everyone busy networking and catching up on news from near and far, while visiting exhibitors hospitality suites after a hard day at the exhibits and tech sessions.

You can see in detail, what is scheduled by going to the website at www.geo-support2004.com. It is updated weekly as more details are finalized.

Mark your calendar now for February 4-7, 2004 and write GEO-SUPPORT 2004 - ORLANDO across that week. You will be receiving your Registration information in September and October along with hotel information.

DON'T MISS IT!

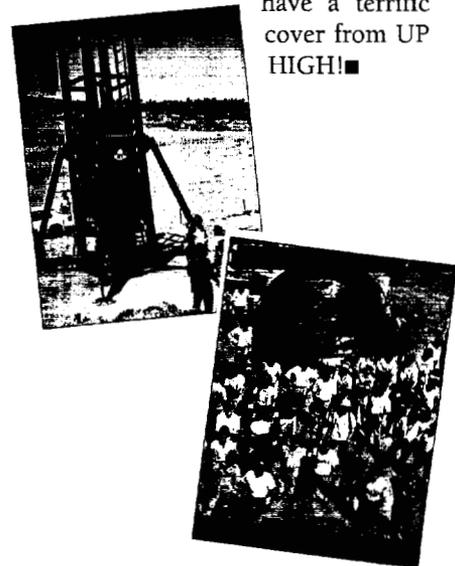
ADSC Membership Directory Hits the Streets

The new 2003-2004 ADSC Membership Directory was sent to all members in late July with additional copies available through the ADSC office by calling 214/343-2091. The price is \$32 for members and \$92 for non-members with postage and handling being an additional charge.

The cover of the directory came with great risk by ADSC member

Andy Steele, Steele Foundations, Washington, DC. As Andy attended the ADSC 2000 Faculty Workshop, he looked up at the Statnamic test frame and said to ADSC Administrative Director, Ted Ledgard, "Climb up there and get a picture of the attendees." Being the intelligent fellow that he is, Ted said, "You climb up there if you want the picture." So he did. Thanks to Andy's bravery, we

have a terrific cover from UP HIGH! ■



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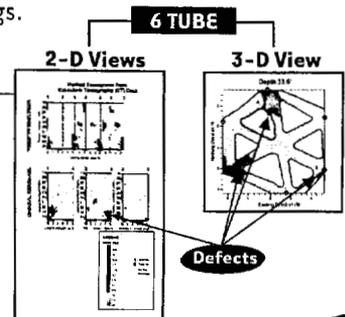
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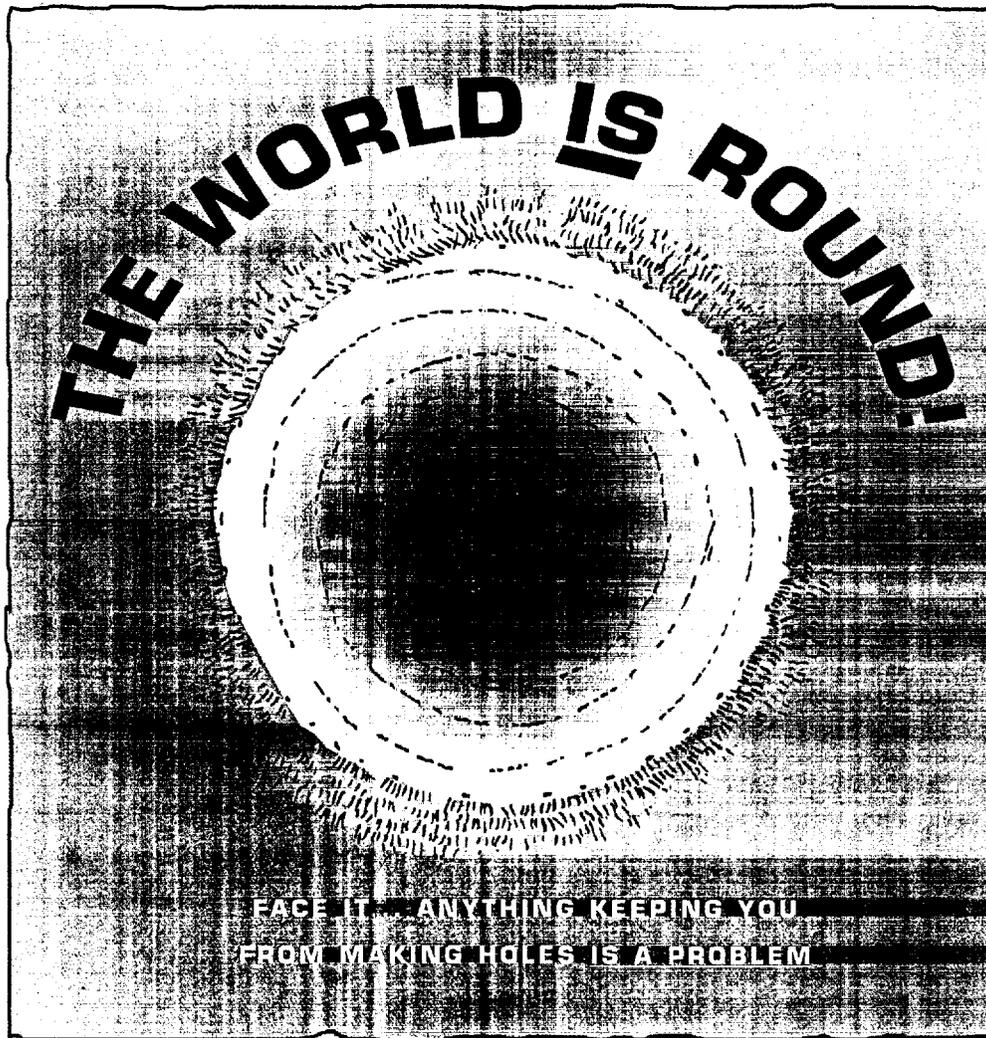
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**Schnabel Foundation's
Ron Chapman Receives Award**

ADSC Contractor Member and past ADSC Board of Directors Member, K. Ronald Chapman, was recently awarded the University of Illinois



Civil and Environmental Engineering Alumni Associations 2003 Distinguished Alumnus Award. Mr. Chapman's award was given "for advancing the state of the art of foundation engineering through innovations in design, development of design criteria, and the construction and observation of performance of earth-retention structures."

Mr. Chapman graduated from the University of Illinois in 1970 with a Master of Science in Civil Engineering, and has been employed by Schnabel

Foundation Company since that time. He is currently Vice President and Western Regional Manager for Schnabel. During his 33 years of experience with Schnabel, Ron has been responsible for over 500 foundation projects in 24 states. These projects have included: permanent ground anchors for retaining walls, waterfront bulkheads, slab tiedowns, dam tiedowns, and landslide stabilization; temporary and permanent soil nailing; temporary excavation support; underpinning of structures; micropiles; and deep soil mix walls.

He is a Registered Professional Engineer in over 20 states, has authored or co-authored numerous papers, and has been a speaker at technical association meetings throughout the United States. He has served on various technical and association committees, and is a past Vice President of the ADSC and past Chairman of the ADSC Earth Retention Committee.

In addition to his recent award, Mr. Chapman received the American Society of Civil Engineers Martin S. Kapp

Foundation Engineering Award in 1999; and the ADSC International Contractor of The Year Award in 1994.

**Nicholson's President Elected
as Member of the Moles**

Andrew D. Walker, President of Nicholson Construction Company, was recently elected to membership of the Moles. The Moles is an organization of individuals engaged in heavy construction, primarily in the New York City metropolitan area.



In addition, Mr. Walker recently became a Fellow of the Institution of Civil Engineers (FICE) in London, England. Founded in 1818, this organization is the world's longest estab-

lished organization in the world's longest estab-

(continued on page 60)



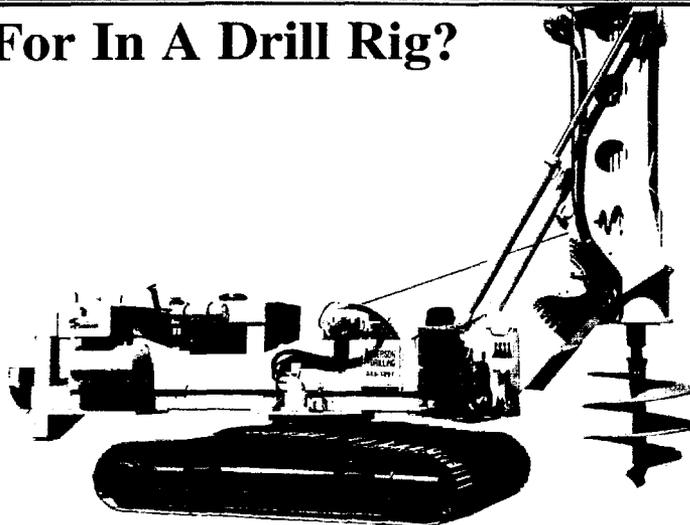
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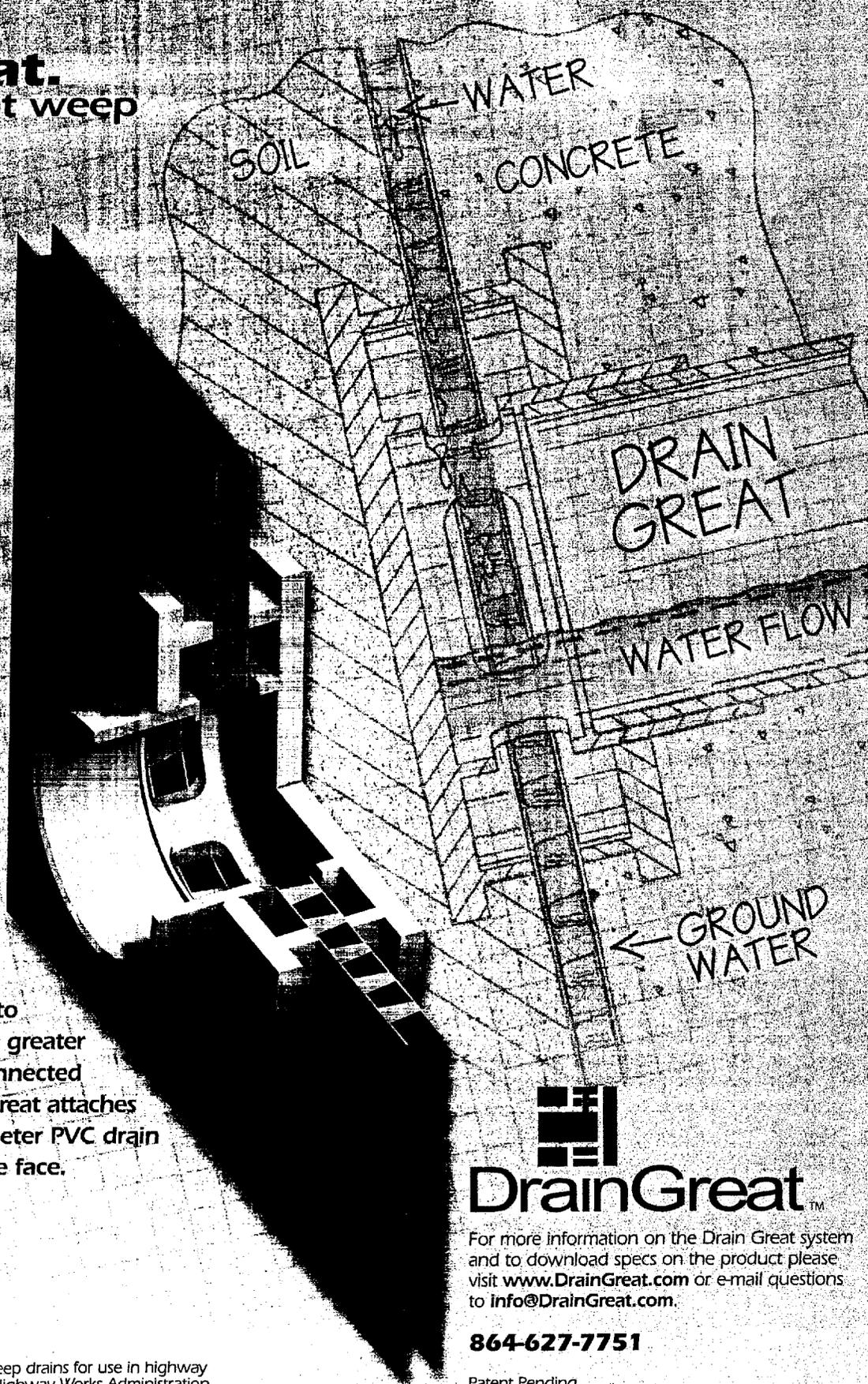
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lished engineering institution and is the prime qualifying body for civil engineers in the United Kingdom. Fellow is the highest grade of membership and FICE is an internationally recognized and respected symbol of excellence. Only those who have achieved distinction in their careers are eligible to receive this level of membership.

Mr. Walker became President of Nicholson Construction in July 2000. He accepted both awards recognizing that his personal achievements are, in many ways, primarily a reflection of the recent accomplishments of Nicholson Construction Company and the dedicated professionals who work there.

Continental Supply Opens in California

Mike Hagy, newly appointed Region Manager and Slurry Engineer, announces



Mike Hagy

that he, Frank Wilson, Senior Slurry Engineer, and Bill Matcaroff, all formerly with Weatherford Drilling Products, have joined Continental Supply Company, which has just become a new ADSC Associate Member.

ADSC National Associate Member, Continental Drilling Tools & Well Supplies, is now the new Master Distributor of CETCO's Caltrans approved, Shore Pac Drilling Polymer and slurry system programs in California. Continental also promotes Slurry Drilling Schools and has the capability of providing programs, products, trouble shooting, and engineering services nationally as well as internationally. Mike can be contacted at 800-794-3737.

Voges Drilling Celebrates 5th Anniversary

ADSC Contractor Member, Voges Drilling Company of New Braunfels, Texas is proud to announce the fifth anniversary of its founding. The company was incorporated in September of

1998 and began operations after purchasing the assets of S. L. Voges Construction – a former ADSC Category IV member.

In the past five years, Voges Drilling has grown to Category III size and is presently "knocking on the door" of Category II. Their fleet has grown and been upgraded and the company's scope of work has been expanded to include highway work as well as turn-key foundation installation. Voges's area of operations is centered in San Antonio and Austin, but has spread out to complete jobs from Fort Hood to the Rio Grande Valley.

Voges Drilling's President, Jack McKinney, would like to thank the ADSC and the ADSC South Central Chapter for their support during this period. "We are also appreciative of the relationships that we have developed with other contractor members and particularly want to acknowledge the support that we have received from some of the ADSC's Associate Members – namely CIA Machinery, H&T Auger and Rodrill, Inc."

Voges Drilling Company can best be characterized as a "new" company with a lot of tradition behind it. As the company continues to develop, we plan to promote the association and its position in the industry.

Essex Crane Announces California Location

New ADSC National Associate Member, Essex Crane Rental Corporation, recently announced a relocation of its Fontana, California facility to 15060 Ceres Avenue, Fontana, California. The phone number there is 909/823-9055. Jim Crawford is the Branch Manager.

Ron Schad, President and CEO of Essex said "This new location in Fontana meets all of our requirements for the future and will allow us to better serve our customers on the West Coast as we continue to grow our business in that part of the country."

In addition to the company's main headquarters in Buffalo Grove, Illinois, Essex currently has five fully-equipped service centers in North America located in Alabaster (Birmingham), Alabama; Arcola (Houston), Texas; Longmont (Denver), Colorado; Fontana (Los Angeles), California; and Tampa, Florida.■

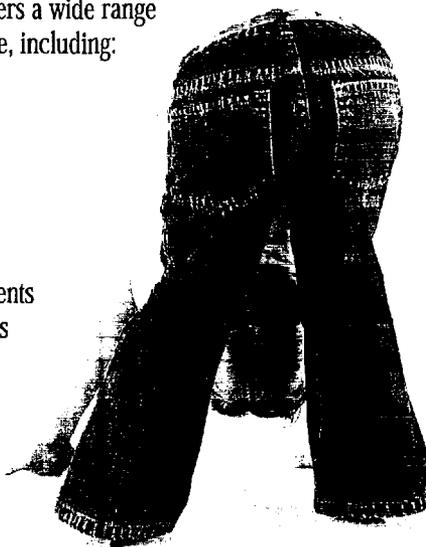
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**C. Felice & Company
Adds CSL**

ADSC Technical Affiliate Member, C. Felice & Company, Kirkland, Washington, recently announced that they have added cross-hole sonic logging (CSL) capabilities to better serve their clients' needs in the area of deep foundations. With the addition of CSL, the company offers a full range of services for the design and construction of drilled shaft and large diameter pile foundations. The services include:

- Integrity Testing
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For more information contact:

Conrad W. Felice
Managing Principal
C. Felice & Company, LLC at:
Phone: (425) 820-0800
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**Reeddrill Reaches
New Heights! 650 25'25'**

In response to the utility needs, *Texoma 650* has attained new "heights" (as in working heights) that allow power companies and contractors to drill and work under energized powerlines while maximizing drill depth capabilities. We now offer an optional mast assembly that further meets this height and depth need.

Texoma 650 new key option features are:

- 25' drill depth capacity!
- 25' working mast height!
- Hole diameters up to 60" (1,524 mm)
- Lowest working height, and transporting length, in the industry.
- "Dry bar" design reduces environmental concerns, related to oil leakage, that is common with other designs.

ADSC National Associate Member, Reeddrill, the manufacturer of *Texoma* brand auger drills, successfully introduced the newest member to their auger drill product line in 2002 – the new *Texoma 650*. The *Texoma 650* is designed to meet the evolving needs of the utility and foundation industry's, featuring a "dry bar" telescoping Kelly system, greater drilling depth, and lower working height for drilling under power lines.

Whether truck or crawler mounted, the *Texoma 650* combines power with versatility to meet the most demanding drill applications.

Reeddrill is a Metso Minerals company, a global leader in the supply of rock and mineral processing systems. For more information, contact:

Lou McDuffy
Reeddrill
 P.O. Box 998, Sherman, Texas 75091
Phone: (903) 786-2981
Fax: (903) 786-6405

**Nicholson Strengthens
Equipment Fleet**

Nicholson Construction Company recently added two new customized Casagrande C14A hydraulic crawler drills to its fleet of geotechnical construction equipment.

The first of the two drill rigs arrived at Nicholson headquarters in April 2003 with a second scheduled to arrive this summer. The C14A drill rigs will be used for PIN PILESM, anchor and jet grouting applications in all soil conditions.

Designed and built by Italian foundation equipment manufacturer, ADSC Associate Member, Casagrande, the C14A is an updated version of the C12 rigs purchased by Nicholson in the early 90s. Nicholson worked closely with its parent company, Rodio S.p.A., and Casagrande to tailor the rig to its exact specifications including retrofitting the rig with a duplex drilling rack. In the end, the collaboration resulted in a more powerful rig with greater efficiency and versatility.

"We wanted to apply what we have learned from the older C12 rigs to create a more powerful, more efficient drill rig," said Lyle Silverman, Nicholson's West Coast regional manager. "The new C14As reflect Nicholson's dedication to innovation and its position as an industry leader."

Nicholson's C14A has a greater rotation torque and rotation speed than its predecessors. Larger pull down and extraction forces, and bigger clamps for larger diameter tooling allow the rig to drill holes up to 16 inches in diameter and drill to depths of 300 feet. An improved control panel and operator station makes it more operator-friendly.

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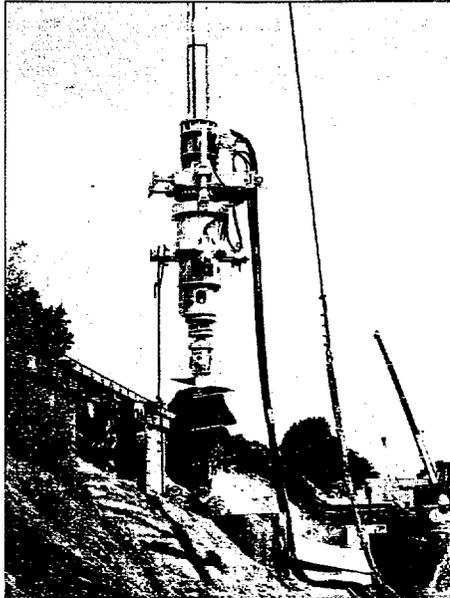
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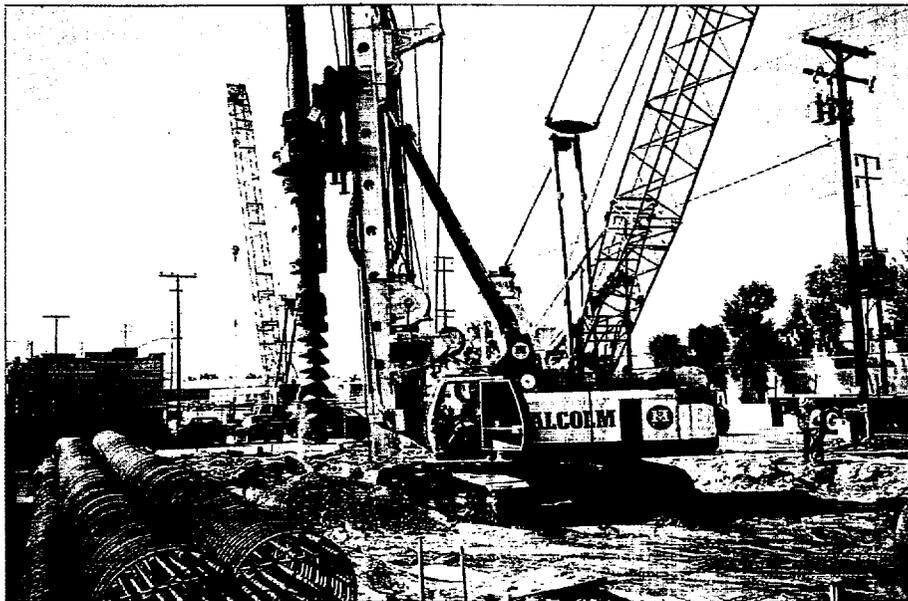


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CALENDAR

GEO-Industry Events

September 11-12, 2003 ASCE will offer *Construction and Contract Law for Engineers* at three locations this fall: September 11-12 in New Orleans, Louisiana; October 23-24 in Parsippany, New Jersey, and December 4-5 in Las Vegas, Nevada. To register, contact ASCE Continuing Education at 1/800-548-2723.

September 19, 2003 The 34th Annual Ohio River Valley Soils Seminar will be held in Lexington, Kentucky at the Embassy Suites. The seminar topic is *Applications of Earth Retaining Systems and Geosynthetic Materials*. Contact Craig Lee at 859/293-5518 for more information.

September 27, 2003 **October 1, 2003** The American Concrete Institute's Fall 2003 Convention will be held in Boston, Massachusetts. *Concrete Solutions – Over and Under* is the theme. For more information contact ACI International at 248/848-3800 or visit their website at <http://www.concrete.org>.

October 1-2, 2003 The Deep Foundations Institute will host their *Technology Seminar on Micropiles* at the Drake Hotel in Chicago. Call Geordie Compton at DFI, 201/567-4232 for details.

October 20-24, 2003 The Southeastern Transportation Geotechnical Engineering Conference (STGEC) will be held at the Embassy Suites Hotel Airport Convention Center in North Charleston, South Carolina. ADSC's Southeast Chapter will support the meeting by providing an exhibit booth and hospitality.

October 29-31, 2003 The Central Pennsylvania Section of ASCE and PennDOT are sponsoring their 20th Geotechnical Confer-

ence at the Hershey Lodge and Convention Center in Hershey, Pennsylvania. For information, contact Cari Beenega at 717/763-7211 or visit the website at <http://www.TowerEng.com.ASCEPA2003.htm>.

October 22-24, 2003 The Deep Foundations Institute will hold its *2003 Annual Conference on Deep Foundations* with the title "Deep Foundations in Compressible Soil and Soft Rock." It will be held at the Eden Roc Resort & Spa in Miami Beach, Florida. Contact DFI at 201/567-4232 or via email at dfihq@dfi.org.

November 12-15, 2003 ASCE's Civil Engineering Conference & Exposition *Keys to Your Future* will be held at the Gaylord Opryland Resort in Nashville, Tennessee. The program will focus on current issues in Professional Qualifications, Leadership & Management, Application of New Technology, and Infrastructure, and in selected technical topics. To register, contact ASCE at 800/548-2723.

July 7-9, 2004 The Geo-Institute of ASCE will host *Geo-Trans 2004*, the Geo-Institute Conference on Geotechnical Engineering for Transportation Projects, on the campus of UCLA, Los Angeles, California. For more information, contact ASCE's Conference Department at 703/295-6350.

November 14-17, 2004 The *Second International Conference on Scour and Erosion* will be held in Singapore. This conference follows the successful First International Conference on Scour and Foundation held in November 2002 in College Station, Texas. For complete details about the Call for Papers and registration, visit their website at <http://www.ICSE2004.org>.

Future ADSC Meetings, Seminars and Conferences

September 15-20, 2003 ADSC's *Management Personnel Training Institute (MPTI)* will be held at Copper Mountain, Colorado. For more information, contact Cindy Colao at the ADSC office 214/343-2091 or ccolao@adsc-iafd.com.

September 24-27, 2003 ADSC's *The International Workshop on Micropiles (IWM) Meeting* will be conducted at the Sheraton Seattle Hotel. This event is by invitation only.

October 10-11, 2003 ADSC's *Fall Board of Directors Meeting* will be held at the Harvey Hotel near DFW Airport, Dallas, Texas. Contact Lori Schirpke-Jordan or Susan King at the ADSC office for details, 214/343-2091.

November 2-8, 2003 ADSC's *Anchor Micropile Installation School (AMPIS)* will be held at the Guilford Technological Community College in Greensboro, North Carolina. Call Cindy Colao at the ADSC office for registration details or visit our website at www.adsc-iafd.com

November 19, 2003 ADSC's will conduct a one-day *Drilled Shaft Design for Constructibility Seminar* in the Baltimore, Maryland area. Dr. Dan Brown, Auburn University, will be lead presenter.

For more information, visit the ADSC website at adsc@adsc-iafd.com, or call Cindy Colao at 214/343-2091.

February 4-7, 2004 The ADSC and the Geo-Institute of ASCE will present *Geo-Support 2004: The International Conference and Exposition on Cooperation and Innovation in the Geo-Industries*. The Hyatt Orlando in Florida will be the site of the international gathering. For more information, contact the ADSC office or visit the web site at www.geo-support2004.com.

April 29-May 1, 2004 ADSC's *Spring Board of Directors Meeting* at the Harvey DFW Hotel, Dallas, Texas. Contact Lori-Schirpke-Jordan at ADSC office for more information.

July 28-31, 2004 ADSC's *Summer Meeting* is scheduled for the Coeur d'Alene Resort in Idaho. Contact Lori Schirpke-Jordan at the ADSC office for more information.

February 2-5, 2005 ADSC's *Annual Meeting* will be held in San Diego, California at the Paradise Point Resort & Spa. Lori Schirpke-Jordan can provide additional information by contacting her at the ADSC office.

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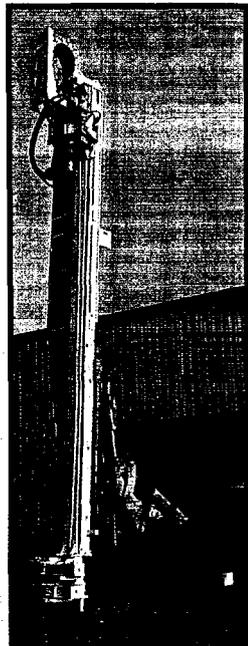
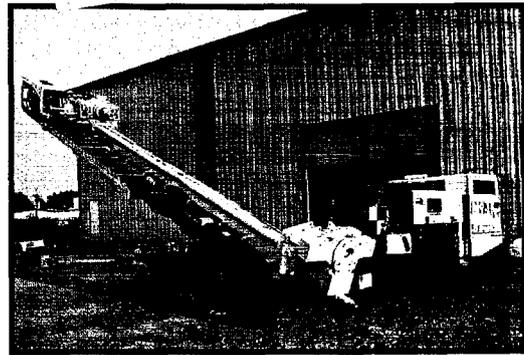
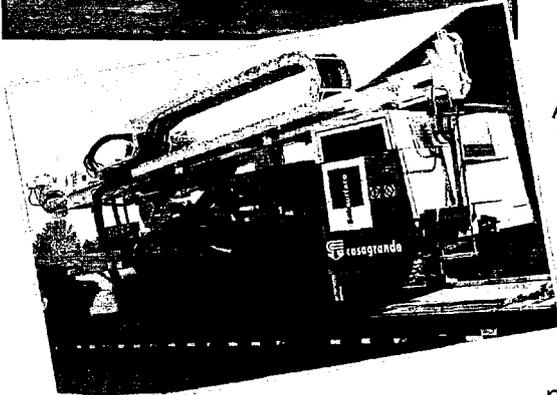
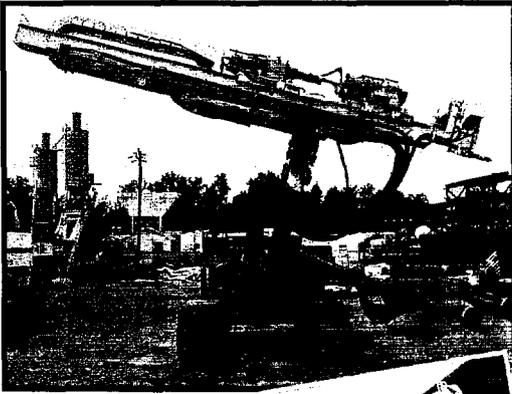
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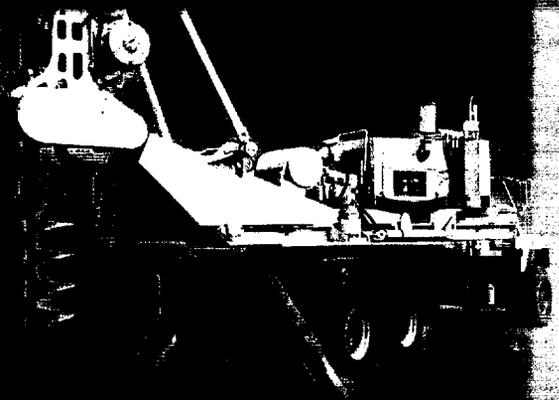
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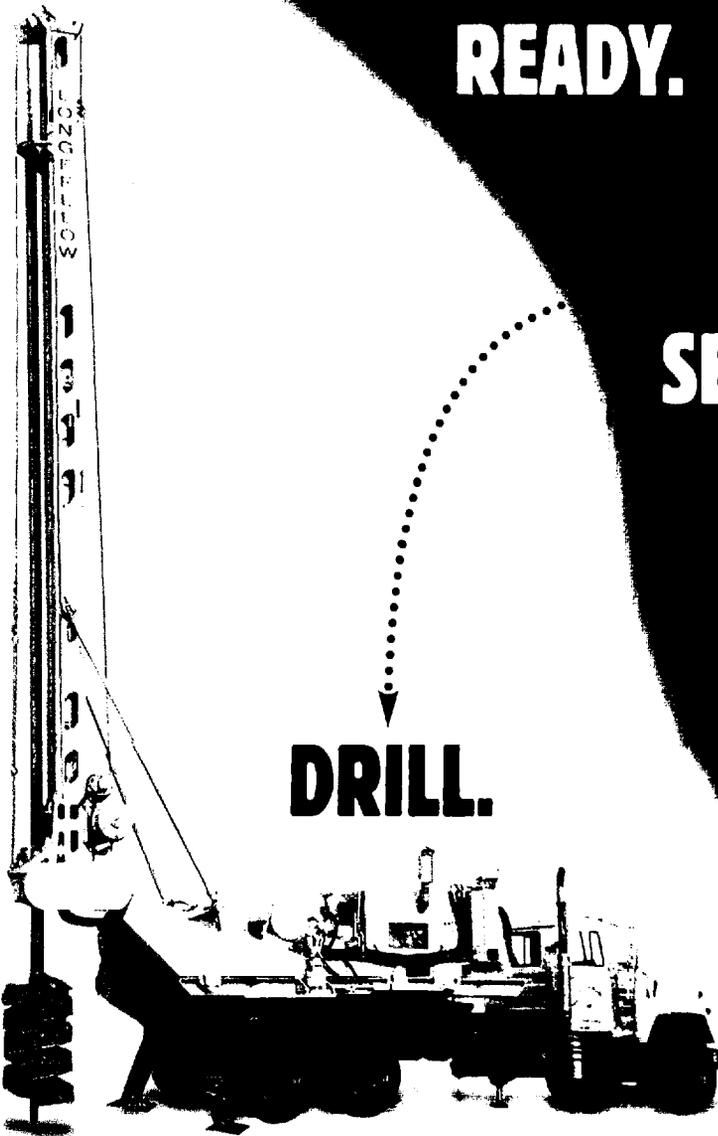
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