

## WELCOME . . .

... to the third issue of "The Gregg Geo News". The Geo News is being published to provide current information on the services we offer, equipment & technologies utilized and project experience.

The Geo News is distributed in electronic form which is emailed directly to you. If you wish to become a subscriber and are not currently on our mailing list simply visit our web site and register to receive email updates. You can also access this newsletter as well as previous issues of the Geo News through our web site at: [www.greggdrilling.com](http://www.greggdrilling.com).

## QUICK FACT

In 2006, Gregg Drilling & Testing introduced a program to provide our clients with a PDA complete with PLog software for every two (2) miles of borings they drill with mud rotary or hollow stem auger. "PLog provides an innovative method to collect and manage borehole data in digital form and we encourage our clients to take advantage of this exciting technology." – John Gregg, President.

We are pleased to announce that Treadwell & Rollo in San Francisco are the latest recipients of this PDA system. For more information on the Mile Drilling Reward Program visit our web site.



The PLog software was developed by Dataforensics. For more information on this software application visit their web site at: [www.dataforensics.net](http://www.dataforensics.net)

## PROJECT SPOTLIGHT

### - SACRAMENTO LEVEE EVALUATIONS -

Gregg Drilling and Gregg In Situ are excited about joining the team chosen to investigate the hundreds of miles of levees in the Sacramento Delta. Following Hurricane Katrina in New Orleans, the importance of levee stability was brought to the forefront. The California Department of Water Resources has developed a strategy to investigate the California levee system and mitigate the risk of flooding.

Since December 2006, Gregg has been drilling borings and conducting Cone Penetration Testing (CPT) to aid in the evaluation of the stability of the levees near Sacramento. The drilling has consisted of hollow stem auger through the levee (approx. 30 feet) and then mud rotary drilling with coring to depths up to 140 feet. Gregg has completed over 100 borings to date totaling over 11,000 feet.

Gregg In Situ has also been heavily involved conducting almost 140 CPT soundings and 12,000 feet of testing. As the project is being conducted in phases, there will surely be more to come.

For more information on the "floodSAFE CALIFORNIA" initiative, visit The California Department of Water Resources website at <http://www.floodsafe.water.ca.gov/>.



## Robertson's Remarks

### - SHEAR WAVE VELOCITY FOR SETTLEMENT CALCULATIONS -



Dr. P.K. Robertson

In this 'Remarks', I would like to discuss the application of shear wave velocity for settlement calculations. A major advantage of the seismic Cone Penetration Test (CPT) is the additional measurement of shear wave velocity,  $V_s$ . The shear wave velocity is measured using a downhole technique during pauses in the CPT resulting in a continuous profile of  $V_s$  along with the cone tip resistance,  $q_c$ , sleeve friction,  $f_s$ , and pore pressure,  $u$ . Elastic theory states that the small strain shear modulus,  $G_o = \rho V_s^2$ , where  $\rho$  is the mass density of the soil ( $\rho = \gamma/g$ ). Hence, the addition of shear wave velocity during the CPT provides a direct measure of soil stiffness. The small strain shear modulus ( $G_o$ ) represents the elastic stiffness of the soil at shear strains ( $\gamma$ ) less than about  $10^{-4}$  percent. In cases where the settlement is controlled by shearing of the soil and not the long term consolidation/compression (i.e. cohesionless (sand & gravel) soils, stiff overconsolidated fine grained soils and short term loading of soft clays) the shear modulus can be used to estimate settlements.

Application to engineering problems requires that the small strain modulus be softened to the appropriate strain level. The softening can be carried out assuming a modified hyperbola where the shear modulus ( $G_s$ ) at any degree of loading is  $G_s = G_o (1 - (q/q_{ult})^{0.3})$ , where  $q/q_{ult}$  is the degree of loading in terms of the applied footing  
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**(Robertson's Remarks Continued)**

pressure,  $q$  and the ultimate bearing capacity,  $q_{ult}$ . Elastic theory also states that the Young's modulus,  $E_s$  is linked to  $G_s$ , by  $E_s = 2(1+\mu)G_s$ , where  $\mu$  is the Poisson's ratio, which ranges from 0.1 to 0.3 for most soils and is typically 0.25. Hence, the Young's modulus for any applied load is  $E_s = 2.5 G_o(1 - (q/q_{ult})^{0.3})$ .

Since settlement is a function of degree of loading, it is possible to calculate the full load-settlement curve for any shallow foundation using  $s = q B i_c / E_s$ , where  $s$  is the settlement of a footing of width  $B$  under loading  $q$  and  $i_c$  is the influence coefficient depending on the footing size and shape.

In general, for most well designed shallow foundations,  $E_s \sim G_o$ . In variable ground, the appropriate value of  $G_o$  (and hence,  $E_s$ ) should be based on the average value of  $V_s$  under the footing over a depth of  $2B$  below the footing. This approach has been validated by research on full size footings (Mayne, 2003).

The seismic CPT can provide an excellent means to estimate the settlement of shallow foundations in many ground conditions under a wide range of loading conditions. Hence, the seismic CPT provides excellent stratigraphic profiling (via,  $q_c$ ,  $f_s$  and  $u$ ), excellent estimates of soil strength (via  $q_c$ ) and excellent estimates of soil stiffness (via  $V_s$ ) in a continuous, cost effective manner. The shear wave velocity can also be used directly as an independent means for the evaluation of liquefaction potential.

Contact Peter Robertson with any questions or comments at: [probertson@greggdrilling.com](mailto:probertson@greggdrilling.com)

## What's New @ Gregg Drilling

### - AIR ROTARY DRILLING CAPABILITIES ADDED -



Gregg Drilling consistently strives to be on the leading edge of drilling techniques and equipment. In order to provide our clients with the most complete range of drilling equipment available, Gregg recently purchased a Gefco Speed-Star 50K air rotary drill rig. Air rotary now joins auger, mud rotary, and limited access as some of the drilling services Gregg currently offer.

This new rig is capable of drilling 1000+ feet and installing wells to 500+ feet. With 50,000 lbs of pull back and a casing hammer, this rig drills efficiently through rock deposits. Without the issues related to drilling with mud, well installation and development are easier and more economical.

Please contact Gregg Drilling in Signal Hill, California at [info@greggdrilling.com](mailto:info@greggdrilling.com) for more information about our air rotary drilling services!

### - GIVING BACK TO THE COMMUNITY -



As an organization, Gregg Drilling takes pride in giving back to the world community through various organizations. Most recently, Gregg Drilling donated a PlayPump to a community in Africa through PlayPumps International. The PlayPump systems are innovative, sustainable, patented water pumps powered by children at play. Installed near schools, the PlayPump system doubles as a water pump and a merry-go-round for children.

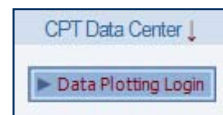
Please visit Gregg's website to learn about the amazing organizations we're pleased to support. <http://www.greggdrilling.com/sharing.htm>

**NOW ON-LINE @  
GREGGDRILLING.COM**

### CPT Plotting Software

This year, Gregg In Situ, Inc. introduced a new software package to plot Cone Penetration Test (CPT) data. Clients can now login to the Cone Data Plotting (CDP) program through Gregg's website, access their recent CPT data and create plots. The software allows users to plot any of the columns of data from Gregg's interpretation spreadsheet (including normalized data!) and choose their own scales. Samples and text can be added to the plots as well. Multiple plots can be created at one time as picture files and downloaded to the user's computer in a zip file.

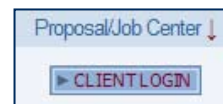
To enter the CPT Data Center on our web site look for the login link shown below:



### Proposal/Project Scheduling Feature

Gregg has recently introduced an on-line proposal and job scheduling feature. This new database enables clients to login through the Gregg Drilling web site to complete and submit their proposal and/or project scheduling requests. This new feature is designed to streamline the proposal and scheduling process and reduce time spent filling out paper forms.

To enter the Proposal/Job Center on our web site look for the login link shown below:



If you do not already have access to either of these features please contact Kelly Cabal at: [kcabal@greggdrilling.com](mailto:kcabal@greggdrilling.com)

Join our mailing list at [www.greggdrilling.com](http://www.greggdrilling.com) and receive the electronic version of "The Gregg GEO News".

