



GRL NEWSLETTER

No. 26

BY THE DEEP FOUNDATION ENGINEERS AND PILING EXPERTS
OF GOBLE RAUSCHE LIKINS AND ASSOCIATES, INC.

AUGUST 1995

ROUTINE TESTING OR A PROFESSIONAL SERVICE?

by Frank Rausche

GRL's engineers have heard it all:

"I've driven piling for 50 years, I know what I'm doing!"

"When that hammer strokes that high it's a good pile."

However, we also hear many comments like:

"They sure saved my behind."

"That's the way to go: test and then drive with no interruptions."

Or, better yet, a question is asked:

"Do you think we can hit it harder now?"

GRL engineers like to work with contractors. With the best available testing equipment, they quickly compute the necessary parameters and then make recommendations based on experience, observations and analyses. But often pile drivers do not like to listen to theoreticians. In fact, it already happened that the GRL professional engineer warned the contractor: *"Five more blows like that and your pile is gone"*. That warning, unfortunately, made a reduction of ram energy psychologically unattractive and five blows later the pile indeed disintegrated.

Let's go back a few decades: the contractor with 50 years of experience remembers jobs with ram strokes less than one meter and required pile capacities of typically 40 tons. The piles were overdriven as capacities were quickly and easily exceeded and stresses were modest. Then came high capacity piles and hammers with much larger strokes and engineers squeezed more economy into their designs. Piles started to bend, buckle, chip, crack, crumble, crush, curl, rupture, rip, slab, snap, ... Specifications required driving a skinny pile with high blow counts to some deep penetration in hard soil with a big hammer and without predrilling or other installation aids. Capacities were to be achieved that required end-of-driving stresses which were about equal to the pile strength.

Dynamic pile testing along with wave equation analyses have made installation of high capacity piling possible. Therefore, unreasonable specifications have been replaced by the requirement that the contractor hires a testing firm. There is, however, a troubling development: the benefits of the testing service are sacrificed for some relatively minor savings by replacing the professional expert with a poorly trained, less costly technician.

It is not enough to put sensors on the pile and check that data is recorded. The

information gathered during the pile installation must be **immediately interpreted** allowing for real time feedback and decision. A modern Pile Driving Analyzer® (PDA), such as the model PAK, provides a vast array of results for each hammer blow, giving the experienced engineer information that answers most installation questions.

However, the engineer must be capable of

- continuously monitoring compression, tension, and bending stresses, cushion condition, hammer behavior, pile alignment etc. to prevent pile damage during installation. The engineer should not only consider axial stresses but also additive bending and local stresses.
- recognizing whether or not damage has occurred, judging its seriousness and finding its cause by checking hammer, driving system, alignment, obstructions, pile quality, and other effects.
- evaluating the efficiency of the driving system, recognizing areas where reasonable improvements are possible and, if necessary, making recommendations for potentially more economical equipment.
- distinguishing between spurious vibrations and truly important record features and thus avoiding wrong decisions based on uneducated or inexperienced data interpretation.
- making recommendations as to time and frequency of restrike testing for optimal economy and evaluating potential benefits and shortcomings of such tests based on local geotechnical experience.
- using data and observations with common sense. For example, a small hammer having driven a pile to hard rock may not be able to activate the required ultimate capacity, but common sense tells us that the well seated pile will provide plenty of capacity. The engineer only has to assure the pile is on hard rock.

Yes, as an alternative, a less experienced person could take the measurements. Then, however, the experienced professional must thoroughly review all records and results. This is a process that often takes as much time as the actual field measurements since a huge amount of data must be explained to the professional and then examined.

In summary, the PDA is a valuable tool only in the hands of well trained personnel. Used

with skill and experience, it can help save time and money through the improved use of equipment and material ■

Dr. George Goble Recipient G. Brooks Earnest Award

The Cleveland, OH section of the American Society of Civil Engineers has bestowed upon George Goble their highest honor. On October 12, the awardee will present a lecture to the section entitled: "From Research at Case Institute of Technology to Actual Field Applications."

Dr. Goble was also invited to lecture undergraduate students of his Alma Mater by the Dean of the College of Engineering of the University of Idaho.

SOON TO COME 1995 PDA USERS' DAYS/SEMINARS

Whether in romantic Heidelberg, Germany - or in fast-paced Cleveland, OH, USA, the September 1995 Users' Days promise to bring much new information and a review of time proven methods. In light of this Newsletter's main article, we hope to meet with many testers from around the world.

Those frequently involved with specifying and using PDA, P.I.T. or CAPWAP® should consider attending our seminar and wave equation workshop preceding the Users Days. This will be an excellent learning opportunity for persons less familiar with pile dynamic methods.

**STRESSWAVE '96
The Fifth International Conference
for the Application of
Stress-Wave Theory to Piles
Sept. 11, 12, 13 1996
Contact: M. Hussein 407-826-4747**

The Organizing Committee has accepted more than 100 papers for presentation and publication in the proceedings volume. A bulletin will be issued shortly.

Are you interested in continuing to receive this Newsletter? If yes, please fill in and return the enclosed card to GRL.

GRLWEAP NEWS

The 1.995-1 GRLWEAP™ version was released. It primarily corrects some of the memory and speed of computation problems that several users experienced with the previous version. So far we have had only positive responses. A brochure describing the new program is enclosed.

Although we have tried hard to explain the meaning of the gain/loss factors for the drivability analyses in the manual, we were asked a few times to state their effect in "plain English". The following may help:

Setup factors in GRLWEAP are soil properties indicating the maximum potential regain of soil resistance after driving. Reverse, a setup factor 2.5 indicates that only 40% of the long term static soil resistance may be present during driving.

Gain/loss factors are relative numbers which indicate how much capacity loss should be considered in a particular analysis. For a setup factor of 2.5 it may be interesting to analyze gain/loss factors .4, .7, 1.0 (i.e., 60, 30 and 0% resistance loss). Another soil layer, with lower setup factor, would experience proportionally smaller capacity losses, e.g., for a 1.25 setup factor the losses would be 20, 10 and 0%.

AN EDUCATIONAL MARATHON

In May, a 4-country Far East tour by two principals of GRL and PDI again demonstrated our commitment to worldwide client support and continuing education for proper application of dynamic pile testing methods. Garland Likins and Dr. George Goble first presented a general lecture in Bangkok to about 100 attendees from 13 countries and then held two PDA Users Days for 35 engineers. George Goble also presented a key lecture at a foundation seminar in Bangkok, arranged by Prof. Balasubramaniam of the Asia Institute of Technology. Coordination and sponsorship of the Bangkok events was provided by Mr. Krai Tungsanga of Pyramid Development.

Then, while George Goble lectured to Malaysian professionals (organized by PDI rep. Mr. Richard Yu of Soil Dynamics), Garland Likins traveled to Korea at the invitation of Mr. J.S. Cha of PDI rep. Young Shin Trading to present a technical workshop for Korean PDA users. Both travelers then journeyed to Jinan, China where Mr. Frank Ko, PDI rep. of Earth Products China hosted special PDA Users Days. These efforts and contacts with our clients help to maintain a good practice and show us where improvement is needed.

GRL

Goble Rausche Likins and Associates, Inc.

Main Office:

4535 Emery Industrial Parkway
Cleveland, OH 44128 USA

Phone: 216-831-6131 Fax: 216-831-0916 E-Mail: info@pile.com

1995-96 CALENDAR OF EVENTS WITH GRL PARTICIPATION

USA

- Sep 8 - 9 ASCE Florida Annual Meeting, Jacksonville, FL, call Scott Jones 904 724-3456
- Sep 14 **GRL Seminar on Dynamic Pile Testing Methods**, Cleveland, OH (Ph: 216-831-6131, Fax: 216-831-0916).
- Sep 15-16 PDA Users Days, Cleveland, OH, (Ph: 216-831-6131, Fax: 216-831-0916).
- Oct 16-18 DFI 20th Annual Members' Conf., Charleston, S.C., call G. Compton 201 567-4232
- 1996
- Jan 7-11 TRB 75th Annual Meeting, Washington, D.C., call G.P. Jayaprakash 202 334-2934
- Mar18-22 University of Florida, 20th Annual Short Course on Fundamentals of Deep Foundations, Cocoa Beach, FL, Dr. Norbert O. Schmidt, Fax: 904 392-6950.

INTERNATIONAL

- Sep 27 **Seminar on Dynamic Pile Testing Methods**, Heidelberg, Germany, organized by Dr. O. Klingmüller, GSP (Ph: 49-621-331361, Fax 49-621-334252).
- Sep 28-29 PDA Users Days, Heidelberg, Germany, organized by C.J. Grävare, Pile Dynamics Europe (Ph: 46-31-450-015, Fax: 46-31-459-980).
- Oct 29 Xth Pan-American Conf. on Soil Mech. and Found. Eng., Guadalajara, Mexico; -Nov 3 contact Ing. Carlos J. Orozco Y Orozco, Fax: 52-3 611-01-44
- 1996
- Jan 19,20 Seminar by Korean Geot. Soc., Seoul, Korea; Dr. M.W. Lee Piletech 82-2-396-0617

1996

- Sep 11-13 **StressWave '96**, Orlando, FL, Fifth Int'l Conference on the Application of Stress-Wave Theory to Piles, see also first page.

UNIPILE

GRL's engineers have opted to use UNIPILE by Prof. Bengt Fellenius (fax 613-741-5594) as its preferred static pile analysis tool. GRL will use this program primarily in preparation of GRLWEAP analyses.

PDCA

The organization of the **Pile Driving Contractors Association** is proceeding. About 350 parties, mostly pile driving contractors, indicated an interest in forming this trade association. Dues statements have been sent out and membership payments are being received. The steering committee expects that an Executive Director will be in office by the beginning of 1996. Questions? Please call Chuck Whiteaker at 415-925-0100.

NEWS FROM PILE DYNAMICS, INC.

PDI is pleased to welcome Marui & Co. to its circle of representatives. Mr. Ryuta Takizawa has been in Cleveland to familiarize himself with PDI's product line and has been successfully demonstrating the equipment in Japan.

PDI welcomes Rick Dailey to its staff. Rick's background includes work on both electronic hardware and software.

IN-HOUSE PILE DRIVER

To fill the need for an in-house training and research facility, GRL's engineers have designed and built a hammer-pile system which provides realistic conditions for PDA use. The system is based on an SPT system with 63.5 kg ram (140 lb) and 762 mm (30 inch) fall height. Currently the pile length is almost 12 m (40 ft).



Case Institute of Technology students Marty Bixler (l) and Joe Beno review PDA data taken on GRL's indoor test stand

Phone

Fax

Boulder, CO:	303-494-0702	303-494-5027
Charlotte, NC:	704-593-0992	704-593-0993
Chicago, IL:	708-776-9890	708-776-9932
Orlando, FL:	407-826-9539	407-826-4747
Philadelphia, PA:	610-459-0278	610-459-0279
Seattle, WA:	360-871-5480	360-871-5483