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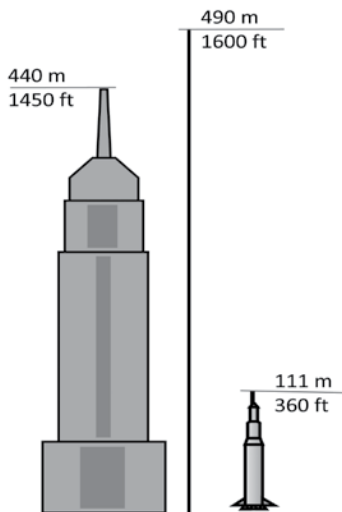
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ONE EXPERT'S TEST IS WORTH A THOUSAND UNPROFESSIONAL ATTEMPTS

Frank Rausche and Mohamad Hussein

Wernher von Braun, who with his team launched the first American satellite into space, said "One good test is worth a thousand expert opinions".

The question is, can our down-to-earth (pun intended!) profession and industry compare themselves to and learn from the trials of the space program? Can we make a twist on Von Braun's assertion to say one expert's test is worth a thousand unprofessional attempts? We think yes, and in more than one way.



The Saturn V rocket of the Apollo program was about 10 m (33 ft) in diameter, weighed 3100 tons and was 111 m (360 ft) tall; GRL tested steel piles of more than 1000 tons weight and about 490 m (1600 ft) length, comparable to the height of the Empire State Building. Some drilled shafts are more than 3.5 m (12 ft) in diameter, 60 m (200 ft) in length, weighing maybe 1650 tons. So while dimensions are of the same order of magnitude, there is one major difference: each Saturn V was only used once, while our foundations have to last for decades or more.

Like the early days of space flight in the late 1950s, deep foundations construction involves many unknowns and, therefore, testing is a must. The soil conditions at each new construction site present new challenges and actually are not as predictable as the space environment near Earth! Near failure pile driving stresses, drilling in a soft collapsing soil or into hard rock make each job like designing a new rocket. Are we comparable to rocket scientists? Yes! And like those who made going to the moon possible, we need **good testing** - good is the key word in von Braun's quote.

Advanced building codes have recognized the need for increased quality testing, and reward it with increased allowable design loads and therefore cost effective deep foundations. Unfortunately, there are plenty of examples of bad tests conducted with unreliable equipment, unproven methods and inexperienced personnel. Worse yet, there are anecdotal rumors of testers reporting what the client demands regardless of what good measurements and analyses reveal. Complex conditions sometimes result in a bewildering variety of test outcomes, which lead some in the industry to choose an "Ignorance is Bliss" approach rather than sort through and reconcile facts and results.

Every testing method has its specific limitations, some obvious, some not. Even a good test may therefore need an expert to interpret it properly. Here are a few examples where a good test and one that does not waste money needs input from a qualified and experienced engineer:

- A static load test has to be well designed, which means that the **reaction system** should be sufficient for either a proof load or a failure load, and it should not interfere with the soil condition around the pile or its results will be incomplete or wrong.
- For a dynamic load test of either driven or drilled piles, sufficient **hammer energy** has to be provided for an activation of the required resistance. It may be tempting to save money by employing an available low energy hammer, but the end result will disappoint. However, when a hammer is able to initially drive a pile with reasonable blow counts and then reaches refusal during a restrike, end of drive and restrike tests can be combined by an experienced analyst to expertly calculate the total long term pile capacity.
- Because soil setup adds capacity with time after pile installation, either static or dynamic testing too early after initial pile driving generally indicates low capacities (in relaxation cases high capacities). Given a good knowledge of the soil conditions, the experienced engineer can propose a testing program which would determine **long term pile capacity** without unnecessarily long waiting times.
- Being able to identify **difficult conditions** causing unusual pile behavior whether under static or dynamic loads helps avoid wrong conclusions. In situations involving, for example, fine silts or fat clays, and plugged or partially plugged open profile piles, care and caution are required for proper data analysis and interpretation.
- Erratic or inconsistent dynamic test data may cause concern regarding **pile integrity**; the expert tester would be able to determine both the validity of the data as well as whether or not the potentially damaged pile is capable of supporting the intended capacity.
- Judging hammers by the **energy** transferred to the pile may or may not be reasonable depending on pile and/or cushion behavior; experience and a rigorous wave equation analysis can help explain the condition.
- Cross Hole Sonic Logging is a reliable testing method, however, it is of limited value if the test engineer fails to recognize inspection tubes de-bonding or bleed water-caused dispersion of the ultrasonic signals in spite of sufficient concrete strength.
- Sonic pulse echo tests have been used with good success for many years in many countries, but because of its limitations it requires an experienced test engineer to look at all available design and construction information and explain limitations and potential mitigations.

So how do we become testing experts, capable of prudent judgment? Obviously, expertise can be gained through education, training, study, and other efforts. PDI and GRL both offer webinars, seminars, workshops, brown bag lunch talks and other learning opportunities; the PDA Proficiency Test (www.PDAproficiencytest.com) helps PDA testers assess their knowledge and obtain a certificate of recognition.

Let's face it: One good test may be worth a thousand expert opinions, but one bad test can generate a thousand ignorant opinions and make a bad situation worse. As deep foundations testers, we must provide good tests and expert opinions. Now that is a worthy goal for the New Year.

Highlights of the 2014 Calendar of events (January - May)

More events and information at www.pile.com/events

PDI Workshops, Seminars and Proficiency Tests:

March 11-14, Darmstadt, Germany: **Seminar on Design, Strength and Settlement Analysis of Deep Foundations, Dynamic Foundation Testing Workshop, PDCA / PDI Proficiency Test** and **Seminar on Deep Foundation Quality Assurance and Pile Integrity Testing**. Register for one or for all events at www.pile.com/events/docs/DarmstadtWorkshop_Mar2014.pdf

March 12-14, Orlando, FL: **Seminar on Deep Foundation Testing and Wave Equation Analysis** followed by **Dynamic Foundation Testing Workshop and Proficiency Test**. Info: www.piledrivers.org

PDI and GRL Webinars: Learn without leaving your desk:
Sessions last 1.5 - 2 hours and start at 9:00 am EST (New York Time). registration@pile.com

January 21-29: **Wave Equation Analysis of Piles using GRLWEAP** with **Frank Rausche**

February 25: **Quality Control of ACIP/CFA Piles** with **George Piscalko**

April 8-9: **Integrity Testing by Low Strain, Cross Hole Sonic Logging Methods and Thermal Integrity Profiling** with **Ryan Allin**

May 13-21: **Advanced applications of CAPWAP® software** with **Brent Robinson**

GRL, PDI and/or PDI representatives will exhibit at the following events

February 11-12, Orlando, FL: Visit **GRL** at the 2014 Annual Florida Transportation Builders' Association Construction Conference. www.ftba.com/convention

February 4-9, San Diego, CA: Visit GRL at the ADSC Annual Meeting www.adsc-iafd.com. GRL and PDI are proud sponsors of this event.

March 13, Stockholm, Sweden: Visit the booth of **PDI Representative PDI Europe** at Grundläggningdagen 2014 (Foundation Day 2014). www.grundlaggningdagen.nu

March 26-28, Shanghai, China: Visit **PDI's representative Earth Products China** at the 4th China International Piling and Deep Foundations Summit. www.pilingchina.com

May 21-23, Stockholm, Sweden: Visit the booth of PDI's representatives PDI Europe, GSP, SLP and DRC, at the DFI and EFC International Conference on Piling and Deep Foundations. www.dfi-efc2014.org A not-to-be-missed event!

May 26-28 Shanghai, China: Visit **PDI's representative Earth Products China** at the GeoShanghai International Conference. www.geoshanghai2014.org

Other Learning Opportunities

February 6-8, New Orleans, LA: **Mohamad Hussein** will teach the ASCE course *Deep Foundations: Design, Construction and Quality Control*. seminars@asce.org

February 23-26, Atlanta, GA: **Frank Rausche** will present a paper at the ASCE Geoinstitute 2014 Geo-Congress. (Visit PDI's booth while you are there) <http://content.asce.org/conferences/geo-congress2014/>

February 25, Lexington, KY: **Ben White** will make a presentation at the ADSC Ohio Valley Chapter Spring Meeting. cmyers@hayesdrillinginc.com

April 10, 2014, Ames, IA: **Travis Coleman** will present at the University of Nebraska Lincoln School of Natural Resources presents Shallow Exploration Driller Clinic. <http://sedc.unl.edu/>

Thermal Integrity Profiler wins 2013 NOVA Award for Innovation

George Piscalko, P.E., and Dean Cotton, with PDI, and Gray Mullins, PhD, P.E., with the University of South Florida in Tampa, Florida, have received the prestigious 2013 NOVA Award from the Construction Innovation Forum (CIF) for the Thermal Integrity Profiler. CIF is an international, non-profit organization that encourages and recognizes construction innovations. The 2013 NOVA winners were selected from more than 700 nominations from 20-plus countries.



GRL welcomes two new engineers

Matt Becker joined the Central office of GRL in September, with practical experience as well as a research background in structural and geotechnical instrumentation. He is currently completing his Master of Civil Engineering degree in Geotechnical Engineering at the University of Delaware.



Matthew Becker



Rory Flynn

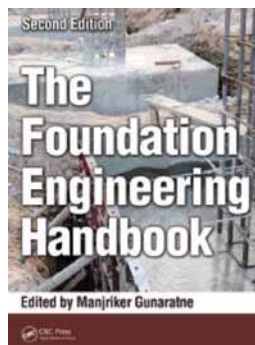
Rory Flynn is a graduate from North Carolina State University with a B.S. in Civil Engineering. He brings to GRL work experience in site investigation and inspection, project management, and as a crew leader. Currently completing his training at GRL Central, he is quickly adding foundation testing and analysis to his engineering skills and will soon be added to the Illinois office staff.

APPLE 8 Set to Impact Deep Foundation Industry

The success of six "APPLE" drop hammers, including the 40 ton APPLE 4, coupled with frequent industry demand, prompted GRL to develop a modular foundation testing hammer with a maximum ram weight of 80-tons. Depending on subsurface characterization and under ideal conditions, the dynamic test device is designed to mobilize foundation capacities up to 8000 tons. Initial tests at the manufacturer's plant suggest that the device can be set up and a test performed within one day.



Second edition of Foundation Engineering Handbook mentions TIP



The second edition of the CRC Press Foundation Engineering Handbook, edited by Manjriker Gunaratne, has been revised to cover the 2009 International Building Code and incorporate concepts and techniques that emerged since the first (2006) edition. Among those is Thermal Integrity Profiling. To the best of our knowledge this is the first engineering textbook to include a reference to this foundation investigation methodology. The book is now available for purchase through online retailers.

www.pile.com: the portal for deep foundation testing services, instruments and software

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