

Measure:
Bearing Capacity
Pile Integrity
Hammer Performance
Pile Stresses

with the Pile Driving Analyzer®



Pile Dynamics, Inc.

Dynamic Pile Testing

Benefits at a glance:

- Evaluates the bearing capacity of driven piles, drilled shafts and augercast (CFA) piles
- Tests deep foundation integrity quickly and economically
- Checks pile stresses and hammer performance
- Used worldwide for more than 30 years
- Proven reliable on thousands of construction sites
- Specified by engineers, contractors, government agencies
- Conforms to international standards* and ASTM D 4945.

Recognition

Dynamic testing is officially recognized by:

American Society for Testing Materials (ASTM)
Deep Foundations Institute (DFI)
Pile Driving Contractors Association (PDCA)
American Society of Civil Engineers (ASCE)
Federal Highway Administration (FHWA)
American Association of State Highway Transportation Officials (AASHTO)
Many U.S. State Highway departments
U.S. Army Corps of Engineers
International Building Code (IBC 2000)
Numerous International Organizations

*For more information on international standards, contact PDI.

What is Dynamic Pile Testing?

It may be called Dynamic Pile Testing, but any type of deep foundation may be dynamically tested with the Pile Driving Analyzer (PDA). Dynamic Pile Testing is based on the theory of Stress Wave Propagation on Piles (CASE Method), and involves the following:

- 1) Accelerometers and strain transducers are attached to the pile or shaft.
- 2) For each impact of a drop weight or hammer blow to the pile or shaft, the sensors acquire acceleration and strain signals and send them to the PDA.
- 3) The PDA conditions, digitizes, displays and stores the signals, and performs automatic calculations.

Two types of Deep Foundation Testing can be performed with a PDA:

Dynamic Pile Monitoring is conducted during the impact driving of steel, concrete, or timber piles to contribute to a safe and economical pile installation. The most important results of this test are soil resistance to driving, hammer performance, dynamic pile stresses during driving and pile integrity. These results can be readily used to formulate a driving criterion. All results are obtained in real time.

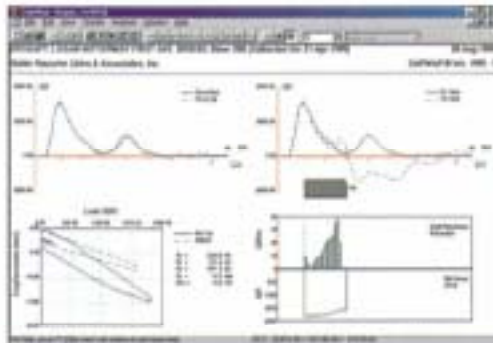
Dynamic Load Testing is conducted independent of the pile installation process. The test has as its primary goal the assessment of pile bearing capacity. It is applicable to drilled shafts, continuous flight auger, cast in situ and driven piles. The pile is impacted with a driving hammer or with a drop weight. Field obtained force and velocity signals are post-processed with the CAPWAP® program. This low cost test is an efficient and reliable alternative to static load tests.

Dynamic testing allows contractors and approval agencies to reliably test all types of deep foundations. The method even works where static testing is impossible, such as on bridge foundations on water, oil platforms and other near shore and offshore sites.

Software

The PDA-W software can calculate over 150 dynamic results in real time. The user may open several windows that display the tension envelope, damage indicator (beta) and resistance versus depth as a pile is being tested. The main screen also displays the values of critical dynamic results compared with user specified target values. The program appearance (colors and fonts) are user customized. The 3:1 file compression technology allows for more data storage in less space. Other useful features are: driving log, data quality alerts, area calculator, easy transfer of data to spreadsheet programs, "copy to clipboard" function for graphs and seamless integration with PDI PLOT and CAPWAP.

CAPWAP is a Windows®-based program that runs on the PAK version of the PDA or on an office computer. The software uses data collected by the PDA sensors to determine resistance distribution, dynamic soil response and simulate a static load test. Hundreds of comparison tests have been done to verify the correlation of CAPWAP analysis with static load testing results.



Pile Driving Analyzer[®] Model PAK

This model provides the user with the broadest range of parameters to verify the integrity and condition of deep foundations. The PAK operator may

choose nine out of more than 150 parameters for calculation and display with each hammer blow. The PAK is built into a light, yet rugged, field-tested enclosure. It

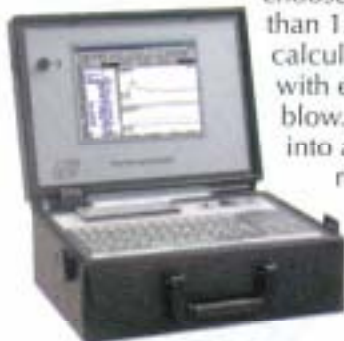
collects and analyzes eight channels of data simultaneously.

Real time analysis, post processing and printing are performed by the PDA-W software. This Windows[®]-based software runs on either the PAK or an office computer. CAPWAP analysis may be run in the PAK unit itself.

Due to its superior data-collection speed, the PDA Model PAK is particularly useful for testing a large number of piles and recording a large number of hammer blows on a site. The eight

channels of strain-data acquisition are essential for large-diameter drilled shafts and spiral-welded pipe or where measurements are required at two different locations along the length of the pile.

The PAK is the only PDA with the capability of monitoring pile installation with a vibratory hammer.



Accelerometers and strain transducers are attached to a foundation shaft . . .

. . . and connected by cable to the PDA.



Accelerometers and strain transducers manufactured by Pile Dynamics conform to ASTM D4945.

SPECIFICATIONS: Model PAK

- Four channels of strain data acquisition
- Four channels of acceleration data acquisition and four integrators of acceleration to velocity
- Impact and vibratory hammer monitoring modes
- PC-compatible Pentium processor/ Windows[®] interface
- 256MB RAM minimum
- 40 GB hard disk minimum
- 8 x 4 x 24 CD-RW
- 3.5" 1.4MB floppy drive
- High-visibility transreflective color LCD for outdoor viewing
- Built-in VGA external monitor port
- Built-in water-resistant membrane keyboard
- Additional external keyboard included
- Built-in mouse
- Serial, USB, Network, and Parallel Ports
- 12-bit A/D converter with 8 channels at up to 20KHZ each
- Size: 155mm by 320mm by 385mm
- Weight: 8kg
- Powered in the field by 12 VDC car battery
- Powered in the office by 100-240 VAC with 12 VDC converter
- 30 minutes internal battery backup

PDA Standard Features:

(Applies to both PAK and PAL Pile Driving Analyzer models)

- Self-checking set-up feature
- Automatic balancing of signals and signal conditioning
- Automatic data storage
- Wide temperature operating range:
Operating Range: 0 to 40° C
Storage Range: -20 to 65° C
- Includes both softside carry-on luggage and hard transit case
- Full one-year warranty
- English, SI or Metric units
- PDA-W software for data processing and analysis
- PDILOT software for report quality data summary
- GROWEAP software for pile driving simulation
- Direct interface to optional CAPWAP software
- Optional transducer systems for underwater testing
- Training, technical manuals and support

Pile Driving Analyzer[®] Model PAL

PAL-R Remote and PAL-L Local Compact Economical Data Capture and Analysis

Technological advances have allowed Pile Dynamics to develop a smaller version of the Pile Driving Analyzer—the PAL. The PAL is available in two models, remote PAL-R and local PAL-L. Both models are housed in a small, rugged, light-weight enclosure. The PAL has no keyboard; all input is entered through a convenient touch screen.



SPECIFICATIONS: Models PAL-R and PAL-L:

- Two channels of strain data acquisition
- Two channels of acceleration data acquisition and two integrators of acceleration to velocity
- PCMCIA removable flash memory card
- High contrast touch screen display doubles as keyboard
- Serial port
- Double precision checksum prevents data transmission errors
- Size: 110mm by 175mm by 200mm
- Weight: 3.2 kg
- Power: Internal battery for approximately 8 hrs. of operation
12VDC from car battery or 100-240 VAC with 12VDC converter

PAL-R: Foundation Testing from the Office

The PAL-R is a PDA that can be operated from a remote location. When this model is used, a trained piling crew attaches sensors to the pile, connects them to the PAL-R, then connects the PAL-R directly to data capable cellular phones via serial port. The cell phone sends the data to a remote computer running PDA-W software for real-time analysis. Typed messages may be sent to and from the field without interrupting data transmission. "Cell phone to cell phone" data transmission is possible for maximum versatility to field laptops.

Engineers can control the operation of the PAL-R and perform dynamic tests without leaving the office. This avoids travel time and expense and also allows CAPWAP analysis and report writing to begin immediately. This time-saving benefit also expedites the engineer's recommendations, making them available sooner. PAL-R facilitates the contractor's test schedule.

For situations when a cell phone connection is unavailable or not desirable, two other modes of operation of the equipment are possible: data collection only (stored data is transmitted at a later time) and local mode (direct connection to a laptop running PDA-W software on site, with the testing engineer present).

PAL-L: For Small Jobs and Backup

The PAL-L is used by the engineer on-site. During data collection or review, force and velocity data are displayed on the screen. Once the sensors are placed on the pile, the PAL-L monitors and records the installation of the pile in real time. The user chooses four out of thirteen parameters for continuous calculation and display for each hammer blow. Up to 1650 records can be stored on the standard PCMCIA card. Multiple interchangeable memory cards make the data storage unlimited.



Pile Dynamics, Inc.

Quality Assurance for Deep Foundations

Remote Pile Driving Analyzer U.S. Patent No. US 6,301,551 B1
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