



Advances in Dynamic Foundation Testing

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For over 40 years, engineers all over the world have tested driven piles, drilled shafts, and augered cast-in-place (CFA) piles with the PileDriving Analyzer® (PDA). Many codes and specifications recognize the reliability and usefulness of the PDA. Today, the PDA is probably the most common tool for deep foundation quality assessment. Typically, for a routine test, the PDA test engineer arrives on site and attaches accelerometers and strain transducers to the foundation shaft, connects them to the PDA with a long cable, and inputs parameters such as sensor calibrations and foundation properties into the PDA. Upon hammer or drop weight impact, sensor signals are sent through a cable to the PDA for processing, screen display, and data storage.

The PDA model PAX is changing this routine. The PAX is equipped for Wireless Data Transmission, eliminating the main cable and the connection cable that, if damaged, cause data quality problems. Small, lightweight transmitters, suspended from the foundation and powerful enough to cover a 100-m distance, send the data to a receiving antenna on the PAX. Each independent transmitter services one accelerometer and one strain transducer; no cable connects the sets of sensors. PAX sensors are "smart"; they remember their calibration sensitivity and transmit it to the PAX, eliminating errors. The advantages of wireless technology are clear: lighter weight, reduced equipment damage, fewer errors, no cables to clean and maintain, less time spent attaching sensors, and faster installation of monitored driven piles (with no connection cable, sensors are installed with the pile on the ground, eliminating climbing of leads).

While "Wireless Testing" improves the data acquisition process, "Remote Testing" has even greater advantages. Remote testing usually involves the field crew attaching sensors to the foundation and turning on the PDA. A PDA engineer then monitors the PDA test from the engineer's office, communicating with the remote PDA anywhere in the world. Remote testing, conceived and patented several years ago by PDI, was incorporated in the PDA model PAL using cell phone technology. In the PAX remote testing is accomplished through the Internet, resulting in a simpler, more reliable, and typically 3 times faster data transmission. Clients may ask: "If I am accustomed to having the PDA engineer on site, what advantages do I have with this new technology? Will I get the same quality result that I have come to rely upon? Can I have the same relationship with my PDA tester? Assuming I am willing to step out of my comfort zone and try the new technology, how do I implement it?"

In answer, first consider the cost advantage: In the traditional test with an engineer on site, a good portion of the testing charges are for travel time and expenses and waiting times at the jobsite. Remote testing eliminates those, and the engineer's time is used more productively. Even when cost is not an issue, if the engineer does not travel to the site, data analysis and report preparation may begin immediately. Getting results to develop driving criteria or other recommendations quickly is often the most important consideration to construction professionals and their schedules.

As for quality of results and the relationship with the tester, when the PAX is on site and an unusual occurrence calls for a test, a quick phone call is all that is needed. Tests that involve restrikes to observe how the ultimate capacity evolves with time can be easily accomplished at the contractor's convenience. During a test, the PDA engineer in the office sees the same data as if on site, assesses data quality and transfers analysis results and other findings instantaneously during testing to the responsible engineers on site. Implementation, particularly on larger projects, includes having a PDA test engineer on site at the beginning of the project to train the crew and explain the process. The PAX is left on site for restrike testing (to investigate set-up), and for potential testing of production piles during installation. A job inspector becomes the PDA test engineer's eyes and ears, answering questions as needed. The wireless and remote procedures simplify foundation testing, thus encouraging more testing and resulting in leaner design (some codes allow for decreased safety factors or increased resistance factors with increased testing because more measurements reduce risk). Wireless and remote dynamic foundation testing help keep projects on schedule and under budget. ■

لما يزيد عن ٤٠ عاماً أجرى مهندسون حول العالم تجارباً على الخوازيق المدارة والمحفوظة المصبوبة في مكانها وعمود الإدارة المثقوبة مستخدمين المحلل المخصص لإدارة الخوازيق PileDriving Analyzer® (PDA). وتؤكد الكثير من الرموز والمواصفات على اعتمادية وفائدة ال PDA. في هذه المقالة، نعرض حسناً ومواصفات نموذج PAX من ال PDA الذي تقضي مهمته الأولى بتغيير الإجراءات الروتينية للتجارب وذلك لأنه يتيح الفرصة للمهندسين بالقيام بالتجارب من دون أي كبلات وعن بعد أيضاً كونه مجهز لنقل المعلومات لاسلكياً إلى مكتب المهندس أينما وجد في العالم والتواصل مع ال PDA البعيد عبر شبكة الإنترنت.

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