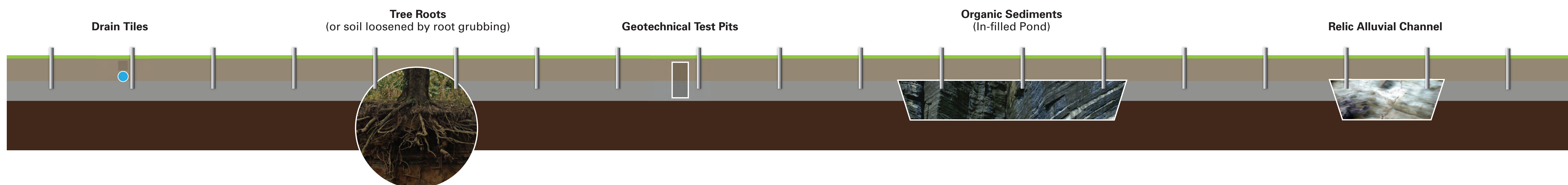


PILE DRIVING PERFORMANCE MONITORING (PDPM) SYSTEM

By Joseph A. Waxse, P.E., D.GE and Michael W. Laney, P.E., G.E., P. Eng; Terracon Consultants Inc.

COMMON HIDDEN SUBSURFACE ANOMALIES THAT IMPACT PERFORMANCE OF SOLAR PILE FOUNDATIONS



Pile driving

PDPM

- Tracks Pile Installation Energy
- Helps Identify Anomalies
- Enhances Quality Control
- Permits Optimization of Pile Design
- Avoids Design of Piles based on "Worst-Case" Conditions



Proof testing

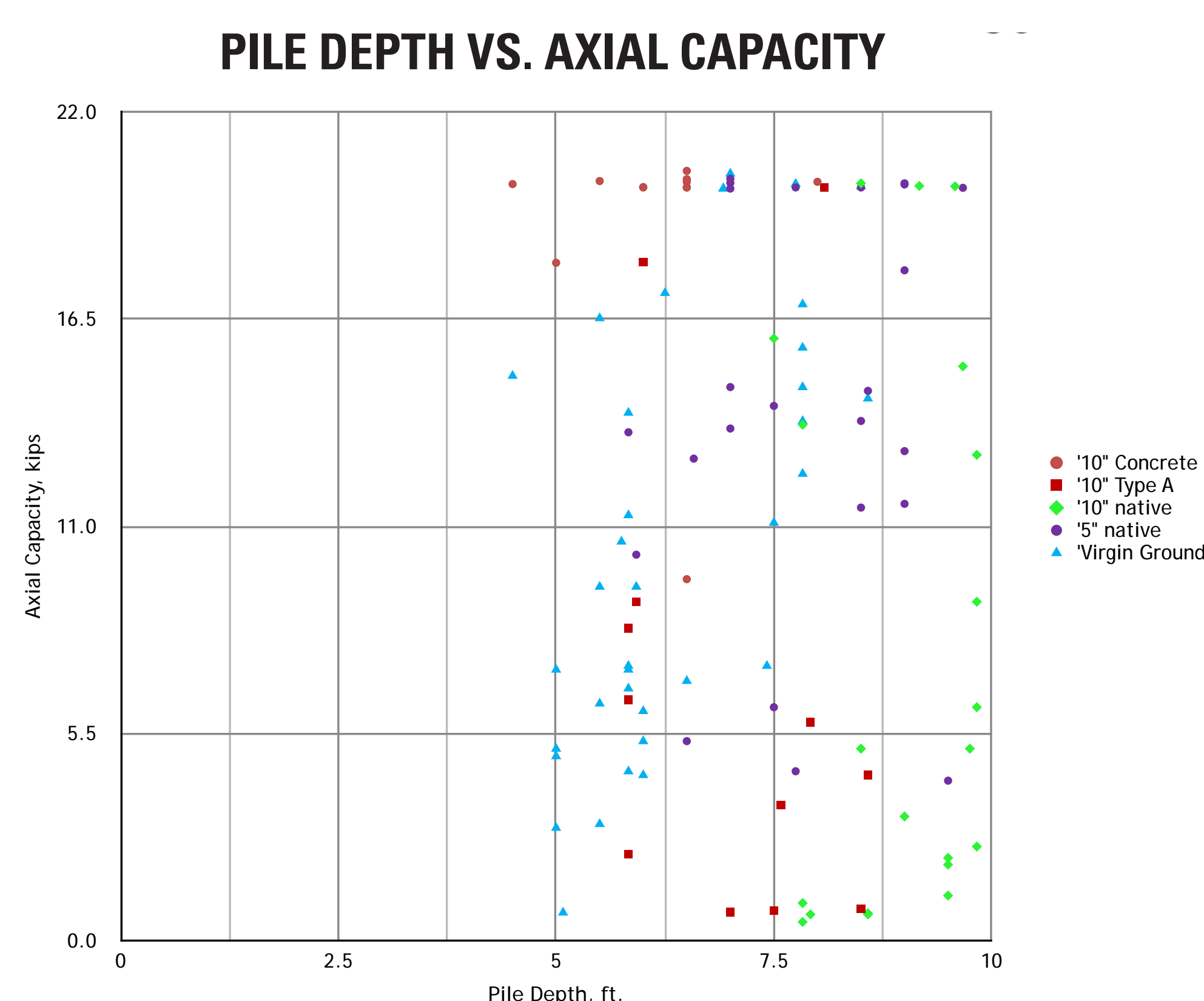
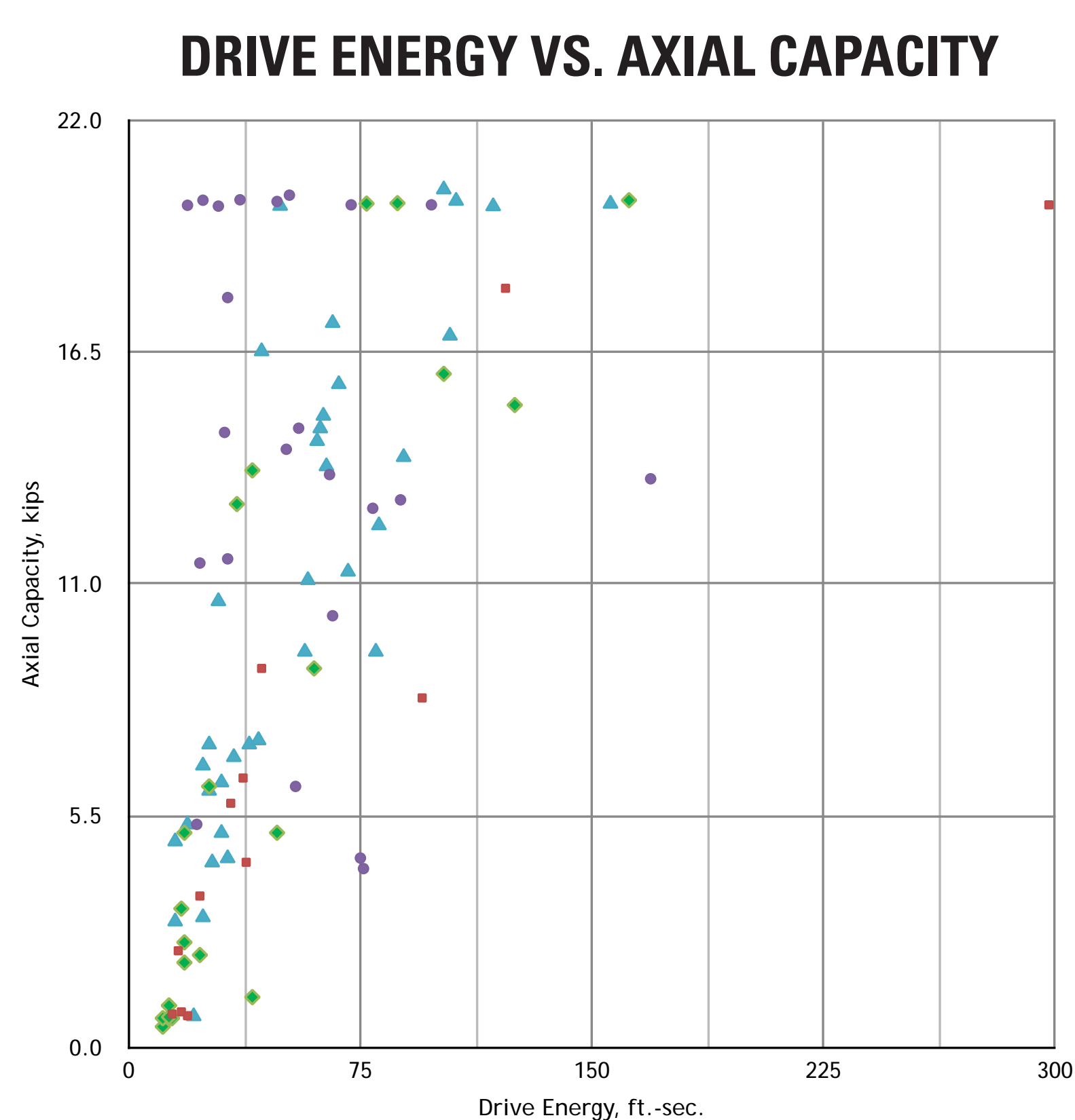
PDPM SYSTEM FEATURES:

- Totally Automated – No Operator Input Required
- Internal GPS Records Pile Location
- Detect Hammer Activation – Records both Push and Drive Depths
- Internal Cell Phone Modem – Data Remotely Uploaded Nightly
- Data Processed Daily to Match Pile to Master GPS File and Check Acceptance Criteria
- Acceptance-Exception Reports Transmitted Daily
- Follow-up Proof Testing Recommendations Provided for any "Exception" Piles
- Acceptance Criteria Adjusted as Appropriate Based on On-Going Proof Test Results

WHY USE PDPM?:

- Justifies Lower Acceptable Factor of Safety to Be Used in Pile Design.
- Performance of an Initial "Test Phase" where <1% of piles are driven with PDPM widely across the entire site can support optimization of project pile design and length orders.
- Statistically, the chances of identifying and testing the piles that need testing on a site are quite slim without knowing how the piles drive – In this case, ignorance is risk and cost – not bliss!
- **Application of this monitoring technique will enable the owners, financiers, consultants and contractors building solar developments to have a complete record of pile installation (i.e. quality control and assurance) which has been lacking so far in this industry.**

EXAMPLE PILE LOAD TEST RESULTS ON PILES MONITORED FOR DRIVE ENERGY



PILE CAPACITY CORRELATES BETTER WITH DRIVE ENERGY THAN EMBEDMENT DEPTH!

Now every pile can be a tested pile

Terracon