



## SPT Energy Calibration

The Standard Penetration Test (SPT) is a widely-used soil exploration tool that uses an SPT hammer to drive a drill string with a split-barrel sampler attached at the bottom of the string. The split-barrel sampler recovers soil samples at the bottom of the borehole after the borehole has been advanced to the required sampling depth. The number of blows required to drive the final 12 inches (300 mm) at a given sample depth is known as the “N-value”, or standard penetration test resistance, which can be correlated to soil strength.

### Why Calibrate with SPT Hammer?

Several different types of SPT hammers are used to conduct Standard Penetration Tests. SPT hammer efficiencies vary, which influences the resulting N-values. For this reason, SPT hammer calibration is recommended by the American Society for Testing and Materials (ASTM). In addition, periodic calibration is required by many US Departments of Transportation.

ASTM D1586 recommends that a measured N-value be normalized to 60% drill rod energy, N60, by multiplying it by the ratio between the measured energy transferred to the rod and 60% of the theoretical potential energy. This compensates for the variability in efficiency, and therefore, improves the reliability of soil strength estimates used in geotechnical designs. Energy transfer measurements are required when SPT results are used to determine the liquefaction potential of sands (ASTM D6066), as in the evaluation of dams and levees and in areas of seismic activity.

### Benefits of SPT Energy Calibration

- Improves the reliability of the Standard Penetration Test (SPT) measured N-values
- Measures energy transferred by the SPT hammer to the SPT rod
- Establishes N60 values for foundation design



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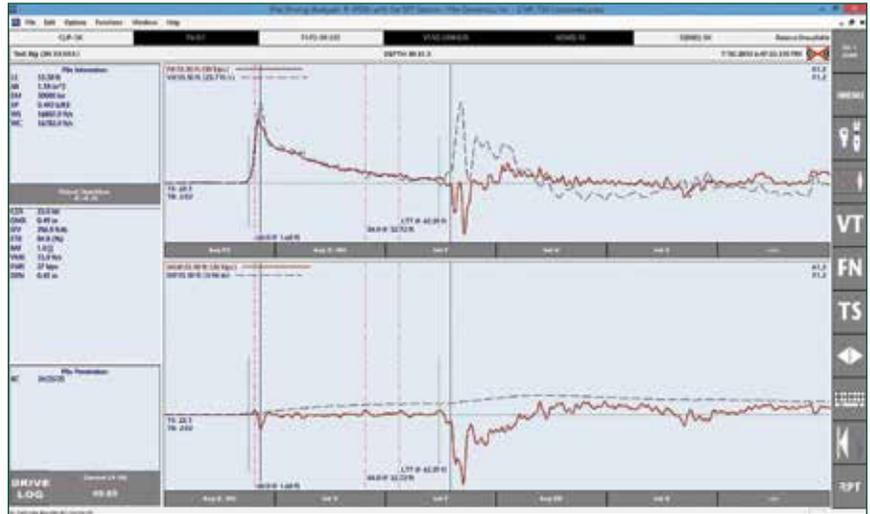
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SPT Report of intervals



Output screen

### The Calibration Process

To perform the SPT calibration, GRL engineers attach an SPT rod section, instrumented with strain gages and accelerometers, to the SPT drill string rod. The instrumented rod section will match the drill rod type being used in the drill string (i.e., AW, NW, etc.). As the drill string is driven into the ground, the strain gages and accelerometers obtain force and velocity signals with each hammer blow. The signals are transmitted to a Pile Driving Analyzer® that displays the force, velocity and energy transmitted to the drill string, calculates and displays the maximum transferred energy value, and stores the complete time record of force and velocity for all SPT hammer blows. GRL engineers typically acquire several SPT energy measurements per hammer at a given test location.

Shortly after the calibration testing is completed, GRL furnishes a calibration report presenting transferred energies, energy transfer ratios (transferred energy divided by the theoretical SPT hammer free fall energy) and the SPT N60 value for each sample interval tested.



#### ASTM Standard

GRL performs SPT Energy Calibration in general accordance with ASTM D1586-11 Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils; ASTM D4699-11 – Standard Test Method for Energy Measurement for Dynamic Penetrometers; and ASTM D6066-11 – Standard Practice for Determining the Normalized Penetration Resistance of Sands for Evaluation of Liquefaction Potential.

