OTD Operations Technology Development

Developing an ASTM Standard for the Utility Dynamic Cone Penetrometer

In this project, researchers developed an ASTM standard and testing procedure for the use of the Utility Dynamic Cone Penetrometer (DCP), a tool that has been shown to be an effective and less expensive alternative to other technologies used to ensure proper soil compaction.

Project Description

Gas utilities have long recognized the need for quality control of soil compaction to improve pavement restoration and reduce call-backs from failed sections.

For several years, the Utility Dynamic Cone Penetrometer (DCP) has been used for soil-compaction control during utility restoration work. Field demonstrations have shown the DCP to be an effective quality-control device that is less expensive than the more commonly used and accepted nuclear density gauge. However, the economic benefits that could be derived from the DCP were limited without an American Society of Testing and Materials (ASTM) procedure for its standard use.

Through this project, researchers developed a standard which gained regulatory approval.

As part of the program, utilities performed demonstrations of the Utility DCP for New York City agencies and Department of Transportation regulators to show the potential of the DCP as a cost-effective alternative to the nuclear density gauge.

Research has shown the Utility Dynamic Cone Pentrometer to be an attractive, cost-saving alternative to more commonly used soil-compaction-measurement equipment.

Deliverable

A published ASTM standard procedure for the use and operation of the Utility DCP was the final deliverable of this project.

Benefits

The development of an ASTM standard procedure for Utility DCP compaction control will establish the tool as an acceptable technology to replace the nuclear density gauge in utility pavement restoration work.

The cost of the nuclear density gauge is about $6,200, compared to about $400 for the DCP (plus an additional cost for optional electronic data-collection add-ons). Further costs with the nuclear density gauge are encountered for licensing, training, maintenance, and disposal.

A 2002 study shows that the natural gas industry performs about 722,000 bellhole excavations per year. At an average cost of $250 to $300 per repair for bellholes and $3,500 per 100 feet of trench, utilities will realize substantial savings by establishing an economic procedure for compaction control and by eliminating the need of using the costly nuclear density gauge in protected streets.

Technical Concept & Approach

The Utility DCP uses a five-pound drop-weight to drive a small cone into the soil, counting the number of drops required to penetrate the soil a fixed distance of 3-¼ inches. The number of drops is determined by calibrating the device to the relative soil compaction of various soil types. Researchers report that in earlier tests the device proved to be a practical replacement for the nuclear density gauge by providing layer-by-layer compaction verification.

Previous work in a GTI Research Collaboration Project (2002-2004) resulted in evaluating and selecting the DCP as one of the three best tools for utility work. A following OTD project (2004-2006) included modify-

ing the DCP to improve its quality, overall effectiveness, and to add electronic data storage and transfer capabilities.

Work in this project included the initiation of a standard request to ASTM Committee on Soils and Rock (ASTM D-18). A case study was presented to ASTM supporting the need to establish the procedure.

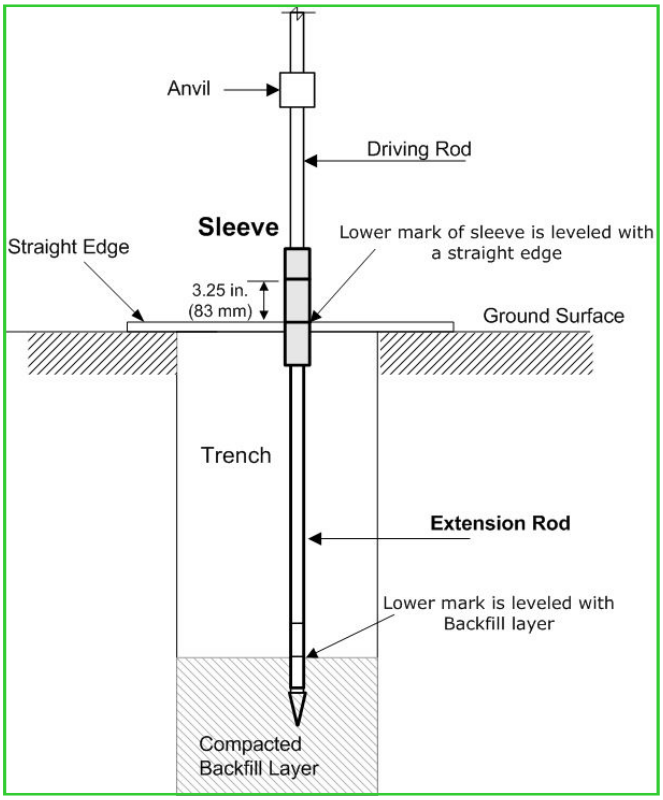
The ASTM procedure required voting and approval of the draft standard and discussion during the ASTM committee meetings. (ASTM committees meet twice a year to discuss the proposed drafts. A new standard may require an average of two to three years before it is approved for publication.)

Results / Status

This project is now complete.

The project team drafted a proposed ASTM standard, which passed the main committee ballot in January 2008. Investigators subsequently addressed comments and negative votes from ASTM members.

ASTM issued the formal reference standard in June 2008 as *ASTM D 7380-08 Standard Test Method for Soil Compaction Determination at Shallow Depth Using 5-lb (2.3 kg) Dyname Cone Penetrometer*.



Schematic of the Dynamic Cone Penetrometer.

For more information:

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