Florida Department of Transportation Research

Performance-Based Quality Assurance/Quality Control (QA/QC) Acceptance Procedures for In-Place Soil Testing, Phase 3

April 2015

Project Number
BDV31-977-25

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Current Situation

Acceptance of earthwork construction by the Florida Department of Transportation (FDOT) requires in-place testing conducted with a nuclear density gauge (NDG) to determine dry density, which must obtain a required percent compaction based upon a laboratory-determined dry density of field samples. However, design criteria are transitioning from empirical measures like dry density to mechanistic-empirical (M-E) measures like stiffness and modulus. Methods of testing and their relationship to Florida conditions require investigation.

Research Objectives

Mechanistic-empirical measures (soil stiffness/resilient modulus) can substitute for density specifications in compaction control and verification of M-E pavement design criteria. A variety of methods for determining resilient modulus were examined to determine whether they could provide equal or better precision when compared to the current NDG method.

Road workers demonstrate the use of a lightweight deflectometer (LWD).

Project Activities

Researchers evaluated several methods of determining the resilient modulus of soil. Equipment evaluated in this research included lightweight deflectometers (LWD) from different manufacturers, a dynamic cone penetrometer (DCP), a GeoGauge, a Clegg impact soil tester (CIST), a Briaud compaction device (BCD), and a seismic pavement analyzer (SPA).

Evaluations were conducted over a range of measured densities and moistures. Testing was conducted in two phases, in a test box and test pits. A third testing phase was conducted on materials found on five construction projects located in and near Jacksonville, Florida.

Researchers conducted interviews with representatives of several state departments of transportation and conducted site visits to examine soil compaction acceptance in other states and to help determine the equipment, testing procedure, and specification requirements that would be most beneficial to this project.

Project Benefits

Replacing the nuclear density gauge method for determining earthwork compaction acceptance offers several benefits. First, the costs are less in terms of the procedure, specific worker training, licensing/radiation safety program associated with equipment using a radioactive source, and more. Results from this project lay a foundation for mechanistic-empirical methods, following the trend toward such construction compaction control methods, providing test results reveal that design criteria are met.

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