RESEARCH PROJECT CAPSULE [19-2GT]

October 2018

TECHNOLOGY TRANSFER PROGRAM

Quality Control/Assurance on Base Course and Embankment with the Dynamic Cone Penetrometer

JUST THE FACTS:

Start Date:
September 1, 2018

Duration:
18 months

End Date:
February 29, 2020

Funding:
SPR: TT-Fed/TT-Reg

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Sponsored jointly by the Louisiana Department of Transportation and Development and Louisiana State University

POINTS OF INTEREST:

Problem Addressed / Objective of Research / Methodology Used / Implementation Potential

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PROBLEM

Current quality control/quality assurance (QC/QA) processes on base courses and subgrades are based on densities and moisture contents obtained from a nuclear density gauge (NDG). The NDG device utilizes a radiation source and sensor for these measurements. Its radiation levels are very low and relatively safe to the operator, if the NDG is used and stored properly.

There is a need for alternative test procedures that utilize a device that can assure quality, while also being easy to use, economically sound, and nonradioactive. This research will investigate using the dynamic cone penetrometer (DCP) as a possible substitute for current QC/QA processes regarding embankments and base courses.

The DCP is a simple tool that is relatively inexpensive compared to nuclear devices, and can be used in areas where NDGs cannot, due to possible space and depth requirements. The DCP can penetrate to greater depths and produce the entire stiffness profile of a layer, while NDGs produce only average density values for the investigated layer.

Figure 1
Dynamic Cone Penetrometer

OBJECTIVE

The objective of this research is to determine if and how the Louisiana Department of Transportation and Development (DOTD) can utilize the DCP as an acceptance tool for base courses and embankment layers. The research will compare the DCP with the NDG for technical accuracy, precision, and consistency. Field testing will be conducted to establish appropriate quality assurance procedures for DOTD.

METHODOLOGY

Researchers will initially perform an extensive literature search, focused on evaluating other state DOT DCP QC/QA methods. The research will then locate existing DOTD projects with DCP and NDG data. A recent LTRC project evaluated variability and measurement error for soil properties in geotechnical engineering design. DCP and NDG data from that research and other earthwork projects recommended by district engineers will be incorporated into this research project.

Field testing with two types of DCP auto readers (Kessler Mag Ruler and Vertek Smart DCP) will be compared for improvements in accuracy and ease of utilization (report documentation). QC/QA field testing with NDGs by district laboratories will be shadowed with adjacent DCP testing conducted by LTRC. Comparison between DCP stiffness and corresponding NDG in-situ density results will be performed. Potential correlations of DCP stiffness with NDG density and moisture contents will be analyzed, along with comparison of costs, benefits, ease of use, testing time, calibration, and training requirements.

Based on results, the QC/QA test procedure TR 645 will be updated, if necessary; and an associated specification for DCP QA passing values similarly to acceptance criteria for the NDG will be recommended.

IMPLEMENTATION POTENTIAL

Upon recommendation by the Project Review Committee, the revised QC/QA process will be implemented. The *Documentation Manual for Project Delivery* and the *Construction Plans QC/QA Manual* will be updated, along with the next edition of the *Louisiana Standard Specifications for Roads and Bridges*, if applicable. The use of a simple non-nuclear tool for embankment and base course QC/QA could save time and funds for DOTD, with improvements to safety and efficiency.

Figure 2
Mag Ruler Interface

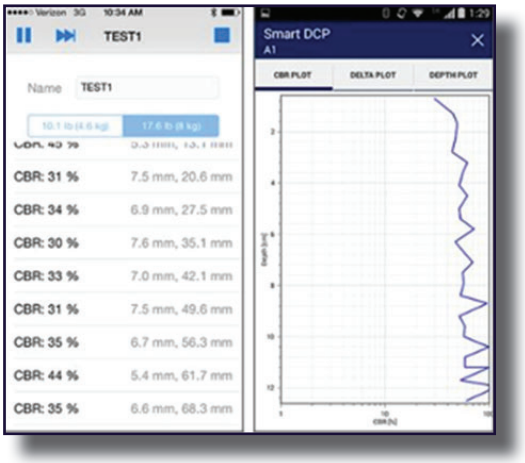

Figure 3
Smart DCP Interface