RESEARCH
PROJECT CAPSULE [17-2B]
August 2017
TECHNOLOGY TRANSFER PROGRAM

Evaluation of Non-Destructive Density Determination for QA/QC Acceptance Testing

JUST THE FACTS:

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12 months

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March 14, 2018

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TT-Fed/TT-Reg

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POINTS OF INTEREST:

Problem Addressed / Objective of Research / Methodology Used Implementation Potential

PROBLEM

Quality control (QC) by the contractor and quality assurance (QA) by DOTD are methods utilized to ensure specifications are met and performance is achieved. For soils and asphalt construction, the current DOTD QA procedures require target densities for each layer and verifies them in the field with a nuclear moisture-density gauges (for soils) and asphalt roadway cores (for asphalt). Contractor QC procedures utilize the nuclear moisture-density gauge as part of their process to monitor density and soil moisture (for soils) and to establish rolling patterns for asphalt pavement construction (for asphalt).

However, nuclear technology in these devices requires extensive usage certifications and handling procedures. Additionally, coring of asphalt pavements can take up to a day for test results to come in and is destructive to freshly-laid asphalt mat. This research project will investigate the potential of non/low-nuclear devices recently developed by Troxler and TransTech with little to no radioactive footprint to possibly replace the nuclear gauge for asphalt and soil QC/QA operations in Louisiana. The newly developed gauges will not require nuclear certification for personnel and storage. For this research, two separate field and lab evaluations will take place: (1) LTRC's Geotechnical group will evaluate the final density procedures for soils and (2) LTRC's Asphalt group will evaluate the final density procedures for asphalt pavements.

OBJECTIVE

LTRC's Geotechnical and Asphalt groups will be conducting two separate field and laboratory evaluations. The Geotechnical group will evaluate field densities of soil layers and the asphalt group will evaluate field densities on asphalt pavement layers.

There are two overall objectives of this research proposal: (1) to conduct a validation study to compare the new Troxler and TransTech gauges against the original nuclear moisture-density gauge and (2) to evaluate the nuclear and non/low-nuclear gauge as QA devices for nondestructive density. The project will utilize intensive field tests and core samples to determine their effectiveness benefits, and implementation potential for QA/QC applications within DOTD.

METHODOLOGY

The research teams will first conduct an extensive literature search of all published materials and ongoing research projects to obtain the latest information on the use of the non-to-low nuclear density devices. To accomplish the objectives of this study, a range of 5 to 10 asphalt paving projects and a similar number of earthwork projects will be chosen for field test sections.

The asphalt group at the Louisiana Transportation Research Center (LTRC) will evaluate two "non-nuclear" devices for this purpose: the Troxler PaveTrackerTM 2701-B Plus and the TransTech Pavement Quality Indicator (PQI 380). Both devices will be used on asphalt projects, and their density readings will be compared to results from roadway cores and nuclear gauges.

The geotechnical group at LTRC will evaluate the Troxler EGauge 4590 (paired with the Troxler 6760 moisture probe) and the TransTech SDG 200 for soil density and moisture determination. Measurements from these devices will be compared to density and moisture readings provided by LTRC's conventional nuclear gauge.

Statistical analysis will be used to determine the accuracy and effectiveness of the new Troxler

and TransTech gauges by comparing the laboratory results of core samples and nuclear gauge readings. The analysis will also be used to recommend an adequate QA sampling plan for non-destructive density determination using these devices.

Cost-benefit comparisons between the three methods (cores, nuclear, and non-nuclear) for density determination will be developed, based on equipment/calibration/training costs, testing time, and ease of use. Potential implementation challenges will also be evaluated.

IMPLEMENTATION POTENTIAL

Density determination using non-nuclear devices is expected to have several advantages over the nuclear gauge or core sample methods, which include less safety concerns, more measurements per project, and faster density determination. Ultimately, the non-nuclear method could save time and money for DOTD and its contractors.

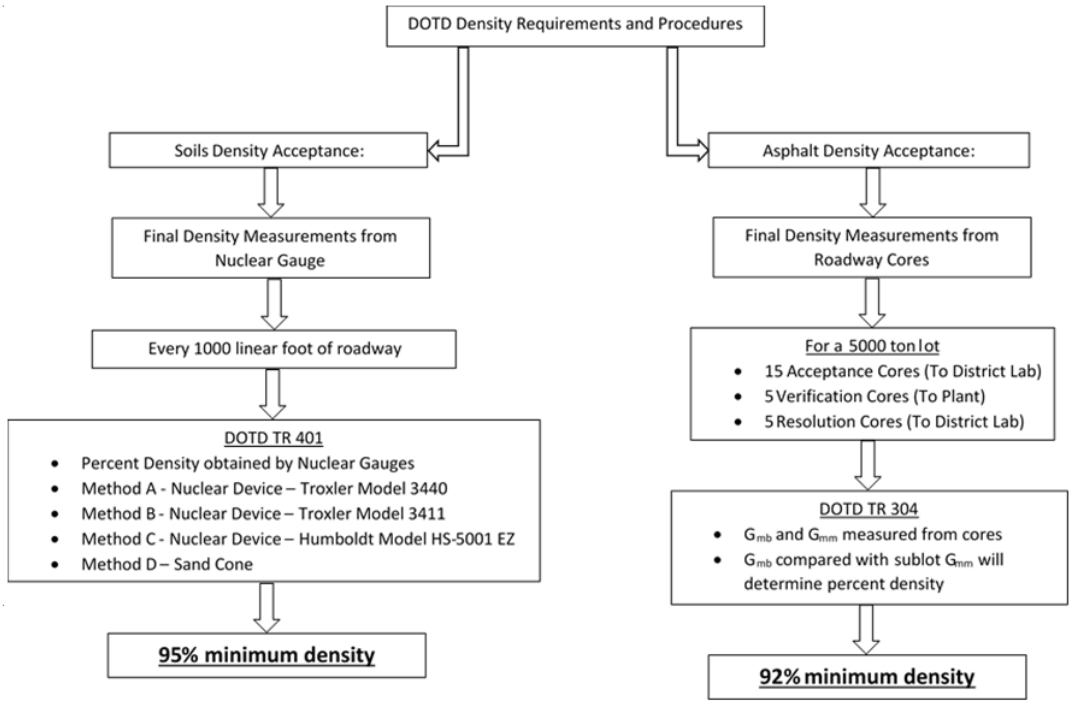

Figure 1
DOTD Density Requirements and Procedures