

Developing Deflection Acceptance Criteria for Compacted, Open-Graded Aggregate (OGA)

Recipient: School of Civil and Environmental Engineering

Oklahoma State University

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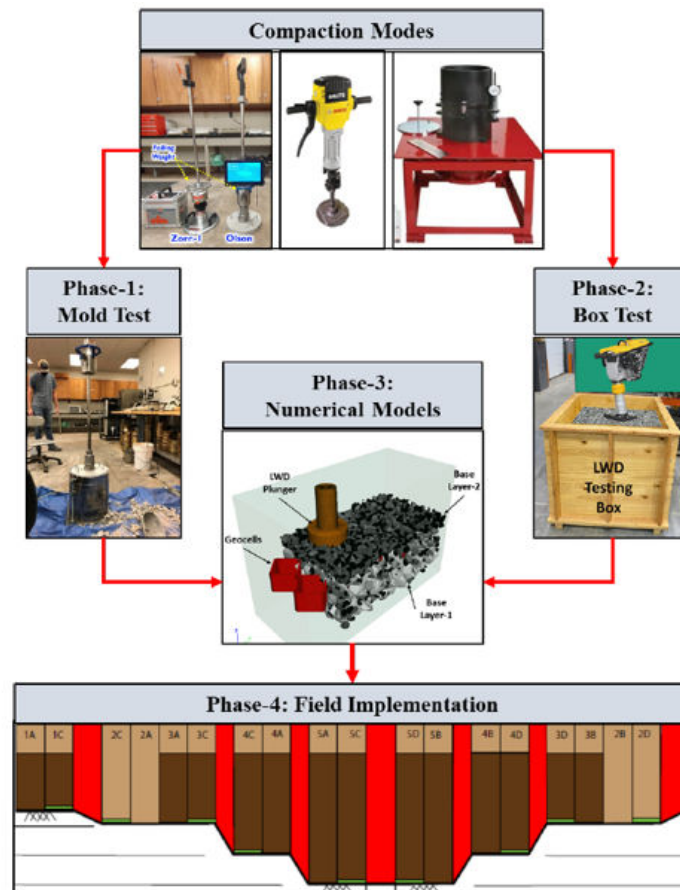
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Project Summary: 31



Background and Need

Quality control and quality assurance (QC/QA) of unbound aggregate layer construction in pavements has traditionally been based on measuring density using a nuclear density gauge. Measuring density of open-graded bases (OGA) for permeable pavements, however, is next to impossible, as results are highly variable. This research addressed the need for developing compaction specifications based on deflection criteria measured with a Light Weight Deflectometer (LWD), a technology in existence since the 1980s. This cutting-edge work follows recent development of LWD protocols and an AASHTO provisional specification for deflection measurements on compacted subgrade soils and dense-graded bases. Several state departments of transportation (DOTs) in the US (e.g. Florida, Indiana, Nebraska and Minnesota) have adopted compaction control specifications for these materials using LWDs. The trend toward using LWDs among other state DOTs is growing due to the inexpensive, reliable, and fast nature of the tests.



A Schematic Illustration of the Research Design

Objectives

This study aimed to create a compaction assessment method for open-graded aggregates (OGA) in base/subbase layers of permeable pavements. The focus was on two OGA materials (ASTM #4 and ASTM #57), examining their packing under various compaction conditions. Multiple Lightweight Deflectometer (LWD) units were used to make the research results and compaction protocols applicable across different devices.



LWD Testing after 3rd Lift (Zorn)



Photographs Showing Representative Particles from ASTM#4 and ASTM #57 Aggregate Materials

Outcomes

This research used various methods, including lab tests, numerical modeling, and real-world pavement testing, to establish a recommended compaction control method based on deflection.

For ASTM #4 aggregate material, with a 12-inch thick layer, the surface deflection after two passes of a vibratory roller was 0.689 mm. It might decrease further with a third pass, but it is unlikely to go below 0.50 mm, which historically was the target recommended by the Concrete Masonry and Hardscapes Association (CMHA). For ASTM #57 material, with a 12-inch thick layer, the minimum surface deflection after two passes of vibratory roller compaction was 0.735 mm, and it may decrease more with a third pass.

However, the study recommends setting the target surface deflection at 0.6 mm or less based on extensive testing. The research team believes that an open-graded aggregate (OGA) layer with surface deflections less than or equal to 0.6 mm represents a satisfactory packing condition, as determined through both lab and field-testing. This target is now deflection recommended in CMHA best practices.

[The complete research report is available online.](#)