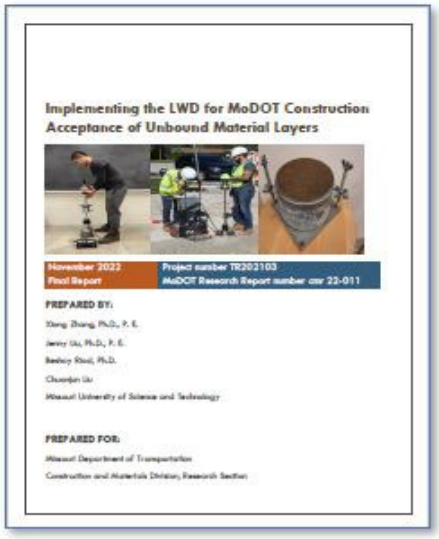
For more information contact: Brent Schulte (573) 526-4328

Research Summary

Implementing the LWD for MoDOT Construction Acceptance of Unbound Material Layers



In recent years, modulus-based compaction quality assurance (QA) of unbound materials using lightweight deflectometer (LWD) is gaining attention and was adopted by several DOTs, as the LWD modulus it provides correlates pavement design and construction better than conventional density-based QA method. However, more research is needed due to differences in typical unbound geomaterial types and equipment conditions in Missouri. In addition, an appropriate, rapid, and accurate moisture content (MC) measurement device is urgently to be identified, since it is the main factor that affects the LWD modulus but existing LWDs cannot measure it.

To study the implementation of the Zorn LWD for the acceptance of unbound material layers on MoDOT projects, a comprehensive literature review and a national survey were firstly conducted to study the current status of implementing LWD. Next, four types of soils including a lean clay, a SGB sand, a base aggregate, and a silty clay were collected from four sites for performing a series of lab tests, including (1) basic physical soil property tests such as sieve analysis, Atterberg limits, modified Proctor compaction tests, and soil water characteristic curve, (2) LWD tests on proctor mold via Zorn ZFG Lab 3.0 LWD device, (3) evaluation of the efficiency of Ohaus MB120 and Aggrameter moisture analyzers, and (4) repeated load triaxial tests. Besides lab tests, field LWD tests were performed using three Zorn ZFG 2000 LWDs and the Ohaus MB120 and Aggrameter were evaluated for MC measurements at four construciton sites. Then, acceptance criteria including MC and field to target LWD modulus ratio were implemented to assess compaction acceptance of tested points at four sites. Finally, by referring to findings from this study and previous studies, guideline for implementing and using LWD was drafted.

> *"Modulus-based compaction quality assurance (QA) of unbound materials using lightweight deflectometer (LWD) is gaining attention and was adopted by several DOTs … however, more research is needed due to differences in typical unbound geomaterial types and equipment conditions in Missouri."*

Based on substantial results from lab and field tests, conclusions were obtained as follows: 1) The three LWD devices are able to capture the moduli changes with variation of MCs consistently at four test sites; 2) good correlation of modulus measurement existed between the

LWD 3879 and 4421 for all tested soils, while that occured only on the SGB sand for the LWD 3878 and 4421, and LWD 3878 and 3879 had fair correlation even though they are the same models; 3) with proper calibrations, the Ohaus MB120 performed better than the Aggrameter though it required relatively critical working condition; and 4) the LWD 4421 had a less strict acceptance criterion, compared with other two LWD devices.

Figure 1: LWD test on proctor mold in the laboratory (left) and LWD test in the field (right).

Project Information

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CONTACT INFORMATION:

Brent Schulte
Intermediate Research Analyst
Missouri Dept. of Transportation
1617 Missouri Blvd.
Jefferson City, MO 65109
(573) 526-4328
Brent.Schulte@modot.mo.gov