

MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 24-529 (project 629) | July 2024

Evaluation of Granular Density and Moisture Testing



the ISSUE

Proper compaction of base materials in roadways is critical to attaining optimum performance of pavements. Achieved field density as a result of compaction remains the single most crucial parameter known to significantly influence the performance of a granular base subjected traffic loads. Historically, the South Dakota Department of Transportation (SDDOT) and several other DOTs have used the Ohio Highway Department (OHD) typical moisture-density curves for compaction quality control of granular materials and granular soils. However, the OHD moisture-density family of curves was not developed for granular materials or South Dakota local materials, and their use resulted in errors in field-measured densities. Therefore, the use of OHD curves are being phased out. Consequently, there is a need for new tests and procedures for compaction quality of granular materials specific to South Dakota.

the RESEARCH

The present study was undertaken and an evaluation program was designed to verify the South Dakota moisture-density curves developed in the SD2014-12 research project. Also, the suitability of the suggested dynamic cone penetrometer (DCP) method as the strength-based approach for determining the in-situ compaction quality was evaluated. Based on this approach, SDDOT's available draft specification language proposed for screening the field compaction applying the DCP test was examined. As a result, the draft specification established the technical criteria based on the outcomes of the field DCP tests required for achieving the desired field compaction.



A University Transportation Center sponsored by the U.S. Department of Transportation serving the Mountain-Plains Region. Consortium members:

Colorado State University
North Dakota State University
South Dakota State University

University of Colorado Denver
University of Denver
University of Utah

Utah State University
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Project Title

Evaluation of Density and
Moisture Testing for Granular
Materials

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the FINDINGS

The moisture-density family of curves developed for SDDOT was found to predict the OMC and MDUW values with an accuracy higher than that of the Ohio curves. The recommended acceptance criteria for compaction quality of base materials using the DCP test parameters (SEAT and DPI) were found to be a conservative method for field compaction quality assessment in about 96% of the studied cases. The draft specification for applying DCP in screening the compaction quality of the granular aggregate bases in South Dakota was effective, except for cases of excessively coarse particles (e.g., recycled concrete aggregates).

the IMPACT

This study's findings have provided research-verified information to assist SDDOT in making decisions for updating the testing methodologies used for in-situ acceptance of compacted granular bases. More specifically, the efficacy and suitability of using two methods, namely the density curves (SD2014-12) and the DCP test, for screening the compaction for granular bases have been verified and evaluated. Fully implementing this project's outcomes will result in time savings, improved safety due to less need for a nuclear density gauge, and compaction quality improvement.

For more information on this project, download the Main report at <https://www.ugpti.org/resources/reports/details.php?id=1266>

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7767 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.



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