



RESEARCH PROJECT CAPSULE [23-4B]

March 2024

TECHNOLOGY TRANSFER PROGRAM

Literature Review of IDEAL-CT and IDEAL-RT Test Methods for Balanced Mixed Design

JUST THE FACTS:

Start Date:

March 4, 2024

Duration:

12 months

End Date:

March 3, 2025

Funding:

TT-Fed/TT-Reg-5

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POINTS OF INTEREST:

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

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PROBLEM

The balanced mix design (BMD) approach was developed through a series of tests to evaluate the laboratory performance of asphalt mixtures as it relates to field performance. These tests were adopted because of changes in mixture composition, as well as decreased confidence in the ability of volumetric properties to relate to performance on roadways. Louisiana is one of the first states to adopt BMD testing to evaluate asphalt mixtures. Per Louisiana DOTD specifications, rutting and cracking resistance are the two distresses that are addressed with BMD tests. The loaded wheel tester (AASHTO T-324) was adopted to characterize rutting resistance, whereas the semi-circular bend (SCB) test at intermediate temperatures (ASTM D 8044) was adopted to ascertain cracking resistance. DOTD has performed considerable research studies to evaluate these tests' ability to characterize field rutting and cracking performance before and after inclusion in the specifications. While the current tests are serving DOTD well in screening poor-performing mixtures during design, the tests require significant time to complete. Additionally, specimen preparation is considered to be cumbersome by many.

New test methods have been developed to evaluate the cracking and rutting performance of asphalt mixtures. Among these, the IDEAL-CT and IDEAL-RT are gaining traction due to their potential advantages. The IDEAL-CT is a cracking test performed at room temperature on 150-mm diameter and 62-mm thick cylindrical specimens at a loading rate of 50 mm/min [1]. The IDEAL-RT test is a rutting test performed at relatively high temperatures on specimens with similar dimensions and loading rates. Figure 1 shows typical IDEAL-CT and IDEAL-RT test setups. Compared to traditional methods like the Loaded Wheel Tester (LWT) and Semi-Circular Bend (SCB) test, both IDEAL-CT and IDEAL-RT offer simpler specimen fabrication and shorter testing times. However, aging procedures are not currently included in the IDEAL-CT testing protocol, while Louisiana's existing protocol requires laboratory aging of SCB specimens to simulate long-term field aging characteristics. If IDEAL-RT and IDEAL-CT can accurately distinguish mixtures with known performance concerns, they could become valuable tools for quality control (QC) and quality assurance (QA) applications. The study will evaluate the theoretical viability of mixtures produced in Louisiana, as well as identify their implementation capabilities.

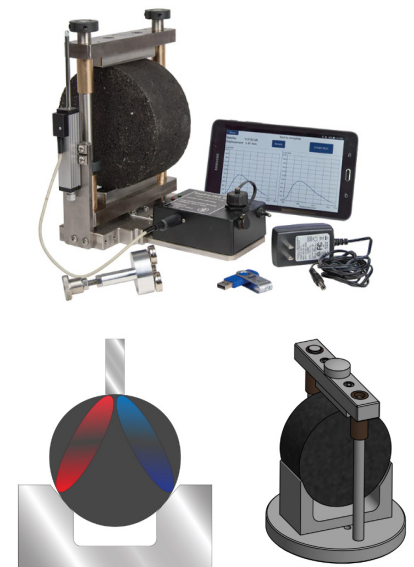


Figure 1. (a) IDEAL-CT and (b) IDEAL-RT test setups

OBJECTIVE & SCOPE

The objective of this project is to evaluate published literature regarding the efficacy of IDEAL-CT and IDEAL-RT test methods to characterize the performance of asphalt mixtures in the field. Many agencies have used and researched these BMD methods, and reviewing their efficiency can provide the state of Louisiana with additional tools and help agencies compare the results with currently implemented test methods, such as LWT and SCB. In order to perform a comprehensive study, LTRC will review published records of IDEAL-CT and IDEAL-RT and develop a summary to provide a better understanding of these methods. Additionally, limited laboratory tests will be performed to ascertain the ability of the IDEAL-CT and IDEAL-RT tests to provide similar field cracking and rutting performance rankings as the SCB and LWT tests, respectively. This study will aid DOTD in determining the viability of these test protocols to be used in BMD specifications.

METHODOLOGY

To achieve the objective of this study, the research team will first conduct an extensive literature search of all published materials, including ongoing research projects, to obtain the latest information on the new methods currently used or being developed for balanced mix design (BMD) and mixture performance characterization. The literature review will focus on the ability of different test protocols used in the various BMD frameworks to distinguish between mixtures containing different additives, as well as those subjected to different aging levels. Transportation Research Information Database (TRID), Computerized Engineering Index (COMPENDEX), National Technical Information Services (NTIS), and LTRC's project final reports will serve as primary sources of information for the literature search. Next, the research team will conduct a limited laboratory study to assess the IDEAL-CT and IDEAL-RT test protocols. Five mixture types, prepared with different mixture additives (i.e., polymer modifiers and additives), aggregate sizes (i.e., 12- and 19-mm nominal maximum aggregate sizes), and different traffic levels, will be collected for evaluation. These mixtures will be collected from asphalt plants in Louisiana during the 2024 construction season. Additionally, the five mixtures will be subjected to LWT, SCB, IDEAL-RT, and IDEAL-CT tests in the laboratory. The results from the aforementioned tests will be compared to ascertain the relationship between the test methods and their ability to rank field performance. A final report will be prepared that will summarize and document all findings, experiments, results, conclusions, and problems encountered during the project execution. Additionally, recommendations for future research needs will be included in the report.

IMPLEMENTATION POTENTIAL

Successful completion of this research will provide DOTD with a detailed understanding of the IDEAL-CT and IDEAL-RT methodologies, as well as a primary comparison between their results and those of the currently used SCB and LWT. The research team will draw on the literature to report the results of these methods, their potential application to QC/QA protocols, and their reliability in relation to field performance.

REFERENCES

- [1] Zhou, Fujie, Soohyok Im, Lijun Sun, and Tom Scullion. "Development of an IDEAL cracking test for asphalt mix design and QC/QA." *Road Materials and Pavement Design* 18, no. sup4 (2017): 405-427.
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- [3] HMA Lab Supply. Smart-Jig IDEAL-CT & TSR. <https://www.hmalabsupply.com/products/smart-tsr-jig>. Accessed on 02/28/2024.