DRISI
Caltrans Division of Research,
Innovation and System Information

Research Results

Testing New Open-Graded Friction Course Mix Designs

Ensuring that the new methodology meets performance requirements

Pavement

DECEMBER 2013

Project Title:
Improved Methodology for Mix Design of Open-Graded Friction Courses

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WHAT IS THE NEED?

Open-graded friction courses (OGFCs) improve skid resistance, particularly in wet weather, and reduce tire noise. The OGFC mix, which is applied as a thin layer on the pavement surface, increases the friction and permeability of the pavement. For the OGFC mix design, Caltrans uses California Test 368, Optimum Bitumen Content for Open Graded Friction Course. This test procedure has several disadvantages and needs to be revised.

To improve the longevity of OGFCs, the National Center for Asphalt Technology (NCAT) proposed a comprehensive approach for OGFC mix design. Caltrans considered the NCAT's new approach in the revisions of California Test 368 and developed a new method for OGFC mix design in partnership with the University of California Pavement Research Center (UCPRC). The new mix design method required calibration through more laboratory testing to ensure that it delivers the design requirements in terms of air-void content and performance. After the mix design is calibrated, it is necessary to test that the method delivers a suitable optimum binder range.

WHAT WAS OUR GOAL?

The goal was to calibrate the new OGFC mix design method to ensure that it delivers the design requirements and incorporates the performance test results in the design chart.

WHAT DID WE DO?

Caltrans, in partnership with the UCPRC, developed a test plan to evaluate 10 OGFC mixes produced from the following:

- Three binder types (a performance graded PG 64-10, a polymer-modified PG 76-22 PM, and a terminal blend asphalt rubber PG 64-28 TR)

- Two aggregate types (alluvial and volcanic)
- Two gradations (coarse and fine)

The researchers measured the volumetric properties of these materials and mixes. The new OGFC mix design method was used to determine three trial binder contents. To ensure that the method delivers a suitable optimum binder range, the results of three performance tests were then incorporated:

- Draindown, which measures the binder's potential to drain off of the aggregate during transport from the plant to the construction site
- Cantabro, a measurement of durability
- Hamburg wheel-tracking device, which measures rutting performance and moisture sensitivity

The researchers also studied the effect of fines content (with a maximum size of 75 µm) on the performance of open-graded mixes.

WHAT WAS THE OUTCOME?

The new OGFC mix design method was verified. The process was enhanced by the development of an Excel macro, an easy-to-use tool to assist and ensure that the volumetric requirements and the performance specifications are met. The macro determines the optimum binder range according to the results of the draindown, Cantabro, and Hamburg wheel-tracking device tests. It was also demonstrated that an increase in the fines content improves the results of these performance tests; therefore, the fines content should be a part of OGFC performance specifications.

WHAT IS THE BENEFIT?

OGFCs will be used throughout California's roadways as appropriate. They improve skid resistance, particularly in wet weather, and generate less noise from tire-pavement interaction. Modifying the OGFC mix design increases its longevity and improves performance. The calibration of the new OGFC mix design method ensures that the desired air-void content is achieved and the performance specifications are met.

IMAGES

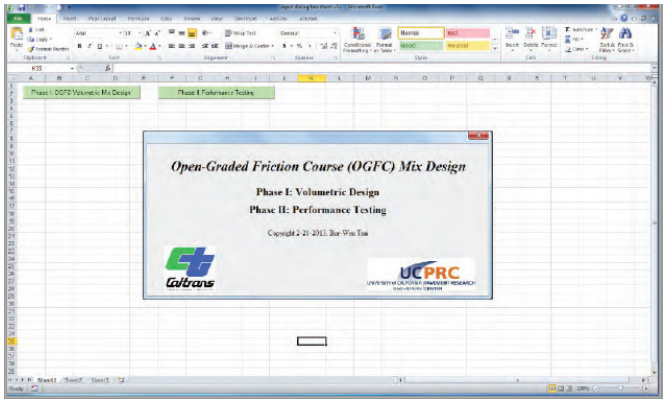

Figure 1: The new Excel macro for OGFC mix design