DRISI
Caltrans Division of Research,
Innovation and System Information

Research Results

Evaluating Mix Designs for Quieter Pavements

New mixes offer superior noise reduction and mechanical durability

Pavement

FEBRUARY 2015

Project Title:
Implementation of New Quieter Pavement Research: Accelerated Pavement Testing and Laboratory Evaluation of Different Open-Graded, Hot-Mix Asphalt Materials

Task Number: 2380

Start Date: November 1, 2011

Completion Date: June 30, 2014

Task Manager:
David Lim
Transportation Engineer
s.david.lim@dot.ca.gov

WHAT IS THE NEED?

Caltrans began the Quieter Pavement Research program in 2007, a long-term effort to develop specifications, guidelines, and standardized laboratory and field test methods to be incorporated into standard Caltrans practices and lead to quieter pavements. Based on an earlier laboratory study, several open-graded friction course (OGFC) mixes that had performed well in the laboratory in terms of durability and sound absorption were selected for further evaluation.

WHAT WAS OUR GOAL?

The goal was to continue developing specifications, guidelines, and other information needed to incorporate quieter pavement research into standard Caltrans practice.

WHAT DID WE DO?

Caltrans, in partnership with the University of California Pavement Research Center evaluated selected mixes using a Heavy Vehicle Simulator (HVS) and laboratory testing on plant-produced materials. The tests examined three new OGFC mixes, with the Caltrans mix serving as the control.
The tests included various performance grade (PG) and polymer-modified (PM) asphalt binders.

- Caltrans 3/8 inch mix with PG 76-22PM binder, average as-built thickness = 0.06 feet
- #4P mix with PG 76-22PM binder, average as-built thickness = 0.06 feet
- #4P mix with PG 76-22PM binder, average as-built thickness = 0.07 feet
- #4P mix with PG 64-16 binder, average as-built thickness = 0.05 feet
- Georgia 1/2 inch mix with PG 58-34PM, average as-built thickness = 0.15 feet

The #4P mixes had a nominal maximum aggregate size of 4.75 mm. The "P" indicates a coarser aggregate gradation identified in an earlier lab study.

The researchers studied the mixes' performance in terms of their constructability, rutting, moisture damage susceptibility, surface texture, permeability, clogging susceptibility, clogging and rutting mechanisms, and tire-pavement noise.

WHAT WAS THE OUTCOME?

While all the mixes are feasible depending on the type of project, preliminary indications revealed the following differences in performance:

- The #4P mixes offer superior noise and mechanical durability compared to the control mix, with similar skid resistance and surface permeability. They have lower macrotexture than the control, but more than dense-graded mixes. A rubberized binder might improve moisture sensitivity and rutting performance, which were better or worse than the control depending on the binder type.
- The Georgia 1/2-inch mix is likely to provide superior skid resistance and rutting performance compared to the control mix, although it could not be fully investigated due to difficulties in getting it produced by local plants as designed. This mix might also cost more because the Georgia department of transportation recommends lime treatment and fibers in addition to the polymer-modified binder.

WHAT IS THE BENEFIT?

Highway noise abatement is an ongoing effort. Caltrans now has guidelines for implementing specific types of quieter pavements, which provide an option to enhance current standard measures to reduce tire-pavement noise. Findings from this study can improve practices for designing and constructing quieter pavements while optimizing safety, durability, and cost.

LEARN MORE

To view the complete report:
www.ucprc.ucdavis.edu/PDF/UCPRC-RR-2013-04.pdf

IMAGES

Figure 1: Heavy Vehicle Simulator used for testing

Figure 2: Georgia 1/2-inch mix with PG 58-34PM; OGFC thickness = 0.15 feet