Florida Department of Transportation Research

Study of Anti-Strip Additives on Granite-Based FC-5 Asphalt Mixtures

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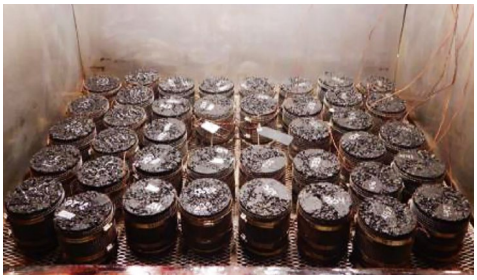
Current Situation

The asphalt mixes used for the top layer – the friction course – of pavements are complex mixtures of asphalt binder, aggregate (such as limestone or granite), and other ingredients that have been found through research to improve the performance and durability of roadways. Designing better asphalt mixes is a subject of continuing research as new products appear or new ways are found to address pavement problems. One such problem is stripping, which often happens when moisture causes aggregates to separate from the asphalt binder, weakening the road surface and leading to loss of material under the effects of traffic and weather. This can be a special problem for open-graded friction courses (OGFCs) that are specially designed with gaps in their structure to allow rapid water runoff, especially in Florida where heavy rainfalls occur regularly.



Pavement samples are conditioned by the asphalt pavement weathering system.

Research Objectives

Auburn University researchers examined whether a liquid anti-strip (LAS) additive, an increase in hydrated lime, or both, would produce longer lasting open-graded pavements. An economic analysis was conducted to determine if the additional materials were justified by the increased service life of the pavement.

Project Activities

The researchers focused on a category of OGFCs called FC-5 mixtures, specifically, those which use granite as an aggregate. The Florida Department of Transportation (FDOT) already requires that these mixtures contain 1% hydrated lime to prevent stripping. The basic research plan called for testing granite-based FC-5 mixtures using four treatments: (1) 1% hydrated lime (the current standard), (2) 1% hydrated lime and LAS additive, (3) 1.5% hydrated lime, and (4) 1.5% hydrated lime and LAS additive. This plan was expanded to include two types of granite and four types of LAS additive. Standard binder bond strength (BBS) testing was used to select the LAS additives that had the best anti-strip performance.

FC-5 pavement samples were made using two FDOT mix designs with different granite aggregates, Georgia granite and Nova Scotia granite, and conditioned using an asphalt pavement weathering system which simulates long-term exposure to water infiltration, vapor diffusion, and thermal and ultraviolet oxidation. Standard tests, including the Cantabro mass loss test and the Hamburg wheel tracking test (HWTT), were used to evaluate the durability and moisture susceptibility of both the unconditioned and conditioned samples.

The study determined that performance could be improved in FC-5 mixtures containing Georgia or Nova Scotia granite aggregates. The performance of FC-5 mixtures containing Georgia granite would be optimized by also requiring a LAS additive. The performance of FC-5 mixtures containing granite from Nova Scotia would be increased by requiring 1.5% hydrated lime and a LAS additive. Both improvements were determined to be cost effective.

Project Benefits

The findings of this project can lead to improved durability of pavement on Florida roads and substantial maintenance and replacement savings.

For more information, please see www.fdot.gov/research/.