Florida Department of Transportation Research

Design and Performance of Open-Graded Friction Course (OGFC) Mixtures Containing Epoxy Asphalt

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Current Situation

Raveling refers to loss of pavement material, often due to inadequate bonding of asphalt and aggregate. When minimal, raveling can create a rough texture, but when it is more extensive, patches of pavement can be lost. This is a special concern for roadways with more than two travel lanes where the speed limit is over 45 mph because in Florida these roads must be paved with an open-graded friction course (OGFC), which means that the top pavement layer must have a porous structure to allow rapid draining of water from the road surface to prevent hydroplaning. Despite the improvement of OGFC mix designs over time, the Florida Department of Transportation remains concerned about the extent of raveling on high-speed roadways where rough areas and lost patches of pavement can allow water to pool and increase the potential for hydroplaning. Therefore, efforts continue to improve OGFC mix designs and reduce raveling.

Open-graded friction courses can be subject to raveling, which leads to a rough pavement texture and further damage.

Research Objectives

Auburn Research and Technology Foundation researchers investigated the use of epoxy-modified asphalt (EMA) to improve the long-term durability and life span of OGFC mixtures on Florida roadways.

Project Activities

The researchers reviewed current practices in using EMA in the scientific literature as well as in discussions with asphalt researchers, epoxy material suppliers, and international agency and industry representatives. Based on the information gathered, the researchers developed an experimental plan consisting of five experiments.

The goal of the first experiment was to evaluate chemical compatibility between two epoxy products (E1 and E2) and four asphalt binders, labeled A, C, G, and Z. Though the binders were quite different chemically, all had fair compatibility with the two epoxies. Tests showed that two combinations – E1-Z and E2-C – were the most compatible over a range of epoxy concentrations. In the second experiment, efforts to determine the optimum epoxy dosage with respect to material cost and OGFC performance found that OGFC mixtures made with an EMA that was 30% to 40% epoxy outperformed a traditional OGFC mixture with a less expensive polymer modifier. In the third experiment, the researchers verified that with some changes, current FDOT procedures for OGFC mixtures could be used with EMAs.

Having determined compatibility, dosage rate, and test method, in the fourth experiment, the researchers characterized the performance of OGFC mixtures prepared with epoxy-modified binders and compared their performance to both polymer-modified and high-polymer-modified binders. Generally, asphalt concrete made with high-polymer-modified asphalt or EMA performed best using standard tests, but variations among the samples suggested future research topics.

In a fifth experiment, the researchers found that pavement made with epoxy-modified binder could be successfully recycled into dense-graded asphalt mixtures.

Project Benefits

More durable pavements can improve safety and reduce maintenance costs on Florida roadways.

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