Florida Department of Transportation Research

Understanding Mechanisms of Raveling to Extend Open Graded Friction Course (OGFC) Service Life

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Current Situation

A road's topmost layer, the friction layer, is literally where the rubber meets the road. The condition of this layer is important for vehicles to maintain proper traction. On high speed roadways, an open-graded friction course (OGFC) is used to reduce hydroplaning by draining water from the roadway quickly. However, this moisture can accelerate the deterioration of the friction layer in the form of raveling. Raveling is one of the leading forms of deterioration for OGFC mixtures, and is often seen as linear patches that are partially bare or potholes. These areas then have a tendency to gather water and other debris, reducing traction and potentially leading to hydroplaning.

Damage to the road surface can allow water to gather, creating an unsafe condition.

Research Objectives

Texas A&M Transportation Institute researchers, working with the Universidad de los Andes in Bogotá, Colombia, studied the mechanisms of raveling in OGFCs through experimental analysis and finite element modeling.

Project Activities

The Florida Department of Transportation (FDOT) helped the researchers identify asphalt mixtures and field sites demonstrating both good and poor field performance. Cores taken at field sites showed that the better performing pavement had a higher binder content; however, both pavements had less binder than specified in the FDOT mix design and exhibited poor drainability and finer gradation than the mix design requirements.

The aggregates and asphalt binders were characterized using standard and advanced techniques to determine their contribution to raveling. Additional laboratory mixtures were produced and characterized using permeability, Cantabro loss, indirect tensile (IDT) strength, and the Hamburg Wheel Tracking Test. The Cantabro loss test best predicted mixture durability compared to observed field performance. AASHTO T 283 and the Moisture Induced Stress Tester (MIST) device were used to evaluate moisture effects on the mixtures' IDT strength and Cantabro loss. All mixtures showed minimal impact from the conditioning protocols, especially MIST conditioning.

The finite element (FE) model consisted of a wheel load passing over a typical OGFC on top of a typical pavement structure. The OGFC was modeled using microstructures obtained with x-ray computed tomography techniques. Effects on the OGFC mixture due to climatic, traffic, and pavement conditions were evaluated. The results suggested that the mixture-related factors which most increase chances of raveling are asphalt binder content, air void content, and temperature. High traffic loads and slow speed vehicles were also found to be detrimental, while the structural capacity of the pavement supporting the OGFC was least likely to promote raveling.

Project Benefits

Better understanding of the mechanisms of raveling will allow development of more durable asphalt mixtures that reduce maintenance and increase the safety of roadway surfaces.

For more information, please see dot.state.fl.us/research-center