Prevention of Premature Pavement Deterioration at the Longitudinal Joint Using a Void Reducing Asphalt Membrane (VRAM).

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In asphalt pavements, longitudinal joints are the commonly the weakest location at the mat's unconfined side of the joint. This can be due to pavers not being able to achieve sufficient compaction to attain high density in this part of the mat. With lower density closer to the longitudinal joint, air voids are higher, and thus the pavement is typically more permeable than the asphalt pavement located at the mat center. Higher air void content leads to higher amounts of water infiltration and thus often causes premature deterioration. To achieve better long-term pavement performance, the permeability of pavements should be reduced to allowable air void levels. Premature deterioration often requires reactive maintenance and sometimes rehabilitation sooner than what the design calls leading to higher life-cycle costs. To achieve higher density in the mat at and within 9 inches of the longitudinal joint a material called VRAM can be used. VRAM is an asphalt composition of asphalt binder, elastomeric polymer, and a wax modifier, which has been recommended and used at longitudinal joints of asphalt pavement to achieve higher density and reduce premature deterioration at longitudinal joints. Though it has been successful in other states such as Illinois and Ohio, there are no many studies that have been done to evaluate how it increases density and improves performance. The composition is applied below a hot mix asphalt layer, and it migrates into hot mix asphalt filling 50-70% of the voids. Pavement sections were constructed in Minnesota in 2018 and are located at TH 22 in Minnesota north of Beauford and south of Mankato for a Minnesota DOT project.

The main objective of this work is to examine how the use of VRAM in pavement increases pavement's resistance to premature pavement deterioration and the extent of migrates into the top HMA layer. To evaluate performance field cores were collected from the pavement with sections one with VRAM and control, having the same mix designs and binder grades. Volumetric data were determined for all cores before mechanical tests were done. To evaluate improvements in mix performance low-temperature fracture testing was done using the disk compact tension (DCT) and semi-circular bend (SCB) tests, while a push-pull test was used to evaluate improvement in adhesion between the top and bottom HMA layers. To study the effects and migration of VRAM up into the HMA top layer, falling head permeability and fluorescence microscopy. The result will then be analyzed comparing the behavior of pavement with VRAM to those without, and conclusions will be drawn with insights on how the use of VRAM affects the pavement properties and resistance to premature deterioration at the longitudinal joint. It is anticipated that the pavement with VRAM will have lower permeability, higher bond energy, and higher fracture energy than the pavement without VRAM. Also, there will be traces of VRAM throughout the specimen.

Keywords: VRAM migration, premature deterioration, permeability, fracture energy, bond energy