POROUS ASPHALT PAVEMENT PERFORMANCE IN A COLD CLIMATE

Background

Porous Asphalt Pavement is an emerging technology in the United States. It consists of standard bituminous asphalt with reduced fine particles and high (20 %) void content. The high porosity of the mix allows water to penetrate directly through the pavement surface. Beneath the pavement, a uniformly-graded stone bed allows water storage and slow infiltration into the subgrade soils. Filter fabric installed between the stone bed and the subgrade prevents migration of fine particles upward and contamination of the stone storage layer.

Potential benefits of Porous Asphalt are compelling. The reduction of stormwater runoff peak and total flow volume may greatly decrease the need for water mitigation structures, ponds, and associated right-of-way. Water quality may be improved by the tendency of the porous pavement to bind and contain heavy metals and other contaminates and by preventing immediate runoff into surface water sources. Safety is improved with reduced water spray and ponding. Vehicle noise is also significantly reduced with porous pavements.

Project Goals and Objectives

The lack of porous asphalt pavement durability research in the seasonally diverse Minnesota climate preceded this research project. The purpose was to study the durability, maintenance requirements, hydrologic benefits, and environmental considerations of a porous asphalt roadway in a cold climate.

Porous Asphalt Installation at MnROAD

Porous Asphalt Surface Texture

The Experimental Plan

In order to accomplish these objectives, in 2008 two porous asphalt test cells were installed on the MnRoad Low Volume Road (LVR). One porous asphalt cell was built on a clay subgrade, and one was built on a sand subgrade.

Project Status

The test cells were monitored for three years and had received approximately 40, 000 applied asphalt ESALs as of the conclusion of the study in December 2011.

Important Conclusions

1. Mixture strength testing such as with the Asphalt Pavement Analyzer (APA) is recommended during the design phase to ensure pavement strength and durability.
2. Construction of porous asphalt pavement involves special mixing, transport, and placement requirements that must be followed closely in cold climates.
3. Porous pavement performance and durability is greatly affected by heavy truck loads, the failure mode for this pavement was primarily rutting and raveling (not cracking).
4. The porous asphalt demonstrated less stiffness and more strain than standard asphalt; however the lack of cracking indicates it can be a very resilient pavement.
5. Snow and ice appeared to melt and clear faster on the porous asphalt than the standard asphalt control cell, particularly in sunny conditions.
6. Subsurface heat transfer was better below the porous pavement and the pavement and base layers warm faster in the spring than in standard pavements.
7. Vacuuming appeared to have a beneficial effect; maintenance of this type is recommended particularly when local conditions could introduce clogging agents.
8. Water quality testing indicated that the porous asphalt reduced copper and zinc concentrations in the filtered water and can cool stormwater prior to release into sensitive resource waters.

Future Research

It is recommended that a porous overlay with a highly rutting-resistant mix be conducted on these two sections to study overlay performance on a porous pavement.

Participants

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