National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

Evaluation of Low Noise HMA Mixes

RESEARCH SYNOPSIS 08-01

Problem Statement

Noise abatement criteria for highways have been established by the Federal Highway Administration (FHWA). To satisfy these criteria, many highway agencies build sound barriers along the highway right-of-way at considerable costs. The use of quieter pavement surfaces, a much more economical alternative, is not currently allowed by the FHWA. Research must first demonstrate the safety, durability and noise reduction capability of quiet pavements surfaces.

Objectives

The objective of this study was the evaluation of several candidate low-noise hot mix asphalt (HMA) mixtures and layer combinations identified from past experience in Europe and the United States, recognizing these mixtures as potential low-noise alternatives for quieter pavements.

Description of Study

The study included the evaluation of pavement sections consisting of single and double layer porous asphalt mixtures, dense-graded Superpave and stone matrix asphalt (SMA) with varying nominal maximum aggregate sizes, a micro-surfacing mix and an unusual open-graded mixture donated by East Alabama Paving (EAP). The pavements were constructed on the untrafficked inside lanes of sections at the NCAT Test Track. The two-layer sections were paved on the north tangent, and the other mixtures on the south tangent as shown in Tables 1and 2.

Table 1. Test Track North Tangent Sections

North	N5	N6	N7	N8	N9
Layer 1	OGFC	OGFC	OGFC	PEM	PEM
Layer 2	DGA	OGFC	PEM	PEM	DGA

Two noise measurement approaches were used to evaluate the sections – sound pressure measurements using the NCAT noise trailer and sound intensity measurements using the on-board sound intensity (OBSI) approach. Testing was done at speeds of 45 mph with the new Michelin standard reference test tire (SRTT).

Table 2. Test Track South Tangent Sections

South	S2	S4	S5	S6	S7	S8	S9
Layer 1	EAP	4.75 DGA	9.5 DGA	<4.75 SMA	4.75 SMA	9.5 SMA	Micro

Key Findings

Figure 1. summarizes the findings of the study and shows the average sound pressure levels (SPL) as measured on the different sections.

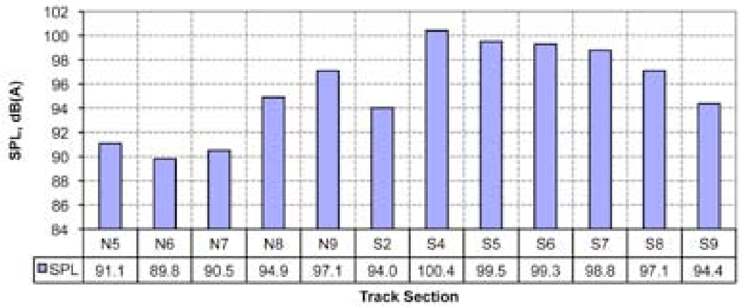

Figure 1. Summary of SPL measured on track sections

The findings of the low-noise HMA study clearly indicated the noise attenuating properties and benefits of porous asphalt pavements. Furthermore, consideration should be given to the layer thickness of these pavements, which appeared to significantly influence tire-pavement noise. While not the original objective of the study, the negative impact on road noise of pavements with very low surface macrotexture for some dense-graded and SMA mixtures was also well illustrated.

Recommendations for Implementation

1. Single and double layer porous asphalt mixtures are the best options for low noise pavements. Consideration must be given to the influence of aggregate size, layer thickness and the potential for clogging that may influence long-term performance of these mix types.

2. The use of very low macrotextured Superpave and SMA mixtures should be avoided. These are fine-graded Superpave mixes with small nominal maximum aggregate sizes (9.5 mm or 4.75 mm) or SMA mixes with 4.75 mm nominal maximum aggregate sizes.

Further Research

The as-constructed gradations of the dense-graded and SMA mixtures were substantially different from their respective job mix formulas. Therefore, the experiment on these mixtures should be repeated to better investigate the influence of nominal maximum aggregate size and macrotexture on tire-pavement noise. It is further recommended that the influence of mixture stiffness be evaluated – one of the low-noise pavement influences not investigated in the present study.

For the Full Report, see NCAT Reports 07-02, 07-03, 08-01 at www.NCAT.us

Acknowledgements and Disclaimer
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