RESEARCH
PROJECT CAPSULE [17-4B]
August 2017
TECHNOLOGY TRANSFER PROGRAM

Development of a 4.75-mm (No. 4) NMS Mixture

JUST THE FACTS:

Start Date:
June 14, 2017

Duration:
24 months

End Date:
June 13, 2019

Funding:
TT-Fed/TT-Reg

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Sponsored jointly by the Louisiana Department of Transportation and Development and Louisiana State University

POINTS OF INTEREST:

Problem Addressed / Objective of Research / Methodology Used Implementation Potential

PROBLEM

Budget constraints are making it harder to maintain Louisiana's transportation infrastructure. A strategy used by several states is asphalt mixtures with smaller NMAS. The Louisiana Department of Transportation and Development (DOTD) currently specifies using asphalt mixtures with a nominal maximum aggregate size (NMAS) ranging from 12.5 mm – 25.0 mm (1/2 in – 1 in). Figure 1 shows the cross section on 12.5 mm versus a 4.75-mm NMAS mixture.

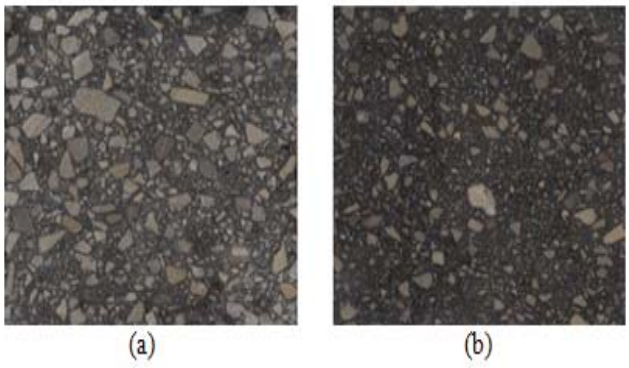

Figure 1
Cross sectional image of (a) a NMAS 12.5-mm asphalt mixture specimen; (b) a NMAS 4.75-mm asphalt mixture specimen [Ho, CH., González, M.F.M. & Linares, C.P.M. Front. Struct. Civ. Eng. (2017)]

Asphalt mixtures with a smaller NMAS can be used for reducing the extra fine aggregate stockpiles, applying thin-lifts on pavement preservation projects, leveling and patching of existing pavement before overlay applications, and providing an inexpensive maintenance option for pavements with low-traffic volume.

Smaller NMAS mixtures can decrease permeability, increase workability, and increase smoothness for roadways due to physical attributes of the material. A potential limitation for smaller NMAS mixtures is permanent deformation in a warm climate. It is vital for DOTD to develop a 4.75-mm NMAS mixture that will resist permanent deformation and provide economic performance.

OBJECTIVE

The objective of this project is to develop a 4.75-mm NMAS asphalt mixture for Louisiana roads, which will involve establishing target criteria for aggregate gradations, volumetric properties (e.g., air voids, VMA, VFA, and dust-to-binder ratio) and mechanical tests. Local aggregates and asphalt cements will be evaluated to determine the most economical mixture.

METHODOLOGY

After conducting an extensive literature search of all published materials and ongoing research projects to obtain the latest information regarding development of 4.75-mm NMAS asphalt mixtures, a test factorial will be created to evaluate various mixture designs.

Different asphalt binders and aggregate gradations will be used. The primary aggregate types that will be examined are gravel and limestone because of their prevalence in Louisiana. Asphalt binder grades will include PG 64-22, PG 76-22, and PG 82-22crm.

Engineering properties of the asphalt mixtures will be evaluated in the laboratory, with results being used to develop appropriate specifications. Evaluations will include Loaded Wheel Tracking (LWT) tests, Semi-Circular Bend (SCB) tests, Dynamic Modulus tests, and friction tests. Results will be compiled into a database. Statistical analyses will be performed to determine the best-performing mixtures for different levels of traffic volume. Economic feasibility of the mixture designs will also be evaluated.

IMPLEMENTATION POTENTIAL

This study will provide DOTD with a specification for 4.75-mm NMAS mixtures that resist permanent deformation and will provide an inexpensive solution for maintaining and preserving Louisiana pavements.