RESEARCH
PROJECT CAPSULE

December 2018

[18-4B]

TECHNOLOGY TRANSFER PROGRAM

Effect of Increased Asphalt Pavement Density on its Durability

Figure 1
Mixture paving

PROBLEM

In-place density is one of the most important factors influencing the performance of an asphalt pavement. The desired level of construction density in asphalt layers in the field is achieved by means of roller compaction.

A freshly laid asphalt layer behind a paver is a loose and evenly distributed mat of hot asphalt mixture with a certain thickness (or depth). The asphalt layer after compaction is a denser layer with a reduced thickness, a smooth and uniform surface, and a homogenous appearance.

In-place density of an asphalt pavement is achieved from a combination of proper design, production, placement, compaction, and quality control of the mixture. This density is typically stated as a percentage of the asphalt mixture's theoretical maximum specific gravity (G_{mm}).

Past studies have shown that as little as a one-percent increase of in-place density can lead to a 10- to 30-percent increase in service life of asphalt pavements. Anticipated cost savings due to increased service life are significantly greater than the added costs for achieving increased density.

Advancements in technology and pavement design/construction techniques yield the potential for increased asphalt pavement density, durability, and cost-effectiveness. Although these advancements are already being employed, standards for in-place density have remained unchanged. With enhanced density targets, improved durability and extended pavement service life is possible.

OBJECTIVES

The overall objective of this project is to evaluate the effects of increased asphalt pavement density on field performance. A demonstration pavement will be constructed to include a control section meeting the current minimum density requirement and a test section having an average 1.5 percent density increase, with subsequent evaluation of volumetric properties and performance characteristics of laboratory and field asphalt samples.

JUST THE FACTS:

Start Date:
October 1, 2018

Duration:
12 months

End Date:
September 30, 2019

Funding:
100% Federal

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POINTS OF INTEREST:

Problem Addressed / Objective of Research / Methodology Used / Implementation Potential

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After this initial performance evaluation, long-term monitoring of the control and test sections will be conducted for determining the ultimate benefits of increased asphalt pavement density.

METHODOLOGY

An asphalt overlay rehabilitation project on US 190 in Livingston Parish has been selected for this study. The existing asphalt pavement will be overlaid with a 2-in. binder course (BC) followed by a 2-in. wearing course (WC).

Asphalt mixtures for the control section BC and WC will be a Superpave 19.0 mm nominal maximum aggregate size (NMAS) and a Superpave 12.5 mm NMAS, respectively, compacted to the existing density requirement (minimum 92 percent G_{mm}). BC and WC mixtures for the test section are proposed to have 1.5 percent increased density (i.e., minimum 93.5 percent G_{mm}).

Options to increase density include the use of warm-mix technologies/processes, temperature control, compaction aids, and increased asphalt content. A suite of tests on laboratory mixtures and field-cored samples will be conducted, including density measurement and performance tests (Hamburg loaded wheel tracking, semi-circular bend, and indirect tensile dynamic modulus).

The research team will analyze the test data to determine the effect of increased density on volumetric properties and laboratory performance, and develop a plan for extended monitoring of the in-service experimental pavement sections.

IMPLEMENTATION POTENTIAL

It is anticipated that results from this study will provide guidance to the Louisiana Department of Transportation and Development for its review and potential update of current field density acceptance criteria for asphalt pavements. These results may also be used by the Federal Highway Administration to provide national guidance for enhancing durability of asphalt pavements through an increase of in-place pavement density.

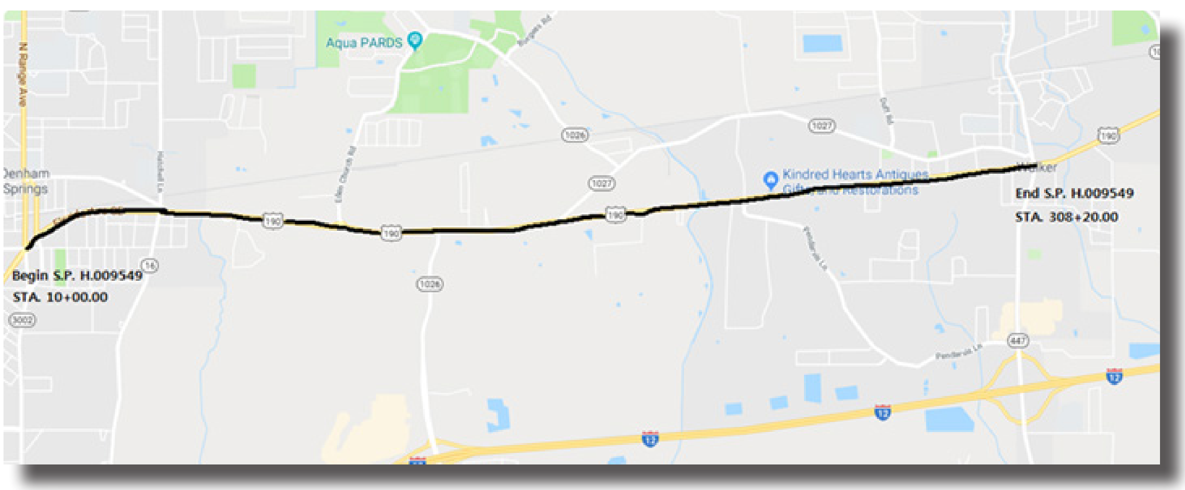

Figure 2
Location of project