RESEARCH
PROJECT CAPSULE [18-5B]
July 2018
TECHNOLOGY TRANSFER PROGRAM

Evaluation of Asphalt Rubber and Reclaimed Tire Rubber in Chip Seal Applications

JUST THE FACTS:

Start Date:
May 14, 2018

Duration:
24 months

End Date:
May 13, 2020

Funding:
SPR: TT-Fed/TT-Reg

Principal Investigator:
Mostafa Elseifi, Ph.D., P.E.
Professor, Department of Civil and Environmental Engineering
Louisiana State University

Administrative Contact:
Tyson Rupnow, Ph.D., P.E.
Associate Director, Research
225-767-9124

Technical Contact:
Samuel Cooper, III, Ph.D., P.E.
Materials Research Administrator
225-767-9164

Louisiana Transportation Research Center
4101 Gourrier Ave
Baton Rouge, LA 70808

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

In recent years, pavement maintenance and rehabilitation activities have increased as compared to design and construction of new pavements. The Louisiana Department of Transportation and Development (DOTD) pavement preservation program performs timely maintenance activities in order to arrest initial deterioration, reduce deterioration rate, and defer costly rehabilitation activities. Historically, the most common preventive maintenance activities (thin overlays and resurfacing) are applied to pavements exhibiting age-related distresses. If structural capacity of the existing pavement is adequate to support future traffic loads, surface treatments (e.g., chip seals) are used due to low initial cost and convenient construction process.

Figure 1
Tack coat truck spraying emulsion

Figure 2
Truck spreading aggregate on top of emulsion

Chip seals, specified as Asphalt Surface Treatment (AST) in Louisiana, are carried out by spraying asphalt emulsion or hot bitumen on an existing roadway surface, followed by the application of a crushed aggregate layer. Chip seals are typically favored on low-traffic roadways for providing reduced surface permeability/raveling/oxidation and improved skid resistance. Bleeding and early loss of aggregate are common distresses while roughness and increased traffic noise are functional limitations of this treatment method.

Asphalt rubber chip seals have been used in other states (e.g., Arizona and California) with advantages of improved durability, crack resistance, and reduced traffic noise. However, these benefits have not been validated for operating conditions in Louisiana's hot/wet climate.

OBJECTIVE

The objective of this study is to improve the durability and to extend the life of AST in Louisiana using rubber-modified asphalt emulsion and using reclaimed rubber in the aggregate layer. Construction methodology, short-term field performance, and cost-benefit analysis will be evaluated.

METHODOLOGY

The research team will start the project by collecting and reviewing literature and studies regarding chip seals with particular attention to rubberized chip seals and the use of reclaimed rubber in the application.

Job mix formulas for rubberized chip seals will be developed based on specifications, design procedures, field experiences, and results from past studies. Aggregate used will be sampled and obtained from DOTD districts to ensure applicability of results to current Louisiana practices. When using reclaimed crumb rubber, a portion of aggregate will be substituted with recycled rubber while keeping the gradation similar to conventional chip seals.

Laboratory performance of designed rubberized chip seals will be compared to that of conventional chip seals. The most-promising job mix formulas will be selected for field trials. During construction, the research team will sample and test materials in the laboratory and will conduct field tests to assess construction quality.

The research team will assess short-term field performance during the first year of exposure to traffic. Performance data will be collected on a four-month basis to characterize the evolution of distress (if any). Based on level of observed distress, the suitability of the designs will be determined and recommended actions to address any deficiencies will be provided. Deflection measurements will be conducted before, soon after, and periodically after construction to monitor structural changes in pavement condition.

An economic evaluation will be performed based on results of field trials. The performance service life of each field trial will be predicted using models developed in earlier research projects. Total cost of a rubberized chip seal will be divided by its performance service life and section length. By comparing the annualized cost of a rubberized chip seal to the annualized cost of a conventional chip seal, the cost-effectiveness of the AST may be determined.

IMPLEMENTATION POTENTIAL

Implementation of this research may enhance the performance of chip seals in pavement preservation activities. An implementation strategy for introducing rubberized chip seals into DOTD pavement preservation practice will be developed.