A new generation of multi-functional asphalt mixtures with superhydrophobic and luminescent properties

Project Number:

22ALSU27

Start Date:

04/01/2022

Principal Inverstigator(s):

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Louisiana State University

Lead Institution:

Louisiana State University

Funding Source(s):

Tran-SET

Louisiana State University

Total Project Cost:

$ 120,484

Developing asphalt mixtures with superhydrophobic and luminescent properties

As the Nation struggles to address poor infrastructure conditions, costing motorists more than $67 billion a year, infrastructure deterioration is accelerated by sea level rise, heavy downpours, inundation, extreme heat, and damages that are projected to increase with continued climate change. While modern technologies such as porous and pervious pavements may help delay road submersion by allowing rainwater to infiltrate rapidly through the pavement surface, the durability of these mixes is not adequate and the mix voids are quickly filled with dust and debris rendering the effectiveness of these mixes questionable especially in the long-term. The lack of visibility and light during nighttime is also a major challenge for sleep-deprived drivers leading to an increase in accident rates at night. Therefore, there is a need to improve visibility at night to enhance safety and comfort to the users under all conditions. The proposed research study will introduce a novel plagiarism, which has the potential to introduce a new generation of multi-functional asphalt mixtures with the ability to repel water driving it to the drainage ditches, reducing the impacts of heavy rain events and snow accumulation on the mobility of the public, and enhancing visibility during nighttime. Through advanced modification, characterization, and laboratory testing, this study aims to formulate a new generation of multi-functional asphalt concrete (AC) materials that would provide reduced water/snow accumulation by using super-hydrophobic nanomaterials and other modification. The prepared asphalt mixtures will be beneficial for both hot and wet climate in the South and cold and snowy climate in the North. Furthermore, the new generation of AC will be formulated to provide luminescence during nighttime. In addition, it will be environmentally friendly and cost-effective by testing and evaluating different blends of polymers, recycled products, and other additives such as Evotherm as a warm-mix agent.

Problem Statement

As the Nation struggles to address poor infrastructure conditions, costing motorists more than $67 billion a year, infrastructure deterioration is accelerated by sea level rise, heavy downpours, inundation, extreme heat, and damages that are projected to increase with continued climate change. While modern technologies such as porous and pervious pavements may help delay road submersion by allowing rainwater to infiltrate rapidly through the pavement surface, the durability of these mixes is not adequate and the mix voids are quickly filled with dust and debris rendering the effectiveness of these mixes questionable especially in the long-term. The lack of visibility and light during nighttime is also a major challenge for sleep-deprived drivers leading to an increase in accident rates at night. Therefore, there is a need to improve visibility at night to enhance safety and comfort to the users under all conditions.

Objectives

The proposed research study will introduce a novel plagiarism, which has the potential to introduce a new generation of multi-functional asphalt mixtures with the ability to repel water forcing it to the drainage ditches, reducing the impacts of heavy rain events and snow accumulation on the mobility of the public, and enhancing visibility during nighttime. Through advanced modification, characterization, and laboratory testing, this study aims to formulate a new generation of multi-functional asphalt concrete materials that would provide reduced water/snow surface accumulation by using super-hydrophobic nanomaterials and other modification.

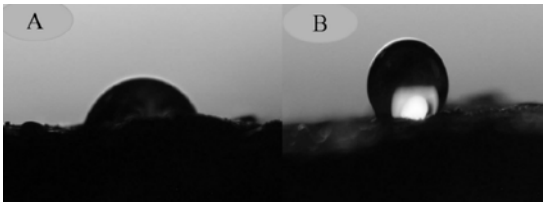

Figure 1. Effects of hydrophobic nanomaterials on water droplets on AC surface

Intended Implementation of Research

Workforce Development, Education, and Outreach: This research project will provide partial funding to a graduate student at Louisiana State University. The student will assist in the literature review and in the proposed activities in the research phase. Results of this work will also be disseminated at national conferences. In addition, this project will present the findings of this study at related events. The research findings will be presented to the transportation industry and to the research community in the form of a webinar. Furthermore, the knowledge and findings from this project will be showcased at related events and venues.

Anticipated Impacts/Benefits of Implementation

The prepared asphalt mixtures will be beneficial for both hot and wet climate in the South and cold and snowy climate in the North. Furthermore, the new generation of AC will be formulated to provide luminescence during nighttime. In addition, it will be environmentally friendly and cost-effective by testing and evaluating different blends of polymers, recycled products, and other additives such as Evotherm as a warm-mix agent.

Web links

- Tran-SET's website https://transet.lsu.edu/research-in-progress/

Tran-SET

Tran-SET is Region 6's University Transportation Center. It is a collaborative partnership between 11 institutions (see below) across 5 states (AR, LA, NM, OK, and TX). Tran-SET is led by Louisiana State University. It was established in late November 2016 "to address the accelerated deterioration of transportation infrastructure through the development, evaluation, and implementation of cutting-edge technologies, novel materials, and innovative construction management processes".

Learn More

For more information about Tran-SET, please visit our website, LinkedIn, Twitter, Facebook, and YouTube pages. Also, please feel free to contact Dr. Momen Mousa (Tran-SET Program Manager) directly at transet@lsu.edu.