Tran-SET
Transportation Consortium of South-Central States

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Use of Bagasse Ash as a Concrete Additive for Road Pavement Applications

Key Points

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18CLSU03

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Lead Institution:
Louisiana State University

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$60,000

Funding Source(s):
Tran-SET
Louisiana State University
Louisiana Transportation Research Center

Total Project Cost:
$120,002

Brief Project Description

This study will investigate potential uses of sugarcane bagasse ash to reduce the cost and carbon footprint of concrete materials for road pavement construction and maintenance.

Problem Statement

Bagasse is the fibrous by-product of sugarcane stalks after they are crushed to extract their juice. Bagasse is used as a primary fuel source for sugar mills by burning the fibrous material into bagasse ash. However, the bagasse produced annually in Louisiana is significantly more than that used for electricity production. Thus, the disposal of fibrous bagasse and bagasse ash poses a significant burden on the sugarcane industry. At the same time, the consumption of cement and concrete in the US and particularly in Louisiana is steadily increasing. This consumption increase produces a significant need of new affordable and sustainable materials to be used as supplemental cementitious materials (SCMs) in concrete mixes. Bagasse ash could provide one alternative to reduce cement consumption, similar to the current use of fly ash.

Existing literature and preliminary research results indicate that ground bagasse ash with low loss of ignition (LOI) can be a suitable substitute to fly ash as a partial replacement of cement in concrete mixes. However, bagasse ash is currently not used in road construction or repair in the US. This study will develop the much-needed engineering knowledge to promote the use of bagasse ash in concrete mixes for concrete road pavement construction and repair.

Objectives

The objectives of this study are to:

- Develop an optimized production process to obtain bagasse ash with high pozzolanic activity;
- Determine the effects of bagasse ash on the mechanical and physical properties of concrete;
- Identify appropriate bagasse ash amounts to obtain concrete with properties that are compatible with its use for road pavement construction and repair;

- Develop a small-scale benchmark application for road pavement repair and document the performance of concrete with bagasse ash.

Intended Implementation of Research

Workforce Development

This study will provide funding to one Ph.D. student and one post-doctoral researcher. Educational material on the usage of bagasse ash in ordinary concrete will be developed and made available to the concrete pavement industry. This material will be added to transportation and materials courses, and will be shared with other universities in Region 6. Summarized YouTube videos and presentation slides will be provided for DOTs and Transportation industries. Findings will be also be disseminated at national conferences such as TRB and ASCE. Finally, seminars and webinars explaining the fabrication process and the usage of bagasse ash as a partial substitute of cement in ordinary concrete will be offered to DOTs, universities, and consultants.

Education

The research team will collaborate with universities within Tran-SET to recruit two students from underrepresented groups during the summer to participate in laboratory activities. The developed educational materials prepared in this study will be shared with our partner community colleges so that they can update their relevant classes.

Outreach

The research team will strongly participate in activities geared toward the recruitment of underrepresented groups in engineering. Examples of these activities include the camps for high school students REHAMS (Recruitment into Engineering of High Ability Multicultural Students) and XCITE (eXploration Camp to Inspire Tomorrow's Engineers-girls camp) summer camps. Members of the research team have a record of participating annually in these activities.

In addition to these camps, the research group will conduct other activities geared towards K-12 students and teachers. These activities include the hosting of middle and high school students to develop science fair projects, laboratory tours for K-12 teachers and students, and presentations on STEM topics (including safety).

Anticipated Impacts/Benefits of Implementation

This study has the potential to: (1) improve the sustainability of Louisiana's construction industry by reducing its carbon footprint and material costs, (2) resolve issues related to the environmental disposal of an abundant agricultural by-product, and (3) significantly increase the value of an underutilized Louisiana resource.

Weblinks:

http://transet.lsu.edu/research/research-in-progress/

https://rip.trb.org/View/1505361