

Evaluation of Bagasse Ash as Cement and Sand Replacement for the Production of Engineered Cementitious Composites (ECC)

Developing novel Engineered Cementitious Composites (ECC) using bagasse ash as sand and cement replacement

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19CASU03

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Louisiana State University

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\$60,000

Funding Source(s):
Tran-SET
Louisiana State University
ESPOL

Total Project Cost:
\$180,169

The objective of this study is to develop novel Engineered Cementitious Composites (ECC) implementing bagasse ash as sand and cement replacement to produce a new generation of ECC that are cost-effective and practical for repair and new construction of transportation infrastructure in the region. In order to achieve this objective, ECC mixtures will be designed with different types (i.e., different levels of processing) and proportions of bagasse. Bagasse ECCs fresh and hardened properties will be evaluated to identify key parameters ensuring a balance of fresh and hardened properties as well as strain-hardening performance.

Problem Statement

The exceptional properties of ECC makes it an excellent material for repair and new construction of transportation infrastructure. However, to date, ECC implementation has been hindered by its cost. To this end, innovative ways of reducing ECC materials cost is of great importance for the large-scale implementation of these composites. On the other hand, sugarcane bagasse ash (SCBA) is an agricultural by-product with no economic value in Louisiana. While SCBA is currently considered a waste, due to its physical and chemical properties, SCBA possesses an excellent potential to be implemented in ECC as sand and/or cement replacement depending on its level of refinement. As such, the possible implementation of SCBA in ECC formulation, open the possibility to reduce the cost and increase the practicality of ECC materials by partially or completely replacing the expensive and not widely available microsilica sand, as well as to partially replacing cement.

Objectives

The objective of this study is to develop novel Engineered Cementitious Composite (ECC) materials implementing sugarcane bagasse ash (SCBA) to produce cost-effective and practical ECC materials for repair and new construction of transportation infrastructure in the region.

Intended Implementation of Research

Education and Workforce Development: This research project will provide funding to one PhD student at Louisiana State University. This will help recruit and train future leaders in the Transportation Sector. The research team will also prepare educational material on ECCs to be incorporated in courses at LSU and share it with other universities. The educational material will also be summarized and disseminated to government entities and the industry. Results of this work will be also disseminated at national conferences such as TRB and ASCE.

Outreach: This project will offer two internships for undergraduate students to introduce them to research in Transportation and Advanced Materials. Moreover, the developed educational material prepared in this project will be shared with our partner community colleges to be used to recruit students to Transportation. In addition, educational information explaining findings on of the project will be offered to research institutes and companies interested in emerging innovative technologies for the Transportation Sector in collaboration with the highway agencies in Region 6.

Anticipated Impacts/Benefits of Implementation

The development of ECC materials implementing sugar cane bagasse ash will deliver costeffective and environmentally friendly high-performance materials for repair and new construction of transportation infrastructure in the region. SCBA-ECC implementation has the potential for significant improvements in durability, resiliency, and structural safety of the infrastructure in the region by providing with a more durable and reliable material alternative directly serving the following objectives of the Center:

Objective 1: Extend the life of the existing transportation infrastructure through the



application of emerging technologies in materials and construction.

Objective 2: Promote sustainability and resiliency of the transportation infrastructure renewal and upgrade.

Objective 3: Introduce and implement cost-effective solutions to the transportation infrastructure backlog of projects.

Objective 4: Develop cost-effective solutions for the construction and maintenance of the transportation infrastructure in metropolitan and rural areas.

Objective 5: Enhance the resiliency of the transportation infrastructure in the event of extreme weather events.

Web Links

- [TranSET's website](https://transet.lsu.edu/research-in-progress/)
- [TRB's Research in Progress \(RIP\) database](https://rip.trb.org/View/1642175)

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 [our website](#), LinkedIn, Twitter, Facebook, and YouTube pages. Also, please feel free to contact Mr. Christopher Melson (Tran-SET Program Manager) directly at transet@lsu.edu.

