



# Transportation Consortium of South Central States

## Key Points

**Project Number:**  
17CASU02

**Start Date:**  
05/08/2017

**End Date:**  
11/08/2018

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**Lead Institution:**  
Arkansas State University

**Funds Requested to UTC:**  
\$55,514

**Funding Source(s):**  
Tran-SET  
Arkansas State University

**Total Project Cost:**  
\$111,274

## Use of Rice Hull Ash (RHA) as a Sustainable Source of Construction Material

### Brief Project Description

Rice hull ash (RHA) is a cementitious material, which may contain about 75% silica in an amorphous form and has an extremely high surface area. RHA is also economically beneficial, but its performance as a construction material has been investigated very little. High silica content makes it a probable pozzolanic material for concrete by following the Roman Concrete technology. The main objective of the proposed study is to assess the usage of rice hull ash (RHA) as a construction material.

### Problem Statement

Rice hull (RH) is one of the main agricultural residues obtained from the outer covering of rice grains during the milling process. RH constitutes 20% of about 700 million tons of paddy produced in the world. When burned, 20% of RH is transformed into about 27 million tons of rice hull ash (RHA) per year. Riceland Foods, a family farmer owned business in Arkansas, is the largest rice miller in the US with an annual production of about 100 million bushels. A significant portion of RHA generated by Riceland Foods is being treated as waste. RHA is a cementitious material, and Riceland's RHA contains about 75% silica in an amorphous form and has an extremely high surface area. RHA is also economically beneficial, but its performance as a construction material has been investigated very little. High silica content makes it probable pozzolanic material for concrete by following the Roman Concrete technology. AASHTO M321 also specifies RHA as a high reactivity pozzolan due to its high silica content. RHA can potentially be used as an alternative modifier to enhance performance properties of soft asphalt binders to withstand heavy traffic load and extreme temperature events. The main objective of the proposed study is to assess the feasibility of the use RHA in producing Roman Concrete and modifying asphalt binders through laboratory investigation of its chemical, physical and mechanical properties. The outcome of the proposed study is expected to be important in setting the direction of the sustainable use RHA in producing concrete and be significant cost saving for AHTD. This project will also help local farmers to be economically sustainable as they are striving to find new markets for RHA.

### Objective



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The main objective of the proposed study is to evaluate the usage of RHA as a construction material for concrete and asphalt. Specific objectives are given as: (i) Evaluate chemical, physical and strength properties of RHA modified concrete and asphalt, and (ii) Evaluate the effect of curing time and environmental conditions on strength properties and durability of RHA-modified concrete.

## **Intended Implementation of Research**

### **Technology Transfer**

The findings from this research study will be disseminated via workshop/webinars, AHTD Transportation Research Council Meetings, Tran-SET Research Day, technical papers, quarterly and final reports, and also possibly via presentations at FHWA ETG meeting.

### **Education, Workforce Development, and Outreach**

Workshops/Webinars for DOT and Pavement Professionals: Two workshops will be conducted throughout the project duration for DOT officials, concrete and asphalt pavement professionals. The first workshop will be held at the middle of the first year, which will focus on the existing practices and planned methodology of this study. After completing the laboratory tests, the second workshop will be arranged focusing the outcomes of tests.

The research activities will be presented to undergrad students and their volunteer participation will be encouraged. The PI will also blend this research into undergraduate and graduate curricula. This initiative is aligned with the recent nation-wide policy to disseminate research in classrooms. Students enrolled in Civil Engineering Materials and Advanced Civil Engineering will be introduced with the use of waste as a construction material. The maximum enrollments in the undergraduate and graduate level courses are 20 and 10, respectively. Of which, about 20% students are expected to be from the underrepresented groups. Such initiatives will also increase the participation of underrepresented groups.

Training High School Students: The PI will train a local high school student as part of an existing internship program with Jonesboro High School. Also, a High School Senior Preview session will be made throughout the project period. This preview session will be helpful educating school going future citizens about the recent innovations in pavement materials, infrastructure and technologies.

## **Anticipated Impacts/Benefits of Implementation**

The benefits of the proposed study are: (a) reuse of waste materials in transportation construction projects, (b) enhance training opportunities for students in the Mississippi Delta region, (c) help local farmers and asphalt industries to be economically sustainable, and (d) build a future workforce.

### **Weblinks:**

- [Tran-SET's website \(http://transet.lsu.edu/completed-research/\)](http://transet.lsu.edu/completed-research/)
- [TRB's Research in Progress \(RIP\) database \(https://rip.trb.org/view/1466418\)](https://rip.trb.org/view/1466418)