Using of Rice Husk Ash (RHA) as Stabilizing Agent for Poor Subgrade Soils and Embankments

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21GTASU01

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Lead Institution:

Arkansas State University

Funding Source(s):

Tran-SET

Arkansas State University

Total Project Cost:

$80,691

Assesing the use of RHA as a stabilizing agent for poor subgrade soils

Arkansas produces the largest amount of rice in the United States. About 20% of the paddy is rice hull (RH). When burnt, 20% of RH is transformed into rice husk ash (RHA). Riceland Foods Inc., a family farmer-owned business in Arkansas, is the largest rice miller in the U.S. with an annual production of about 100 million bushels. A significant portion of RHA generated by Riceland 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 in stabilizing poor subgrade soils and embankments, but its performance as a construction material has been investigated very little. RHA can potentially be used as a stabilizing agent for poor subgrade and embankment soils, which are very common in Arkansas, Oklahoma, and other states.

The main objective of the proposed collaborative study between Arkansas State University (A-State) and Oklahoma State University (OSU) is to assess the feasibility of the use of RHA in stabilizing poor subgrade and embankment soils through laboratory investigation. Based on the laboratory testing and results of this project, the investigators of this project will have a good understanding of the important features and efficacy of RHA as a stabilizing agent for poor soils. In particular, if there are short-term and long-term reactions, whether there are new minerals form as a result of the reactions, and whether the stabilization/modification processes are temporary or permanent will be understood.

Problem Statement

Arkansas is the largest rice-producing state in the US with an annual production of about 200 million bushels. A significant portion of RHA generated by local milling companies such as Riceland Foods is being treated as waste. Besides Arkansas, Louisiana and Texas are two other major rice-producing states in the US. RHA is a cementitious material, and it 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. RHA can potentially be used as a stabilizing agent for poor subgrade and embankment soils, which are very common in Arkansas, Oklahoma, and other states. Even though the prospect of using RHA in stabilizing soft and expansive subgrade soils is high, no performance data of such initiatives is available in the public domain. The proposed study aims at generating such much-needed performance data through extensive laboratory tests.

Objectives

The main objective of the proposed study is to evaluate the usage of RHA as a stabilizing agent for poor subgrade (clay) soils through laboratory testing. Specifics objectives of the current study are given below:

- Collect Review the current stabilization practices in the states in FHWA Region 6;
- Characterize the physical and chemical properties of RHA;
- Evaluate physical, chemical, and mechanical properties of RHA modified soils;
- Determine optimum dosage of RHA for treating subgrade/embankment soils; and
- Perform life cycle cost analysis of RHA-modified subgrade soils

Intended Implementation of Research

Workforce Development, Education, and Outreach: Training will be provided to undergraduate and graduate students. These students are expected to work on the project and enter the transportation workforce upon their graduation. High school students will be given internship/shadowing opportunities in the research laboratories. These students are likely to choose STEM education in college. Also, the research techniques and outcomes will be shared in courses such as Soil Mechanics and Transportation Engineering taught by senior personnel of this project. Both A-State and OSU teams will perform this task.

Anticipated Impacts/Benefits of Implementation

The findings of this study will help government agencies (state, city, and county) and contractors in the region to use knowledge learned on the use of stabilizing agents in improving poor subgrade soils and embankments. It is expected to be a significant cost saving for these agencies by stabilizing poor soils with commercial and agricultural by-products. Main deliverables from this research project are:

(1) An implementation report containing technology transfer (T2) activities involving the major stakeholders and implementation ratings established by the project review panel.

(2) A final report and quarterly reports containing the technical findings and an overall assessment of the research. These reports will provide detailed information regarding embankment and subgrade stabilization procedures and test results.

(3) Presentation(s) at symposia such as the ARDOT Annual Technical Research Committee (TRC) Conference, Oklahoma Transportation Research Day (OTRD), and at the Tran-SET Annual Conference to showcase the findings of the study.

(4) A Podcast (radio) and a webinar broadcasting major findings of this research.

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.