

Viability Assessment and Cost Benefit Analysis of Using Reclaimed Asphalt Pavement (RAP) in Unbound Pavement Layers in Louisiana

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Lead Institution:

Louisiana State University

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Tran-SET

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Total Project Cost:

\$ 46,896

Evaluating the viability of using RAP in pavements in Louisiana

In Region 6, Portland cement is widely used in pavement construction to stabilize soil and base layers. When Portland cement is blended and compacted with soil and water, a hydration process and chemical alteration of the soil takes place. The hydration process forms a paste, which acts as a glue to hold the soil particles together. Once this mixture hardens, it forms a rigid material, which is durable and resistant to rutting. Unfortunately, this mixture also causes the material to contract, producing shrinkage and reflective cracks. Consequently, in Louisiana, many roadways previously constructed with soil cement have experienced severe shrinkage and reflective cracks, which caused premature roadway failures and is aesthetically unappealing to the traveling public. Therefore, it would be beneficial to South-Central States, including Louisiana, to identify alternative modifiers to substitute for Portland cement in soil and base layers in the future. One of these potential promising alternatives is using Reclaimed Asphalt Pavement (RAP) to strengthen the unbound pavement layers (base/subbase course and subgrade). As such, this project will determine whether RAP in Louisiana could be utilized in unbound layers, including base, subbase, and subgrade and will also determine the optimum RAP content while conforming to current Louisiana Department of Transportation and Development (LaDOTD) specifications.

roadway failures and is aesthetically unappealing to the traveling public. Therefore, it would be beneficial to South-Central States, including Louisiana, to identify alternative modifiers to substitute for Portland cement in soil and base layers in the future. One of these potential promising alternatives is using Reclaimed Asphalt Pavement (RAP) to strengthen the unbound pavement layers (base/subbase course and subgrade). It is well recognized that including RAP in unbound pavement layers increases the material strength and hence, improves the resistance of the pavement to fatigue and rutting. Other reported benefits include sustainability in the highway construction industry through reducing the scrap RAP in landfills. While many state agencies allow and encourage utilizing RAP in unbound layers, there are still several unanswered questions to be addressed regarding this technique. There is a considerable debate over the optimum content of RAP to be included in the unbound layers. States like New Jersey and Colorado specified up to 100% RAP to be used as a base material; yet this percentage was then modified to 50% in both states. In states such as Illinois and South Dakota, RAP is not allowed as a base material. Limited research was directed towards this topic in South-Central States as they primarily use cement for soil treatment. Another major challenge is the cost-effectiveness of this technique when compared to using soil cement in unbound layers. Therefore, it is crucial to conduct a research that would assist Louisiana Department of Transportation and Development (LaDOTD) decide whether RAP could be utilized in unbound layers and specify the optimum RAP content while conforming to current LaDOTD specifications. The research should also assess the cost-effectiveness of this technique when compared to the commonly used soil cement in Louisiana.

Problem Statement

In Region 6, Portland cement is widely used in pavement construction to stabilize soil and base layers. When Portland cement is blended and compacted with soil and water, a hydration process and chemical alteration of the soil takes place. The hydration process forms a paste, which acts as a glue to hold the soil particles together. Once this mixture hardens, it forms a rigid material, which is durable and resistant to rutting. Unfortunately, this mixture also causes the material to contract, producing shrinkage and reflective cracks. Consequently, in Louisiana, many roadways previously constructed with soil cement have experienced severe shrinkage and reflective cracks, which caused premature

Objectives

The objective of this study is to determine whether RAP in Louisiana could be utilized in unbound layers, including base, subbase, and subgrade and to determine the optimum RAP content while conforming to current LaDOTD specifications. This assessment will consider the impact of storage time and temperature on the



performance of RAP-aggregate blends for soil and base layers. Among the objectives of this project is to evaluate the effect of including RAP in unbound layers on the expected pavement performance, in terms of rutting and fatigue cracking. Based on the results of this evaluation, the project will further assess the cost effectiveness of this technique considering the associated costs and benefits when compared to the commonly used soil cement in Louisiana.

Intended Implementation of Research

Workforce Development, Education, and Outreach: This research project will provide funding to one master student at Louisiana State University. This will help recruit and train future leaders in the Transportation Sector. The research team will also prepare educational materials 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. This project will offer one summer internship to high school students within the High School Student Research (HSSR) Intern Program organized by Dr. Adam Melvin at LSU.

Anticipated Impacts/Benefits of Implementation

Implementing the results of this research is expected to increase the pavement resistance to fatigue and rutting, which are common problems in South-Central United States.

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.

