Evaluation of Remediation Strategies for Shrink-Swell Clays in Western Alabama

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Outline

- Introduction
- Insitu observations, Soil Behavior, Shear Strength, and Tree interaction
- Remediation Strategies
- Instrumentation Program
- Performance
- Evaluation
- Summary and Conclusions

Introduction

Introduction - Background

- Expansive clays shrink and swell with fluctuations in moisture
- Causes billions of dollars of damage to pavements and lightly loaded structures in the United States, annually
- Many roads in Alabama are constructed over expansive clay
- Techniques are needed to remediate this problem with minimal road closures

Alabama Highway 5

- Farm-to-market road
- AL 5 is a popular route for trucks between Birmingham and Mobile
- In many places, road closures are not feasible due to lack of detour routes
- Initial observations showed extreme pavement distress resulting in a very rough and unsafe road
- Ruts
- Cracks
- Standing water
Impacts and Remediation of Expansive Clays:
Lessons Learned from AL 5
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Summary and Conclusions

- AL 5 in Southern Perry County Alabama exhibits extreme pavement distress.
- The causes of this distress are likely a combination of:
  - The presence of Montmorillonite (high PI) clays beneath the roadway that have potential swelling pressures of 1500psf
  - Low long term drained shear strength of the Montmorillonite clays
  - Frequent overloaded truck traffic
  - High uptake trees within the right of way
- Five remediation techniques were implemented in test sections at AL 5
  - Sand Blanket
  - Vertical Barriers
  - Lime Columns
  - Paved Shoulders
  - Edge Drains
Impacts and Remediation of Expansive Clays: Lessons Learned from AL 5

Summary and Conclusions

- Instrumentation was installed during the summer of 2016 to measure:
  - Pavement strain beneath the resurfacing
  - Pore pressure in the subgrade
  - Soil Suction in the subgrade
  - Water content in the subgrade
  - Weather
- The final resurfacing was completed in the summer of 2016 after all remediation implemented.

Summary and Conclusions

- Instruments were monitored up through May of 2020.
- Measurement shows accumulating compressive strain in the pavement.
- Moisture contents are somewhat stable below 7.5 ft.
- IRI tests show some decline, but the ride overall is well below damage threshold, with some local defects.

Summary and Conclusions

- Evidence proves the presence of clays that possess a high potential to swell.
- Atterberg limits of the clays suggest their swelling potential.
- Shrinking and swelling cycles not only cause roadway settlement/heave, but also contributes to reduced soil strength in embankments.
- Trees close to the roadway are contributing to pavement damage.
- Visual and IRI tests show little distress since resurfacing.

Summary and Conclusions

- When considering new construction or resurfacing, soil sampling along with Atterberg limits should be routinely used to identify the presence of expansive clay minerals.
- When the minerals are identified, the following actions should be considered:
  - Observe the presence and types of trees and their proximity to the roadway, if they are broad leaf and within the right or way, they should be removed.
  - The safety widening should be increased to a minimum of 6 feet.

Implementation

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Questions?
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