



Project Summary

Texas Department of Transportation

0-5797: Design, Constructability Review and Performance of Dual Base Stabilizer Applications

Background

Base stabilization with asphalt emulsion through full-depth reclamation has been used in a few TxDOT districts. On the other hand, using calcium-based additives to stabilize base courses in road construction or rehabilitation has been a common practice in most TxDOT districts. It is expected that the blend of calcium-based additives with asphalt emulsion (dual stabilization) will produce a base which has an optimum combination of strength, stiffness, moisture resistance, and flexibility with desirable early strength and modulus gains. In this case, the calcium-based additives may reduce the plasticity of the base fines making it a more friable material that blends well with emulsions. These benefits need to be evaluated through a comprehensive investigation so that an appropriate mix design and specification can be developed.

What the Researchers Did

The main objective of this research project was to develop a laboratory test protocol to help in mix design for dual stabilization of base materials and guidelines for the construction of bases with emulsion treatment. To achieve this objective, a number of tasks were completed. These tasks include:

- conducting an in-depth investigation on the effects of emulsion content and mixing water content on the performance of the dual-stabilized bases,
- performing a systematic parametric study to determine the factors that affect strength and modulus of emulsion-treated mixtures,
- determining the amount and type of calcium-based additives to be used in a given material, and evaluating the effects of the addition of calcium-based additives on the engineering properties of dual-stabilized bases,
- selecting several sites under construction to acquire materials to perform mix design and to evaluate the performance of emulsion stabilized projects in situ under realistic conditions,
- developing guidelines and procedures for laboratory testing to obtain the optimum mix design and validating them, and
- conducting case studies on four construction projects to provide recommendations and guidelines for construction based on the results and observations from these studies.

What They Found

The findings and recommendations from this research project are as follows:

- The amount of emulsion should be limited to ensure the constructability of the mix. A worksheet was developed to ensure that the maximum emulsion permitted is compatible with the initial amount of water added.

Research Performed by:

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- Indirect tensile strength (IDTS) is more sensitive to the amount of emulsion. As such, the main strength criteria for mix design should be based on the IDTS as opposed to the compressive strength.
- The strain at failure of a specimen prepared with an emulsion-treated mixture increases significantly when compared to a mixture without emulsion, which could reduce pavement cracking.
- Emulsion-treated materials have low dielectric constants and high retained strength and modulus after moisture conditioning, provided that the average initial curing temperature is not lower than 70° F.
- Initially mixing (or adding) water of about 60% of the optimum moisture content is sufficient for adequate compaction for most materials if the reclaimed asphalt pavement content in the mixture is less than 50%.
- A small change in gradation of a material has a minimal effect on the strength and modulus of the material but impacts its moisture susceptibility.
- Mixing method has a significant effect on the strength of materials, especially in the case of materials with higher fine contents. The high shear mixer may produce more uniform mixtures.
- Compaction method does affect the strength and modulus of emulsion-treated bases. The mixes with the gyratory compactor exhibit higher strength and modulus. However, the laboratory results should be further compared with those observed in the field so that the method which is more representative of the field conditions can be selected.
- The temperature at which the material is mixed does not impact the final strength and modulus achieved as long as it is not lower than about 70° F.
- The temperature at which an emulsion mixture is initially cured (2 to 3 days) has a significant effect on the final strength and modulus achieved.
- The nuclear density gauge may not be a good tool for quality control and quality assurance for emulsion-treated bases.
- For the most part, the current TxDOT Special Specification for emulsion-treated bases is reasonable, if enforced during construction.

What This Means

Full-depth reclamation with asphalt emulsion treatment is a cost-effective method for rehabilitation of distressed roads, provided that the road mixing and compaction are properly performed under appropriate weather conditions.

For More Information:

0-5797-1 Design, Constructability Review and Performance of Dual Base Stabilizer Applications

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