



Project Summary

Texas Department of Transportation

0-5562: Guidelines for Using Local Materials for Roadway Base and Subbase

Background

Flexible base materials that meet TxDOT specifications are becoming more difficult to get in many TxDOT districts. High quality materials have to be hauled long distances, significantly increasing the costs associated with construction or rehabilitation of roadways. Out-of-specification or low quality local materials are normally available. Under the current TxDOT specification (Item 247), a material can be considered out-of-specification for a variety of reasons such as inadequate gradation, inadequate plasticity, and inadequate strength. In many cases, the local materials miss the standard specifications by a small margin. Some of the parameters used to classify a base may be less significant than others. If through appropriate improvement of the materials (chemical treatment and/or gradation adjustment) or structural design (including the addition of a sub-base layer), the use of the local materials can be permitted, significant monetary benefits in terms of construction speed and cost saving could be realized.

What the Researchers Did

The main objective of this research project was to evaluate the out-of-specification / marginally low-quality base materials from local sources and develop guidelines and test protocols for the use of such materials in the construction of low-volume roads. To achieve this objective, the research team completed the major tasks by:

- collecting ten materials from eight local pits in five districts,
- conducting extensive laboratory tests on the collected materials to determine whether the materials can be used as-is, need to be treated with a minimum amount of calcium-based additives, or need a gradation adjustment,
- validating the outcomes from traditional laboratory tests through small-scale simulation under different moisture conditions,
- performing structural and sensitivity analyses on the use of local materials in low-volume roads, and
- providing a tool for cost evaluation on the use of local and haul-in materials.

What They Found

Based on the results from laboratory and field tests as well as structural and sensitivity analyses, the following findings and observations were obtained for the use of local base materials:

- Permanent deformation of the base layer in a pavement with thin surfacing controls the amount of rutting that the pavement experiences.

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- Current pavement design algorithms (e.g.: FPS19 or Texas Triaxial Design) should be used with care for the base courses of lower quality materials. These algorithms tend to provide base thicknesses that may exaggerate the rutting of bases. More advanced analysis is recommended to ensure the stability of low quality bases.
- The use of low quality materials as subbase seems feasible and advantageous. The top 6 in. to 8 in. of the base layer in a low-volume road with thin surfacing seems to contribute the most to rutting. As such, for a base thicker than 12 in., the use of the low quality material as subbase, especially for strong subgrades, is recommended.
- Treated with a small amount of calcium-based additives (1% to 2%), the quality of most low quality materials can be significantly improved. In this study, for all cement-treated base materials (1% cement) and most of the lime-treated base materials (1% lime), both unconfined and confined strengths met the minimum requirements in TxDOT Item 247.
- For most materials, adjustment in gradation did not significantly improve their quality.
- Most of the untreated materials did not achieve adequate modulus. The resilient modulus of treated materials was significantly higher.

What This Means

The use of local materials for roadway bases and subbase is feasible and would result in considerable cost savings, provided that the mix design with appropriate treatment is developed and the structural analysis is carried out.

For More Information:

0-5562-1 Guidelines for Using Local Materials for Roadway Base and Subbase

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