



Project Summary

Texas Department of Transportation

0-6361: Development of a New Mix Design Method and Specification Requirements for Asphalt Treated Base (Item 292)

Background

Asphalt treated bases (ATBs) in Texas are usually designed and constructed as per Tex-126-E, “Molding, Testing, and Evaluating Bituminous Black Base Materials,” and Item 292, “Asphalt Treatment (Plant-Mixed),” of the 2004 Standard Specification book. This specification is a hybrid of base and hot mix asphalt concrete procedures and requirements, which are sometimes incompatible. In addition, this Item uses a specific Texas Gyrotory Compactor (TGC) that is not readily available to all districts. Some districts use test method Tex-204-F, Part III, “Mix Design for Large Stone Mixtures Using the Superpave Gyrotory Compactor.” However, this procedure was originally developed to design Type A and Type B hot mix asphalt at 96% density on 6 in. by 4.5 in. specimens. The objectives of this project were to develop a new mix design procedure and a specification for asphalt treated bases that can use standard equipment such as the Superpave Gyrotory Compactor (SGC) to mold the specimens for mix design.

What the Researchers Did

To achieve the objectives of this project, current TxDOT procedures such as Tex-126-E and Tex-204-F were evaluated and modified to develop a new mix design procedure and a specification. A comprehensive parametric study comparing the results of two feasible test protocols with the existing test procedures was performed. The impact of the number of gyrations, curing temperature, binder grade, and asphalt content variation were evaluated using prepared laboratory specimens. Properties including density, unconfined compressive strength, indirect tensile strength, and modulus using the existing and proposed test procedures were compared. Based on these studies, a new mix design method for determining the optimum asphalt content (OAC) for ATBs was developed. The recommendations were then evaluated at six actual construction projects for verification of the proposed mix design method.

What They Found

Considering the constructability and long-term performance of ATB's, the optimum asphalt content is obtained with full consideration of the variations in density and strength with asphalt content.

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The most practical setup for laboratory tests was achieved by using a generically named Tex-204-H test protocol with the following attributes:

- A Superpave Gyrotory Compactor should be used to prepare 6 in. diameter and 4.5 in. high specimens using 75 gyrations.
- Density should be measured based on the weight and volume of the specimens as usually done for compacted unbound aggregate bases.
- Indirect tensile strength test should be performed at temperature of 75°F after the specimens are cured for 24 hrs at temperature of 75°F. This procedure was more sensitive to asphalt content while reducing the mix design period.

The selection of the optimum moisture content is based on the following process:

- The minimum asphalt content recommended is the asphalt content where the maximum density is achieved.
- The maximum asphalt content recommended is the asphalt content that satisfies a target indirect tensile strength of at least 85 psi and a relative density of 97%.
- The optimum asphalt content is the average of the minimum and maximum asphalt contents.

The asphalt content should be limited to 6% for economic reasons. For mixes that require more than 6% asphalt, either the gradation of the aggregates should be modified or Type A/B hot mix asphalt should be considered.

After observing the construction process and evaluating the performance of placed ATBs at six sites, it seems that the current construction specifications for this type of material are appropriate as long as a reasonable process control is in place and a minimum target density of 97% of the laboratory maximum density is achieved. Similar to flexible bases, a target field density of 100% of the laboratory maximum density is desirable.

What This Means

ATB is a dense-graded hot mix asphalt (HMA) with a wide gradation band that can be used as a base course. One of the main problems with semi-rigid pavement structures is transverse cracking in the stabilized base and the related propagation of cracks to the surface, which diminishes the life of pavements. In these cases, the ATB may be more flexible and resistant to fatigue cracking as compared to cement stabilized bases.

Other factors that may lead to a decision to use the ATB are the following:

- lack of high quality flexible base aggregates
- reduce construction time, therefore decrease delay in construction
- minimize moisture sensitivity as a consequence of moisture ingress

The results of this study can potentially provide a more durable and more constructible ATB layer.

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