Optimizing Laboratory Mixture Design as It Relates to Field Compaction to Improve Asphalt Mixture Durability

Introduction

Most departments of transportation, including Indiana, currently use the Superpave mixture design method to design asphalt mixtures. This method specifies that the optimum asphalt content for a given gradation be selected at 4 percent air voids. During construction, these mixtures are typically compacted to 7–8 percent air voids. If mixtures were designed to be more compactable in the field they could be compacted to the same density as the laboratory mixture design, which would increase pavement durability by decreasing the in-place air voids. The objective of this research was to optimize the asphalt mixture design in order to increase in-place asphalt pavement durability without sacrificing the permanent deformation characteristics of the mixture.

Findings

• It is possible to design asphalt mixtures with 5 percent air voids without lowering the effective binder content; this can be accomplished by varying the aggregate gradation of the mixture.
• Asphalt mixtures designed using lower compaction levels than currently specified by the Superpave method can be designed to have $|E^*|$ and FN values as high as, or higher than, conventionally designed mixtures, without lowering the effective binder content.
• On average, the mixture data appeared to indicate that 53, 52, and 42 were the optimum numbers of gyrations for the three re-designed mixtures developed in the laboratory.
• Asphalt mixtures designed in the laboratory at 5 percent air voids can be compacted to 5 percent air voids in the field. The field test indicates this can be done without additional compaction effort.
• Results of testing re-heated, plant-produced mixtures are somewhat variable, as indicated in the post-trial test results. Some test results seem to indicate the standard mixtures may perform better.
while other results favor the re-designed mixtures. The performance of the test sections will help confirm whether the re-designed mixtures are or are not better performers than the standard mixtures.

**Implementation**

While the findings of this study are encouraging, the amount of testing was limited, making it difficult to recommend the exact manner in which INDOT should proceed. The following recommendations are offered as a starting point:

- For medium to high traffic levels, 50 appears to be the correct number of gyrations to be used in designing asphalt mixtures with optimum binder content chosen at 5 percent air voids.
- For lower volume roads, 30 gyration mixture designs might be more appropriate. Further laboratory and field testing should be conducted to verify this number.
- Low-temperature and moisture susceptibility testing should be completed for both standard and re-designed mixtures to help quantify the enhanced durability of the re-designed mixtures.
- Additional laboratory work should be done so as to include the effects of more traffic levels; mixtures containing RAP, RAS, or both; and additional binder grades and aggregate types.
- The performance of the trial projects placed as part of this study should be monitored for performance.

**Recommended Citation for Report**


View the full text of this publication here: http://dx.doi.org/10.5703/1288284316010

Published reports of the Joint Transportation Research Program are available at http://docs.lib.purdue.edu/jtrp/.