



## Tech Brief

### DEVELOPMENT OF QUALITY STANDARDS FOR INCLUSION OF HIGH RECYCLED ASPHALT PAVEMENT CONTENT IN ASPHALT MIXTURES

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#### RESEARCH PROJECT TITLE:

Development of Quality Standards For Inclusion of High Recycled Asphalt Pavement Content in Asphalt Mixtures

#### SPONSOR:

Iowa Highway Research Board (TR-624)

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## Objectives

The objective of this research is to examine the effects of different methods of RAP stockpile fractionation on the volumetric mix design properties of high-RAP content surface mixes while meeting all specified criteria for standard HMA mix designs.

## Problem Statement

One of the most difficult aspects of high-RAP mix design is meeting the volumetric mix design criteria specifications, mainly the film thickness and dust-binder ratio, due to the large amount of fine aggregate material introduced to the HMA mix by the RAP materials. It is important to evaluate the effectiveness of these specifications on limiting the negative impacts of the volumetric properties associated with high-RAP contents on the HMA mixture. Therefore, new procedures that can mitigate the negative impacts of those high-RAP properties should be explored so that contractors have alternatives available in order to use the maximum percentage of RAP materials allowed under the current specifications

## Research

The focus of this research is to investigate methods of addressing the potential negative impacts of the recycled asphalt pavement materials and thereby increase the amount of RAP material that can be used in the target mix design (300K ESAL 1/2" HMA surface mixture). The purpose of fractionation for this research is to decrease the amount of fine aggregate material that would be introduced to the HMA mixture by the RAP material. To effectively design these fractionation methods, all RAP materials used in the study were extensively analyzed to determine the appropriate sieve size thresholds for separation of the original RAP stockpiles.

## Benefits

Increasing the amount of RAP materials used in low-volume, surface course mixtures will substantially improve the long-term sustainability of the transportation network in Iowa. High-RAP content mix designs would decrease the cost of maintaining and resurfacing these networks.

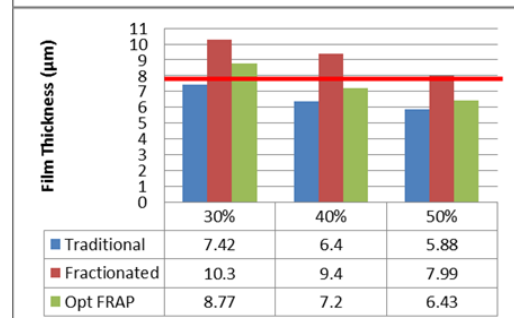
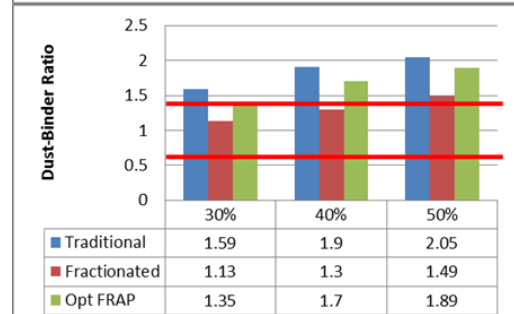
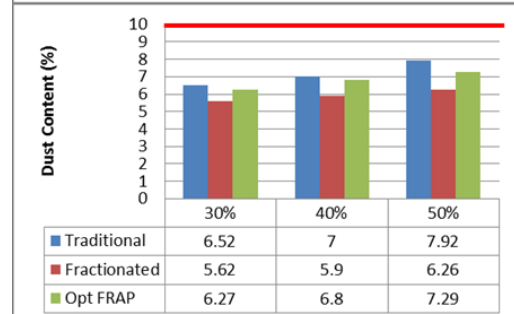
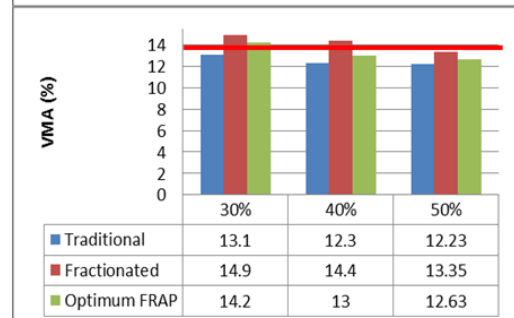
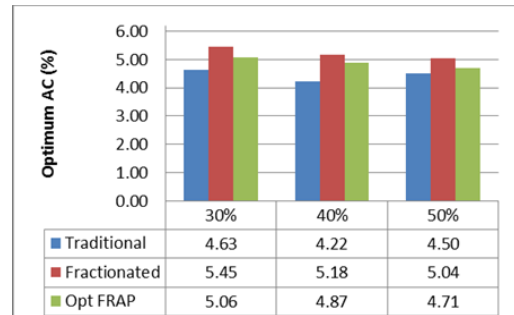
## Key Findings

Based on the limited laboratory experiment, the following conclusions are derived:

1. A single virgin asphalt binder performance grade modification was effective in mitigating the negative effect of the aged RAP binder.
2. Based on beam fatigue test, there is no significant change in predicted fatigue life of asphalt mixtures with high Rap contents.
3. Component analysis of RAP materials retained on each sieve is effective in identifying the distribution of fine aggregates and asphalt binder for a different size of RAP materials.
4. Fractionation methods designed to increase the amount of Coarse RAP material are effective in reducing the fine aggregates and dust content.
5. Fraction methods are effective in producing the High-RAP mixture that meets Iowa DOT's mix design criteria.
6. The fractionation method to discard RAP materials passing No. 16 sieve was very effective in improving the design volumetrics with up to 50% RAP materials.

## Additional Studies (Phase 2)

1. Moisture sensitivity test for the mix design: Hamburg test should be performed on various amounts of RAP materials up to 50% and different aggregate types
2. Field test section: Test section should be built using various amounts of RAP materials up to 50% and different aggregate types.
3. Threshold to change PG grade: Binder test like DCT test should be performed to identify the threshold to change the PG binder grade in consideration of rejuvenating additives.
4. Performance test: Dynamic Modulus and Flow Number tests should be performed on various amounts of RAP materials up to 50% and different aggregate types



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