



Memorandum

Subject: **ACTION:** Recycled Materials in
Asphalt Pavements

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From: /s/ Walter C. Waidelich, Jr.
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Infrastructure

In Reply Refer To: HIAP-1

To: Directors of Field Services
Division Administrators
Resource Center

Recently there have been an increasing number of state highway agencies reporting pre-mature cracking in relatively new asphalt pavements. A similarity in many of these pavements is the high content of recycled asphalt binder.

Issue: Asphalt binder replacement (ABR) is a term used for the asphalt from either reclaimed Asphalt pavements (RAP) and/or recycled asphalt shingles (RAS) used to replace a portion the total asphalt binder in new pavements. RAP is commonly used to replace from 15 to 25 percent plus of the total binder in a new pavement. However, there have been increased concerns with pavements which in addition to RAP also contain high levels of RAS (for example 5 percent RAS used by weight of the total mix can replace as much as an additional 25 percent of the total binder). Based on the percentage of ABR, various degrees of stiffness will be experienced by the in-service pavements. Increased stiffness can have a positive impact on performance by preventing rutting and may reduce cracking potential due to less pavement deflection under loads. However, increased stiffness can also have a negative impact on performance with increased cracking due to low temperatures or thin pavement sections. Additionally, there is concern for potential increased asphalt aging during the pavement performance life, in particular with RAS that contains already higher aged asphalt binder. There is also an inability to accurately predict an asphalt mixture's cracking potential with existing laboratory test procedures that are not always related to actual pavement condition and might provide conflicting recommendations.

Challenge: Isolating a single contributory issue is difficult because there are many other issues besides high ABR that can affect how asphalt mixes will perform. Some of these include:

- location of the pavement lifts being placed (surface or lower layers),
- existing pavement condition being overlaid,

- processing of RAS into very fine sized material for better blending, handling of RAP,
- mix design using actual measured values for material specific gravities in order to accurately calculate the total mix binder demand,
- and sampling during production as part of the quality assurance process.

Current Activities: Considerable efforts are underway to evaluate the use of RAP/RAS and reliability of existing test procedures in characterizing asphalt mixture cracking potential, at the national level these include:

- FHWA Accelerated Loading Facility current evaluation of test sections with various amounts of RAP and RAS, to determine relationship to pavement cracking.
- The National Center for Asphalt Technology and the Asphalt Institute investigation of laboratory tests to predict optimal fatigue performance.
- National Cooperative Research Studies Program efforts 9-55 “*Recycled Asphalt Shingles in Asphalt Mixtures with Warm Mix Asphalt Technologies*”, 9-58 “*The Effects of Recycling Agents on Asphalt Mixtures with High RAS and RAP Binder Ratios*”, and 9-59 “*Binder Fatigue, Fracture, and Healing and their Contribution to Hot-Mix Asphalt Fatigue Performance*”.

Recommendation: In the interim, state highway agencies using or creating specifications for RAP and RAS should keep aware of changes in AASHTO standards, particularly M 323-13 *Superpave Volumetric Mix Design*, MP 23-14 *Reclaimed Asphalt Shingles for Use in Asphalt Mixtures*, and PP 78-14 *Design Considerations When Using Reclaimed Asphalt Shingles (RAS) in Asphalt Mixtures*. Obviously past performance is also an important consideration.

If you identify related issues of concern or for further information contact John Bukowski, Materials and Quality Assurance Team Leader (john.bukowski@dot.gov) or Tom Harman, Pavement and Materials Technical Service Team Manager (tom.harman@dot.gov).