

# Performance of Recycled Asphalt Shingles in Hot Mix Asphalt

The Missouri Department  
of Transportation

# Proposed Transportation Pooled Fund

◆ Solicitation 1208 found at  
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<b>Lead Agency:</b>	Missouri Department of Transportation
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<b>Duration:</b>	24 months
<b>100% SP&amp;R Approval:</b>	Pending Approval
<b>Commitments Required:</b>	\$680,000
<b>Commitments Received:</b>	\$85,000

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## TPF Sponsors

- [FHWA Federal Highway Administration](#)
- [TRB Transportation Research Board](#)
- [AASHTO American Association of State Highway and Transportation Officials](#)

### Background:

The use of recycled asphalt shingles (RAS) in hot-mix asphalt (HMA) applications has grown across the US over the last 10 years. Although the majority of states are using manufacturers' RAS, there has been a rapidly growing interest in the use and applications of tear-off RAS in hot-mix asphalt (HMA). Many states share common concerns and questions in the use of tear-off shingles. Previous research has allowed for only limited laboratory testing and field surveys. Researchers and bituminous/material engineers still require additional research to study the effects of tear-off RAS on the performance of HMA applications and their economic value. Multiple state demonstration projects would provide adequate laboratory and field test results to more comprehensively answer the design, performance and environmental questions/concerns remaining. These concerns include the qualification of tear-off RAS for use in HMA and utilization of tear-off RAS ensuring acceptable long-term HMA performance.

### Objectives:

The primary goal of this study is to address research needs of state DOT and environmental officials to determine the best practices for the use of recycled asphalt shingles in hot-mix asphalt applications. The study will address the following research objectives:

1. To address the concerns of quality assurance (QA)/ quality control (QC) in the sourcing, processing and incorporation of the RAS to achieve a final product that would meet the requirements for use in state HMA applications. Create a specification that includes sufficient language to cover the QA/QC concerns.
2. To conduct demonstration projects to provide laboratory testing and field surveys to determine the behavior and performance of RAS in HMA at varying percentages, climates and traffic levels.
3. To create a comprehensive database on the performance of RAS in HMA applications.

### Scope of Work:

This research would include the following tasks and testing:

1. Conduct a literature search and review of nationwide applications of manufactured and tear-off shingles to provide an up to date literature review:
  - a. Specifications
  - b. Case studies / demonstration projects
  - c. Environmental white papers and completed research on asbestos and polycyclic aromatic hydrocarbons (PAHs) in RAS
2. Review and implementation of QA/QC of equipment and best practices for processing and sourcing of shingles through field demonstration projects:
  - a. Sourcing and mapping of clean tear-off shingles
  - b. Processing into RAS (grinding, screening, equipment)
  - c. Standard procedures to measure deleterious materials in RAS
  - d. Environmental practices
    - i. Worker health & safety
    - ii. Certification procedures to assure the supply of tear-off shingles are free of asbestos

containing material

- iii. PAH testing
  - e. Specification review to include language that covers all concerns of QA/QC
3. Field - visual surveys of HMA pavement applications using RAS:
- a. Past case studies and demonstrations
  - b. State DOT and county applications
  - c. New research and demonstrations over study period
4. Characterization of binder qualities:

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- a. Blending of RAS binders with virgin binders
  - b. Blending of RAS binders with recycled asphalt pavement (RAP) binders
  - c. Total available binder in RAS and percent effective in the mix
  - d. Low temperature cracking
  - e. Rutting
  - f. Fatigue
5. Mix design and performance testing:
- a. Gradation (fractionation)
  - b. Development of mix designs
  - c. Aging effects
  - d. Fatigue cracking
  - e. Rutting
  - f. % RAS for best performance according to regions
6. Statistical analysis:
- a. Field - visual surveys
  - b. Characterization of binder qualities testing
  - c. Mix design (volumetrics) and performance testing
7. Development of final report and technology transfer applications:
- a. Methods for characterizing shingles
  - b. Mix design specifications

**Comments:**

The commitment requested from each partner is \$85,000 which may be transferred over a two year period. The research will be conducted at the Iowa State University by Chris Williams and at the University of Minnesota by Mihai Marasteanu.

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# Objective

1. Address concerns in QA/QC in sourcing, processing and incorporation of the RAS into HMA and create a Specification that meets state
2. Conduct Demo projects, laboratory tests and field surveys to determine the performance of RAS in HMA at varying percentages, climates and traffic levels.
3. Create a comprehensive database on performance of RAS in HMA.

# Scope of Work:

1. Development of final report and technology transfer applications: Conduct nationwide review of applications of manufactured and tear-off shingles.
2. Review of QA/QC of equipment and best practices for processing/sourcing shingles through field demonstration projects:
3. Field – visual surveys of HMA pavement applications using RAS:

# Scope of Work: (Cont'd.)

4. Characterization of Binder Qualities:
5. Mix design and performance testing:
6. Statistical analysis:
7. Development of final report and technology transfer applications:

# Commitments:

- ◆ Recruited: Missouri, Iowa, Minnesota, California, Colorado
- ◆ Committed: MoDOT - \$85,000 total over 2 yrs.
- ◆ IA & MN committed but haven't posted on TPF site (\$340,000)  
CA & CO - funding is still in progress
- ◆ Need \$680,000

States attending workshop:

Arkansas, Colorado, Florida, Indiana, Iowa,  
Kansas, Minnesota, Missouri, Oklahoma

# For More Information:

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[www.pooledfund.org](http://www.pooledfund.org)