



Oklahoma Department of Transportation Planning & Research Division FFY 2013 Request for Proposals

Research Problem Statement Title:

Fatigue Performance of Asphalt Pavements Containing RAS and RAP

Problem Statement:

This project needs to evaluate the fatigue behavior of pavements constructed with hot mix asphalt containing recycled asphalt shingles (RAS) and recycled asphalt pavement (RAP). Specifically, changes in fatigue cycles with the changes in the amount of RAS and RAP will be examined using the four-point fatigue testing of beam specimens prepared from actual asphalt pavement sections obtained from the field. Effect of virgin binder grade on the fatigue performance will be examined. Indirect tensile strength tests (ITS) on field cores will be conducted and the results compared with the fatigue cycles. In addition the effects of RAS and RAP on creep compliance should be evaluated.

Proposed Research:

Roofing shingles are typically composed of 25 to 30 percent asphalt cement, 40 to 60 percent hard aggregate contained on the 30 and 60 sieves and 3 to 12 percent fiber. All of these ingredients are routinely used in hot mix asphalt (HMA) pavements. Consequently, the use of recycled asphalt shingles (RAS) in asphalt pavement throughout the U.S. is steadily increasing. With increased environmental awareness, the use of recycled asphalt pavement (RAP) is also increasing substantially nationally. Oklahoma Department of Transportation (ODOT) is currently developing special provisions for binder content that limit the binder replaced by the binder contained in RAS and/or RAP. Also, ODOT, along with the Oklahoma Asphalt Pavement Association (OAPA), is expected to develop special provisions for incorporation of RAS in HMA in the near future. Several states including Missouri, Georgia and Texas have specifications for design of HMA containing RAS and RAP. Actually, Missouri is one of the top users of RAS in the U.S. The state is looking at using 48,000 tons of shingles on state road work in 2011 [Source: Asphalt Institute, 2011].

An important issue that DOTs must address in adopting RAS in HMA mixes is the hardness of the asphalt cement in the shingles. The asphalt cement in the shingles is usually air-blown and is substantially harder than the normal asphalt binder used in a standard HMA mix. So, the agency may use a softer binder, such as a PG58-28 versus a PG64-22, to offset the harder binder contained in the shingles. Similar arguments are also applicable to binders in RAP. A harder binder generally increases propensity to cracking and reduced tensile strength and fatigue life. The proposed study is intended to generate useful data for ODOT and the paving industry in Oklahoma on the fatigue behavior of pavements constructed with HMA containing RAS and RAP. The amount of RAS and RAP in HMA mixes will be varied but the total amount kept within certain specifications (e.g., RAP and/or RAS limited to 25% binder replacement).

Suggested Tasks (to include but not limited to):

- Perform literature search
- Perform necessary lab testing
- Evaluation of Climatic Data
- Statistical analysis of data

Implementation:

The Principal Investigator (PI) will provide an assessment of the results of the study which should include expected benefits and action needed for successful implementation. The PI should include draft specifications, if applicable, with final recommended implementation activities, methods or schedules to meet ODOT goals.

Benefits:

ODOT, along with the Oklahoma Asphalt Pavement Association (OAPA), is expected to develop special provisions for the incorporation of RAS in HMA in the near future. The findings of this research are expected to aid engineers in having a better understanding of the use of RAS and RAP both in HMA and WMA.

Deliverables:

All projects require the submission of the following reports:

- Monthly Progress Reports
- Multi-Year Projects require a Year-end Annual Report
- Copies of the project Draft Final Report in Microsoft Word and ADA accessible Adobe Acrobat pdf electronic formats
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The Year-end Annual Report, Draft Final Report, Final Report and Color Article should be submitted to satisfy all federal and state requirements pertaining to the accessibility of documents including but not limited to:

- Oklahoma State Statute 62 § 41.5e and the Americans with Disability Act (ADA) of 1990, 42 USC 12.01 et seq.

The PI must also participate in the following project meetings:

- New project initiation meeting
- Semi-annual project meeting
- Close-out project meeting
- Continuing project meeting

Existing Research:

The following information has been provided as a convenience only and does not constitute a thorough literature review.

Who Thought Recycled Asphalt Shingles (RAS) Needed to Be Landfilled? Using RAS in Asphalt
<http://trid.trb.org/view/2008/C/882962>

Evaluation of Influence Factors to Crack Initiation of LTPP Resurfaced Asphalt Pavements
Using Parametric Survival Analysis

<http://trid.trb.org/view/2011/C/1092630>

Use of Data from Specific Pavement Studies Experiment 5 in the Long-Term Pavement
Performance Program to Compare Virgin and Recycled Asphalt Pavements

<http://trid.trb.org/view/2011/C/1092713>

Influence of Recycled Asphalt Pavement on Fatigue Performance of Asphalt Concrete Base
Courses

<http://trid.trb.org/view/2010/C/919406>

Laboratory evaluation of fatigue characteristics of recycled asphalt mixture

<http://trid.trb.org/view/2008/C/864368>

Fatigue resistance of bituminous layers incorporating reclaimed asphalt pavement

<http://trid.trb.org/view/2006/C/916281>

Evaluation of Cracking and Pavement Deformation Resistance Characteristics of Recycled
Asphalt Pavement Binders

<http://trid.trb.org/view/1998/M/706789>

Current Research:

Improved Mix Design, Evaluation, and Materials Management Practices for Hot Mix Asphalt with
High Reclaimed Asphalt Pavement Content

<http://trid.trb.org/view/2008/P/1102315>