Title: Development of a Ground Tire Rubber Special Provision

Problem Statement:
While Ground Tire Rubber (GTR) has been in use in the United States, especially in Arizona and Texas, it has not gained traction in the state of Arkansas. In theory, GTR can be used as an alternative to synthetic polymer (such as SB, SBS, or SBR) that can reduce cracking and rutting in flexible pavements. With the combination of increasing virgin material prices and attention to recycling from the public and FHWA, Arkansas is in a strong position to consider the use of GTR in asphalt concrete hot mix (ACHM). However, the performance of ACHM with GTR is not well documented in Arkansas. Therefore, this research will examine GTR performance in both asphalt binder and ACHM. All of the standard asphalt binder tests will be run at Arkansas State and all of the standard ACHM tests will be run at University of Arkansas. These tests will be run on neat asphalt binder, SBS modified asphalt binder, and GRT modified asphalt binder. From this evaluation, a special provision will be developed that will provide guidance to ARDOT for the incorporation of GTR into ACHM.

Potential Solution to Problem:
The objective of this research will be to develop a special provision for the use of Ground Tire Rubber in asphalt concrete hot mix. This will be achieved through the following steps: 1) identification and suggested revisions to Section 404 and 409 for asphalt binder, 2) identification and suggested revisions to Sections 407 and 410 for asphalt concrete hot mix surface course, 3) a standalone special provision document summarizing suggested revisions, and 4) a procedure that will allow ARDOT to detect if GTR is being used to modify an asphalt binder. Financially, various sources state that polymer adds anywhere from 15-40% additional cost to asphalt binder. This percentage could be decreased by using a recycled material.

Estimated Project Duration: 24 Months
Prepared By: Andrew Braham and Zahid Hossain
Agency: University of Arkansas and Arkansas State University
Phone: (479) 575-6028

Reviewer:

Standing Subcommittee Ranking: 1/1
Advisory Council Ranking: 7/14
Statement Combined with Statement Number(s): 

Updated September 2021
Title: Development of a Ground Tire Rubber (GTR) Special Provision

- **GTR properties**
  - 5-20% GTR by weight of asphalt binder
  - Size 1.5 and 3.0 mm (15 and 30 mesh)

- **Blend GTR with asphalt binder**
  - 350 to 375°F
  - React for 30 to 60 minutes

- **What is “reacting”?**
  - Physical, not chemical
  - Rubber particles swell (up to 5x)
  - Lighter oils in binder may absorb into rubber

- **Extender oils can be used to soften base binder**
- **Increases rutting and cracking resistance in flexible pavement**
GTR can replace other synthetic polymers

- Common in Arizona and Texas
- Typical synthetic polymers used in Arkansas
  - Styrene-Butadiene (SB)
  - Styrene-Butadiene-Styrene (SBS)
  - Styrene-Butadiene Rubber (SBR)
- These all reduce rutting and cracking
- Synthetic polymer drawbacks
  - Increasing virgin material prices
  - Not leveraging recycled materials

Arkansas could benefit from using a recycled material to improve performance of asphalt concrete hot mix
Building a GTR special provision

• Full laboratory comparison of:
  – Neat asphalt binder
  – SBS modified asphalt binder
  – GTR modified asphalt binder

• Asphalt binder tests
  – Penetration
  – Viscosity
  – Sessile Drop
  – Atomic Force Microscopy
  – All Superpave binder tests
  – Surface Free Energy compatibility
  – Texas Boiling Test compatibility

  Plus identification test for GTR in asphalt binder

• Asphalt mixture tests
  – Tensile strength ratio
  – Dynamic modulus
  – Flow number
  – IDEAL-CT
  – I-FIT
  – Hamburg Wheel

With two aggregate sources
Objectives and benefits

- **Objectives**
  - Proposed revisions for asphalt binder: Sections 404 and 409
  - Proposed revisions for ACHM surface course: Sections 407 and 410
  - Standalone special provisions for GTR
  - Procedure to identify GTR

- **Benefits**
  - Polymer adds 15-40% to cost of binder
  - GTR could reduce