



# Impact of Recycled Asphalt Shingles (RAS) on Asphalt Binder Performance

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### Current Situation

Asphalt shingles and pavement can be recycled into new pavements, with economic and environmental benefits. Recycled asphalt shingles (RAS) and recycled asphalt pavement (RAP) are abundant, and while their use in road construction has steadily increased, it is limited by concerns that increasing amounts of recycled materials may impact pavement performance. This is especially true of RAS, which is used as a partial replacement for virgin asphalt binder. The challenge is that it is difficult to accurately characterize the properties and behavior of RAS so that the amount that can be used in asphalt mixtures can be set with greater precision.

### Research Objectives

In this project, University of Florida researchers evaluated the effects of adding RAS and RAP to virgin asphalt binder, in an effort to accurately determine key properties of the resulting mixtures.

### Project Activities

The researchers adopted a mortar test, which allowed them to avoid solvent-based binder extraction and recovery, which is very time consuming and may affect binder properties.

The two types of RAS acquired for the study were characterized for particle gradation, asphalt content, aggregate gradation, and glass fiber content. Binder was extracted from the RAS samples to determine its true grade, a performance measure of asphalt binder. For the three types of RAP used, binder was extracted, aggregate was size-graded, and the binder's true grade was measured. Two virgin binders were selected for the project: PG 67-22, often used in Florida, and PG 58-28, a polymer-modified asphalt (PMA), often used in high traffic areas. In addition to RAS, RAP, and virgin binder, a fourth ingredient called a rejuvenator was also needed. Rejuvenators are oils derived from petroleum used to compensate for the stiffness of asphalt mixtures containing RAS or RAP. Two rejuvenators were selected: aromatic oil extract and refined engine oil bottoms.

Experimental testing consisted of making a series of mixtures for mortar testing at high, intermediate, and low temperatures. Tests run at the various temperatures led to corresponding shift factors. A shift factor is a measure of the stiffness of the asphalt mixture. Mixtures with different amounts of RAP and RAS were tested to determine the grade change rate, a factor that helps predict binder true grade for RAS and RAP mixtures. In preliminary studies, the researchers had found that the standard data analysis to determine the grade change rate was unreliable, and they developed an alternative analysis method that does not require a shift factor and is more efficient. Through their program of testing, the researchers were able to develop a comprehensive and more accurate description of the effects of RAS and RAP on mixtures with virgin binders and rejuvenators.

### Project Benefits

A more thorough understanding of the behavior of recycled asphalt materials will allow higher levels of recycling with benefits in performance and economy.

*For more information, please see [www.fdot.gov/research/](http://www.fdot.gov/research/).*



*Reroofing generates 10 million tons of asphalt shingle waste each year in the U.S.*