**Introduction**

Since the late 1990s PennDOT has been experimenting with the addition of shingles, both manufactured recycled asphalt shingles (RASs) and post-consumer asphalt shingles (RCASs) in hot mix asphalt (HMA) pavements. By composition, shingles typically contain asphalt cement, granulates, felt, and other miscellaneous materials. Shredded shingles have been allowed as a replacement for a percentage of virgin asphalt cement in HMA. Early studies focused on the uses of shingle tabs (RAS) because the waste material was more homogenous and less contaminated with other debris. In 1999, PennDOT issued Provisional Specifications for RAS in Bituminous Concrete Courses.

The use of RCAS was a bigger challenge, but without a doubt a much larger source. RCAS are the third-largest category of construction waste disposed in landfills.

**Summary of Project**

In 2003, PennDOT District 6-0 completed a rehabilitation Project on approximately 2.8 miles of SR 4033 in Bucks County. Approximately 1.9 miles of the roadway was paved using 9.5 mm Superpave with 5% RCAS, while approximately 0.9 miles of the roadway was paved using a control mix of 9.5 mm Superpave virgin asphalt content. The RCAS additive in the mix had to meet or exceed the PG 64-22 binder grading. The design mix allowed for a 1.3% contribution of asphalt from the shingles towards the total asphalt content.

Due to the excessive stiffness of the recovered asphalt from the RCAS, an elevated melting temperature was used to mold the pulverized shingles. As a result, the HMA containing RCAS had to be placed at a higher temperature than normal paving conditions would require. The asphalt plant increased the mixing time of the mix to meet the necessary asphalt content. The paving Project was monitored for 5 years post completion and produced various results. Specifically, the pavement showed signs of deterioration within 1.5 years of initial placement.

In 2008, the final performance evaluation was completed for the Project. The final evaluation yielded unsatisfactory results that were attributed to the amount of binder contributed by the asphalt shingles being lower than expected.

**Project Update**

In 2015, the wearing course of the segment of SR 4033 that was improved as part of this demonstration Project was replaced using a 9.5 mm conventional Superpave wearing course.

In 2017, to advance the use of RCAS in pavement design, PennDOT initiated a research Project to develop a Specification for the use of RCAS in asphalt mixtures. The contract is held with Pennsylvania State University and is being funded by PennDOT in cooperation with the Federal Highway Administration (FHWA).

At the end of the three-year study, PennDOT will assess whether a Specification can be developed for the standard use of RCAS in pavement design for roadways in Pennsylvania. Additionally, this research data will be shared with the FHWA and other state transportation agencies.

In 2019, PennDOT implemented the use of Warm Mixed Asphalt (WMA) over HMA. Since shingles are typically used in HMA’s this is another consideration that will need to be addressed before a use Specification can be released, and adequately implemented.

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**For Additional Information:**

Go to the Strategic Recycling Program page on the PennDOT website at [https://www.penndot.gov/ProjectAndPrograms/RoadDesignEnvironment/Environment/PollutionPrevention/Pages/default.aspx](https://www.penndot.gov/ProjectAndPrograms/RoadDesignEnvironment/Environment/PollutionPrevention/Pages/default.aspx), or send a request to PennDOTSRP@pa.gov.