

**Project Number**

BE194

**Project Manager**

Howie Moseley

*FDOT Materials Office***Principal Investigator**

Edith Arambula-Mercado

*Texas A&M Transportation Institute*

# Florida Department of Transportation Research

## High Reclaimed Asphalt Pavement (RAP) Asphalt Mixes for Low Volume Roads

*February 2019***Current Situation**

Road maintenance and rehabilitation activities by the Florida Department of Transportation (FDOT) generate about 1.8 million tons of reclaimed asphalt pavement (RAP) every year. Disposing of this material safely and productively is a continuing challenge. FDOT already uses RAP in some resurfacing projects, based on the results of previous research projects. Higher percentages of RAP are not appropriate for high volume, high speed roads, but lower volume roads could be paved with mixtures containing higher amounts of RAP.

**Research Objectives**

Researchers at the Texas A&M Transportation Institute developed mix design guidelines for mixtures with RAP content greater than 60% for use on off-system, low volume roads (average daily traffic < 750 vehicles).

**Project Activities**

Three types of high RAP mixtures were considered in this project: hot, cold with emulsion, and cold with foamed binder. Typical virgin aggregates (granite and limestone), RAP sources (limestone and granite/limestone), binders (PG 52-28 and PG 67-22), and emulsion (CSS-1H) were procured from Florida. For hot mixtures, only 60% RAP mixtures were considered, but for cold mixtures, 60%, 80%, and 100% were studied.

All hot mixtures showed adequate moisture susceptibility performance, and few showed evidence of stripping in the Hamburg Wheel Tracking Test. However, most showed accelerated rutting. Recycling agents improved their intermediate temperature cracking resistance and decreased their stiffness.

Cold mixtures were moisture susceptible. Limestone RAP and virgin aggregate showed less moisture susceptibility than limestone/granite RAP and virgin granite. Poor moisture susceptibility was improved by adding hydrated lime. Generally, cold mixtures did not meet minimum IDT strength requirements. Adding Portland cement helped, but all mixtures experienced accelerated rutting at early load cycles and showed poor durability.

A cost comparison indicated savings of 20% to 50% with cold recycling, compared with removal and replacement of pavement. A life cycle cost analysis was conducted for four mixtures with limestone RAP and limestone virgin aggregate: (i) hot with 60% RAP, (ii) foamed cold with 60% RAP, (iii) foamed cold with 80% RAP, and (iv) foamed cold with 100% RAP. The most favorable option was the foamed cold recycled mixture with 100% RAP content.

**Project Benefits**

Using RAP in paving projects has environmental as well as economic benefits.

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



*Low volume, rural roads are good candidates for paving with mixes containing high amounts of reclaimed asphalt pavement.*