



Testing asphalt mixtures that include reclaimed materials and rejuvenators can save resources and ensure the durability of Iowa's roads.

# RESEARCH SOLUTIONS

## Reclaimed asphalt may offer resource savings and improved pavement performance

The Iowa Highway Research Board (IHRB) has executed a multiphase study of different techniques for including reclaimed asphalt pavement (RAP) in road construction. Although using RAP instead of virgin aggregate materials generates cost savings, contractors must use a softer asphalt grade. This research, Phase IV of the study, investigated incorporating rejuvenating additives to soften the RAP and facilitate proper blending with other aggregate. Laboratory and field testing evaluated different RAP mixtures and rejuvenators, assessing pavement durability over time when exposed to typical usage and temperature fluctuations on Iowa's roads.

### THE NEED

Following guidance from public highway agencies that encourage the use of recycled asphalt materials (RAM) in road construction, IHRB is assessing higher percentages of RAP in asphalt mixtures. Despite the cost savings associated with RAP, the asphalt binder in RAP is stiffer than virgin materials, which can lead to cracking when temperatures drop. Rejuvenators effectively relax aged asphalt material, making it more flexible. Yet too much rejuvenator

can create softer pavement that may develop ruts over time. Finding the optimal percentage of RAP to virgin materials and incorporating the best dosage and type of rejuvenator can result in specifications for consistent pavement quality when RAP is used.

### RESEARCH APPROACH

Testing conducted in [Phase III](#) confirmed that high RAP mixtures with rejuvenators were more

resistant to low-temperature cracking than were high RAP mixtures without rejuvenators. The study also identified the analytical methods best suited to test different RAP mixtures for their performance and production cost savings.

Phase IV included a review of the literature and additional laboratory tests that provided comparison data on rejuvenators commonly used in asphalt production. Results denoted



**“Reclaiming asphalt is resource friendly, saving virgin materials and creating other cost advantages for agencies and construction companies. Piloting these technologies allows us to explore incorporating higher amounts of RAP in Iowa’s roads without compromising quality and safety.”**

**— ASHLEY BUSS,**  
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their susceptibility to cracking, rutting, and moisture intrusion. The study also offered an analysis of stockpiling and processing methods for RAM in Iowa, delineating the pros and cons of different approaches.

Laboratory and field testing evaluated asphalt mixtures with different percentages of RAM and with different rejuvenators. Two rejuvenators, Invigorate and Tufftek, were incorporated into three RAP mixtures that contained 22 percent, 34 percent, and 45 percent RAM. Field tests compared the six pavement sections, constructed in Cerro Gordo County, Iowa. A laboratory analysis compared mixtures from the field with similar mixtures that lacked rejuvenators.

## WHAT IOWA LEARNED

Pavement performance tests demonstrated that RAP mixed with rejuvenator measured favorably compared to RAP without rejuvenator:

- Results confirmed that 34 percent and 45 percent high RAP mixtures with rejuvenators were compacted well, exceeding 93 percent field density.

- RAP mixtures with rejuvenators performed better in rutting performance.
- Rejuvenators may improve cracking resistance in RAP with higher percentages of RAM.
- There is a good correlation between the flexibility index and fracture energy values.
- One year after construction, all sections performed well with little distress. Cracking was delayed in sections with rejuvenators.

## PUTTING IT TO WORK

Since results from Phase IV indicate the potential of high RAP mixtures for use in Iowa’s roads, further study is warranted. The next phase of this study will gather more data on RAP performance, with specific focus on best approaches for implementation. There is still opportunity to assess the long-term performance of RAP and to identify the optimal mixtures that minimize the cracking observed in the field tests. Also, rejuvenators are a relatively new technology, so quality assurance is needed to monitor

mixtures created at the construction site compared to mixtures produced at facilities with greater measurement capabilities.

## ABOUT THIS PROJECT

**PROJECT NAME:** [Development of Quality Standards for Inclusion of High Recycled Asphalt Pavement Content in Asphalt Mixtures — Phase IV Final Report | Technical Brief](#)

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