

# Minimum Virgin Binder Limits in Recycled Superpave Mixes in Kansas

Report Number: K-TRAN: KSU-13-5 • Publication Date: July 2016

**Masoumeh Tavakol**  
**Mustaque Hossain, Ph.D., P.E.**

*Kansas State University Transportation Center*

## Introduction

Use of recycled materials in asphalt pavement has become widespread recently due to rising costs of virgin binder and increased attention to sustainability. Historically, recycled asphalt pavement (RAP) has been the most commonly used recycled material for hot-mix asphalt (HMA). However, recycled asphalt shingle (RAS), another recycled material, has recently become popular. Although there are some guidelines regarding use of RAP and RAS in HMA, their effects on mixture performance, especially on mixtures containing RAS, are not thoroughly understood.



*Top: RAP Production and Material*

*Bottom: RAS Production and Material*

---

## Project Description

In this research, three recycled Superpave (SR) mixture designs from the Kansas Department of Transportation (KDOT) with 9.5-mm (SR-9.5A) and 19-mm (SR-19A) nominal maximum aggregate size (NMAS) were selected as control mixtures. Mixtures containing higher percentages of recycled materials (RAP and RAS) were developed using KDOT blending charts. A total of nine mixtures with varying virgin binder contents were designed and assessed for moisture susceptibility, rutting resistance, and fatigue cracking propensity using modified Lottman, Hamburg Wheel Tracking Device, flow number, Dynamic Modulus, and S-VECD direct tension fatigue tests.

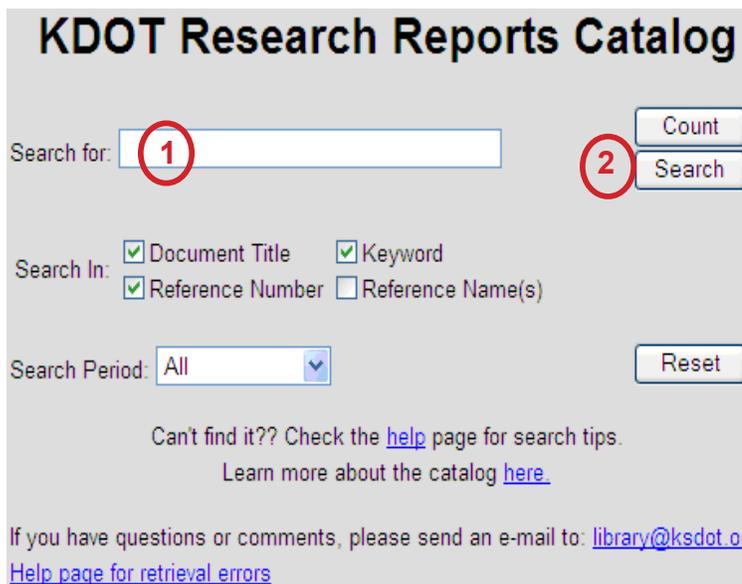
## Project Results

Results confirmed the effect of NMAS and material source on mixture performance. For SR-9.5A, the mixtures showed increased susceptibility to moisture and rutting damage below virgin binder content of 75%. For SR-19A, mixtures with virgin binder content of 70% showed satisfactory performance properties. Mixtures with virgin binder contents lower than 60% definitely showed inferior performance.

## Project Information

For information on this report, please contact Mustaque Hossain, Ph.D., P.E.; Kansas State University, 2124 Fiedler Hall, Manhattan, KS 66506; (785) 532-1576 phone; [mustak@ksu.edu](mailto:mustak@ksu.edu).

---



**KDOT Research Reports Catalog**

Search for:

Search In:  Document Title  Keyword  Reference Number  Reference Name(s)

Search Period:

Can't find it?? Check the [help](#) page for search tips.  
Learn more about the catalog [here](#).

If you have questions or comments, please send an e-mail to: [library@ksdot.org](mailto:library@ksdot.org)  
[Help page for retrieval errors](#)

## Directions for Downloading the Full Report

To download the full report, visit <http://kdotapp.ksdot.org/kdotlib/kdotlib2.aspx> and do the following:

1. Enter K-TRAN: KSU-13-5 in the search box.
2. Click the Search button to the right of the search box.
3. You may have to scroll to find the specific report.
4. To download the report, click on the title of the report to open the PDF file and save it to your hard drive.

If you have any questions, please email us at [KDOT#Research.Library@ksdot.org](mailto:KDOT#Research.Library@ksdot.org).

---

**KDOT RESEARCH**