Kansas Department of Transportation

TECHNICAL SUMMARY

# Review and Analysis of Hamburg Wheel Tracking Device Test Data

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(Clockwise) Final Test Setup of Hamburg Wheel Tracking Device, Close-Up of Specimens under the Wheel Load, Specimens Ready for Testing in HWTD, and Failed Specimens with High Rut Depth

## Introduction

Approximately 89% of the paved-road network in Kansas is asphalt surfaced (bituminous and composite). According to the Kansas Department of Transportation (KDOT), typical design performance period of hot-mix asphalt (HMA) pavement for new construction or reconstruction is approximately 12 years. In most cases, these pavements are overlaid as they reach the end of their design life. Both bituminous and composite pavements are usually overlaid with Superpave HMA for pavement preservation. The new highway program of KDOT also emphasizes pavement preservation. KDOT is currently seeking to extend the lives of Superpave mixes for these overlays through educated better selection of asphalt and aggregates. Thus, KDOT is contemplating use of the Hamburg Wheel Tracking Device (HWTD) as a performance tester.

## Project Objective

1. Building a database of KDOT-related Hamburg Wheel Tracking Device (HWTD) test results from tests done at KSU to date, and
2. Analyzing HWTD test data base generated in objective #1 at KSU and correlating that data with different mixture variables and performance.

## Project Description

The Hamburg Wheel Tracking Device (HWTD) test (TEX-242-F) and the Kansas Test Method KT-56 (KT-56), or modified Lottman test, have been used in Kansas for the last 10 years or so to predict rutting and moisture damage potential of Superpave mixes, especially mixes containing Reclaimed Asphalt Pavement (RAP). Thermal Stress Restrained Specimen Test (TSRST) was performed on selected mixes following AASHTO TP 10. All specimens tested were prepared with the Superpave gyratory compacter.

## Project Results

Results showed that the number of wheel passes and rut depth from the HWTD test are significantly different for Superpave mixes with various RAP content. Recycled Superpave mixtures with crushed gravel aggregates and sand significantly improve overall rutting performance compared to crushed stone or crushed stone and gravel combinations in the mix. Aggregate type also influences rutting performance of virgin Superpave mixtures. Rutting performance of Superpave mixes with or without RAP is significantly affected by the binder source.

Statistical analysis proved that the total number of wheel passes, creep slope, and stripping slope of Superpave mixes with RAP in HWTD tests are significantly affected by RAP content, binder grade, and asphalt sources at 90% confidence interval. RAP percentage in the mix, aggregate type, and interaction between RAP content and aggregate type also affect the pure stripping failure phase (stripping slope) and total wheel passes at the stripping inflection point. Analysis of variance (ANOVA) on Superpave mixtures with RAP showed the number of wheel passes at stripping inflection point and stripping slope are significantly affected by mix type and binder source. Rutting performance is highly influenced by voids in mineral aggregate (VMA) and RAP asphalt content. Superpave mixtures with higher RAP content also tend to fracture at higher temperatures in the Thermal Stress Restrained Specimen Test, indicating that these mixtures are more vulnerable to low-temperature cracking. Thus, low-temperature cracking potential of high RAP mixture must be evaluated during the mixture design process.

For virgin Superpave mixtures, total asphalt content plays a very important significant role in controlling overall rutting resistance of the mix. Moisture susceptibility of these mixtures is highly influenced by total asphalt content, VMA, VFA, and dust-to-binder ratio. Thus, accurate determination of volumetric properties is essential.

## Project Information

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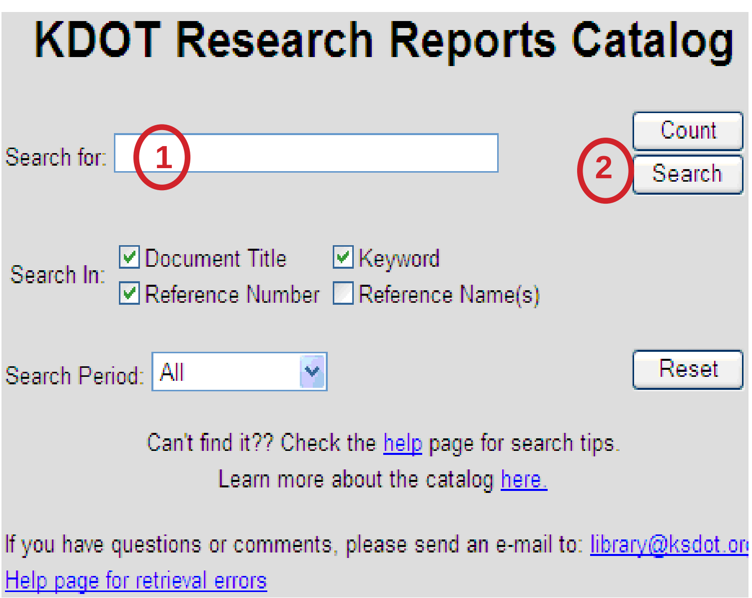


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