

Evaluation of Safety Effectiveness of Composite Shoulders, Wide Unpaved Shoulders, and Wide Paved Shoulders in Kansas

Report Number: K-TRAN: KU-11-1 ▪ Publication Date: March 2013

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Introduction

Incremental increases in paved shoulder widths have been studied and are shown in the Highway Safety Manual (HSM). While each incremental increase in shoulder width is beneficial, there is evidence that suggests the relationship between safety improvements and incremental increases in shoulder width may not be linear. It is possible that the net safety gains for wider shoulder increments are not as high as incremental benefits of the initial increments of

shoulder width. Thus, a highway agency may have opportunities for greater system-wide safety benefits from paving longer roadway segments with a narrower shoulder rather than paving shorter roadway segments with a wider shoulder. This approach is tempered by consideration of long term degradation in shoulder width and slope over the life of a facility due to normal pavement maintenance activities. Practitioners must balance long-term sustainability, cost, expected operations and safety benefits of proposed improvements. For new and reconstruction projects, the cost of additional shoulder width is minimal compared to retrofitting an existing facility.



Composite Shoulders on US Highway 24, Williamstown, Kansas

Project Description

Determining the benefits of various shoulder improvement approaches fits within the Kansas Department of Transportation's (KDOT) "Practical Improvements" approach to maximize benefits relative to the construction and maintenance costs required. Among the 8,300 miles of rural two-lane highways in Kansas, approximately 25 percent of them are equipped with composite shoulders consisting of three feet of pavement with the remainder aggregate or turf. Their safety effectiveness was studied using the Empirical Bayes (EB) approach and the cross-sectional approach. Three developed Safety Performance Functions (SPFs) were used to create Kansas-specific Crash Modification Factors (CMFs) for composite shoulders compared with segments with no or unpaved shoulders.

Project Results

It was found that upgrading narrow unpaved shoulders to composite shoulders can reduce shoulder related crashes by up to 61 percent and fatal and injury crashes by 31 percent. It was also found that wide paved shoulders can provide more safety benefit than composite shoulders, and wide unpaved shoulders can provide slightly less safety benefit than composite shoulders. Based on these results, 20-year projections were developed projecting the safety effectiveness that can be achieved through implementing these safety improvements.

This research also shows examples of how CMFs can be used to conduct a benefit-cost analysis. This procedure can produce data driven insight into the safety benefits and limitations of composite shoulders on rural two-lane highways. It is expected that the result will be valuable as KDOT and other state highway agencies considers various options and their benefit-cost ratios for the investment of state maintenance funds. It is expected that this research will also aid engineers and decision makers in continuing to build a safe and efficient highway systems in Kansas through the predictive method detailed in the HSM.

Project Information

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