TECHNICAL SUMMARY

Calibration of Highway Safety Manual Prediction Models for Freeway Segments, Speed-Change Lanes, Ramp Segments, and Crossroad Ramp Terminals in Kansas

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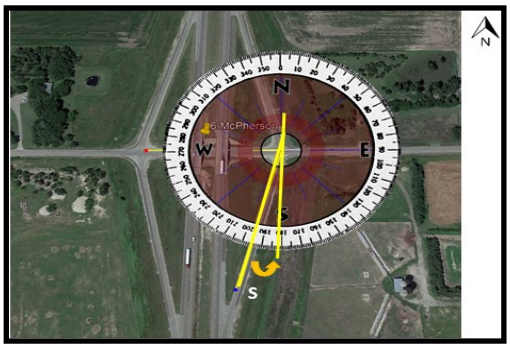
Sunanda Dissanayake, Ph.D., P.E., F.ASCE.
Imalka Chiranthi Matarage

Kansas State University Transportation Center



Google Earth Measuring the Skew Angle of a Ramp

Introduction

Crash prediction models in the Highway Safety Manual (HSM) are used to quantify the safety experience of new and existing roadways. Safety Performance Functions (SPFs) or crash prediction models are statistical formulas developed on limited data from a few selected states, Kansas not being one of those states. Therefore, the HSM recommends calibration of HSM-default SPFs, or development of local SPFs, to enhance the accuracy of predicted crash frequency. This report demonstrates the HSM calibration procedure and its' quality assessment for freeway segments, speed-change lanes, ramp segments, and crossroad ramp terminals in Kansas. The study used three years of recent crash data, the most recent geometric data, and HSM-recommended sample sizes for all facilities considered for the calibration.

Project Description

Primary objectives of this research are as follows:

To apply the calibration procedure provided in Appendix B of the HSM to Kansas freeway segments, speed-change lanes, ramp segments, and crossroad ramp terminals.

To assess the quality of estimated calibration factors for all facility types considered in this study.

To estimate calibration functions when estimated calibration factors do not provide a better fit to local data.

To compare performance among estimated calibration factors; developed calibration functions; and estimated calibration factors by ranges of AADT and segment length using cumulative residual plots.

To provide recommendations for the best safety prediction approach for each facility type considered in this study.

Project Results

The HSM methodology overpredicted fatal and injury (FI) crashes and underpredicted all property damage only (PDO) crashes for freeway segments. The HSM methodology consistently underpredicted both FI and PDO crashes for both entrance- and exit-related speed-change lanes. The HSM methodology overpredicted all FI crashes, underpredicted multiple vehicle PDO crashes, and overpredicted single vehicle PDO crashes for entrance ramp segments. In the case of exit ramp segments, the HSM methodology underpredicted all multiple vehicle crashes and overpredicted all single vehicle crashes. The HSM methodology overpredicted all FI crashes and underpredicted all PDO crashes for both signal- and stop-controlled crossroad ramp terminals.

Cumulative residual plots and coefficient of variation were used to evaluate the quality of calibrated HSM-default SPFs. Results of calibration quality assessment indicated that estimated calibration factors were satisfactory for all freeway and ramp facilities considered in this study. However, for further accuracy and comparison purposes, calibration functions were developed to improve the fit to local data. Calibration functions were better fitted compared to calibrated HSM-default SPFs for freeway and ramp facilities in Kansas. Challenges faced, how those challenges were addressed, and data collection techniques used in this study are discussed. In summary, estimated calibration factors and developed calibration functions of this study would greatly improve making accurate decisions related to freeway and ramp safety in Kansas.

Project Information

For information on this report, please contact Sunanda Dissanayake, Ph.D., P.E., F.ASCE; Kansas State University, 1013 Mid-Campus Dr, Manhattan, KS 66506; 785-532-6191, sunanda@k-state.edu.

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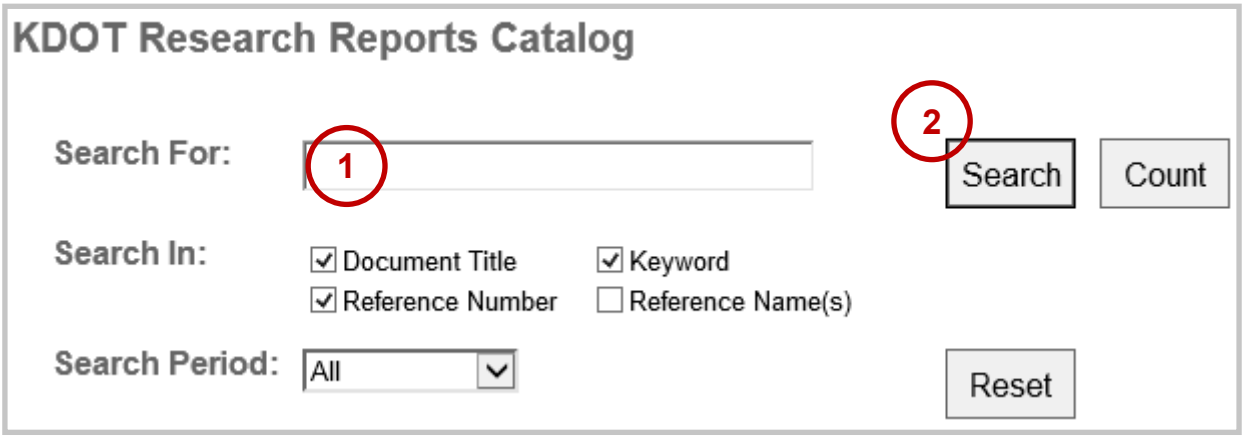

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