

MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 20-416 (project 438) | August 2020

Calibration of HSM Predictive Methods on State and Local Rural Highways



the ISSUE

Performance-based safety objectives are more attainable with the use of the Highway Safety Manual (HSM), a publication of the American Association of State Highway and Transportation Officials. The HSM provides statistically sound safety analysis methods that have been developed over decades of highway safety research. However, the safety performance functions in the HSM, which were developed based on safety data collected in multiple states, may not be accurate for local conditions. Additionally, the base site conditions in the HSM might not be representative of local roadways. Although calibration procedures are available in the HSM, they need to be refined or modified to accommodate South Dakota's data availability, as well as roadway, traffic, and crash characteristics. It is imperative to develop a South Dakota version of the HSM models by using proper calibration methods and to provide guidance for future calibration activities.

the RESEARCH

All South Dakota rural state highways were screened using the controlling variables for base conditions specified in the HSM, and the highway segments or intersections with attributes that are different from the HSM base conditions were defined as South Dakota state-specific base conditions. South Dakota-specific safety performance functions (SPFs) were developed using the same statistical techniques applied in the HSM (i.e., negative binomial generalized linear regression model). And the HSM crash modification factors (CMFs) are converted to South Dakota-specific base condition. Therefore, a combination of South Dakota state-specific and HSM models are recommended. In conclusion, the HSM predictive method was assessed for its ability to provide reliable crash predictions when used with South Dakota data. When the HSM method was inadequate in providing close estimates, modifications were introduced (i.e., establishing local base conditions, developing state-specific SPFs, and adjusting CMFs accordingly). After this calibration, predicting crashes on South Dakota's rural state highways is now more accurate.



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Project Title

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the FINDINGS

Most of the data elements required for model calibration are available at the South Dakota Department of Transportation. However, several key data elements were redefined according to the project's technical panel, including a rural state highway, a rural state intersection, segment-related crashes (wildlife-vehicle collisions included), and intersection-related crashes. Due to the sample size constraint, state-specific SPFs were developed only for undivided rural two-lane two-way highways, rural multilane divided highways, rural three-leg stop intersections on rural two-lane two-way highways, and rural four-leg stop intersections on rural two-lane two-way highways. HSM SPFs were recommended for all other highway facility types (i.e., rural multilane undivided highways, rural three-leg stop intersections on multilane highways, rural four-leg stop intersections on multilane highways, and rural signalized intersections on multilane highways). The new calibration factors were found to be more accurate compared with the values following the HSM method. A combination of state-specific and HSM models resulted in specific recommendations for each highway facility type.

the IMPACT

The appropriate and more accurate SPFs and CMFs will be used by the South Dakota Department of Transportation to screen South Dakota roadways to find problem areas for further safety review, to compare safety design alternatives, evaluate site-specific safety issues, and program and plan future safety projects.

For more information on this project, download the entire report at <https://www.ugpti.org/resources/reports/details.php?id=992>

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7767 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.



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