Texas A&M Transportation Institute

Texas Department of Transportation

PROJECT SUMMARY REPORT

0-7142: Develop Safety Scoring Tool for the Wet Surface Crash Reduction Program

Background

The Texas Department of Transportation currently uses the Safety Scoring Tool (now called Safer by Design [SBD]) to evaluate the safety aspects of a project and Form 2088 to evaluate the pavement friction demand. The research team leveraged the inputs and framework of the SBD and the commonalities with Form 2088 to improve the SBD and the Wet Surface Crash Reduction Program. The developed scoring tool will bridge the gap between the approaches in the two current tools, the SBD and Form 2088.

Integration of the SBD and Form 2088 provides the benefits of streamlining the data inputs already required for the SBD and Form 2088 to avoid duplication of effort. This research will effectively improve the quality of the assessment of pavement friction safety.

This project developed a risk assessment procedure related to reducing wet-weather crashes that incorporates pavement surface type and aggregate selection. The project also set up the framework to integrate this procedure into the SBD.

What the Researchers Did

The research team developed a risk assessment procedure by analyzing the factors that affect pavement surface friction demand. These included crash records, the factors on Form 2088, the factors in the SBD method, skid number (SN), climate, pavement surface type, traffic volumes, and type of facility. The research team analyzed data (the original data set contained 167,495 segments corresponding to 79,978.2 miles) for a 5-year range (2018–2022). The analysis considered the relationship between wet crashes and skid numbers.

A framework was set up to integrate Form 2088 into the SBD by estimating the crash modification factors (CMFs) based on the proposed pavement properties. The CMFs used in the SBD method were developed for combinations of crash types and highway configurations. The CMFs can be calculated from the variables shown in Table 1 and the proposed pavements estimated skid number.

For example, the CMF for a rural two-lane roadway would be calculated using Equation 1 and Table 1.

$$CMF = 1 - ratio + ratio * CMF^{(sn-base)} \quad \text{(Eq. 1)}$$

Where:

- *ratio* is the number in Table 1 for the roadway and crash type.
- *base* is the number in Table 1 based on the roadway type.
- *sn* is the estimated skid number for the proposed pavement.

Therefore, using Equation 1 produces $1 - 0.169 + 0.169 \times 0.98^{(sn\ -\ 34.48)}$.

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The research team developed case studies in the Fort Worth, Bryan, and Atlanta Districts to evaluate the SBD, Form 2088, crash, and skid data for designated projects.

What They Found

The research team proposed risk categories based on the pavement SN to help the designer evaluate the proposed pavement friction design. At an SN greater than 39, there was no difference in risk for a dry- or wet-weather accident, consistent with previous findings based on a crash rate ratio by Long et al. (*1*). The research team proposed risk levels illustrated in Figure 1.

What This Means

The CMFs developed for the SBD method, along with the risk assessment, can be used to evaluate the anticipated pavement friction for a project so that it is "safer by design."

Table 1. Ratio of Crashes and Base Number for Different Roadway Categories.

Roadway Type	All Wet Crash Ratio	Fatality and Injury Accident Wet Crash Ratio	Property-Damage-Only Wet Crash Ratio	Base
Rural 2 lanes	0.169	0.0513	0.1177	34.48
Rural multilanes undivided	0.1727	0.0519	0.1207	29.37
Rural multilanes divided	0.2552	0.0583	0.197	25.85
Urban 2 lanes	0.1458	0.0435	0.1022	27.68
Urban multilanes undivided	0.1165	0.038	0.0785	28.42
Urban multilanes divided	0.166	0.0481	0.1179	24.45

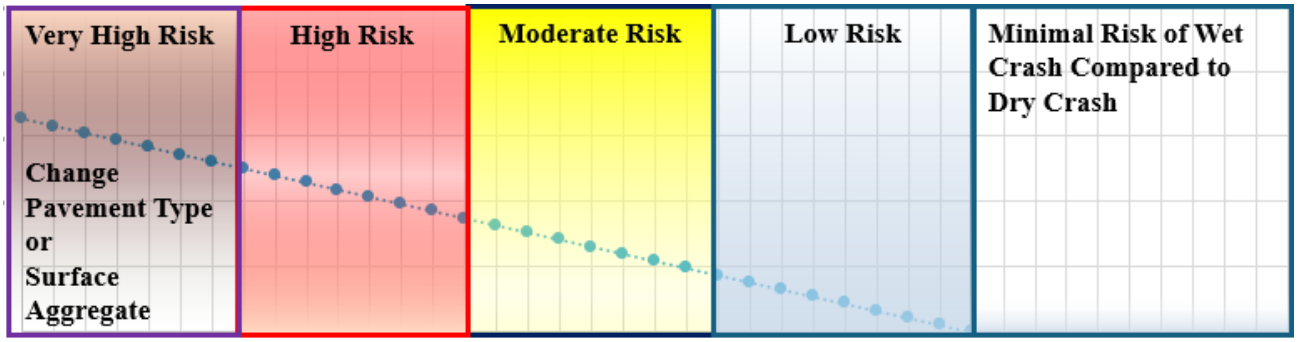

Figure 1. Wet-Weather Crash Risk Levels.

1. K. Long, H. Wu, Z. Zhang, and M. Murphy. *Quantitative Relationship between Crash Risks and Pavement Skid Resistance.* Report No. 0-6713-1. Center for Transportation Research, University of Texas at Austin, 2014.

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