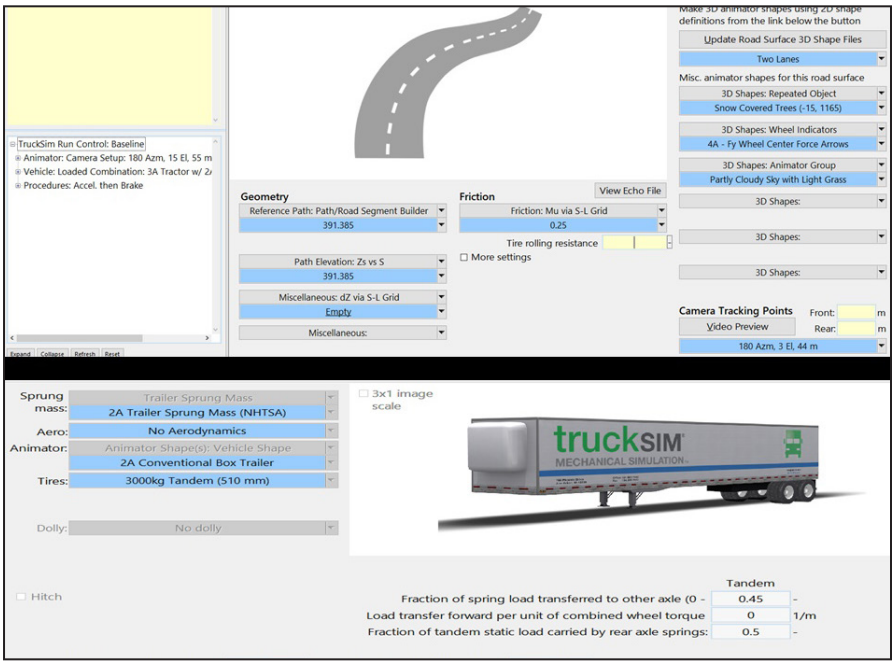
MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 22-457 (project 574) | July 2022

Proposing New Advisory Speeds in Mountainous Areas Considering the Effect of Longitudinal Grades, Vehicle Characteristics, and the Weather Condition



the **ISSUE**

Wyoming roadways are characterized by adverse weather conditions and tight horizontal curves with steep downgrades or vertical curves. Skidding and rollover are the main threats on these curves. This research aims evaluates the appropriateness of the posted speed limits and vehicle stability on Wyoming's hazardous curves.

the **RESEARCH**

This research is intended to propose a new design framework to set speed limits on combined curves with respect to vehicle stability. Therefore, a high-fidelity dynamic simulation modeling approach was used to assess lateral and roll stability of different vehicle types on various road surface conditions. Skidding and rollover margins accurately quantify the impact of the geometric and environmental characteristics on vehicle performance when cornering.

MOUNTAIN-PLAINS CONSORTIUM REGION 8

A University Transportation Center sponsored by the U.S. Department of Transportation serving the Mountain-Plains Region. Consortium members:

Colorado State University
North Dakota State University
South Dakota State University
University of Colorado Denver
University of Denver
University of Utah
Utah State University
University of Wyoming

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Project Title

Proposing New Speed Limit in Mountainous Areas Considering the Effect of Longitudinal Grades, Vehicle Characteristics, and the Weather Condition

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the FINDINGS

Results showed that current speed limits are unsafe and should be modified under some circumstances. Vehicle stability significantly changes based upon the vehicle type and configuration coupled with weather conditions. Therefore, appropriate speed limits vary accordingly. The developed models of skidding and rollover margins quantify accurately the impact of the geometric and environmental characteristics on vehicle performance when cornering. In addition, the impact of crosswind parameters (speed and direction) changes based on the curve features and truck configurations. Further, the results provide critical wind speeds and directions that truck drivers should be cautioned of to avoid rollovers. Among all considered factors, operating speed has the highest impact on the lateral and roll stability of vehicles. Speeding behaviors coupled with high gross weights would be more hazardous to drivers. A better understanding was achieved for vehicle skidding and rollover events reflecting real-world scenarios.

the IMPACT

This research provided guidelines regarding the design of road sections with combined (horizontal and vertical) alignments and the implementation of safety countermeasures on existing curved roads. The study offered a holistic design framework for safe vehicle speeds on combined curves with respect to lateral and roll stability, including vehicle configurations (weight/truck load height) and wind parameters (speed and direction). This study filled the gap in the literature regarding the impact of these key factors on vehicle stability and how to assign appropriate speed limits on these challenging sections.

For more information on this project, download the Main report at https://www.ugpti.org/resources/reports/details.php?id=1085

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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