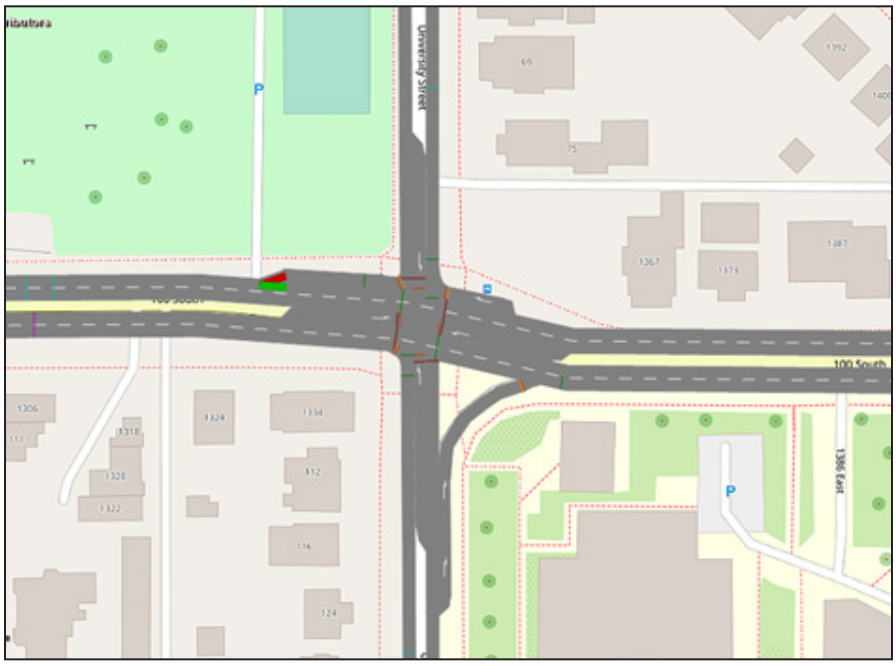
MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 22-484 (project 590) | September 2022

Impact of Connected Vehicle Technology on Traffic Safety under Different Highway Geometric Designs



the ISSUE

It is expected that compared to conventional vehicles, CAV can upgrade flow capacity, travel time, and, most importantly, the safety of traffic roads. Road elements that can impact drivers' performance include the number of lanes, lane width, design speed, curves, road slope.

the RESEARCH

To reflect CAV behavior and roadway elements, multiple simulation scenarios are designed that contain road features that can cause crashes. These scenarios are simulated with traffic composition, including conventional vehicles and CAV with different penetration rates. Also, the driving behavior of each class of vehicle is included to account for their effect on traffic performance. These simulations are done in VISSIM with scenarios that study the effect of the number of lanes, design speed, intersection, limited sight distance, conflict zone, and road grade on road safety. The trajectory of roads is used to analyze the safety performance quantitively. Safety analysis includes potential crash rates and severity. Besides, flow characteristics of conflicts are also evaluated for flow performance under different traffic combinations.

This study is basically developed to investigate how CAV can affect safety performance under different geometric designs and find the level when this safety is constructive. Scenarios are designed based on Salt Lake City, Utah, traffic network. Locations are picked based on recent crash location and roadway that includes the main contributor to crashes.

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

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the FINDINGS

Results indicate that CAV's presence in traffic flow can elevate safety performance, especially in freeways. Signalized intersections do not show an improvement in traffic safety, which is due to the limited information available on the interaction of conventional vehicles and CAV. Also, CAV potential safety features might not be fully applicable in controlled roadways. However, the reduced number of rear-end and lane changing conflicts proves that CAV successfully reduces crash rates. In addition, potential crashes results demonstrate that due to smaller speed variance and reduced decelerations, crashes will be less severe. Evaluation of safety performances shows that safety improvement by CAV will be significant.

the IMPACT

This project can help study the safety benefits of connected automated vehicles (CAV) under various driving conditions.

The expected impact of this project will give better insights into how road geometric designs can affect CAV safety performance. Also, the penetration rate of CAV plays a key role in affecting road safety as well.

For more information on this project, download the main report at https://www.ugpti.org/resources/reports/details.php?id=1103

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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