

Influence of Level 1 and Level 2 Automated Vehicles on Fatal Crashes and Fatal Crash Occurrence

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Introduction

Motor vehicle crashes are one of the top ten causes of death in the United States. In 2019, more than 36,096 people lost their lives in road crashes. All drivers are at risk of being involved in a crash, regardless of whether they drive on familiar roads with the safest vehicles. According to Traffic Safety Facts published by the National Highway Traffic Safety Administration (NHTSA), approximately 94% of crashes in the United States between 2005 and 2007 were caused by human error.

Connected and automated vehicles (CAVs) are expected to enhance traffic safety and operational performance by reducing human involvement in various driving tasks with the assistance provided by smart features. Level 1 and level 2 CAVs equipped with smart features are already penetrating the market, and their effects on crash occurrence needs to be identified. This research focuses on exploring the factors affecting

fatal crashes involving level 1 and level 2 CAVs and comparing them with level 0 vehicles. Investigating the factors affecting crashes involving level 1 and level 2 CAVs will provide insights on the involvement of these CAVs (equipped with smart features designed to enhance safety) in certain types of crashes.

Study Methods

A python script was written to retrieve data pertaining to smart features in vehicles involved in fatal crashes based on their vehicle identification number (VIN). To compare the fatal crashes involving level 1 and level 2 CAVs with crashes involving level 0 vehicles, the team conducted the proportional test. It was identified that some of the factors are equally affecting (equal slope) level 1 and level 2 CAVs, whereas the other factors are unequally affecting (unequal slope) level 1 and level 2 CAVs. Thus, the partial proportional odds model, which gives flexibility to model factors with

equal and unequal slopes, was adopted. To identify the effect of individual smart features on safety, the team conducted a comparative analysis between vehicles equipped with specific smart features and other vehicles involved in fatal crashes.

Findings

Some of the key findings are:

- Level 1 and level 2 CAVs are less likely to be involved in crashes at four-way intersections, on two-way routes with medians, at nighttime, and in conditions with poor lighting compared to level 0 vehicles.
- CAVs have a higher likelihood of being involved in crashes with non-motorists such as pedestrians and bicyclists compared to level 0 vehicles.
- CAVs were found to be more involved in crashes on one-lane routes compared to level 0 vehicles.
- Adaptive cruise control (ACC) and forward collision warning system (FCWS) are not efficient in improving safety in case of rear-end collisions.
- Vehicles with pedestrian automatic emergency braking (PAEB) and lane-keeping assistance (LKA) are efficient in improving safety by reducing collisions with pedestrians and roadside departures, respectively.

Policy/Practice Recommendations

The findings and results from this research help identify the factors affecting fatal crashes involving CAVs, and potential areas for improvement in vehicular technologies as well as road geometry. They also will help in developing a readiness plan to proactively address anticipated safety challenges in future years.

About the Authors

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To Learn More

For more details about the study, download the full report at transweb.sjsu.edu/research/2034



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