# Improving Safety of Autonomous Vehicles: A Simulation-based Study using High-Definition Maps and Traffic Flow Analysis

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Ensuring the safety of self-driving cars is a critical concern for the transportation industry. While physical testing is limited, computer simulations offer an effective approach to assess self-driving car safety under specific conditions. Prior studies have explored the impact of weather, lighting, road type, and self-driving algorithms on safety. However, most of these studies rely on virtual maps generated by software rather than real-world environments.

This study aims to address this gap by incorporating high-definition map data into CARLA self-driving simulation software, thereby creating a more realistic depiction of traffic conditions and minimizing the expense of generating road network layers. Furthermore, the study utilized Vissim traffic simulation software to simulate traffic flow and signal phases at specific locations, resulting in a more extensive assessment of the safety of self-driving cars.

The study was conducted in the vicinity of the Shalun High-Speed Railway Station in Tainan, Taiwan, with the primary focus on the main roads. The researchers gathered data on traffic flow and signal timings to evaluate traffic conditions and safety risks. The safety risks were analyzed based on the incidence of sudden braking observed during the simulation.

The expected results of this study will contribute to the development of autonomous vehicles (AVs) that are safer and better equipped to handle the complexities of real-world road conditions. By incorporating real-world data into the simulation process, we can more accurately model traffic flow and identify potential hazards, ultimately leading to safer and more efficient self-driving cars on the road.

**Keywords:** autonomous vehicle (AV), CARLA, high-definition (HD) map, self-driving car, sudden braking, traffic flow, Vissim