This dissertation presents the contributions to the research that describes the improving the safety of lane changes by minimizing the side-sweep accidents due to automobile blind spots. Sidesweep accidents are one of the major causes of loss of life and property damage on highways. This type of accident is caused by a driver initiating a lane change while another vehicle is blocking the road in the target lane. In this research, we evaluate two different types of lane changing scenarios: traditional and non-traditional. The traditional scenario is the visual inspection by the driver through the rear and side view mirrors (the old fashion way) and also assisted by the turn signals. Non-traditional scenario, the driver is assisted by other techniques such as vehicle-to-vehicle (V2V) communication.

We are trying to evaluate and quantify the degree that impact of each of these scenarios could reduce the occurrence of side-sweep accidents. Implementations of traditional and non-traditional scenarios also could reduce the occurrence of such accidents. We present the design of a simulator that takes into account common sources of lack of driver awareness such as blind-spots and attention. Then, we study the impact of both traditional, non-technological communication means such as turning signals as well as unidirectional and bidirectional V2V communications. In this research, a simulation framework was developed that models in detail the situational awareness and decisions of the driver (e.g., checking mirrors before initiating a lane change).

Framework decision variables include visibility, windows, mirrors, and blind spots of the vehicle as well as the times of checking the mirrors and initiating a lane change. A particular focus was given on investigating the impact of the spatial dimensions, angle orientation of automobile blind spots and the frequency of side-sweep accidents in various conditions (e.g., traffic density and relative velocity). Furthermore, discusses the information gathering behavior of human drivers in respect to the ways in which they collect information about the surrounding traffic before they make a decision about a lane change and describes how vehicle congestion and relative velocity influence the driver decisions when changing a lane. Using this framework, a simulation study is delineated with corresponding results. Some of the experimental results are comparable with the real-world observations of the National Highway Traffic Safety Administration.

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The public is welcome to attend.