ABSTRACT

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Vehicle crashes are a major concern within the road safety area, which has led to a great amount of research on the topic. However, real-world crash data collection periods are often extensive and result in a great delay in improving safety. Therefore, certain surrogate measures, such as traffic conflicts, are considered for safety management.

The definition of a traffic conflict has evolved over the course of half a century and encompasses a failure-based road event that, without timely response by road users, inevitably results in a crash if no evasive action is taken. This counterfactual concept was validated with specific road events datasets, including rear-end events and vehicle-bicycle encounters. However, observing conflicts for an extended period is still a major difficulty given the current technology. As for the typical intersection, conflict data can be observed for a relatively short period using LiDAR. This data is converted to the corresponding expected crash frequency and should eventually be expanded to include annual data. Thus, an important task remains: how to estimate the annual expected crash frequency based on short-term expected crashes. This is also the contribution of this study.

With advanced statistical methods, researchers can develop a model to calculate the ratio of expected annual crash frequency to the expected crash numbers in the observation period. This ratio is defined as an expansion factor in this study. This thesis describes a method of calculating expansion factors for different types of crashes at signalized and unsignalized intersections in Indiana. Traditional and emerging data, such as traffic volume, speed, road characteristics, weather, and other features of the randomly selected 194 intersections, were used to estimate the logistic model for predicting hourly crash probability. An example of implementing the models to calculate expansion factors for a specific intersection in the test set is provided to evaluate the method.