Joint Transportation Research Program

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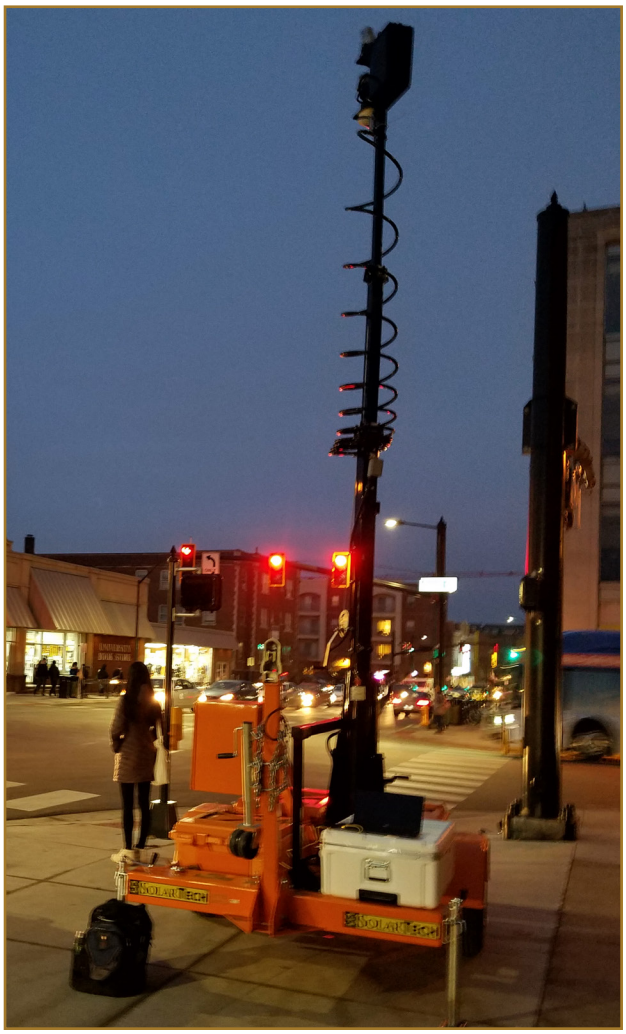
Guidelines for Evaluating Safety Using Traffic Encounters: Proactive Crash Estimation on Roadways with Conventional and Autonomous Vehicle Scenarios

Introduction

With the expected arrival of autonomous vehicles, and the ever-increasing levels of automation in today's human-driven vehicles, an efficient and rapid method of safety evaluation and countermeasure identification is needed to effectively monitor and analyze safety. Traffic encounters (defined as any event that brings the possibility of a crash) have the potential to be an effective surrogate measure. The two long-standing hurdles of applying traffic encounters to engineering practice—(1) cumbersome field observations, and (2) the lack of proven methods for estimating the crash frequency—are both being resolved through recent or current studies. Two JTRP funded projects, SPR-3831 and SPR-4102, have resulted in the Center for Road Safety developing two LiDAR-based traffic monitoring systems that are capable of recording traffic encounters. Traffic conflicts are severe cases of traffic encounters, and they are associated with a high risk for crashes. The theoretical basis of estimating crash frequency based on traffic conflicts has recently been advanced and published. The preliminary evaluation of the method's ability to estimate the frequency of rear-end collisions is encouraging results.

The theoretical basis of estimating crash frequency based on traffic conflicts has recently been advanced and published. This project made progress toward real world implementation of traffic encounters-based method using the TScan system.



TScan unit collecting data.

Findings

The TScan units were deployed in the field for prolonged periods to identify and track traffic at select intersections. The data sets were then used to evaluate and improve object detection and tracking algorithms to improve traffic conflict detection results. Guidelines for collecting and interpreting encounters and conflicts and estimating the annual number of crashes are included in this report.

To facilitate application of the guidelines, computer-based engineering tools were developed to analyze trajectories and identify traffic encounters and conflicts. A visualization tool—the encounter diagram builder—presents the spatial distribution of encounters and conflicts in a similar way as the already-existing collision diagram tool. The numerical outcomes produced with the tools include a list of traffic encounters, a subset of encounters confirmed as conflicts, and the estimated annual number of crashes based on traffic conflicts.

Implementation

The upgraded two TScan trailer-based prototypes are available for use. The guidelines in the appendices introduce the end user to the process of using traffic encounters and conflicts for safety evaluation, and the companion manuals guide users through the process of data collection and processing.

Efficient use of the developed system requires properly training end users. An INDOT-CRS collaborative process is needed to gradually introduce INDOT personnel to using TScan in safety evaluations. This period will also be an opportunity for collecting feedback from the end user and for making limited modifications to the system and documentation.

Recommended Citation for Report

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