CENTER FOR TRANSPORTATION RESEARCH

PROJECT SUMMARY

Texas Department of Transportation

0-7050: Improving the Identification of Curve-Related Crashes in the Crash Records Information System (CRIS)

Background

In 2020, there were more than 35,000 fatal crashes in the U.S., around 25 percent of which occurred on or near horizontal curves where a roadway alignment changes direction. According to the Federal Highway Administration (FHWA), crashes are, on average, three times more likely on horizontal curves than on other highway segment types. Indeed, curves play a significant role in crashes in Texas. From 2010 to 2017, about 9 percent of all crashes and 22 percent of fatal crashes were related to curves. However, a recent analysis revealed that Texas's Crash Records Information System (CRIS) may misclassify a substantial number of curve-related crashes. For instance, the CRIS missed about one-third of curve-related motorcycle crashes. Consequently, the safety impact of curves on crashes is underestimated. Improved methods for identifying curve-related crashes, additional insights into curve characteristics, and enhanced knowledge of their impact on traffic crashes are needed. To fill this gap, this research aimed to develop an automated methodological procedure that can effectively improve the identification of curve-related crashes in CRIS.

What the Researchers Did

The research team started with a thorough review of horizontal curves and their impacts on traffic crashes. This review encompassed the following topics: characteristics of horizontal curves; impacts of horizontal curves on crash risk, frequency, and severity; and factors affecting crashes on horizontal curves. A comprehensive study was then conducted to investigate available data sources that contain reliable roadway geometry and inventory information. Curve-related parameters that can provide information on the identification of curve-related crashes in the CRIS database were also examined. Then, a systematic data analysis was performed to identify the patterns and characteristics of curve-related crash misclassification in the CRIS database. Next, a methodological procedure to improve the identification of curve-related crashes was developed, automated, and evaluated. Finally, using the Texas Peace Officer's Crash Reports (CR-3) of misclassified crashes, the research team comprehensively investigated potential causes for curve-related crash misclassifications in CRIS.

What They Found

Data Consistency in CRIS

A comprehensive data analysis was conducted to check data consistency in the CRIS database. Approximately 77 percent of crash records have consistent curve-related information, whereas 23 percent of crash records contain internally inconsistent curve attributes, showing in one data field that the crash is curve-related but in

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the other data field that the crash did not occur on a horizontal curve.

Six Types of Curve-Related Crash Misclassifications in CRIS
The research team examined the accuracy of curve information in CRIS using the Highway Curves GIS layer provided by TxDOT. Based on this examination, curve-related crash misclassifications in CRIS were categorized into six types. Under the optimal buffer zone setting, the research team computed the percentage of crashes that fell into each of the six misclassification categories using CRIS 2017–2020 data. The analysis showed that, on average, 27.1 percent of crashes during this period were misclassified in terms of whether they were curve-related.

Automated Methodological Procedure for Identifying Curve-Related Crashes in CRIS
To improve curve-related crash identification in CRIS, the research team first developed a methodological procedure for systematically identifying misclassifications of curve-related crashes. Leveraging Python programming language and ArcGIS Python libraries, the CTR research team accomplished the automation of the developed procedure through two major tasks: 1) visualization of the customized CRIS data in ArcGIS Pro, and 2) verification of curve-related crash classification using the Highway Curves GIS layer as a reference. The performance evaluation proved that the automated methodological procedure could help identify curve-related crashes both effectively and efficiently.

Findings from Texas Peace Officer's Crash Report (CR-3)
The research team reviewed 60 randomly selected CR-3 reports and summarized the results and key findings. Even though it is almost impossible to pinpoint the exact cause(s) of each type of misclassification, rational inferences could be made on the probable cause of each individual crash misclassification based on available information. Based on the inferences, Type 1 and Type 6 misclassifications are most likely caused by inaccurate GPS coordinates that fail to precisely reflect the actual location of the crash. Type 2 and Type 5 misclassifications are most likely caused by either incorrect curve classification derived from CR-3 reported data fields or inaccurate GPS coordinates. Type 3 and Type 4 misclassifications are primarily caused by incorrect curve information generated by the CRIS system or inaccurate GPS coordinates.

What This Means

Accurately identifying curve-related crashes is important to understanding and characterizing curves' impact on crash risk and severity and, in turn, how to reduce such crashes. Under this research project, an automated procedure has been developed that, along with other findings from the project, will allow TxDOT engineers to use currently available data to better identify curve-related crashes in support of TxDOT's safety goal of zero fatalities.

For More Information

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