TECHSUMMARY October 2023

State Project No. DOTLT1000341 | LTRC Project No. 20-1SA

Evaluation of Traffic Crash Characteristics on Elevated Sections of Interstates in Louisiana

INTRODUCTION

Interstates are becoming increasingly important to traffic mobility in Louisiana, with the state's interstate system seeing a 61% rise in vehicle miles traveled (VMT) from 2000 to 2019. This substantial increase has posed challenges in reducing crash rates with fatalities increasing by 23% from 2019 to 2020. Elevated interstate sections pose unique challenges due to high-speed traffic on non-expandable lanes and limited shoulder widths, which could be exacerbated by adverse weather. Crashes in these sections not only affect individuals involved, but also result in heavy property damages that can be very costly to the state and federal governments. Even non-fatal crashes can complicate incident response management due to the limited access points and a lack of traffic rerouting options on these elevated sections.

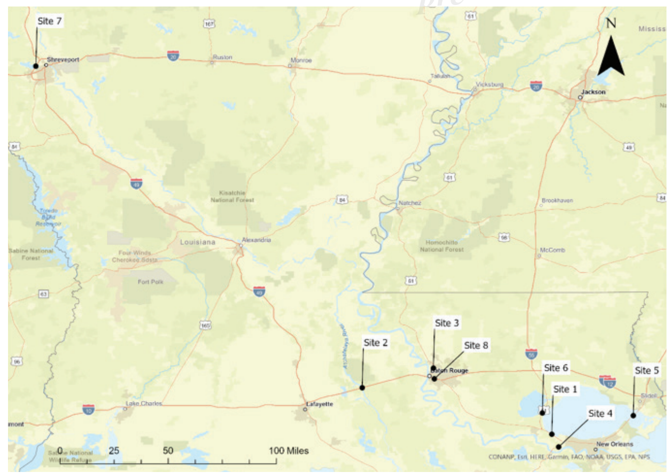

Figure 1. Location of selected sites in Louisiana

Among Louisiana's elevated interstates, the Atchafalaya Basin Bridge on I-10, which links Baton Rouge and Lafayette, has been of particular safety concern. From September 2003 to the time of research, it remains the only segment in the state with truck lane restrictions and differential speed limits. More recent data (2015-2020) persistently reveals high crash rates of 81.7 per 100 million VMT. To address the high crash risk, the Atchafalaya Basin Bridge has been designated a highway safety corridor, calling for the Louisiana Department of Transportation and Development (DOTD) to install infrastructure and enforcement measures. Understanding crash characteristics, speeding patterns, and compliance rates can better facilitate the implementation of these measures. Given the common geometric characteristics of the state's other major elevated interstates, it is vital to analyze the speeding and crash patterns along similar elevated segments for a comprehensive understanding of the safety issues they present.

OBJECTIVE

The main objective of the research project was to conduct a crash analysis on selected elevated highway segments to identify common crash characteristics, issues, and similarities or differences between car and truck crashes. Specifically, the research aimed to determine if the crash characteristics observed on the elevated section of I-10 over the Atchafalaya Basin were similar to those on other elevated highway segments in Louisiana. The project also aimed to analyze speed data and identify crash hotspots in all selected elevated sections. Another objective was to utilize a video analytical software that could classify and count vehicles for estimating the compliance of truck lane restrictions on the Atchafalaya Basin Bridge.

SCOPE

- The research project was limited to a total of eight elevated interstate sections in Louisiana, each more than 1 mile in length and equipped with cameras during the study period (Figure 1).
- In the context of speed analysis for this study, speeding occurs on a site when the estimated 85th percentile speed is above the posted speed limit. The degree of speeding is quantified as the amount by which the 85th percentile speed exceeds the posted speed limit (PSL) for a particular segment under investigation.
- The use of video analytical software to explore truck lane restriction compliance was limited to footage from five specific camera locations on the Atchafalaya Basin Bridge, which was the only elevated section with truck lane restrictions in place.

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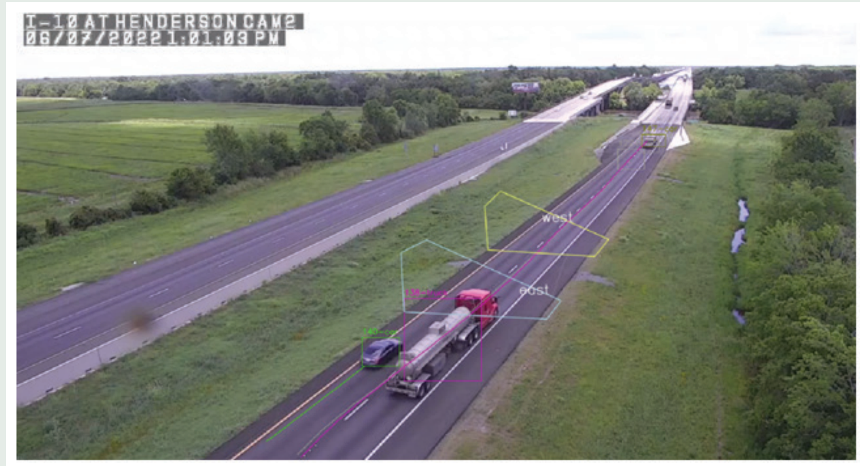

Figure 2. Trajectories of vehicles in DeepMetrics

METHODOLOGY

The project employed various approaches to analyze crash and speed data, identify crash hotspots in all elevated sections, and estimate compliance rates for truck lane restrictions on the Atchafalaya Basin Bridge. The PDA suite's Massive Data Downloader interface was used to collect unobstructed traffic speed data from XD or TMC segments for 2019 through September 2022, specifically on Tuesdays to Thursdays between 1 pm and 3 pm. Utilizing crash data for 2015–2020 from selected elevated sections, researchers could identify prevalent crash characteristics, locate hotspots with frequent crashes beyond a certain threshold, and compare these hotspots with associated geometric characteristics and speeding patterns.

The research team used the DeepMetrics (DPM) software, which has four main virtual components or panels: Detection, Tracking, Counting, and Flow Panel. Through a two-step process, the non-compliance of trucks using the right lane was estimated. The unique tracking system of the DPM system assigns each vehicle a unique ID based on spatial and temporal information, detecting their entrance and exit points (Figure 2). By tracking vehicle trajectories, researchers counted trucks on the left lane, then subtracted this from the total on all lanes, yielding the number of vehicles on the right lane.

CONCLUSIONS

A comprehensive analysis of 10,022 crashes from 2015–2020 on all eight sites revealed a collision distribution of 47% rear-end, 20% single-vehicle, and 16% sideswipe. Notable crash factors include crash hour (12 pm to 6 pm), drivers aged 25-64, and inattentiveness or distractions. Individual elevated section sites exhibited distinct crash characteristics, with rural sites having higher single-vehicle crash percentages and urban sites having higher rear-end crashes.

Speed data analyses from the RITIS probe data platform revealed that speed limit violations were prevalent across nearly all analyzed elevated interstate sections, particularly on two longer sites with a 60 mph speed limit. Speeding up to 10 mph above the PSL was observed at connected elevated segments due to a decrease in the speed limit from 70 mph at non-elevated segments. Speeding was lower in areas with sharp curvature or high AADT with merging/diverging vehicles. ArcGIS-based crash hotspot analysis did not reveal a common pattern concerning roadway geometric characteristics. The Atchafalaya Basin Bridge had the highest percentage of hotspots with trucks as a crash factor at 29%, and a notable 44% of hotspots were attributed to non-dry conditions.

DeepMetrics (DPM) software and manual estimation using video footage were used to assess right-lane truck compliance on the Atchafalaya Basin Bridge, revealing truck lane non-compliance at approximately 20%, with DPM estimates indicating compliance rates ranging from 77.1% to 82.3%.

RECOMMENDATIONS

Based on the findings of this research, the following recommendations can be provided:

- The list of hotspots and associated crashes could be used when developing safety countermeasures for hotspots on elevated sections. Prior to applying countermeasures on elevated sections, the results combining crash hotspots, degree of speeding, and truck percentage can be utilized as a supplementary guide for strategic countermeasure development.
- Since the results relating to speeding and truck percentages are inconclusive, further research can be conducted to investigate lane-by-lane volume (for both passenger vehicles and trucks) and lane-by-lane speed. This research should provide concrete evidence on the impact and identification of associative crash and geometric characteristics in connection with differential speed limits (DSL) and compliance with truck lane restrictions.