TECHSUMMARY February 2021

State Project No. DOTLT1000225 / LTRC Project No. 18-5SA

Evaluating Pedestrian Crossings on High-Speed Urban Arterials

INTRODUCTION

The 2016 National Transportation Safety Board (NTSB) report shows that, on average, 16 pedestrians are killed daily in the United States. In 2016, Louisiana ranked as the 7th worst state in pedestrian fatalities, behind New Mexico, Florida, South Carolina, Arizona, Delaware, and Nevada. Initial analysis of pedestrian crashes in Louisiana from 2013 to 2017 paints a picture of the problem. Out of 7,415 pedestrian crashes, 74% occurred on low-speed roadways, while 26% occurred on high-speed roadways. However, fatal pedestrian crashes on high-speed roadways accounted for two-thirds of the state's total pedestrian fatalities, i.e., 358 from a total of 535 fatal pedestrian crashes. Land-use analysis of pedestrian crashes on Louisiana high-speed roadways reveals a similar trend. As seen in Table 1, between 2013 and 2017, metropolitan areas accounted for 80% of total pedestrian crashes, 71% of fatal pedestrian crashes, 81% of serious injury crashes, and 82% of other injuries. This further reveals that the problem is more pronounced on high-speed roadways in metropolitan areas than in rural areas.

To address pedestrian safety and help achieve Louisiana's Strategic Highway Safety Plan's (SHSP) goal to halve fatalities by 2030, there was a need to understand the problem better and identify the risk factors that contribute to pedestrian fatalities and severe injuries on high speed arterials. This research specifically examined contributing factors to pedestrian crashes on high speed urban arterials in Louisiana.

Land Use Type	Pedestrian High Speed Roadway Crashes			
	Fatal Crashes	Serious Injury Crashes	Other Injury Crashes	Total Crash
Metropolitan	254 (71%)	169 (81%)	1137 (82%)	1560 (80%)
Rural	104 (29%)	38 (19%)	248 (18%)	390 (20%)
Total	358 (100%)	207 (100%)	1385 (100%)	1950 (100%)

Table 1. Land-Use Distribution of Pedestrian High Speed Roadway Crashes

OBJECTIVE

This study aimed to provide a preliminary assessment of Louisiana's roadways in terms of existing pedestrian crossing facilities, identify any associations of pedestrian crashes with the presence or lack of such pedestrian crossing facilities, and provide information on studies to be undertaken to provide DOTD with a system-wide solution for pedestrian crossing facilities on its high-speed urban arterials.

The study also analyzed factors contributing to pedestrian crashes by investigating how different movement types, by pedestrians and motorists, influence pedestrian crashes on high-speed urban roadways while probing the influence of other traffic and roadway characteristics. Specifically, tasks performed to meet the objectives were:

1. Conduct a literature review of state legislation on the provision of pedestrian crossing facilities on arterials.
2. Undertake a study of pedestrian crashes to identify any associations with the lack or presence of pedestrian crossing facilities.
3. Determine and review the types of traffic studies that need to be conducted in order to provide appropriate pedestrian crossing facilities on urban arterials.
4. Propose a breakdown classification of high speed arterial roadways.
5. Identify factors contributing to pedestrian crash severity on Louisiana high-speed urban roadways.
6. Identify and examine the main predictors of pedestrian crash severity.
7. Identify geometric and traffic control characteristics that influence the frequency of pedestrian crashes.
8. Identify pedestrian motorist movements that result in pedestrian crashes.
9. For intersection crashes, identify locations with frequent pedestrian crashes and type of control at these intersections.

LTRC Report 641

Read online summary or final report:
www.ltrc.lsu.edu/publications.html

PRINCIPAL INVESTIGATOR:
Julius Codjoe, Ph.D., P.E.
225-767-9761

LTRC CONTACT:
Elisabeta Mitran, Ph.D.
225-767-9129

FUNDING:
SPR: TT-Fed/TT-Reg - 5

Louisiana Transportation Research Center

4101 Gourrier Ave
Baton Rouge, LA 70808-4443

www.ltrc.lsu.edu

SCOPE

Nine major metropolitan areas in Louisiana were selected to represent urbanized areas for this study: New Orleans, Baton Rouge, Lafayette, Shreveport, Houma, Monroe, Alexandria, Hammond, and Lake Charles. Only high-speed roadways in this areas were included in this research. Based on the literature and the analysis conducted, the recommended definition of high-speed roadways is "roadways with posted speeds of 45 mph or greater."

METHODOLOGY

The research team compiled and analyzed data from a database of crash data between 2013 and 2017, GIS data from DOTD that provided roadway information, and aerial view roadway features extracted from Google Earth. The analyses undertaken include: data-driven safety analysis (DDSA) to identify any correlation between pedestrian crash frequencies and roadway characteristics and with intersection/non-intersection features; spatial hotspot or heat map analysis to visually identify hotspots of high pedestrian crash locations and whether they correlate with bus stop locations; decision tree analysis to identify significant influencing variables that impact pedestrian crash frequency; and location movement classification method (LMCM) analysis to understand how different pedestrian and motorist movements correlate with pedestrian crash frequencies.

CONCLUSIONS

Findings from this research analysis offer preliminary assessments that can be used as the basis for additional studies. The study mapped out pedestrian crashes, from 2013 to 2017, on high-speed arterials in Louisiana's urban and urbanized areas. Analyzing data on pedestrian crashes for the study areas from Louisiana's crash database, the following conclusions were drawn:

- The Data-Driven Safety Analysis (DDSA) undertaken provided assessments and trends requiring future studies to provide further insights. For instance, crash densities were highest on roadways with generic names "Plaza" and "Expressway" and also tend to increase from roadway categories CAT 1 to CAT 5. Pedestrian crashes in urban areas were most frequent on roadways without shoulders and sidewalks, while for urbanized areas, it was roadways with high ADT and no sidewalks.
- Findings from Spatial Hotspot or Heat Map Analysis show that most fatal and severe injury crashes were at hotspot locations for urban and urbanized areas: mostly along roadway networks surrounding interstate corridors. For large and densely populated study areas, such as Shreveport, Lafayette, Baton Rouge, and New Orleans, most hotspot locations have a high concentration of bus stop locations.
- Decision tree analysis identified the following significant influencing variables that impact pedestrian crash frequency: the condition of pedestrians (such as alcohol-impaired and inattentive), distance to control, ADT, and day of the week.
- The Location Movement Classification Method (LMCM) analysis revealed that most pedestrian crashes involve pedestrians trying to cross the first half of a roadway. In contrast, the movement with the least amount of crashes are pedestrians moving opposite to the direction of traffic flow. For motorists, straight movements (rather than turning movements) correlate most with high pedestrian crash frequencies.

RECOMMENDATIONS

Based on the research experience, challenges faced, and measures adopted in the duration of this research, the following recommendations were reached:

- From the statistical evaluation of the lower limits used by other states compared to Louisiana's roadways' speed limits, the research arrived on a recommendation that the definition of high speed for Louisiana should be roadways with posted speeds of 45 mph or greater.
- The current Louisiana roadway classification is based on the functional classification system; nonetheless, for the analysis undertaken, the study proposes five roadway categories, as seen in Figure 1, similar to what is defined by the North Carolina's Street Design Guide.
- Category CAT 1 is highly tailored to pedestrian movements while CAT 5 is a high-speed and tailored towards vehicles on high-speed routes. CAT 2, CAT 3, and CAT 4 fall linearly between the two extremes.
- In analyzing the crash narratives, the research team found inconsistencies in the actual narrative and what has been coded in the database. A quality assurance check is recommended for random crash reports at regular intervals to ensure officers' narratives are correctly coded.
- This research makes no recommendations for pedestrian crossing facilities on high-speed arterials. Instead, the study provides findings that are to be used as a basis for future studies that will help DOTD develop a system-wide solution to address pedestrian safety on its high-speed urban arterials. Future research could include actual implementations and before/after studies to evaluate any potential countermeasures.

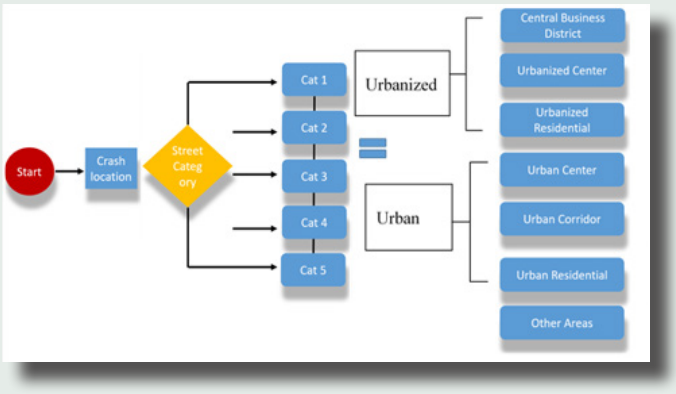

Figure 1. Proposed street classification for an urban and urbanized area