LOUISIANA TRANSPORTATION RESEARCH CENTER
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Reduce Pedestrian Fatal Crashes in Louisiana by Improving Lighting Conditions

INTRODUCTION

Pedestrians are the most vulnerable road users of the highway transportation system, and their safety at nighttime is an ongoing safety concern. A disproportionate number of pedestrians are involved in fatal crashes at night (with or without streetlight) compared to the daylight. According to the Fatality Analysis Reporting System (FARS) database, 2019 is the 10th consecutive year in which the pedestrian fatalities at nighttime accounted for more than 70% of all the pedestrian fatalities in the United States. The situation is even worse in Louisiana, where approximately 80% of the pedestrian fatalities occurred at night in 2019. However, the causes for the overrepresentation of pedestrian crash involvement at nighttime have not been explored in detail. While lack of visibility is one of the most dominant factors behind nighttime pedestrian crashes, other crash contributing factors including pedestrian characteristics, driver and vehicle characteristics, roadway geometric features, and environmental factors are associated with such crashes. To improve pedestrian safety, we need to better understand the magnitude of the problem and identify the risk factors that contribute to pedestrian crashes at nighttime, especially in Louisiana.

OBJECTIVE

The primary objective of this study was to investigate the impact of lighting conditions on pedestrian crashes. The main objectives were:

1. Learning and documenting lighting policies/guidelines/practices in Louisiana and other states. Emphasis will be given to pedestrian focus street lighting policies.
2. Investigating lighting conditions at intersections, crosswalks, and segments with frequent pedestrian crashes and their impact on pedestrian safety in Louisiana.
3. Recommending the targeted practical lighting requirements based on the analysis.
4. Making suggestions on crash coding modification in the pedestrian crash report (lighting condition, type of lighting such as street, business, parking, or residential houses, etc.)

SCOPE

The study focused only on analyzing the nighttime crash data at all roadway types within the state. Interstate pedestrian crashes were tagged separately and removed from the modeling though used in data exploration. Though the study attempted to get the cost of lighting from multiple sources and preferred to use the average cost, the study eventually used the cost provided by Lafayette Utility System as it was the most recent updated local cost for streetlights.

METHODOLOGY

A comprehensive database was developed containing 8,149 pedestrian crashes that occurred during the 2014-2018 period. Since pedestrian crash characteristics are significantly different based on intersection and segments, the database was divided into two parts: intersection and segment to facilitate the analysis. Additionally, to identify the impact of the streetlight on pedestrian crashes, only the crashes that occurred at night were considered. Site-specific factors (e.g., presence of streetlight, shoulder, median, crosswalk) were collected with the help of Google

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Maps. To identify the relationship between the presence (or absence) of streetlights with site-specific factors, a binary logistics regression model separately for intersection and segment was developed. The research team also investigated pedestrian crash patterns under different lighting conditions (daylight, dark with streetlight, and dark without streetlight) through a data mining approach. Finally, a benefit-cost analysis was conducted to compare the cost of installation of streetlights and the benefits of reducing crashes.

CONCLUSIONS

As the analysis revealed, 44.93% of pedestrian crashes occurred at nighttime, when the pedestrian volume is the lowest. There were 49% of total pedestrian crashes and 74% of fatal crashes that occurred between 6 pm and 6 am. Approximately 90.01% of the pedestrian crashes occurred in urban areas compared to only 7.46% occurred in rural areas. Surprisingly, 20% of rural crashes resulted in fatalities, compared to only 7% in urban regions. In rural areas, most of the pedestrian fatalities (62.71%) occurred in the dark without lighting. It indicates that the pedestrians are at higher risk in the rural areas at dark with no lighting. The results of binary logistic regression model shows that the intersections with raised median, multilane approaches, and high approach speed are more likely to be lighted. At segments, the number of lanes, speed limit, and visibility of pedestrians was identified as significant factors affecting the presence of lights. The results from association rules mining also revealed several interesting crash patterns. For example, at night with lights, pedestrian alcohol/drug involvement is identified as one of the key factors leading to crashes. Other crashes contributing factors associated with intoxicated pedestrians are driver age group of 55 to 64 years, pedestrians in dark clothing, speed limit less than 35 mph, pedestrian crossing at intersection, female drivers, and mixed land use (business and residential). The fatal pedestrian collisions are more likely to occur in areas with both businesses and residential areas. Severe pedestrian collisions are more common on the high-speed highways with a speed limit of over 55 mph. At night without lights, dark-clothed pedestrians were identified as the most vulnerable group involved in crashes. Other crash contributing factors were high-speed limit roadways (>50 mph), residential areas, and pedestrian alcohol use. The fatal crashes during dark conditions (with and without lighting) are associated with roadway having a speed limit of 50 mph or higher. The ARM model can be used to prioritize the locations for pedestrian lighting. The ratio of benefit to cost ratio is estimated as 4.98 for intersections and 5.62 for segments suggesting, which strongly justify the roadway lighting installation for pedestrian safety.

RECOMMENDATIONS

Using the data mining techniques prioritize the locations for pedestrian lighting. In the future, the study recommended to use some advanced data mining techniques to address the spatial distribution of pedestrian crashes.