Safety Performance Evaluation for Elderly Pedestrians

Embry-Riddle Aeronautical University, Daytona Beach, FL

Hongyun Chen, Sarah Murray, Brock C. Pennington, and Fanny Kristiansson

Abstract

According to the latest National Highway Traffic Safety Administration's report, there were 5,977 pedestrians killed in traffic crashes, which accounted for 16% of all traffic fatalities in 2017. Florida has much higher pedestrian fatalities rate at 70% higher than the national average. By 2020, approximately 40.8% of Florida residents will be reaching above 50 years of age. More than 15.5 million 65+ Americans live in areas where public transportation is inadequate or nonexistent. These non-driving adults must then either walk or use another nonmotorized mode of transportation.

Elder adults are more vulnerable as pedestrians, and safety issues have not been well addressed for them. Even though the 65+ population accounts for 13.7% of overall population in the US, about 18% percent of all fatalities people were 65+. Not many researches or countermeasures have been researched and developed for this age group. This group may suffer age-related physical changes such as vision impairments, hearing impairments, chronic conditions, cognition changes, less muscle efficiency, etc., which place them at a higher risk for injury or death.

The objectives for this research project are to: 1) determine the safety performance of elder adults as pedestrians; and 2) to understand crash prone locations and major contributing factors through historical crash data of several years. Results from this study will provide traffic agencies with a better understanding of the crash occurrences, help in incident management, and improve safety and reduce the number of crashes and crash severity levels.

Historical Crash Analysis

- The historical crash analysis aims to analyze crashes, determine crash prone locations, and produce safety improvement developments.
  1) Historical crash data for 8 years was collected (2010-2017)
     a. Pedestrians grouped into 65 and under and 65+
     b. Frequency, rates, patterns, trends, etc. analyzed per group
     c. Statistical analysis performed to determine differences between groups
  2) Identify crash prone locations and major contributing factors
     a. Area types and location types will be compared between groups
     b. Statistical analysis performed to compare contributing factors to crash occurrences and injury severity levels between groups
- Negative Binomial will be used to model crash frequency

$$\Pr(Y = y) = \frac{\Gamma(\alpha + y)}{\Gamma(\alpha) y!} \left(\frac{\beta}{1+\beta}\right)^{y} \left(\frac{1}{1+\beta}\right)^{\alpha}, y = 0,1 \ldots$$

- The frequency of pedestrian cashes is predicted in regression:

$$Y = \exp(\beta_0 + \beta_1 x_{i1} + \cdots + \beta_k x_{ik})$$

3D- Zebra Crossing

Countermeasure Development

The research team will collect potential countermeasures based on the contributing factors identified in the historical crash analysis. The research team will collect the up-to-date engineering solutions. For example, if vision impairment is one of the major impacts at the crossing sections, installing the 3D crossing could be a potential countermeasure as shown in the picture.

Significance

The results are expected to help traffic agencies to have a better and more up to date understanding of the safety problems related to elderly pedestrians. The study proposes the development of zone-based development procedures that traffic agencies could use to prioritize safety improvements, especially in elderly communities. Results will also likely be incorporated into potential future research ideas, plans and designs. Additionally, understanding crash characteristics, prone locations, patterns, etc. will help to prioritize resources when responding to crashes