# Investigation of the Patterns of Pedestrian Fatalities

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## 1. Summary

According to the National Highway Traffic Safety Administration, in 2020, there were 6,516 pedestrians killed in traffic crashes, a 3.9-percent increase from the 6,272 pedestrian fatalities in 2019 [3]. This project investigates the increasing number of incidents of pedestrians being injured or killed on the roads, utilizing the extensive data provided by the Florida Department of Transportation (FDOT) [4]. The growing concern over pedestrian safety demands a thorough analysis to identify the root causes of these incidents and to devise effective strategies for making our streets safer. By examining the FDOT data, which includes details on accident locations, timings, and victim demographics, we aim to uncover patterns and identify the primary factors contributing to these tragic events [1], [2], [4].

Our research focuses on identifying major risk factors for pedestrians, such as the most dangerous locations, times when accidents are more likely, and which demographic groups are most at risk. Understanding these trends will allow us to recommend specific measures to reduce these incidents, including infrastructure improvements, public education campaigns, and stricter enforcement of traffic laws [2].

Preliminary analyses suggest a correlation between pedestrian accidents and certain urban areas, specific times of day, and risky pedestrian behaviors. This evidence supports the need for a comprehensive approach to safety, combining physical roadway improvements, enhanced public awareness, and rigorous enforcement of traffic regulations [1].

The significance of this study lies in its potential to inform and shape policies that could significantly reduce pedestrian fatalities and injuries. It contributes to the broader goal of promoting safer urban environments where walking and cycling can be enjoyed without fear.

## 2. Background

Pedestrian fatalities illustrate a severe road safety concern in Florida. Despite devoted efforts to improve road safety, pedestrian fatalities continue to ensue at terrifying rates, necessitating a thorough investigation into the underlying habits and contributing factors.

The Florida Department of Transportation (FDOT) data highlights the critical role. In 2022 alone, Florida documented 10,013 pedestrian-related crashes, resulting in 765 fatalities. Although there was a 5% decrease in crashes and an 8% decrease in fatalities compared to the previous year, pedestrian fatalities stress the urgent need for subtle measures to better pedestrian safety across the state [5].

As Daylight Savings Time ends and daylight hours decrease, the risks for pedestrians escalate. The bulk of hit-and-run fatalities happen at night, aggravating the risks faced by pedestrians when visibility is zero to none.

The effect of drugs and alcohol further worsens the risks associated with pedestrian safety in Florida. Individuals under the influence may also jeopardize their ability to wander roadways safely on foot, adding complexity to the problem of mitigating pedestrian fatalities.

Through joint efforts and data-driven insights, Florida can work towards creating safer streets and protecting the lives of pedestrians, ensuring that everyone can navigate the state's roadways with peace of mind.

**Data Collection Process**

The dataset derives from the Florida Department of Transportation (FDOT) and the Florida Department of Highway Safety and Motor Vehicles (FLHSMV). It includes information on fatal and serious injuries sustained by non-motorists (such as pedestrians and bicyclists) on public roads in Florida from January through June 2019 [4]. The data is taken from "Long Form" crash reports presented by law enforcement agencies to FLHSMV and processed and verified by FDOT. The dataset has coordinates and various attributes relevant to the crash and individuals involved, such as crash date, time, location, person type, gender, age, injury severity, and suspected alcohol or drug use. It seeks to provide an understanding of road safety and facilitate analysis for improving transportation infrastructure and policies.

## 3. Issues Affecting Pedestrian Fatalities in Florida

**3.1 (J. Bush) Trends Over Time:** Various tendencies affect Pedestrian Fatalities such as seasonal trends, temporal patterns, long-term changes, comparative analysis, technology and infrastructure impact, and policy implications all contribute to understanding and addressing pedestrian accidents. Long-term trends reflect differences in safety measures and societal behavior. Comparative analysis with factors like population growth provides context.

**3.2 (N. Belii) Impact of Alcohol and Drugs**: How do suspected alcohol and drug use relate to the occurrence of these incidents? Are incidents involving suspected alcohol or drug use more likely to result in severe or fatal injuries? Alcohol and drug use significantly impact pedestrian safety, leading to increased risks of accidents and fatalities on our roadways. Is there a clear correlation between substance use and pedestrian fatality rates, with incidents involving alcohol or drugs showing significantly higher fractions of fatal crashes? These substances impair judgment, coordination, and reaction times, making both drivers and pedestrians more susceptible to accidents.

**3.3 (M. Lupercio-Sanchez) Correlation Analysis**: Is there a correlation between the location of incidents and demographic factors? Areas with higher population density might encounter more pedestrian interactions due to increased foot traffic and congestion. Similarly, lower-income neighborhoods may lack adequate infrastructure or safety measures, significantly leading to higher incident rates. Access to public transportation could also play a role, as locations with limited transportation options may see more pedestrians walking along busy roads, raising the risk of accidents.

**3.4 (J. Saliby) Pedestrian Activity (Crossing the Road):** Various factors affect pedestrian actions when crossing roads, factors such as speed, signal compliance, and interactions with vehicles. Additionally, foot traffic flow investigation examines discrepancies at intersections, considering variables such as vehicle speeds and pedestrian-vehicle conflicts. Infrastructure effectiveness is evaluated, focusing on elements like crosswalk markings and pedestrian signals. Driver awareness and responsiveness are probed, assessing adherence to regulations like yielding to pedestrians.

**3.5 (A. Agudelo) Pedestrian Activity (Working or Playing on the Road):** Is it essential for the need for awareness campaigns, enforcement of safety regulations, and infrastructure improvements to protect pedestrians from harm? Whether it's construction work, playing sports, or other recreational activities, being on the road exposes pedestrians to unpredictable dangers due to the proximity to moving vehicles.

## 4. Problem Statement and Description of Method of Solution

**4.1 Hypothesis 1 and Method of Solution 1:** Trends over Time

“How does time of day and weekday impact pedestrian involvement in crashes?”

During hours when people are released from school or work, an increase in pedestrian crashes may be seen as they travel to or from these locations. Categorizing the time of day and weekday to visualize pedestrian impressions on specific time periods can be used to pinpoint other external factors. The data may be leveraged to identify high-risk times and days when additional safety measures/ enforcement strategies may be needed. Understanding the factors contributing towards increased congestion or crashes may help identify the times when infrastructure, such as traffic lights, can be improved upon.

**4.2 Hypothesis 2 and Method of Solution 2**: Impact of Alcohol and Drugs

“Are incidents involving alcohol and drugs more likely to cause severe injuries or fatalities?”

Driving under the influence of alcohol or drugs is dangerous and can take the lives of those behind the wheel or on foot. Examining the role that alcohol and drug use plays in pedestrian accidents will provide

insight into if such incidents are more likely to result in severe injuries or fatalities. We will leverage the data to calculate the chi-square measure and compare it to the critical value to determine whether there is a correlation between injuries and influenced driving. Trends and risk factors associated with these incidents can be identified through our analysis. Knowing this information can instigate the development of targeted interventions to reduce influenced driving. Being more knowledgeable regarding the effect of alcohol and drugs on the road will ultimately help us create a safer environment for pedestrians.

**4.3 Hypothesis 3 and Method of Solution 3:** Demographic correlation

“Is there a correlation between pedestrian incidents and their demographic?”

Younger pedestrians, such as children walking home from school, may not have the appropriate training on navigating roads to best avoid accidents. Older pedestrians also may be hindered due to physical factors. Comparing the count of incidents and its fatality rate by decade age group will help isolate which demographics are most susceptible. Understanding and analyzing the age of pedestrians can provide insights into the effectiveness of existing safety measures. These measures may include age-specific crossing assistance programs or speed limit adjustments near schools and senior centers

**4.4 Hypothesis 4 and Method of Solution 4:** Pedestrian location

“Does pedestrian location impact chances of being severely injured?”

We will investigate whether the type of road affects the severity of pedestrian injuries, which could inform safer urban design. Comparing crashes against fatality rates at the different crash sites on a scatter plot will highlight the most pertinent locations. This analysis may help determine which road systems may require additional safety measures to protect pedestrians.

**4.5 Hypothesis 5 and Method of Solution 5:** Pedestrian activity

“Are pedestrians more likely to be involved in an accident depending on their activity?”

Understanding what pedestrians were doing at the time of the crash is crucial to identifying who is most vulnerable. We will utilize a bar chart to visualize the different types of walking methods against fatality rates. The information from the chart may be utilized to target which walking methods are the most unsafe to promote and educate pedestrians regarding safer practices, aimfully reducing fatality rates. Furthermore, infrastructure or technology may be improved to ensure pedestrians are protected. The results from this analysis may provide insight into how we may guide future safety enhancements.

## 5. Results from Analyzing the Database

### 5.1 Hypothesis 1 Results

[Refer to Appendix A1 and A2]

The descriptive statistics show the total number of pedestrian impacts at different times and on other days of the week. There are quite a few peaks, though, which represent the days of the week and the times of the day in which there are also varying numbers of pedestrian impacts.

The chi-square test analyzes if the day and time of the week(s) are associated with pedestrian deaths. After substituting the values, the calculated Chi-square value is compared against critical values to determine whether you had independence. Comparing the chi-square statistic to the critical value will summarize any relationship between the time/day of the week and pedestrian fatalities or lack of one.

**Descriptive Statistics**

Pedestrian impressions were plotted on a bar chart categorized by time of day and weekday.

**Chi-Square Test**

- Counted values for all day slots and some days of the week are recorded.
- Independent fatality rate (TF) expected values are derived assuming no time/day connections are used during the calculations.
- The operation of chi-square statistics and its comparison with critical values gives the shared proportion by implication.

**Results**

From our analysis, we can conclude that while there is a peak in pedestrian accidents during the evening hours, the time of day is not significantly associated with fatality rates. For the day of the week, although there's no significant association at the 5% significance level, the significance level of 10% does suggest an association with fatality rates, specifically on Thursdays and Saturdays.

### 5.2 Hypothesis 2 Results

[Refer to Appendix B]

Descriptive statistics examine fatality rates of crashes that involve alcohol/drugs against those with no alcohol/drugs involved. The aim is to gauge the existence of an appreciable disparity between these two groups regarding the likelihood of correctly answering the questions.

The Chi-square test determines whether alcohol/drugs are a substantial factor in pedestrian fatalities. As before, the Chi-squared statistic obtained from the calculation is compared to significant values to deduce the degree of independence.

**Descriptive Statistics**

One of the charts shows the mortality rates of accidents with or without alcohol/drugs on the vertical axis.

**Chi-Square Test**

- The number of deaths with and without alcohol/drug use as factors are freshly obtained data.
- The beer/drug use and probability of fatality coefficient are assumed to be independent.
- Using a chi-square (X^2) appreciation, we calculate the chi-square measure and contrast it with the critical value to check independence.

**Results**

The analysis shows a clear correlation between alcohol and drug use with increased pedestrian fatality rates in traffic incidents. Both substances showed significantly higher fractions of fatal crashes, with chi-square statistics (66.46 and 46.46) greatly exceeding the critical values, indicating that the presence of alcohol or drugs is almost certainly related to the likelihood of fatal outcomes in pedestrian accidents.

### 5.3 Hypothesis 3 Results

[Refer to Appendix C]

Descriptive statistics demonstrate the distribution of pedestrian crashes and fatalities in different age groups, while indicative statistics convey the relative risk for each age group. Such analysis reveals the age group of those who become easy victims of such incidents.

The two independent variables (sex and age group) are examined through the Chi-square test to determine whether there is a significant association between the victims' age group and the number of pedestrian fatalities. The Chi-square statistics are then used to check them against critical values to evaluate independence.

**Descriptive Statistics**

A chart showing the correlation between the number of crashes and the fatality rates in each age category is created.

**Chi-Square Test**

- Age-specific mortality rates, as well as the mortality rate of each group, are calculated.
- Chi-square values are computed and compared with the critical ones to make a statement about independence.

**Results**

The overall trend suggests that adults in their active years, spanning from 20 to 50, are most frequently involved in pedestrian accidents. This could be reflective of greater exposure due to factors such as active commuting, increased occupational and social activities. Additionally, the fatality rate by age graph

indicates that older pedestrians, particularly those over 90, have a significantly greater risk of fatality. Statistical tests confirm a strong relationship between age and the likelihood of fatal outcomes, with a chi-square statistic (41.304) substantially above the critical value, implying that age is a determining factor in accident severity. Furthermore, a positive correlation coefficient (0.169) indicates that as pedestrians age, their vulnerability to fatal accidents increases slightly.

### 5.4 Hypothesis 4 Results

[Refer to Appendix D1 and D2]

Descriptive statistics demonstrate how the distribution of pedestrian crashes by location and fatality rate replaces pedestrian death in different places, such as intersections, crosswalks, etc. Thus, investigation commensurate with high-risk pedestrian locations distinguishes.

The Chi-square test tests the relationship between pedestrians and fatalities and whether some locations are more dangerous than others.

**Descriptive Statistics**

The scatter charts illustrate crashes and fatality rates at these interesting sites, respectively, with the X-axis and Y-axis.

**Chi-Square Test**

- Fatalities for each case are recorded, along with the number of departing vehicles, and expected values at each location are computed.
- Critical values are calculated and applied to CPLR to measure independence.

**Results**

The analysis indicates a significant correlation between the location of pedestrian accidents and fatality rates. While most accidents occur midblock in car lanes, unexpected areas like driveways and no-traffic zones have higher fatality rates. The chi-square statistic (52.041) confirms a strong statistical relationship between the crash site and the severity of the outcome.

### 5.5 Hypothesis 5 Results

[Refer to Appendix E1 and E2]

Descriptive statistics present the distribution of pedestrian crashes and fatality rates based on pedestrian activities (e.g., walking, jogging, etc.).This analysis helps understand which activities carry higher risks. The Chi-square test evaluates the association between pedestrian activity and fatalities, identifying if certain activities are more hazardous.

**Descriptive Statistics**

The bar chart displays the number of crashes and the fatality rates between different walking activities.

**Chi-Square Test**

- The observed and expected fatalities are identified and assigned for each activity.
- Chi-square values are obtained, and these are compared against the critical value to find out if a relationship exists or not.

**Results**

The data indicates that crossing the road is the most common activity before pedestrian accidents, while working or playing on the road is associated with the highest fatality rate. The Chi-Square test result of 18.64, equating to a p-value of approximately 0.005, allows us to state with 99.5% confidence that there is a correlation between pedestrian activity and the likelihood of fatality in an accident.

## 6. Conclusion

Our project examined various factors contributing to pedestrian accidents and their outcomes. In analyzing the data, we observed that:

- The time and day of accidents showed a notable trend, with evenings and weekends being more common for incidents.
- Substances like alcohol and drugs were significantly linked to an increase in fatal outcomes.
- Age played a role, with older pedestrians being more vulnerable to fatal accidents.
- Certain locations, such as driveways and non-traffic areas, unexpectedly had higher fatality rates.
- Pedestrian activity before an accident, specifically crossing roads and engaging in activities on the road, had a clear connection to the likelihood of fatality.

In summary, pedestrian safety is affected by a complex variety of factors including time, substance use, age, location, and activity. Our findings highlight the need for targeted interventions based on these factors to improve pedestrian safety. To make streets safer for pedestrians, we need to consider educational programs, traffic law enforcement, and urban design.

**References**

[1] A. Schmitt, Right of Way: Race, Class, and the Silent Epidemic of Pedestrian Deaths in America. Island Press, 2019.

[2] R. A. Retting, S. A. Ferguson, and A. T. McCartt, "A review of evidence-based traffic engineering measures designed to reduce pedestrian-motor vehicle crashes," American Journal of Public Health, vol. 93, no. 9, pp. 1456-1463, 2003.

[3] National Highway Traffic Safety Administration, "Traffic Safety Facts: 2020 Data - Pedestrians," DOT HS 813 310, May 2022. [Online]. Available: https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813310

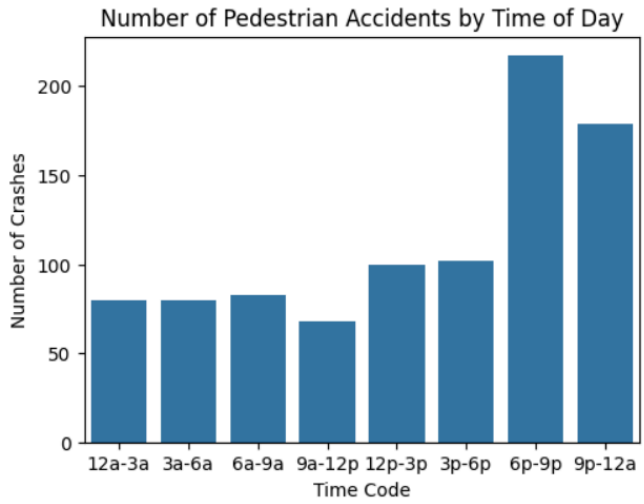
[4] Florida Department of Transportation, "Florida NonMotorist Fatal and Serious Injuries Jan - Jun 2019," FDOT Open Data Hub. [Online]. Available: https://gis-fdot.opendata.arcgis.com/datasets/fdot::florida-nonmotorist-fatal-and-serious-injuries-jan-jun-2019/about.

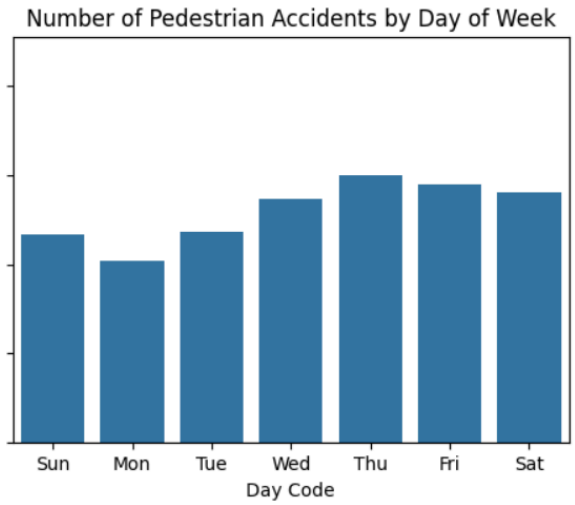
[5] “Pedestrian Safety”. The Florida Department of Highway Safety and Motor Vehicles (FLHSMV). [Online]. Available: https://www.flhsmv.gov/safety-center/driving-safety/pedestrian-safety/#:~:text=In%202022%2C%20there%20were%2010%2C013%20pedestrian%2Drelated%20crashes,darker%20earlier%2C%20the%20risks%20for%20pedestrians%20increase [Accessed Mar. 10, 2024]

**Appendix A**

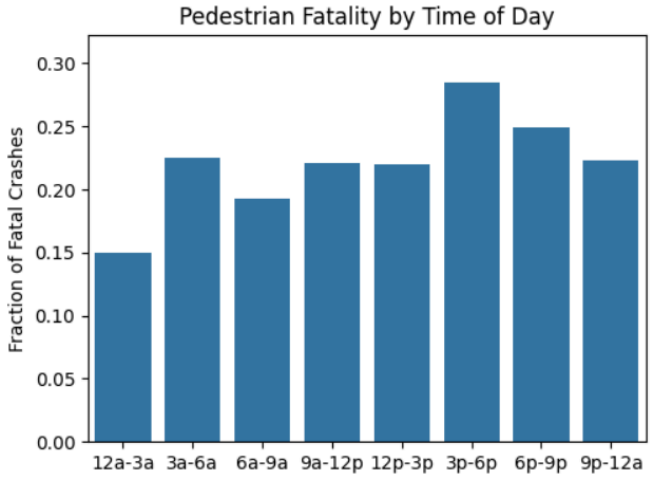
**Trends Over Time**

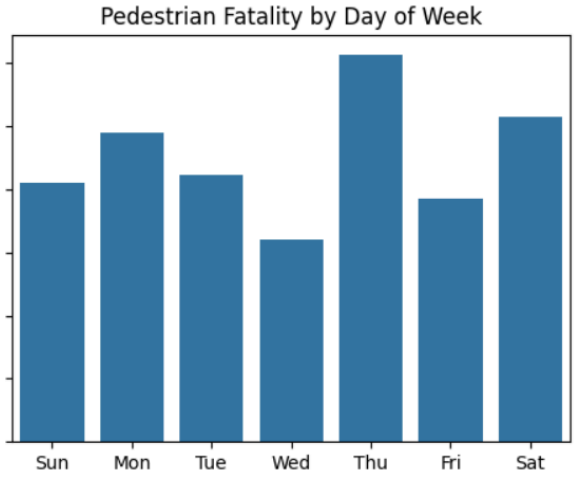
**A1:** Graphs illustrating pedestrian accidents by time of day and day of week




**A2:** Graphs illustrating fraction of fatal crashes against time of day and day of week

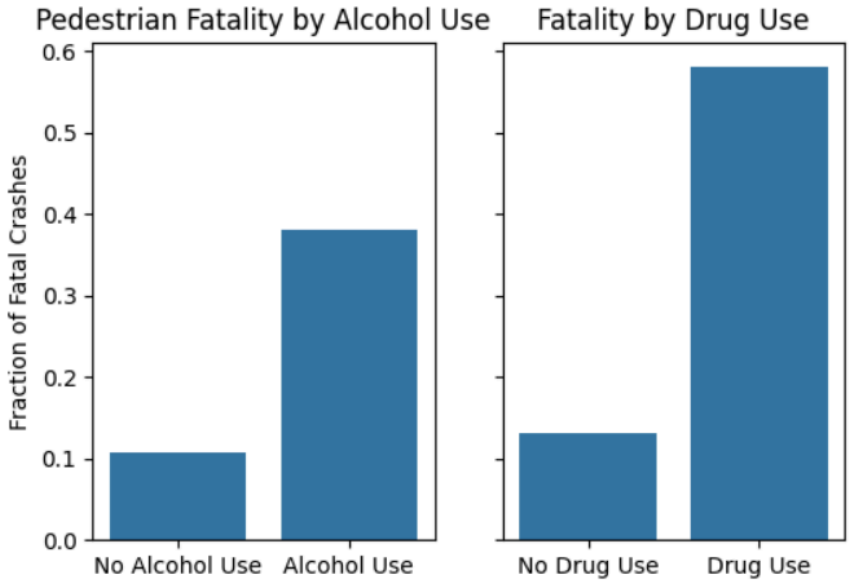


**Appendix B**

**Impact of Alcohol and Drugs**

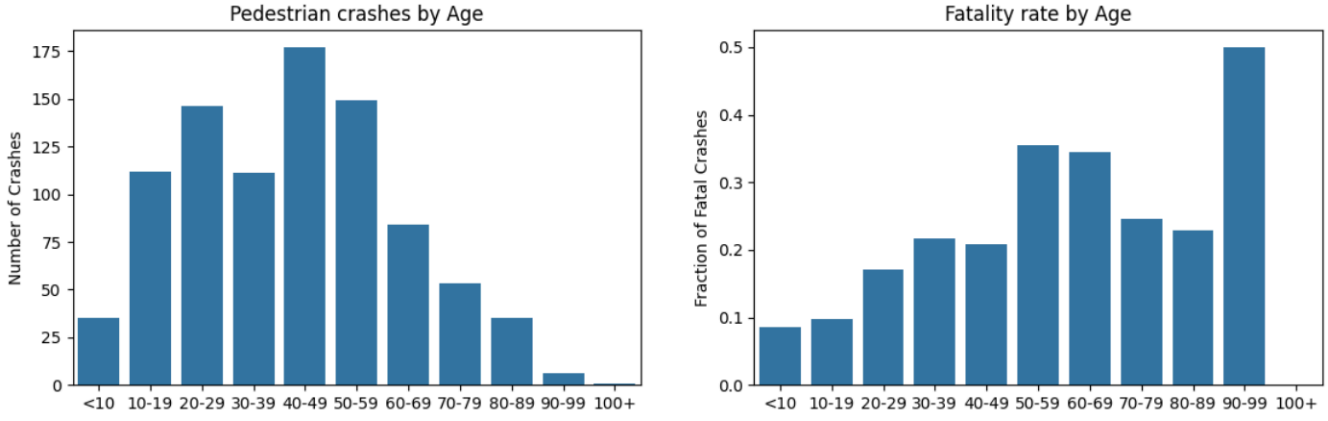
Graphs depicting fraction of fatal crashes against presence of alcohol and drug use




**Appendix C**

**Demographic Correlation**

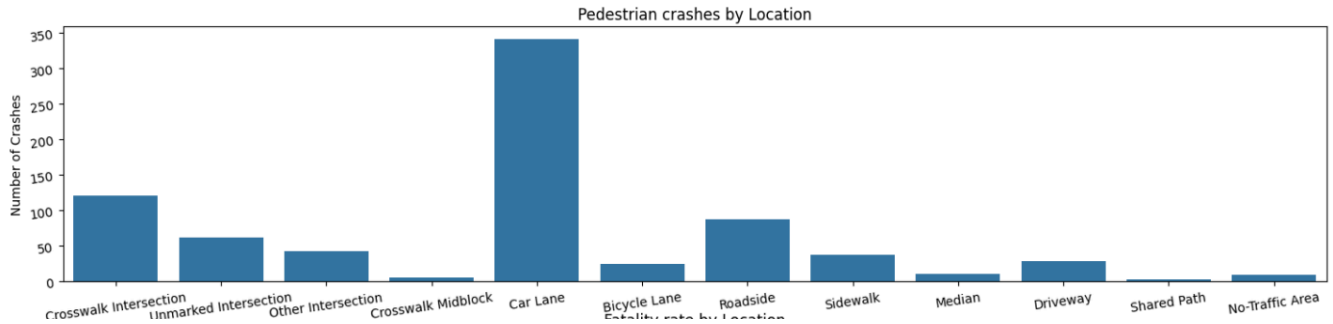
Graphs comparing crash count and fatality rate by age of pedestrians



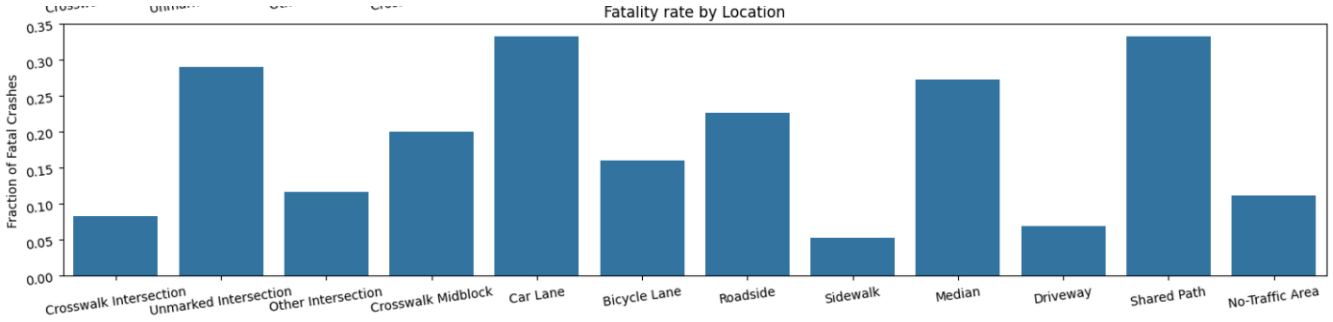
## Appendix D

## Pedestrian Location

### D1



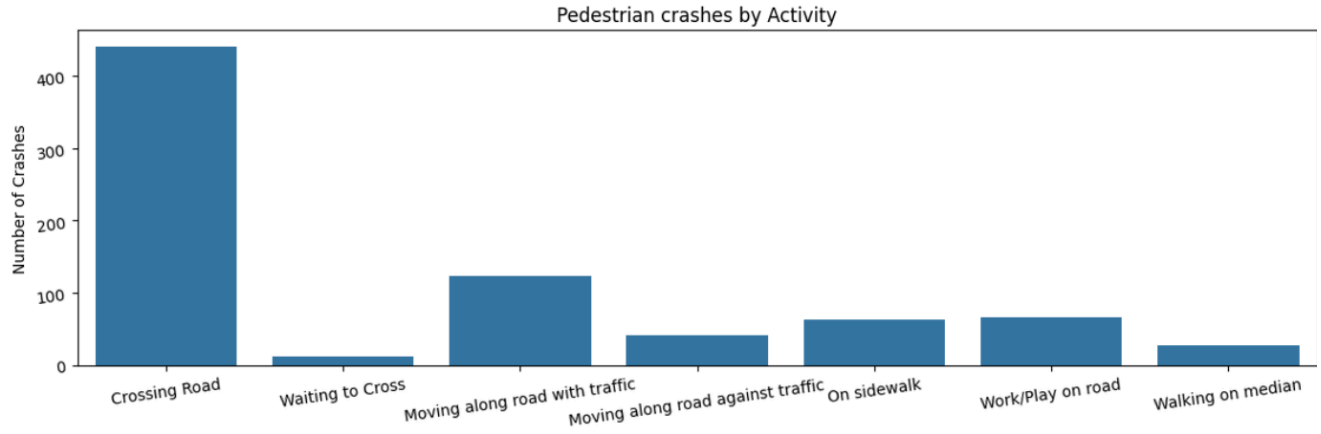

### D2




## Appendix E

## Pedestrian Activity

**E1:** Graph showing pedestrian crashes by activity at time of accident



**E2:** Graph showing fatality rate by activity at time of accident