

# Crashes in the City of Madison

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## 1 Introduction

In the City of Madison, there have been 40001 documented crashes, resulting in 201 deaths, during the years 2000 to 2018. This study aims to identify the common features of these crashes to guide safety improvement efforts. This report consists mainly of three sections: when, how, and where crashes occur.

The data used in this study is based on crash reports filed for each crash as well as the general purpose crash data file produced by the Wisconsin Department of Transportation (WisDOT), Bureau of Traffic Operations (BTO), and distributed by the Wisconsin Traffic Operations and Safety (TOPS) Laboratory at the University of Wisconsin-Madison.

## 2 The highlights of our report

1. A significant drop in the number of nighttime alcohol-related crashes was observed from year 2007 to year 2013, possibly caused by the release of a new policy (ALDO). The drunk driving rates did not climb back up even after ALDO ended.
2. Alcohol-related crashes peaked at 2am on weekends when more than 40% of total crashes was alcohol-related.
3. On weekdays, rates spike around 8am and 4pm, perhaps due to increased traffic related to workplace commuting.
4. About half of the drivers (49%) involved in alcohol-related crashes are aged from 21 to 35. In addition, there was 11% of drunk drivers were under 21 years old.
5. About 70% of drunk drivers were male.
6. The number of crashes per year has remained steady around 5000 cases, despite of population increase from 208 thousand to 258 thousand from 2000 to 2018.
7. The top five crash types were parked vehicle (27%), tree (9%), traffic sign (5%), pedestrian (5%) and bike (5%).
8. 60% of the injuries happened on the 6% of the streets, such as E Washington Ave and S Gammon Rd.

### 3 When do crashes happen in Madison?

#### 3.1 Week and Hour

Figure 1 shows the rate at which accidents occur at different times of day, during the weekdays and weekend. (The curves from Monday to Friday are very similar @Figure 14.). The two peaks of the working day curve are 7am-8am and 4pm-6pm, which may be caused by the increase in traffic volume from commuting, in turn leading to an increase in the number of crashes. In addition, it can be clearly seen from the figure that the number of crashes during off-hours is higher than that of work hours.

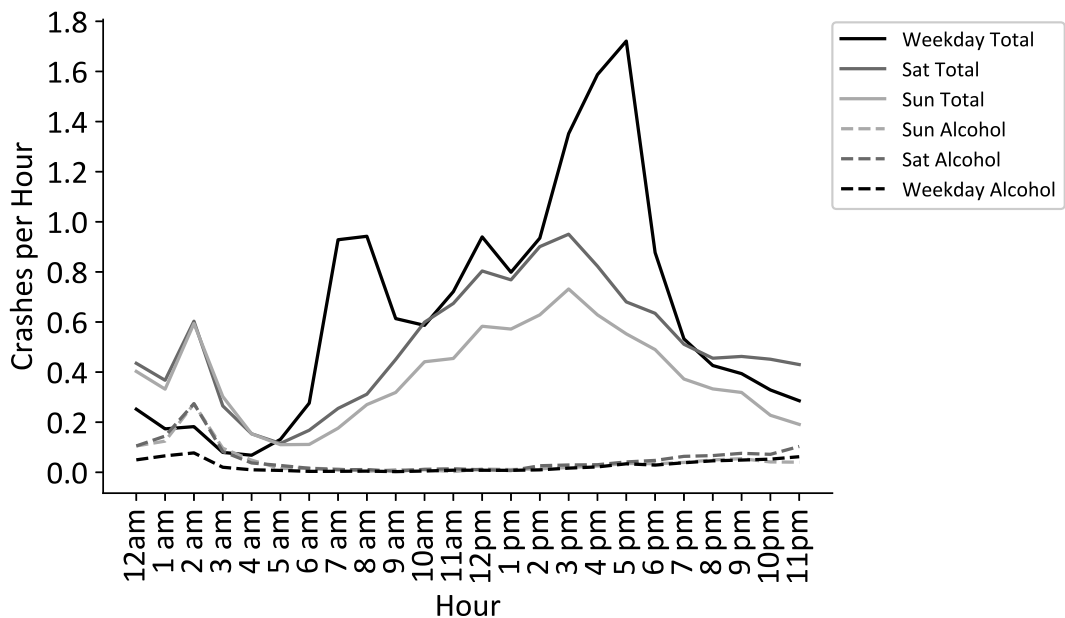


Figure 1: # of Weekly Crashes Distributed by Hour

For the Alcohol-Related crashes, it can be concluded that the peak hours of drunk driving are between midnight and 3am, regardless of which day of the week. However, buses in Madison do not operate after midnight. In order to solve this problem, we can refer to the weekend late-night bus service provided by some schools in New York State<sup>1</sup>, or the popular chauffeur service in China<sup>2</sup>.

<sup>1</sup>Nazareth College, Rochester Institute of Technology, the State University College at Geneseo and the University of Rochester are among local colleges that have various late-night bus services - usually on weekend nights - to off-campus sites.

<sup>2</sup>The company introduced Didi Chauffeur (or Didi Daijia in Chinese), a service that lets users summon temporary personal drivers. Car owners who find themselves physically unable to drive can tap one of Didi Kuaidi's apps, and a driver will head to the person's location and hop in their car. The most obvious use for the service is to provide designated drivers after

### 3.2 Month

We took the top five types of crashes in Madison and looked at their monthly distribution. As can be seen from the figure, the most obvious pattern of crashes is bicycle accidents. With the increase of temperature, the number of accidents keeps increasing, while in the cold months, there is a significant decline. The number of crashes in the trough month is only 12.7% of the peak month. The biggest type was the number of crashes involving parked vehicles, the spike in winter may be explained by slippery roads, while fluctuations in other months may be related to the number of parked vehicles or just the number of total crashes.

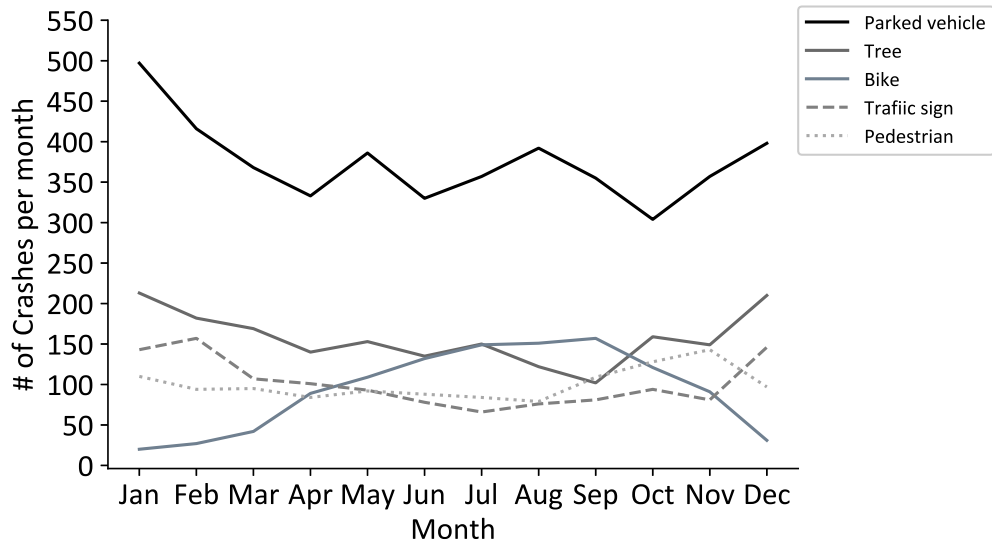


Figure 2: # of Crashes Distributed by Month

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a night out drinking. Designated drivers may opt to take public transportation to get back home, or bring a folding bike along. The company might provide shuttle buses for chauffeurs when demand is high. Or they could hitch a ride back using one of Didi's other Uberesque services—like Didi Dache, which provides taxi rides.

### 3.3 Year

Figure 3 shows the number of drunk driving in Madison City suddenly dropped a lot in 2007(a new policy ALDO<sup>3</sup> to restrict the operation of Madison City bars was introduced), which leads to that total number of drunk driving in 2013 was only 50% in 2007. This policy expired in 2011 and lowered the bar restrictions on the basis of the original policy<sup>4</sup> for two year's extension.

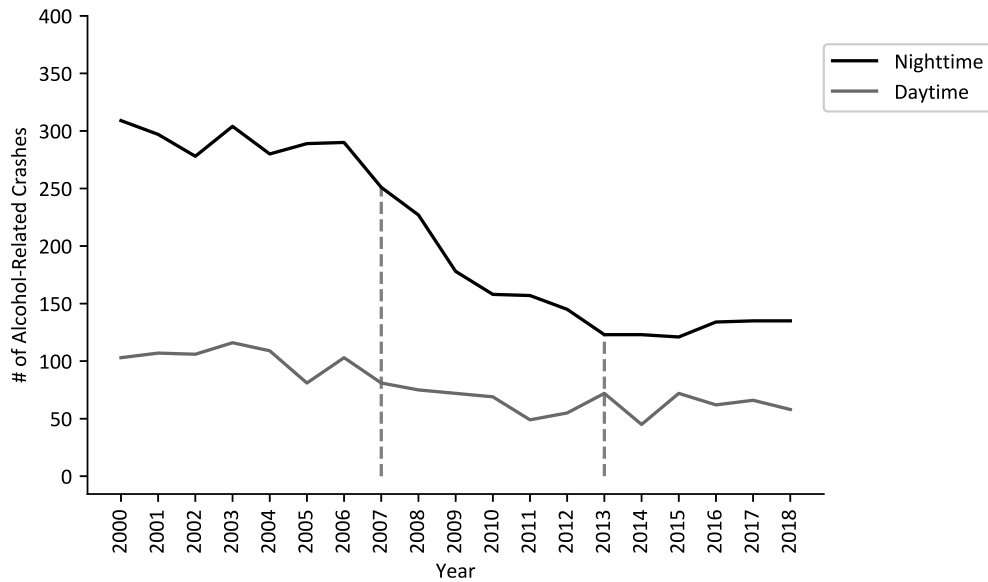


Figure 3: # of Alcohol-Related Crashes Distributed by Year

ALDO expired in 2013, but the number of alcohol-related crashes has not significantly increased in the post-ALDO years. As an alternative to it, the city is looking at creating new zoning regulations<sup>5</sup> for places that sell alcohol. The officials concede that ALDO (The main aim is to reduce drunk crime) in 2007 has failed because the number of drunk crime did not drop significantly,

<sup>3</sup>ALDO forbids new tavern licenses inside the downtown area — bounded by Blair Street on the east, Park and Regent streets on the west, and the lakes on the north and south. People can still get liquor licenses there for new restaurants, but they are required to generate at least 50% of their revenue from food sales.

<sup>4</sup>Under the compromise plan, up to seven new nightspots could open Downtown provided they draw no more than 65 percent of revenue from alcohol sales and focus primarily on entertaining patrons. Movies, music, theater, sports, bowling and arcade games all qualify.

<sup>5</sup>The new alcohol license ordinance creates a special zoning area for the 500 and 600 blocks of State Street, the north side of the 600 block of University Avenue, the 400 blocks of North Frances and West Gilman streets and west side of the 10 block of North Broom Street where there are many licenses and alcohol-related problems. No new taverns or new retail alcohol sales will be allowed in that area, but brew pubs, nightclubs and restaurant-nightclubs can be permitted as conditional uses.

but there is no doubt that the policy does make a significant impact on drunk driving. In addition, the number of daytime crashes has barely changed, which is also a good indication of reducing the amount of drunk driving.

## 4 How do crashes happen in Madison?

### 4.1 Age

From Figure 4, we can see the age ratio of crashes in different hours. Based on the previous analysis of drunk driving time, we've already known that the peak hours of drunk driving are between midnight and 3am. During this time period, the drivers' age in crashes is mostly under 35. While the drivers above 35 are mostly involved in the crashes during the daytime.

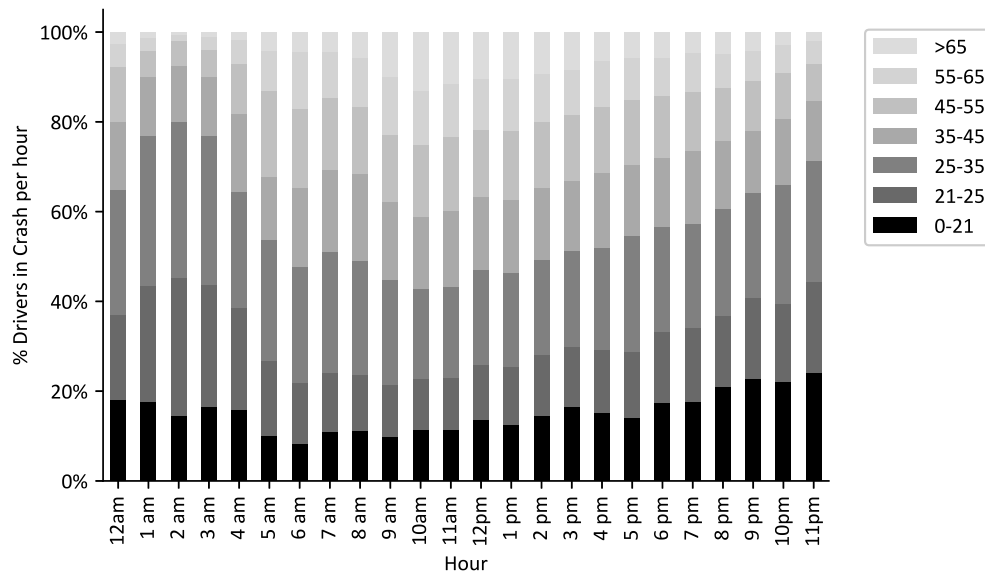


Figure 4: Age Distribution of Drivers in Crashes

## 4.2 Gender

Figure 5 shows the gender composition of drivers involved in crashes in the City of Madison from 2000 to 2018. We can see that no matter the total number of crashes or the number of drunk driving, male are higher than female. Although the total number fluctuates between years, the trend of men's lines and women's lines is very similar.

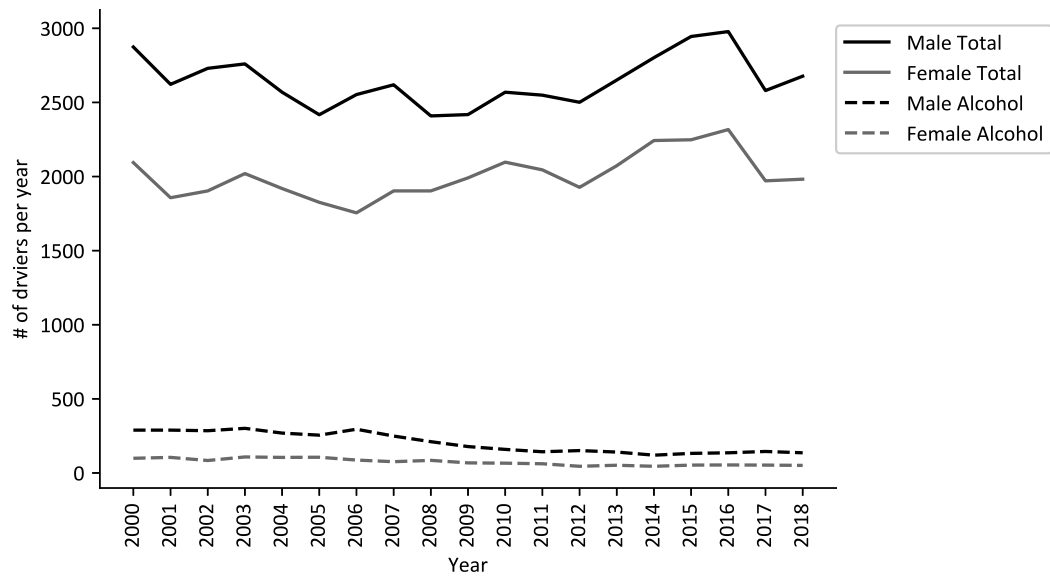


Figure 5: Gender Distribution of Drivers in Crashes

### 4.3 Types of crash

Figure 6 shows the top five types of fatal crashes and their total number of crashes. Although crashes related to train has the highest fatal rate, but the total number of this type is extremely low. So we can say that the most dangerous type of crashes is which hits pedestrians.

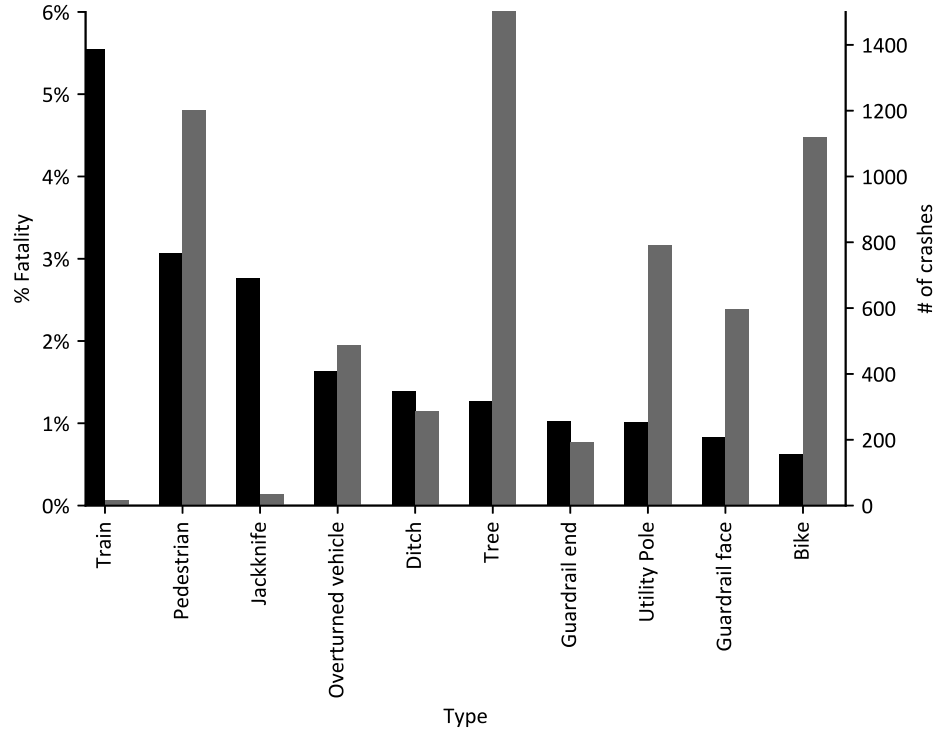


Figure 6: % Fatality Distributed by Type

### 4.4 Severity

#### 4.4.1 Speed and Severity

Table 1 shows the percent of crashes in different speed limits at three different severity levels in the City of Madison.



Table 1: the correlation between severity and speed limits

	0-25	30-40	45-55	60+
Fatal	0.24%	0.75%	1.42%	3.32%
In-capacitating	13.52%	11.50%	15.69%	16.24%
Non-Incapacitating	86.24%	87.75%	82.89%	80.44%

We can say that for fatal crashes, the higher the speed limit, the greater the number. For minor injuries that are non-incapacitating, the lower the speed limit, the greater the number. For incapacitating accidents, there is no significant difference in the amount of occurrence between different speed limits.

#### 4.4.2 Age and Severity

From Figure 7, the percentage of minor injuries and disabilities between different age groups fluctuates very little in the City of Madison. So we infer that there's no correlation between age and crashes that don't kill people. We can also see that the percentage of incapacitating accidents in the drunk driving is higher than that of all crashes and the percentage of non-incapacitating accidents is lower than that of all crashes, so we conclude that drunk driving accidents will cause more serious harm to the driver.

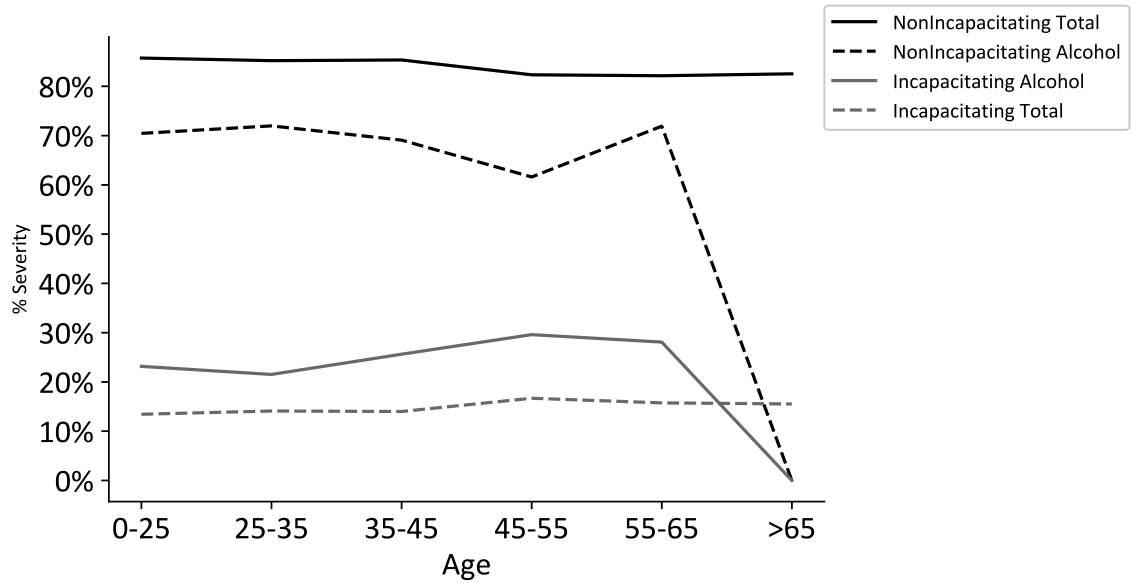


Figure 7: % Severity Distributed by Age

From figure 8, we can see that among all accidents, crashes involving drivers aged 45-55 have the lowest fatality rates in the City of Madison. This might be because drivers in this age group are more experienced than younger drivers and have quicker reflexes than older drivers. But in the case of drunk driving, crashes involving drivers aged 45-55 have the highest fatality rates. This may be because physical well-being declines with age and drunk driving are more likely to be fatal. However, older people over the age of 55 tend to be more cautious, so the fatality rate in drunk driving events is not high.

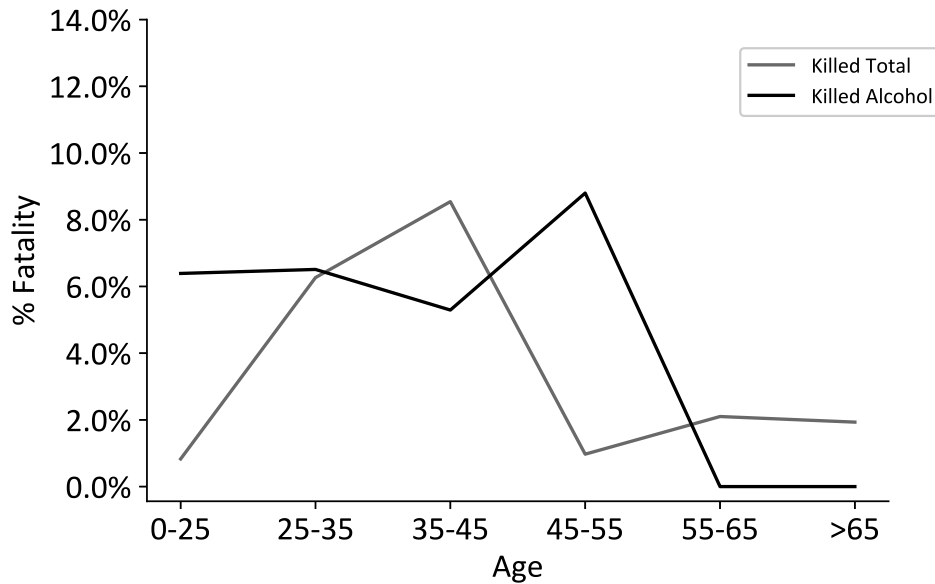


Figure 8: % Fatality Distributed by Age

## 5 Where do crashes happen in Madison?

### 5.1 Year

We observed a significant decline in the number of crashes associated with alcohol driving after 2007 which caused by the release of a new policy called ALDO(ended in the year of 2013). Thus, we plotted out the crash maps from 2000 to 2007 vs. 2008 to 2013. Here on the maps, we can clearly tell that not only were there fewer crashes after 2007 but also on some of the streets where there used to crash, we can't see any of those accidents anymore.

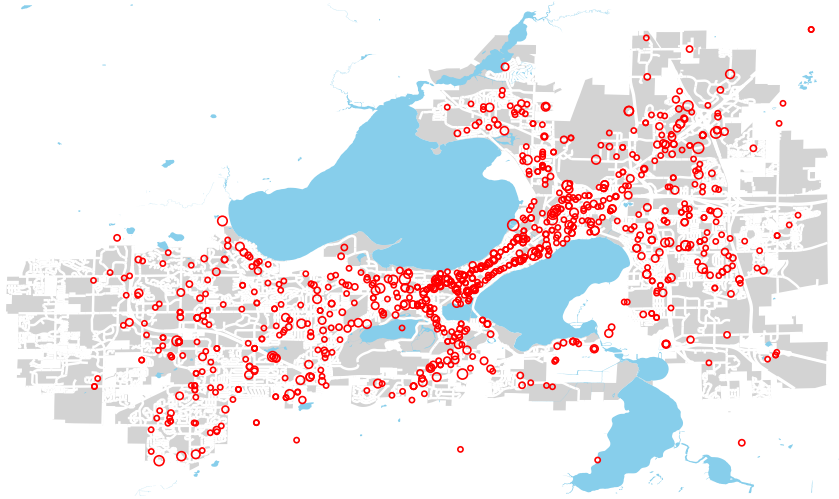


Figure 9: Crashes in Madison before 2007

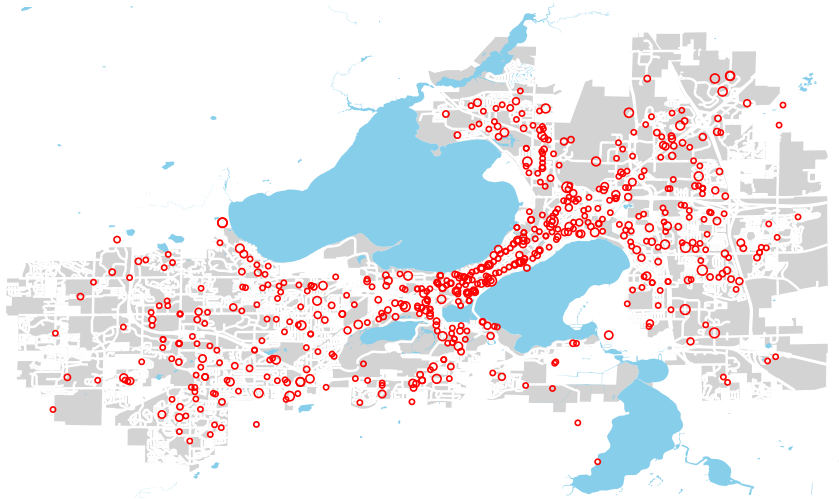


Figure 10: Crashes in Madison after 2007

## 5.2 Deer

Madison has a high number of crash on deer (806 crashes over 19 years). Figure 11 shows the locations where crashes on deer have occurred in Madison over the past 19 years. As expected, The majority of crashes on deer have occurred on the periphery of Madison, and mainly in the northern part and around the Mendota Lake.

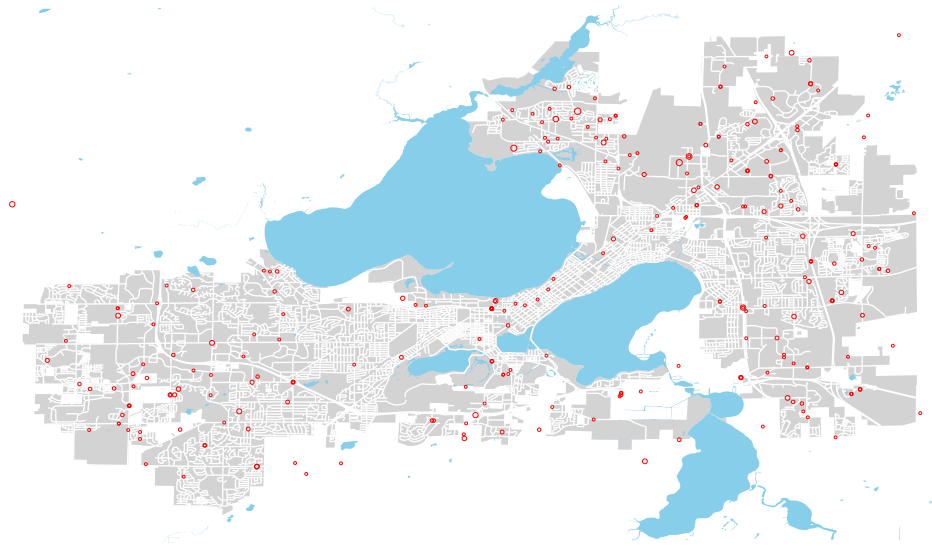


Figure 11: Deer-Related Crashes in Madison

## 5.3 Bike and Pedestrian

Figure 12 and Figure 13 show the locations where crashes have occurred in Madison over the past 19 years on bike (ranked fifth in types of crash) and pedestrian (ranked fourth), respectively. We found that bike crash map and pedestrian crash map shared a similar pattern where most of those crashes occurred in downtown Madison.



## 6 Conclusion

In the City of Madison, most of the crashes occur during commuting time, and drunk driving is concentrated between midnight and 3am. Due to the ALDO policy in 2007, the number of drunk driving has dropped significantly. When it comes to drivers involved in either all crashes or alcohol-related crashes, there are more men than women. Besides, the severity of the crashes is related to both age and speed. Finally, it is surprising that 60% of the injuries happened on 6% of the streets.

## 7 Appendix

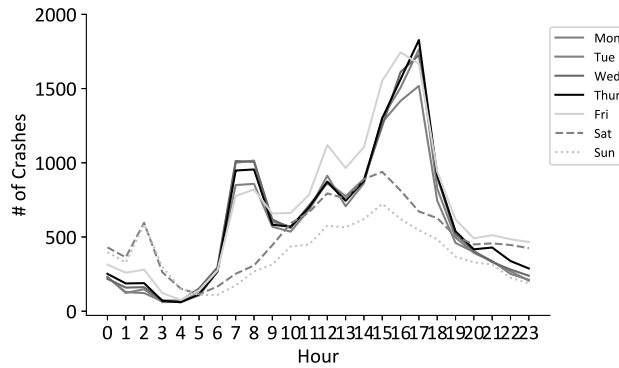


Figure 14: # of Weekly Crashes Distributed by Hour

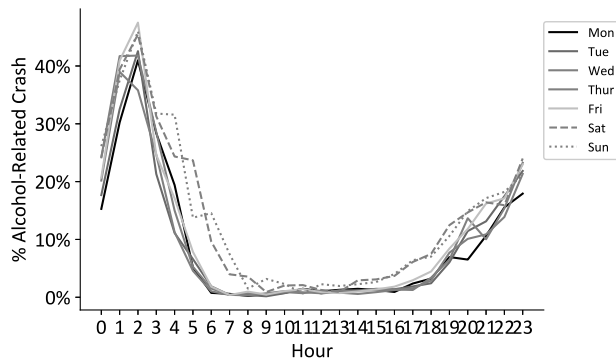


Figure 15: % Weekly Alcohol-Related Crashes Distributed by Hour