

The Confluence

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Crash Analysis for Lake Saint Louis Police Department

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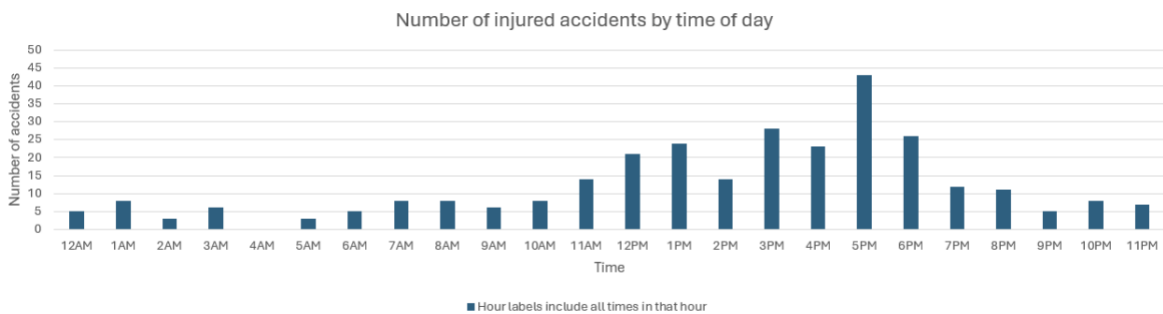
April 25, 2024

1 Industrial Problem

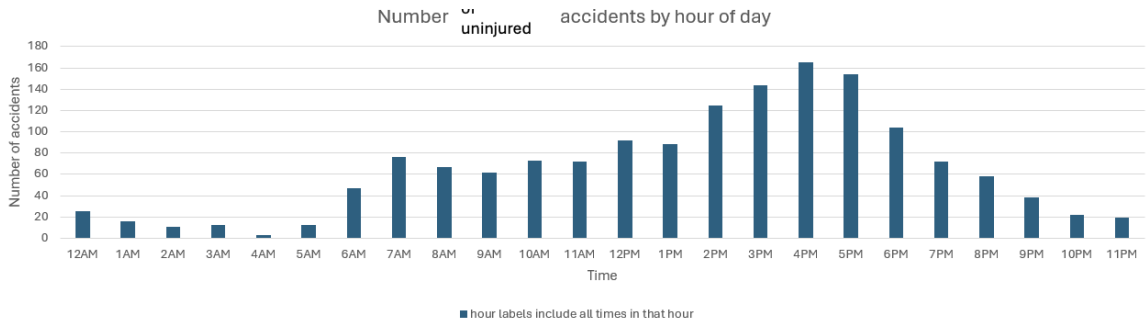
Lake Saint Louis is a small city of just under 17,000 people in the same county as Lindenwood University. Originally a planned community, it is easily accessible by Interstate 64 and Interstate 70. It also contains two large lakes and shopping centers that attracts visitors to the area. As a result, there have been a number of traffic crashes in the area. The Lake Saint Louis Police Department (represented by Lieutenant Josh Gilliam) along with George Ertle, the City Administrator, has requested that Lindenwood's PIC Math group review data from 2019-2023 to identify patterns. We have reviewed the crash data at several locations and under multiple conditions and have uncovered some noticeable trends. We also have insights that may result in changing driver behavior or provide an engineering solution that may reduce collisions.

2 Overview of Results

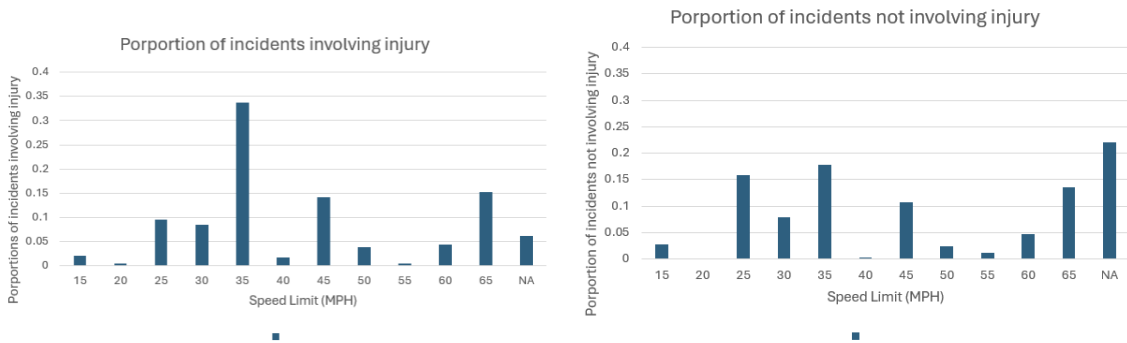
We split the overall data into two groups organized by crashes with injuries and crashes without injuries. From there we compared the proportions of speed limits, proportions for probable causes of collision, and the time day crashes were occurring. We noticed that the majority of crashes happened during ideal conditions of clear or cloudy weather, dry roads, and daylight lighting. We can assume that there are more cars on the road in these ideal weather conditions compared to days with hazardous or less ideal weather and road conditions. This naturally happens especially in severe snow storms because many businesses and schools are closed. We can also assume people are more attentive during bad weather to avoid involvement in a collision.



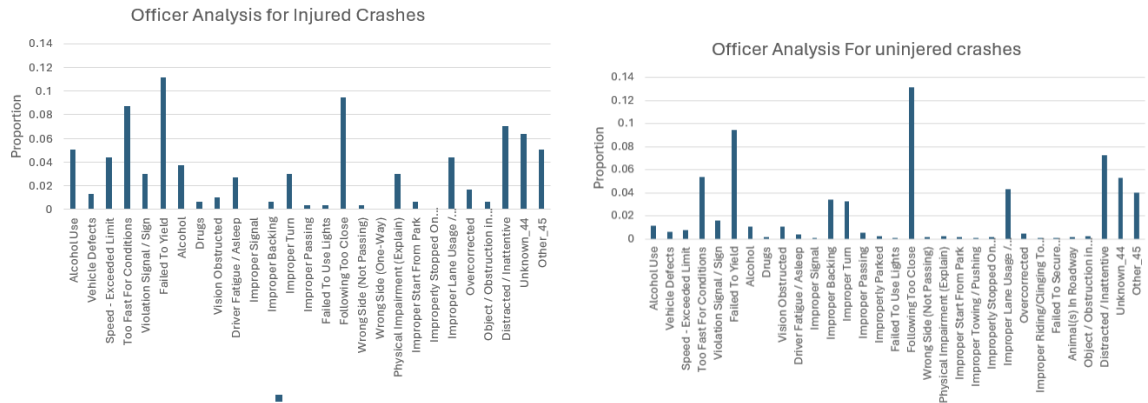
Submission to The Confluence



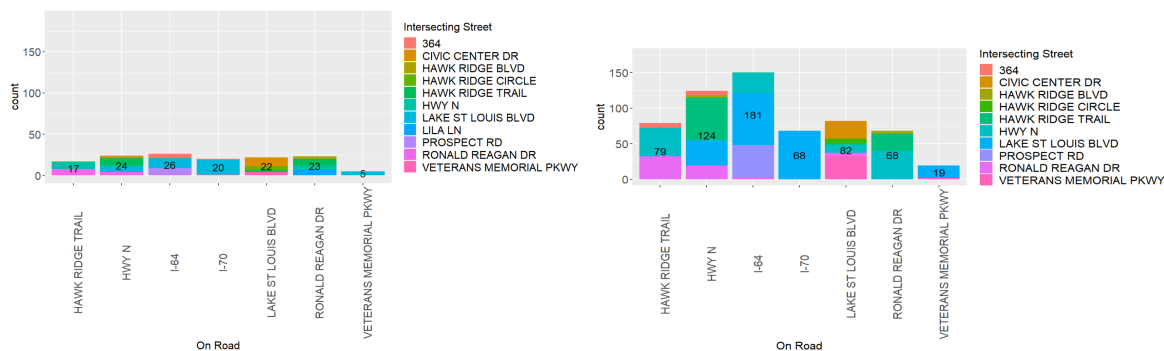
Above is the graphs depicting the time of day that most collisions transpire. It is clear that the general trend shows most crashes happen between 3pm and 7pm with the peak at 5pm. Most people are travelling home from work and excited to finish up their activities for the day, so they would be more likely to drive less cautiously.



These graphs show the proportion of collisions at various speed limits throughout Lake Saint Louis. We noticed in our data that numerous crashes without injuries happened on private property such as parking lots. That would help explain the significant number of crashes reported with "N/A" as the speed limit. It is clear that most incidents, regardless of injury status, occurred at the 35 mile per hour speed limit. One reason is that Lake Saint Louis has one road (Lake St Louis Blvd) at that speed limit that is the main road of travel to get anywhere within the city. Generally, there are more miles of road with the speed limit of 35 in Lake Saint Louis.



These graphs show the proportion of collisions for various reported causes. For uninjured crashes, the cause with the highest proportion was following too close. For injured crashes, the cause with the highest proportion was failing to yield. This demonstrates a relationship between failing to yield and a higher risk of injury.

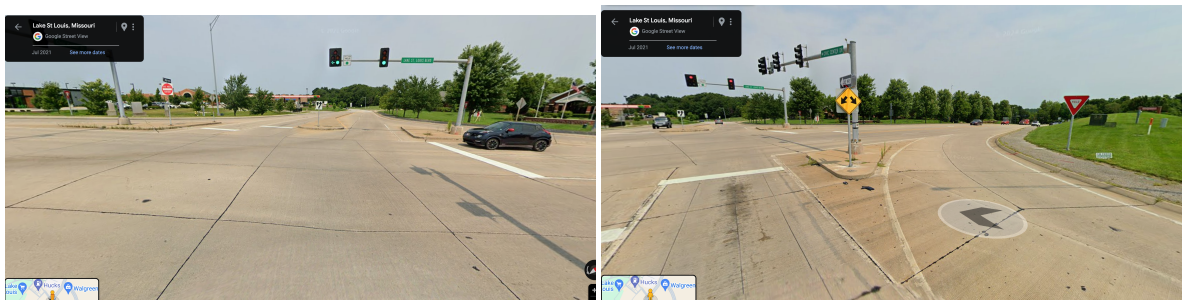


After looking at the data altogether, we separated the data into various intersections first looking at the road on which the collision occurred then the intersecting street correlating to the crash. The graphs above exhibit the significant intersections due to the high number of collisions these roads have had in the past five years. We decided to look into two different intersections that clearly reported a high number of crashes.

The first intersection is Lake Saint Louis Boulevard and Civic Center Drive which is represented in the orange section in the Lake St Louis Blvd column. This intersection was more significant in the crashes involving injury compared to the rest of the inured data.

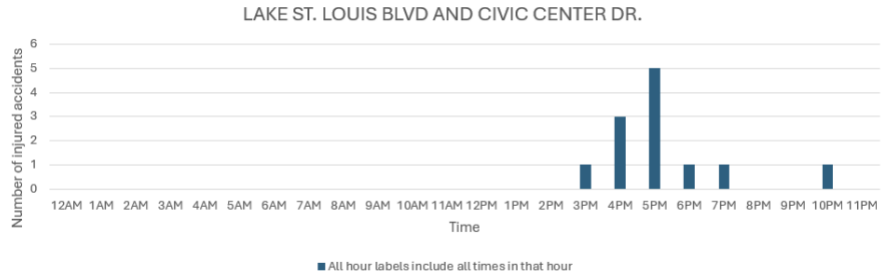
The second intersection we compared is Highway N and Hawk Ridge Trail which is represented in the green section in the Hwy N column. This intersection was evident to be more significant for crashes without injuries compared to crashes with injuries.

3 Lake Saint Louis Boulevard and Civic Center Drive

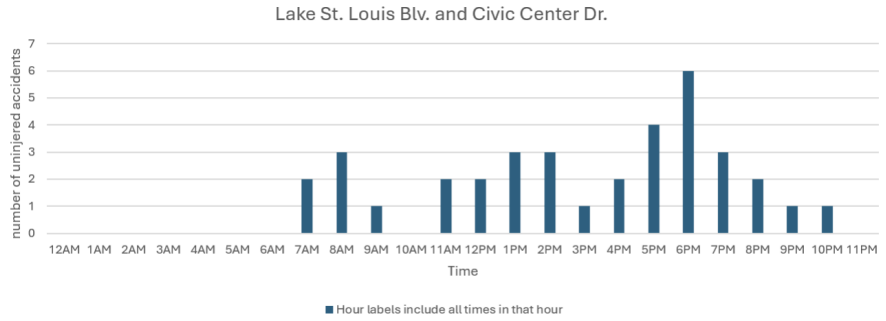


The first intersection depicted here is the intersection at Lake Saint Louis Boulevard and Civic Center Drive. We noticed that the weather and road conditions for crashes at this intersection follow the general ideal weather, road, and lighting conditions mentioned above.

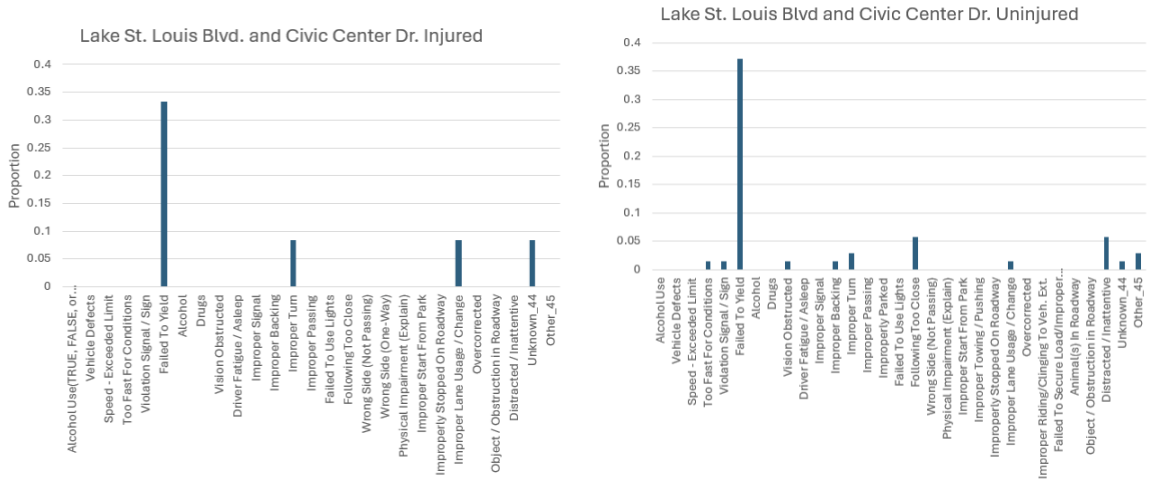
Injured Crashes



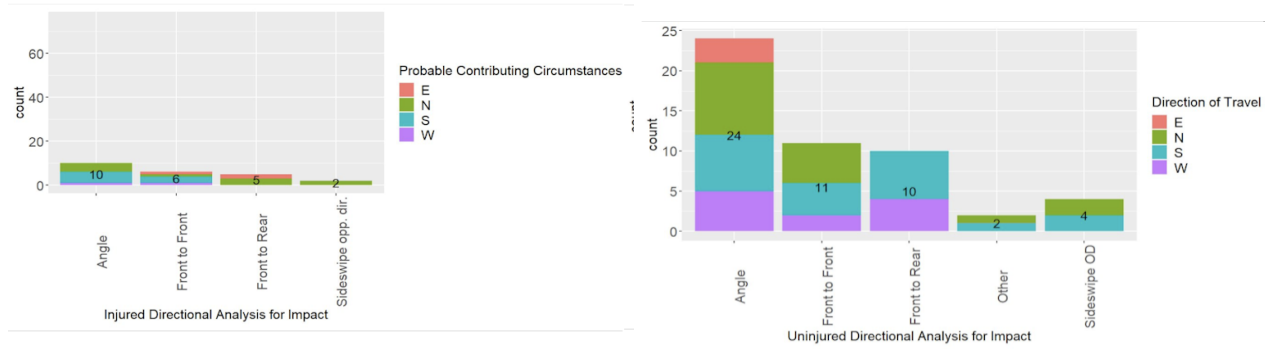
Uninjured Crashes



These graphs show the time of day that most crashes happen. The time frame when most crashes happen for this intersection is 4pm-7pm which follows the general time frame we saw in the overall data. It is interesting to see that the majority of crashes occur in the evening rush rather than the morning rush, as one would think there would be an even split.

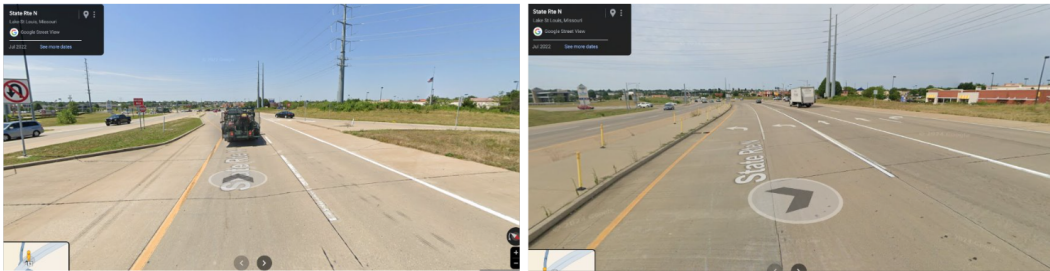


These graphs are showing the major probable causes for crashes at this specific intersection. It is clear to see that failing to yield is the highest cause of crashes for both injured and uninjured. This could be useful for the police department to use when responding to a traffic collision since failing to yield is a traffic offense for which the driver can be cited.

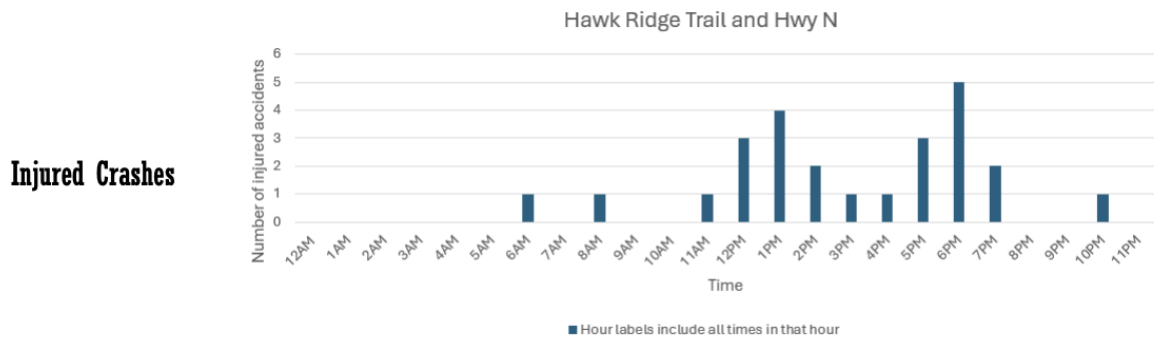


Upon request from the police department we investigated the effect direction of travel had on the amount of crashes occurring at this specific intersection. There was some anticipation that this would've proved to be a crucial factor, where in reality that didn't come to fruition. It can be seen that there is an even split of directions travelled within the crashes, as no particular direction stands out as being more severe than the others.

4 Highway N and Hawk Ridge Trail

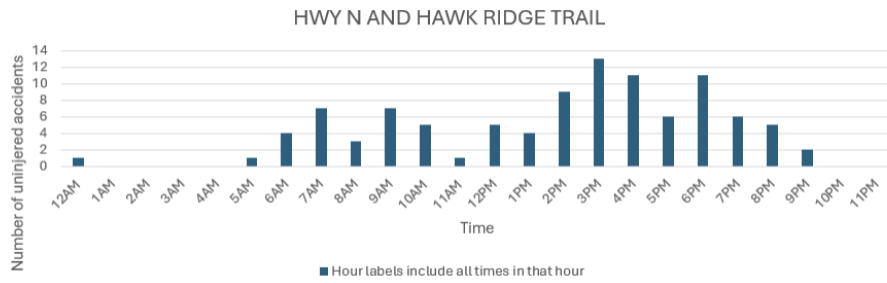


Here is look at the intersection. As you can see in the pictures, there is not much to see as far as road signs go. As you drive down this road, the two lanes depicted in the image on the left split into five different lanes. There are no paint markings or road signage to direct drivers once this happens. Additionally, this intersection reaches a stop light after the road randomly changes from Highway 364 (a major freeway connecting large cities) to Hwy N (a main road connecting major parts of the city to each other). We noticed there are no road signs to alert drivers of this change in speed on the roadway. This creates a chaotic, unsafe environment for all drivers.

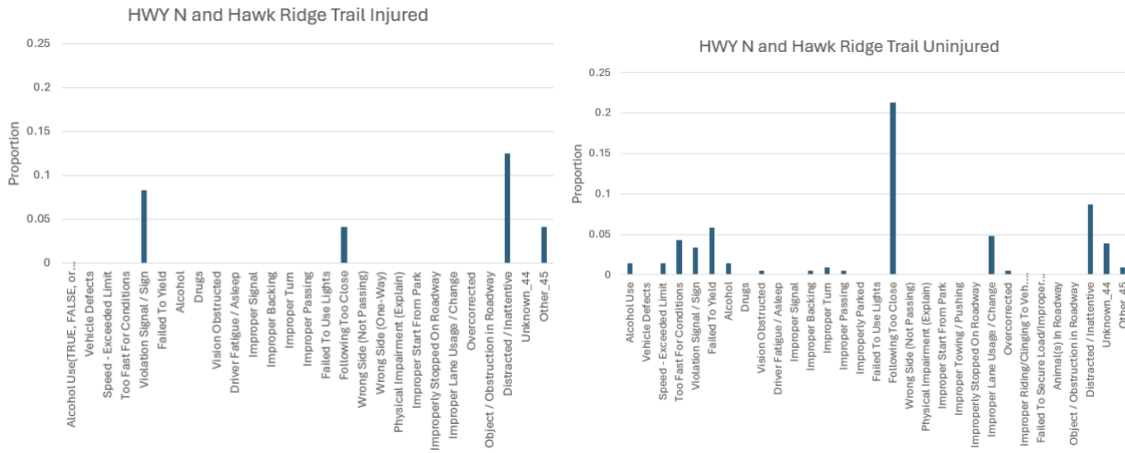


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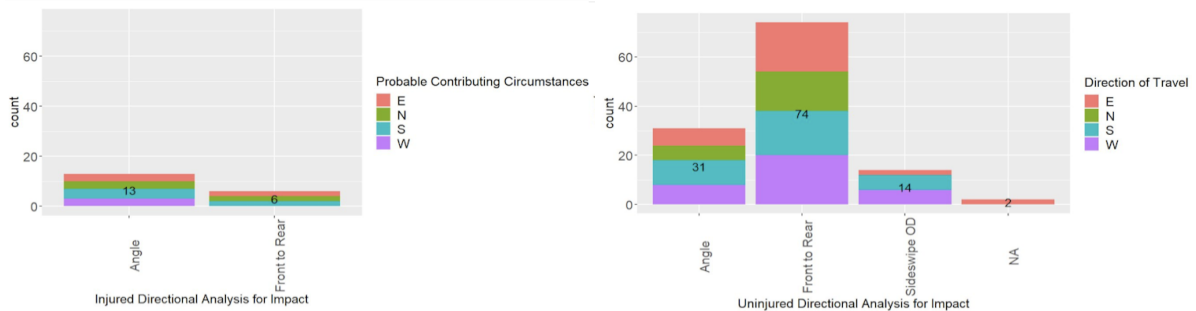
Uninjured Crashes



These graphs show the time of day most collisions happen at this intersection. Much like the data found in the Lake St Louis Boulevard and Civic Center Drive intersection, the majority of crashes occurred during the evening rush. This was also the same trend found in the general data, as there is a disproportional amount of crashes occurring, and not a consistent spread.



These graphs are showing the major probable causes for crashes at this specific intersection. It is clear to see that the majority of crashes occurring for those that were injured were due to inattentive and distracted driving, followed closely by following too close. Whereas on the other hand, the majority of crashes that occurred for those that are uninjured were following too close, with other factors not being as prevalent. These causes are different to the previous intersection, however all of the probable causes can be grouped under the same bracket of not taking enough care and attention when driving.



These graphs show the trend between the type of crash and direction of travel. As seen in the previous intersection, there are no consistent trends in the collisions. Crashes happen in each direction of travel at this intersection.



These images depict the road sign options that could mitigate the chaos at this intersection. This is helpful for the city administrator to bring up when they meet with MODot when it comes to deciding where funding should go.

5 Possible Limitations of Solutions

The intersections that we analyzed were on roads maintained by the state Department of Transportation (MoDOT). Installing new signage for these intersections—better communicating changes in direction and speed of travel to drivers—would require a significant amount of money from MoDOT.

On the report that police officers fill out for a vehicular collision there is a section to indicate probable contributing circumstances. The officers can mark what they believe (based on evidence of the crash or witness statements) was the cause for the accident. For about half of the accidents in the data provided the police officers marked "N/A" for the probable contributing circumstances. After discussing with Lieutenant Gilliam, it is probable that newer officers may struggle with confidently identifying a probable contributing circumstance. Having more information in this section would allow us to draw stronger conclusions.

It is possible that some officers might have written the information wrong on the reports where the on road and intersecting street are switched. There was not a satisfactory solution to identify when this was the case, so we just executed analysis based on the information provided.

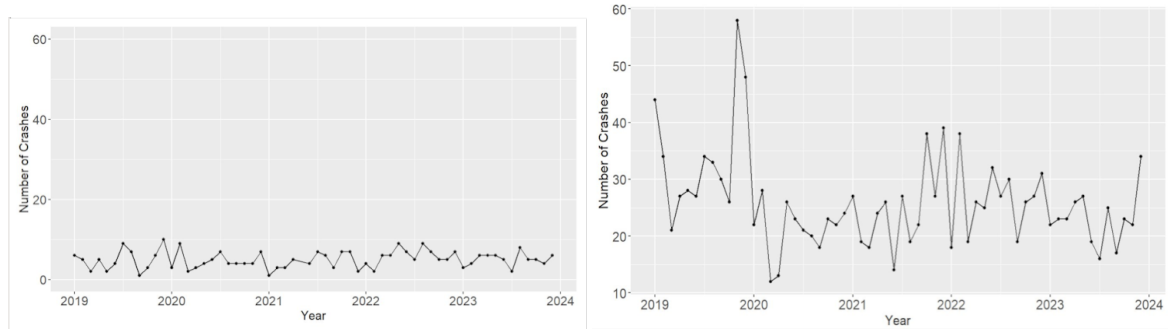
We created multiple spreadsheets of data to complete various tasks. Although we were diligent in our efforts to keep errors minimal, it is possible that errors were made in the data when converting one sheet to another. It is also possible different sheets were used to make each graph in one section of research.

6 Conclusion

It is clear that the time of day follows the trends seen in results for all collisions; however, the officers mostly report that following too close and improper lane usage are the probable causes for collisions. Thus, we recognized a need for change at this intersection. Additional signage could be added to alert drivers of the stoplight and

lane direction.

We created a time series graph and noticed some interesting peaks. To further our research, we want to sort the data according to the peak time of year and analyze probable causes for those crashes and where those collisions take place. Pictured below is the time series graph for injured and uninjured crashes over the past five years.



Other future work includes the following:

- Conduct further analysis on additional intersections.
- Conduct research to intersections maintained by the city/county
- Analysis of other intersections with probable cause of collision failed to yield.
- Create a heat map of crash at each intersections in Lake St. Louis
- Sort crashes by time of day and find significant intersections.
- Correlation between time of day and type of crash (angle, front to rear, etc.)
- Correlation between number of cars involved and type of crash or probable cause
- Correlation between number of injuries and type of crash or probable cause

7 Acknowledgments

This opportunity and connections were provided by our Mathematics Professors Dr. Nick Wintz and Dr. Wojciech Golik. Our data was provided by George Ertle, City Administrator for the city of Lake Saint Louis, and Joshua Gilliam, Lieutenant of the Lake Saint Louis Police Department.

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