

Your Project Title

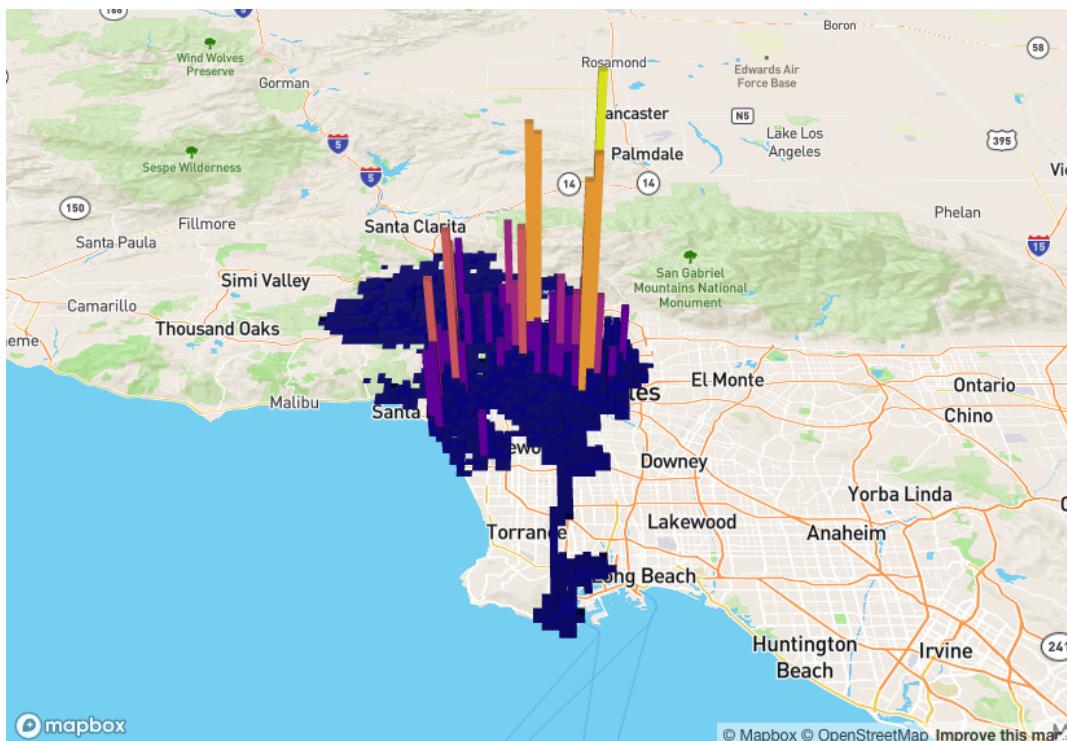
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Introduction

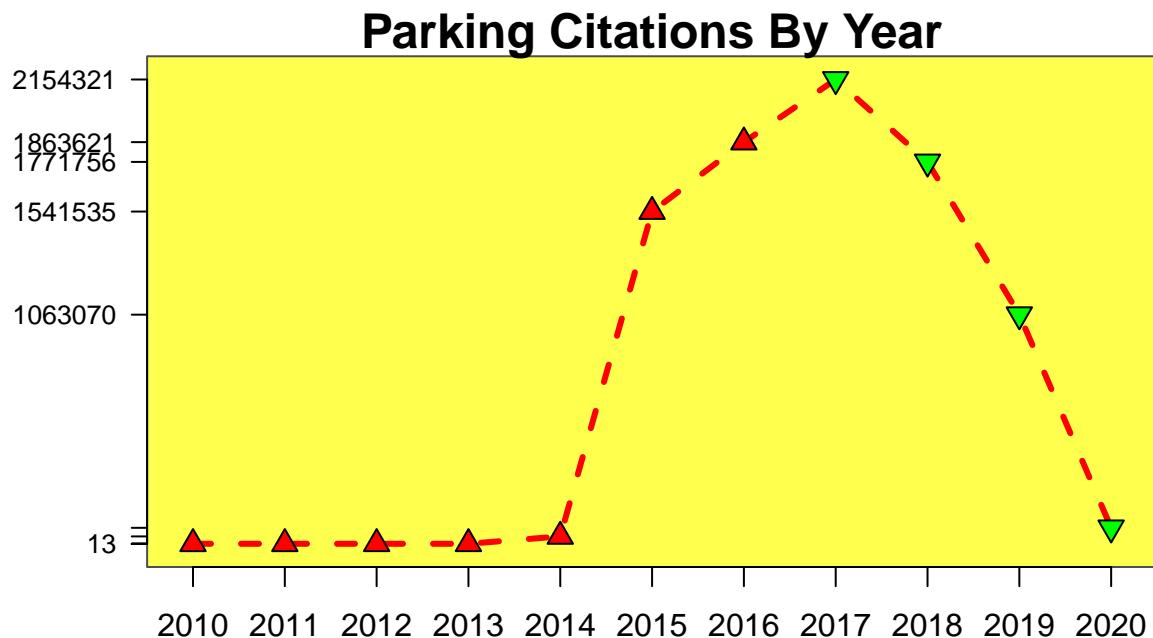
Alex, Anushi, Matt and Griffin all come from different backgrounds and majors, so in discussions for which dataset we wanted to analyze, we explored a wide range of topics from public health to the New York City subway. We eventually decided to take on data from another large metropolis, but this time in sunny Los Angeles. In Los Angeles, the beautiful beaches, countless celebrities, and hollywood homes are magical for visitors. However, LA traffic is often very bad and parking in tourist areas can be a nightmare. As the second largest city in the United States, there are over 6.4 million vehicles in the Los Angeles urbanized area¹. Our dataset, Parking_Citations, contains all the details of nearly 10 million parking violations in Los Angeles from 2010 to the present. That means we have access to the records that account for fines totalling close to \$600 million. With so much money at stake and the huge volume of data, the city of Los Angeles keeps track of these records electronically. We intend to take this massive amount of data and transform it so that the intricacies of parking violations can be easily understood.



Big Data

The raw data was accessed directly from the City of Los Angeles Department of Transportation (LADOT) through the city's Open Data website². The original data set contained 9.97 million rows, each containing details on one parking violation. We identified the fine amount and location data as the most important variables and therefore removed all rows containing empty or NA values in those two columns. This narrowed the amount of rows to about 8.5 million. LADOT uses US Feet coordinates according to the NAD_1983_StatePlane_California projection, which is not easily comparable to standard latitude and longitude values, so our next step was to use `sp` package for R to transform our location data. Our final cleaned data set contained data on 8,502,692 tickets, including information of the time, date, location, vehicle information, parking offense, and more. Although well over the 1 million row minimum requirement, this large amount of data will allow us to explore the trends in parking violations in LA over a relatively large time frame.

Overview graphs



When we began our analysis, we had to get some idea of what we were dealing with. With no instructions, We first boiled down the data into a more understandble form. The data gave us a good amount of information, and it also gave us a good starting point. The data showed a skewed distribution over 11 year span. From 2010 to 2014 there were less than 40 parking citations recorded. In 2014 that number increased to 34,000. After that, we saw a drastic 44 percent change into 2015, when 1,541,535 parking citations were recorded. The count peaked at 2,154,321 citations in 2017. This peak accentuated both the steep rise leading up to 2017 and also the surprisingly steep decline afterwards. While this graph gave us a good handle on the numbers, there were questions unanswered about the data collection. The drastic increase from 2014-2015 may be explained by an attempt by the City of Los Angeles to digitize their citations. But that explanation is contradicted by the equally sharp decline after 2017. This left the question of how many citations did they actually collect? The graph didn't tell us exactly, but it gives us a range of values that captures the true value or something close. Even without the actual answer, this graph highlighted the magnitude of the citations in LA. ##Basic Graphs

Year	Dollars_Collected
2010	730

Year	Dollars Collected
2011	630
2012	2276
2013	3062
2014	2371400
2015	107172874
2016	130124585
2017	151608139
2018	124738695
2019	75291586
2020	2275
Total	591316252

Top_Violations	Count	fine_amount
NO PARK/STREET CLEAN	2389114	73
METER EXP	1634877	63
RED ZONE	635504	93

Violation.Description	Fine.amount
DP- RO NOT PRESENT	1100

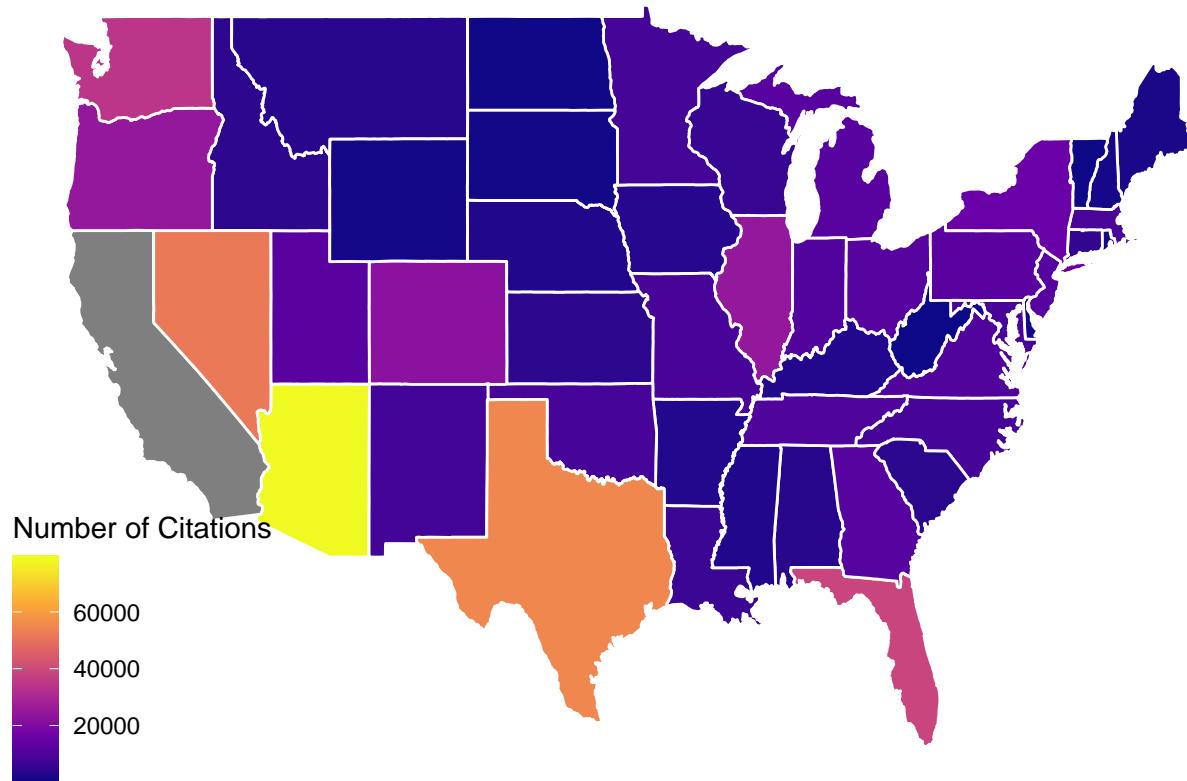
Location	count
1301 ELECTRIC AVE	11363
101 LARCHMONT BL N	7815
1600 IRVING TABOR CT	7346
2377 MIDVALE AVE	6113
5901 98TH ST W	5790
4301 TUJUNGA AV	5687
7000 HAWTHORN AVE	5606
2800 E OBSERVATORY	5378
4300 TUJUNGA AV	5279
100 LARCHMONT BL N	5236

Los Angeles is not just a city with horrible traffic, it's also a city where it is terribly hard to park, especially in tourist areas, shopping districts, or other special zones. Over the past decade, The City of Los Angeles collected \$591,316,252 digitally. The amount of dollars collected mimicks the movement in the previous graph of citations byt year Our Top_Violations table explains that the top three violations are parking in a street clean area, parking with an experied meter, and parking in a red zone. Street Cleaning happens every day in Los Angeles, albeit on different sides of the roads depending on the day of the week. Because the side of the street that is cleaned changes on a daily bases, many people are caught parking on the wrong side of the road and are penalized. People who are in a hurry, who do know the law, sometimes ignore it or assume that the street cleaner has passed or won't come and are also penalized frequently. Parking in a red zone is The City of Los Ageles's third most frequently cited violation. A red curb, or red zone, indicates no parking, standing or stopping for public safety reasons³. Parking violations vary in their severity. Violating a red zone parking law is a public safety issue, so the fine is more expensive than that of a meter experation ticket, which is stil very expensive! At the very least, do not get caught parking in a disabled vehicle designated spot without reason. That fine will cost you 1100 dollars. Parking citations by location indicated where the

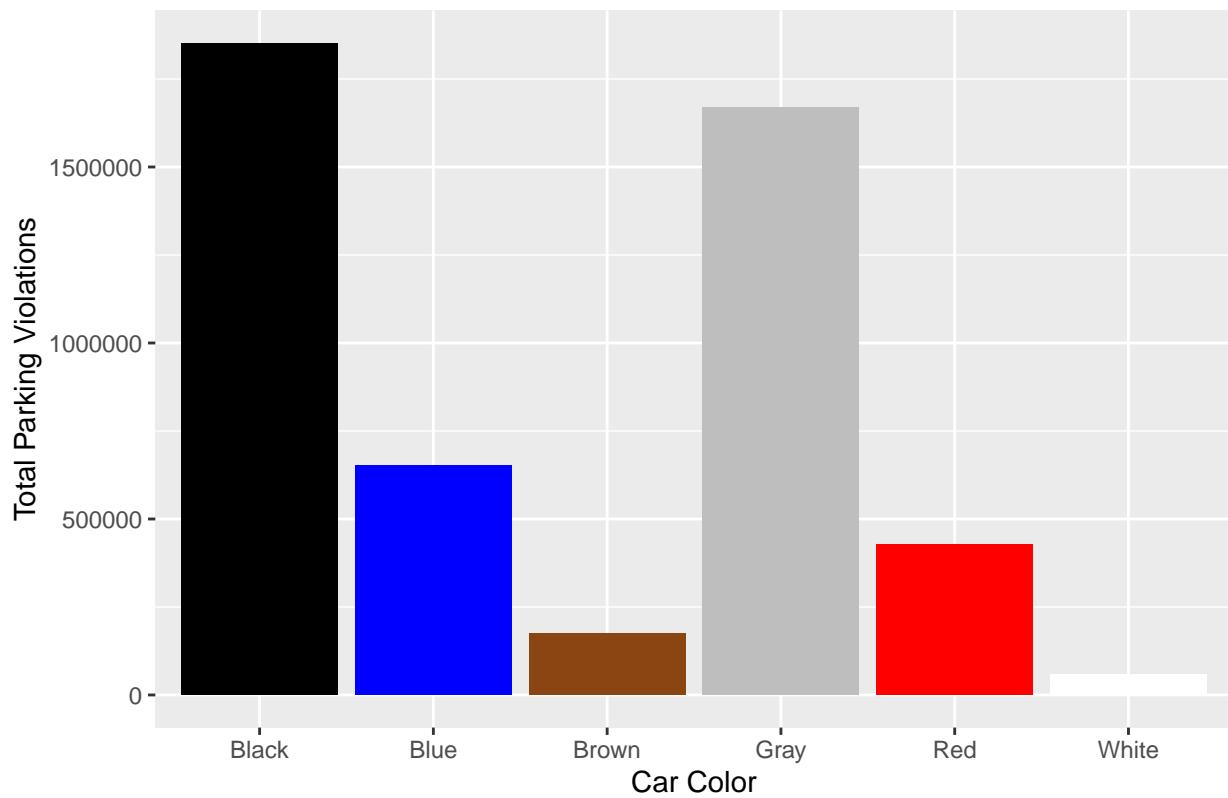
most violations have occurred. These violations happen in major hotspots of the city which have heavy tourist foot traffic and very little space. The lack of parking forces people to park in residential areas, where there are high chances of fines. 1301 Electric Ave is a street where people park to visit Long Beach, California's famous Seal Beach. Irving Court is very close to the Venice Beach boardwalk and the Abbot Kinney shopping district. Hawthorne Avenue is the spot just south of the bustling Hollywood Blvd. Among these hotspots is also The Griffith Observatory. These Los Angeles must-sees attract more cars and tourists than an area can hold and so are, unsurprisingly, the locations with the most cited violations.

Who receives parking citations?

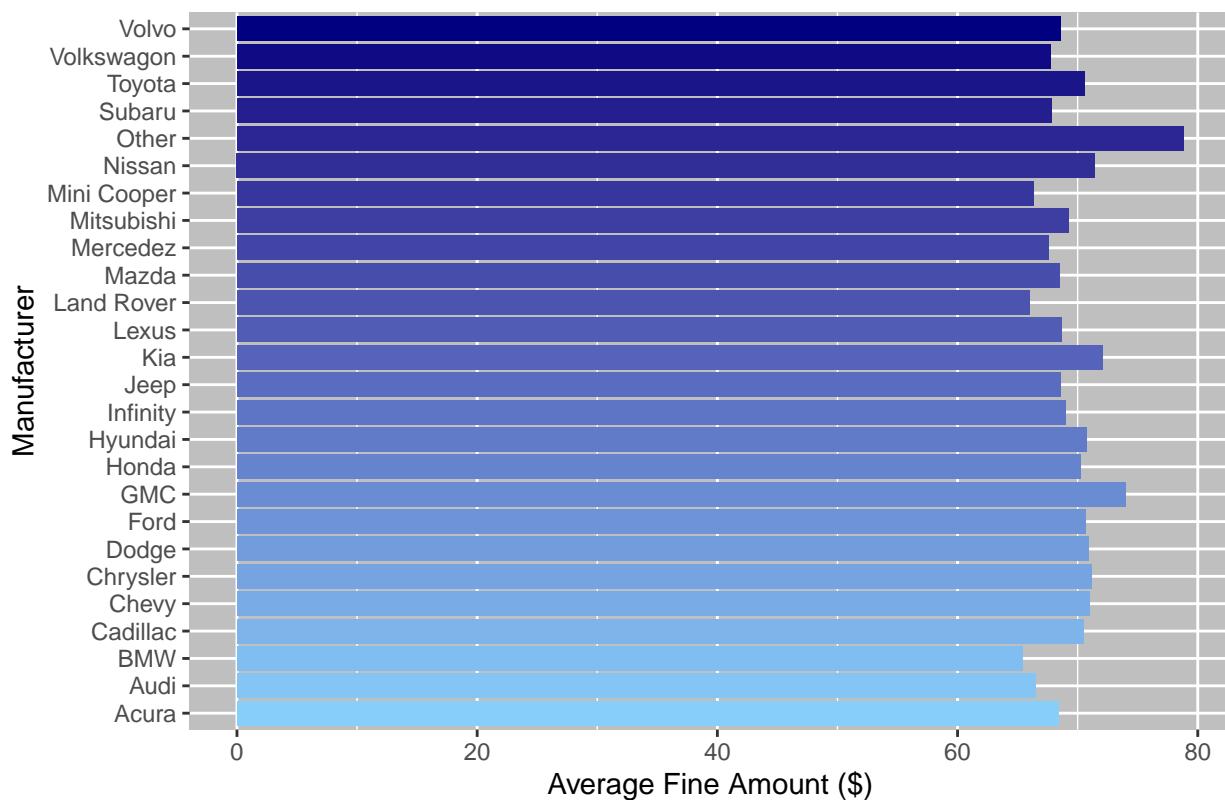
Number of Citations for Vehicles with Out of State Registration



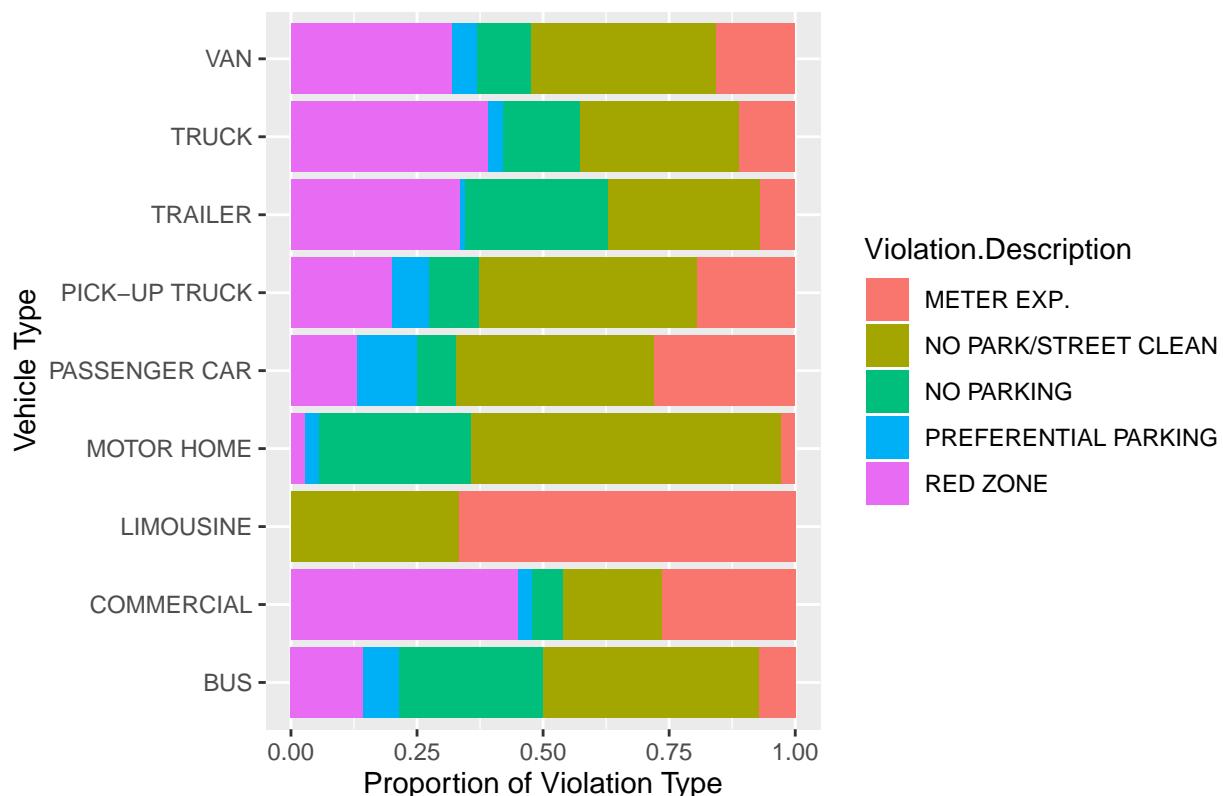
Total Parking Violations by car color

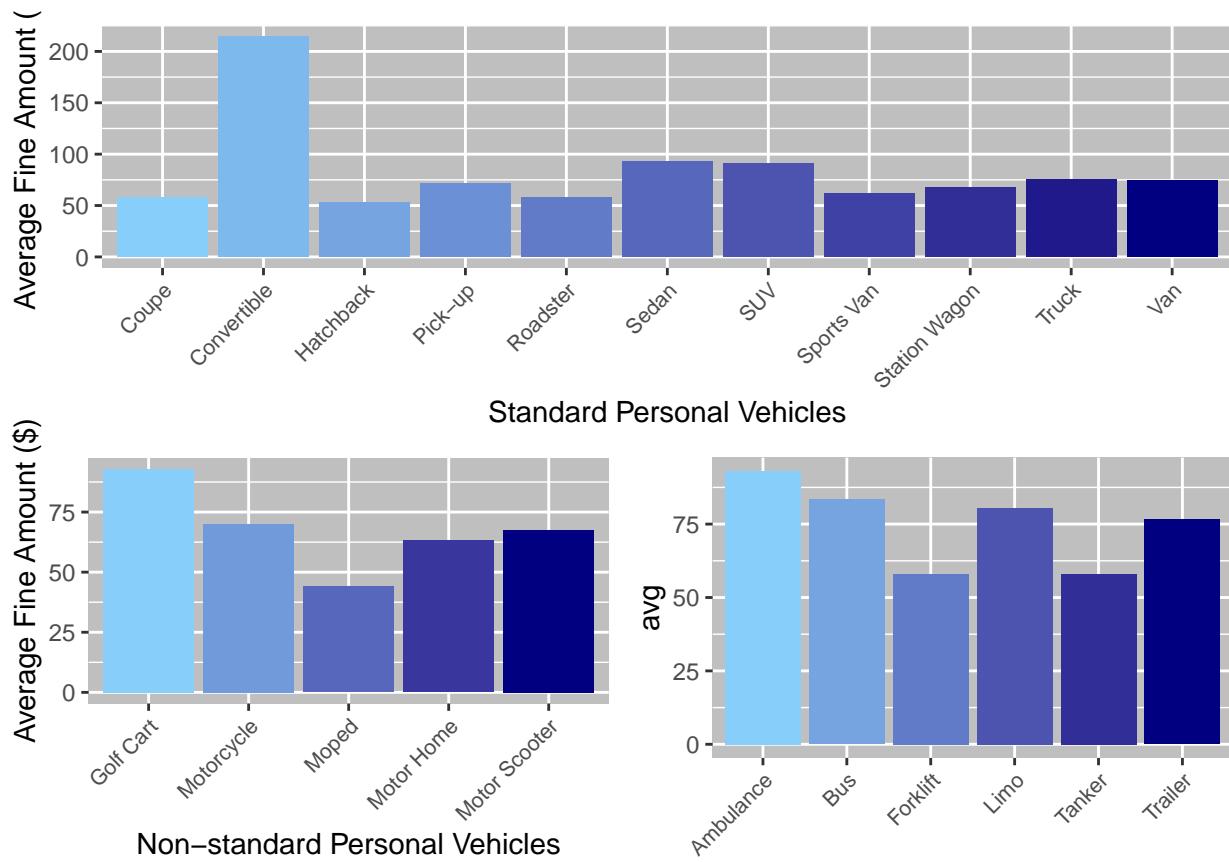


Average Fine Amount by Manufacturer



Percent of Different Violations by Vehicle Type



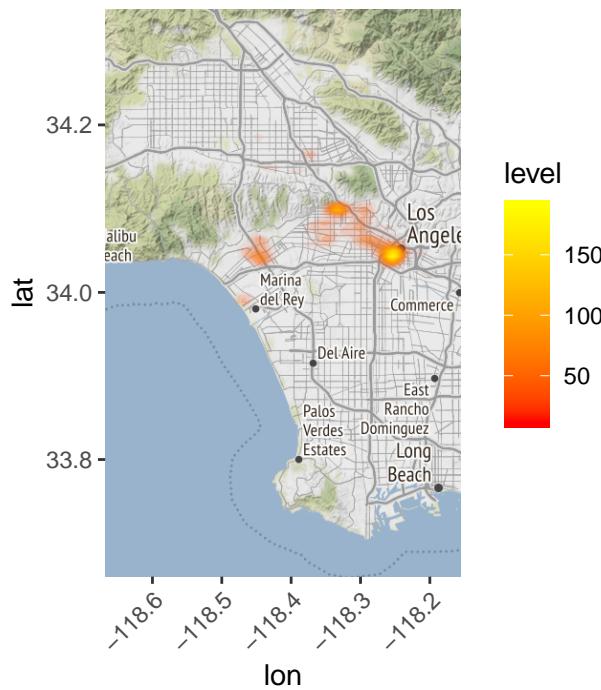


Where do parking violations occur?

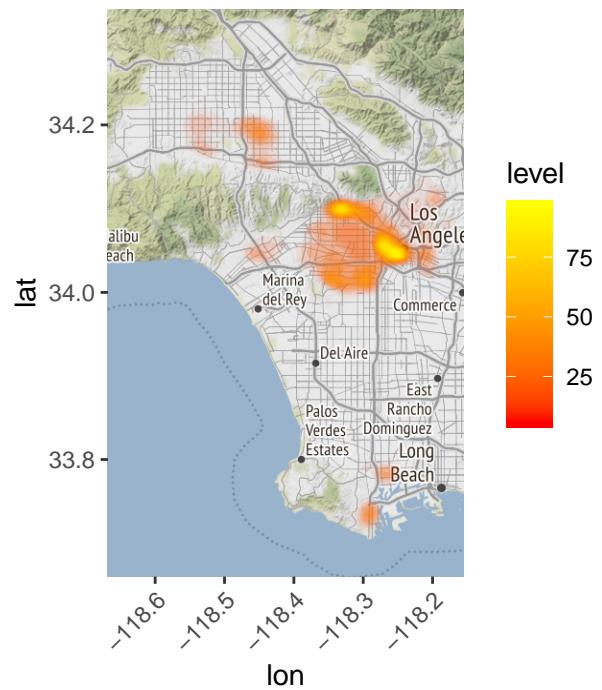
Does weather or crime affect the parking convictions overall?

In our investigation of how parking citations are distributed across the city of LA, we wondered how crime data and potentially weather data would fit in with our parking citations data. We used 2 SQL databases of both LA weather and LA crime to compare with our initial data. By using a heatmap on the city of LA with out data we can see different concentrations of crime, weather, etc., and in conjunction with our initial dataset we can see if there are any correlations between crime, weather, and our parking citations.

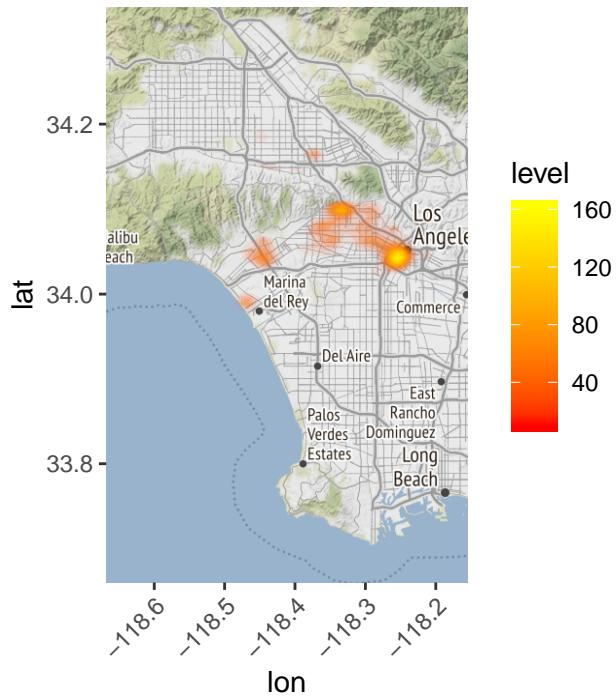
Weather



Overall Crime



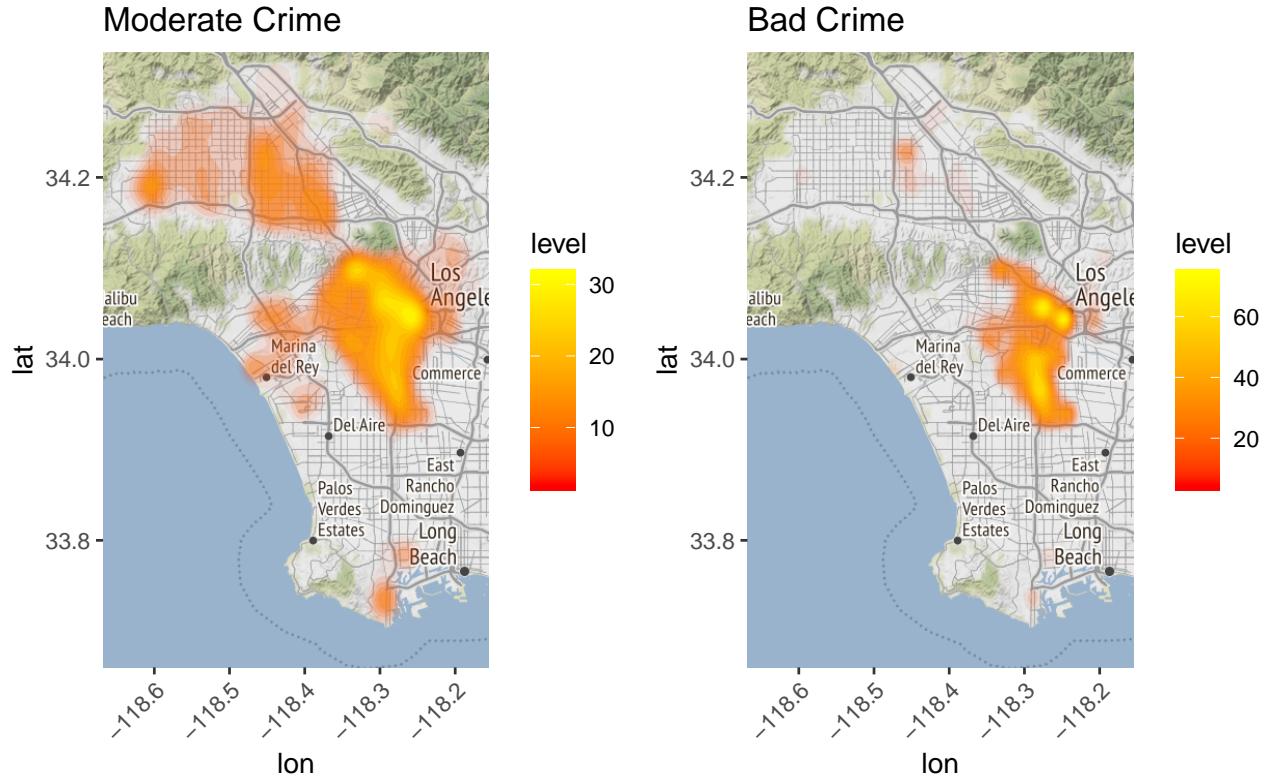
Parking Citations



The graphs show the density of parking citations in LA, the density of parking citations when weather was above half an inch of rain, and all crime in LA. From these heatmaps we can see that though there is a greater spread with crime over the downtown LA area, there is a big concentration around the central downtown area. It should be noted that the concentration of crime is much lower as shown by the legend on the graph, but the heatmap does still show that there is still a concentration centred around downtown LA.

Crime and its effect

The crime map does account for overall crime regardless of severity, so we thought that it would be a good idea to rate the crime by severity. In our data for crime, we are supplied with crime codes that indicate the type of crime committed. Because the crime codes are known and this is a database of reported crimes for LA we can assume that this would give a fairly accurate map of crime activity in LA. We also made the assumption that if there is more crime in an area it is more likely that there is increased police activity in that area, and therefore more citations can be given. Crime codes are on a numeric scale where the lower the crime code number, the more severe the offense, so we thought that it would be an interesting idea to

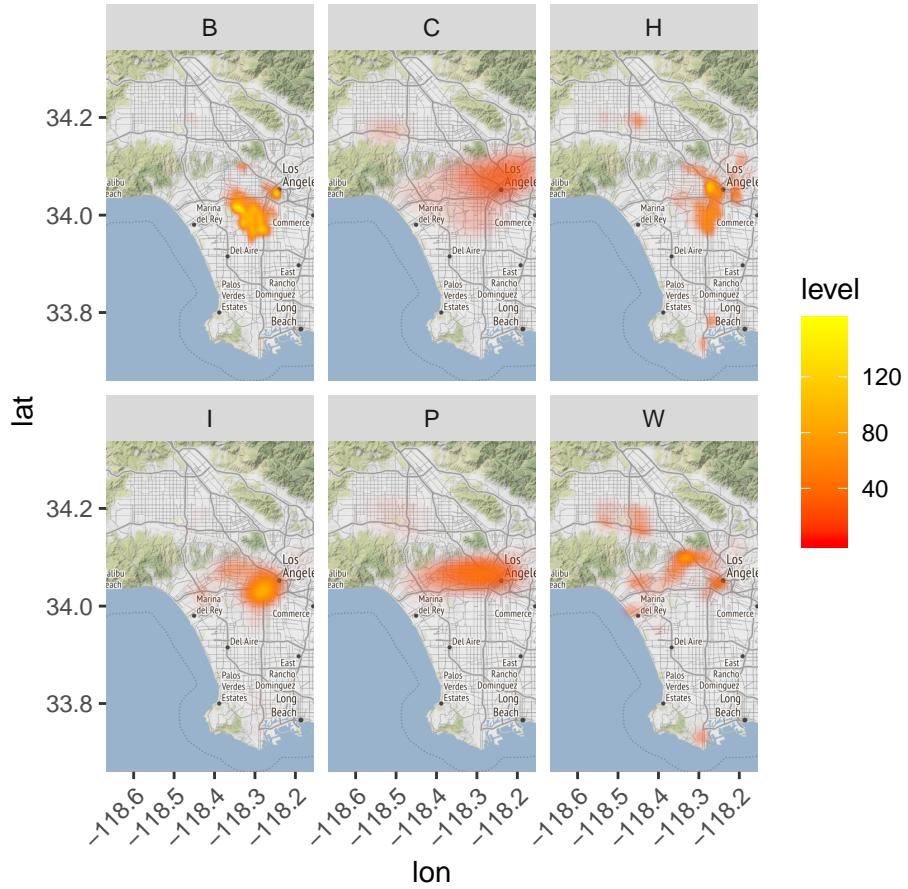


As shown in the graphs moderate crime with a moderate crime code tends to be way more spread out over the city when compared to the severe crime. Looking at the legends also gives credence to this as the density is way less than that of the severe crime with severe crime being extremely concentrated and much more dense than the moderate crime. When we compare to our parking citation data, we can see that there is an overlap in the central downtown area, but besides that there is still a lot of crime happening outside of the area regardless of severity suggesting that crime does not necessarily correlate to parking citations.

Demographic areas

Using our crime database we can find the demographics by crime and see in which areas crime happens based on demographic. By plotting these maps we can find demographic data by region which we can use to see whether or not there are demographic differences in parking citations frequency.

Demographic Data



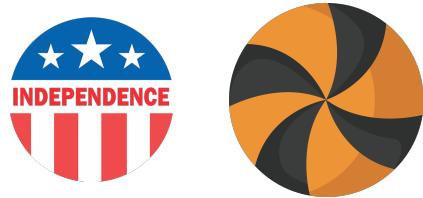
Using this data, we can see that every one of our ethnicities does go around the central downtown LA area. We also see certain trends with our severe crime data. People of Black descent appear to be closer in proximity to the severe crime hotspot and people of Chinese descent appear to be further from the more severe crimes in the area. When we compare to parking citations it would suggest not only that crime has no effect on parking citations, but also that demographics does not necessarily contribute to frequency of citations and certain areas may not be more likely to receive citations because of their ethnic makeup.

When do violations occur?

Holiday Parking

Major holidays account for some of the busiest travel days in the year, so we decided to investigate how the total amount of money collected on each day was distributed. We selected New Year's Eve, Super Bowl Sunday, Valentine's Day, St. Patrick's Day, July 4th, Halloween, Thanksgiving, and Christmas and summed up the fines issued for each day. The totals were then plotted proportionally for each holiday seen below.

New Year's	Super Bowl Sunday	Valentine's Day	St. Patrick's Day
Total: \$1,965,659	\$554,469	\$1,497,590	\$1,841,597



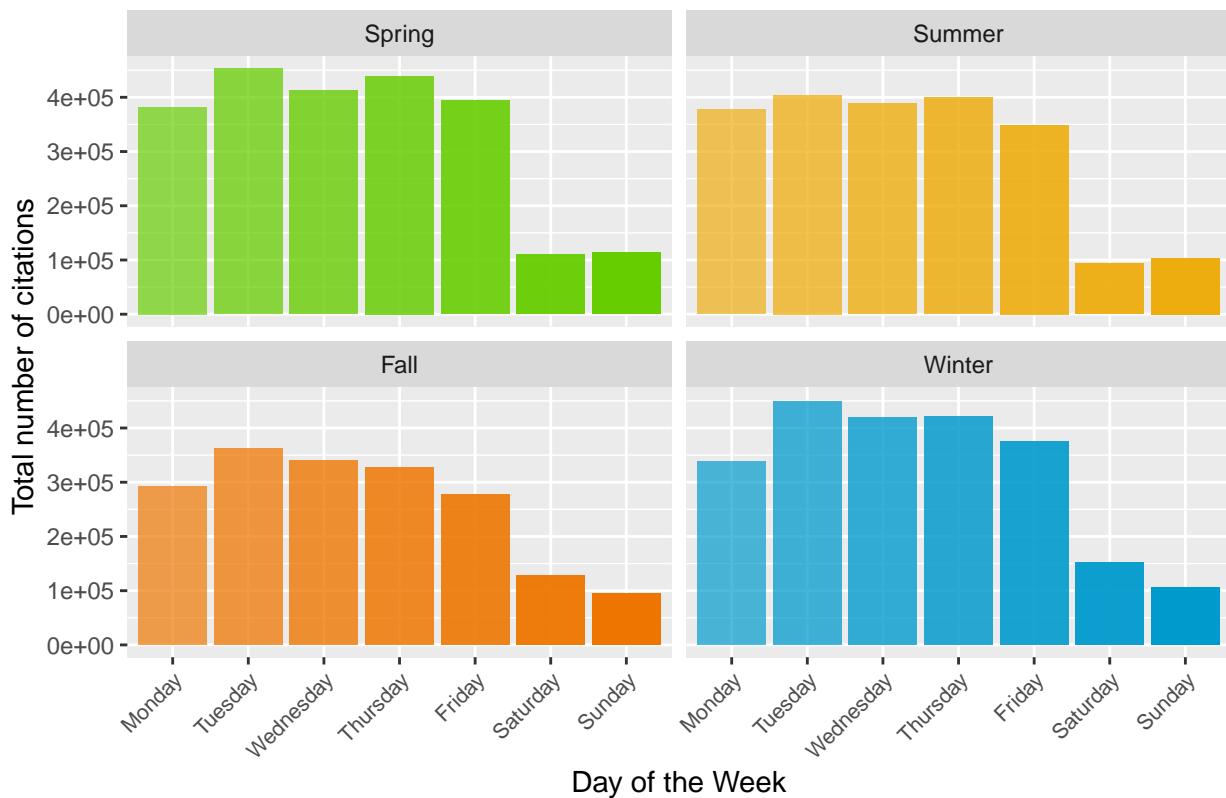
July 4th	Halloween	Thanksgiving	Christmas
\$1,373,611	\$1,619,969	\$284,933	\$209,549

Our analysis found a striking difference between the fine amounts for holidays. We observed that holidays typically associated with drinking, New Year's, St. Patrick's Day, and July 4th, tended to have more fines issued. We were surprised to find that Christmas and Thanksgiving had the two lowest total fines issued, as we associated these holidays with travel. These lower than expected values could possibly be explained by other variables, however, such as a decrease in LAPD/LADOT staff working on these days or increased leniency. We did expect Halloween to have a large fine amount, as finding legal parking while Trick-or-Treating can be difficult. We expected the Valentines Day's results as well, but were surprised that Super Bowl Sunday was so low, as traveling to parties and drinking often occurs on that day. Super Bowl Sunday, however, is the only holiday that is always on a certain day of the week, whereas all of the other holidays could fall on any day. This led us to investigate whether the day of the week influenced how citations were issued.

Days of the Week

While analyzing which day of the week elicited the most citations, we also decided to group by the season of the year to see if that would affect the total volume of citations issued.

Distribution of tickets throughout the week for each season

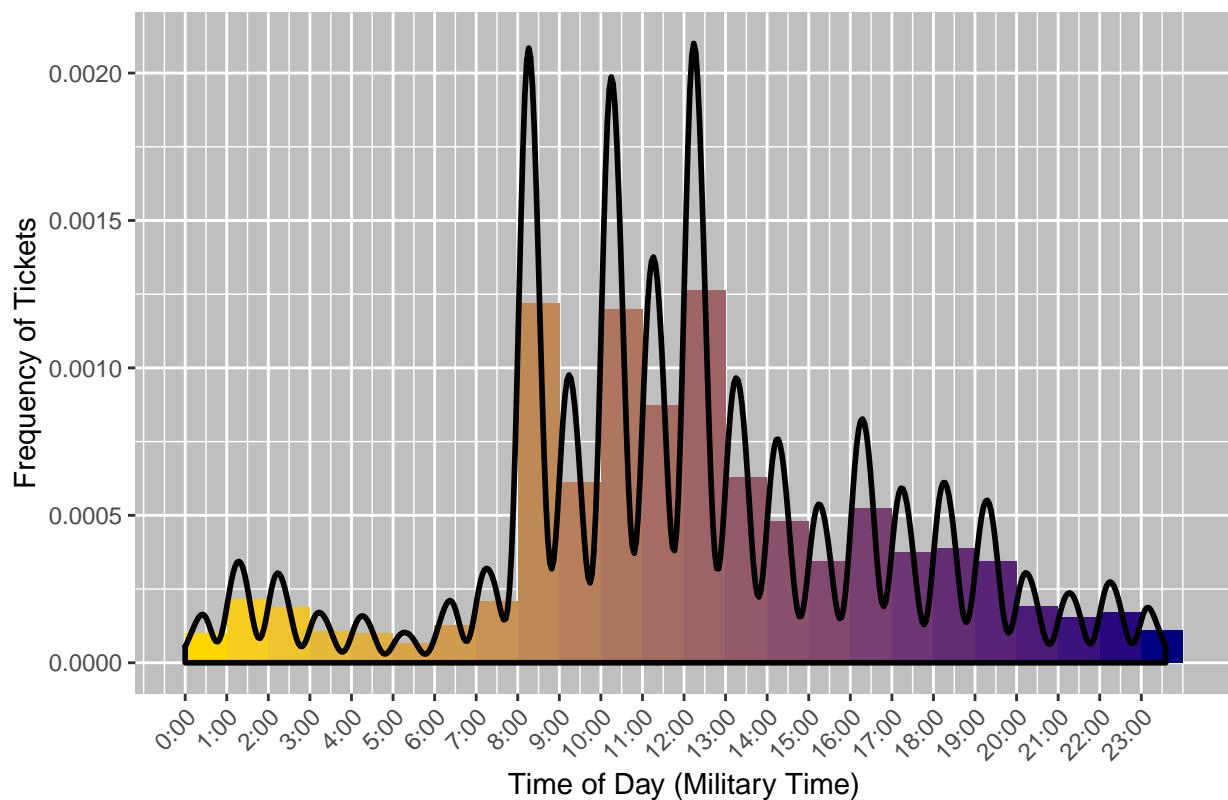


Across every season, Tuesday had the greatest volume of citations issued, while the weekends had the fewest. This finding was interesting, because the increased traffic usually generated on weekends did not translate into the volume of citations, but somehow created the opposite effect. Additionally, while we expected to see the citation volume skyrocket in the summer with the influx of tourists ignorant to LA parking laws, summer volumes were overall lower than both the spring and winter. This data did, however, validate the possibility that Super Bowl Sunday had relatively low fines, as Sundays in general received less citations than weekdays.

Time of Day

We also explored how citations were issued over the course of the day.

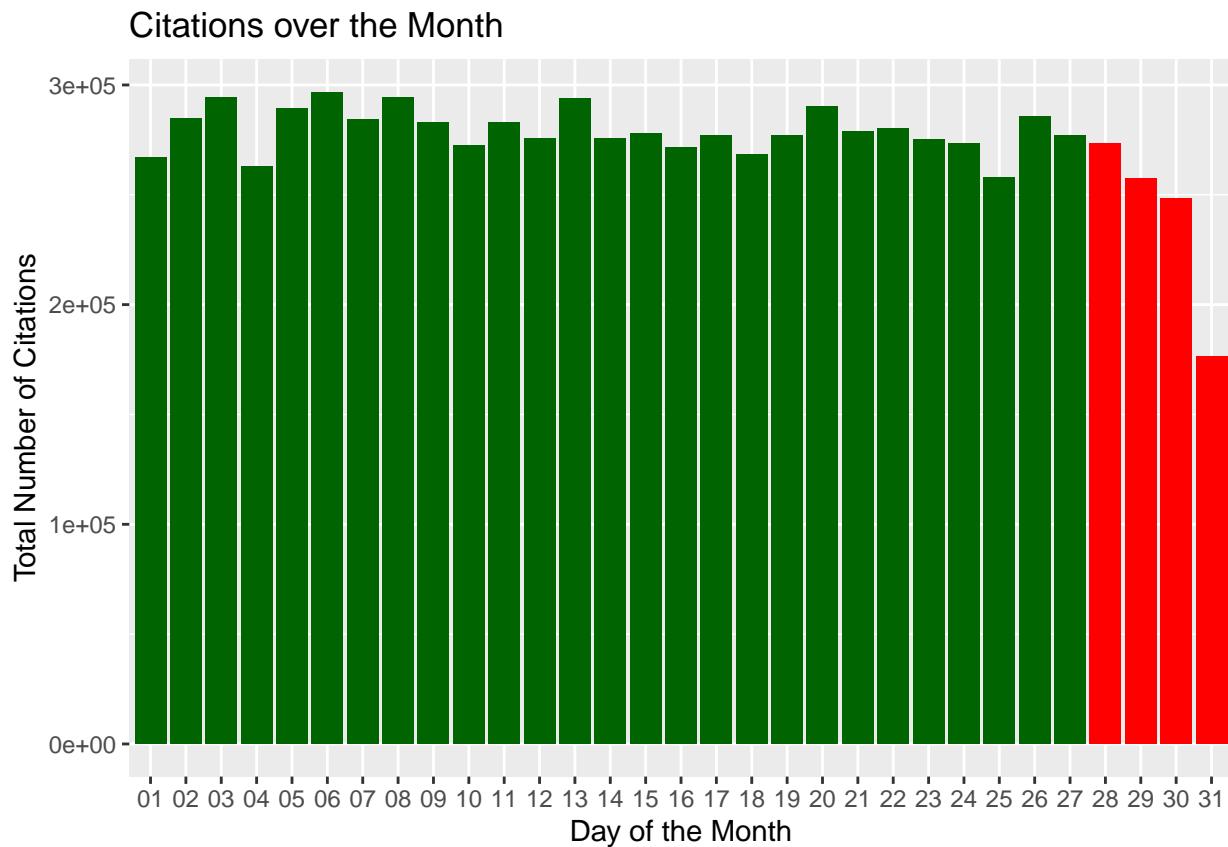
Frequency of Parking Tickets Throughout the Day



The greatest frequency of citations were issued between 8:00am and 2:00pm, with peaks occurring in the first half of each hour. Unsurprisingly, very few citations were issued in the early hours of the morning, wth the lowest frequency occurring between 5:00-6:00am.

Quotas

It is a common misconception that ticket frequencies increase at the end of each month as many people believe that officers have monthly quotas to fill. We explored whether an increase in ticket frequency was observed at the end of the month by plotting the total count of tickets for each day of the month for all months.



As seen in the plot, not only did we find no evidence of citation frequency ramping up toward the end of the month, we found that citation frequency tends to remain relatively stable. The extremely low frequency on days that are the 31st of the month is caused by only 7 out of 12 months having 31 days.

Conclusions

The Parking Citaitons Analysis evolved into more than just a matter of counting. Our first graphs uncovered startling statistics about prices and fines. When looking at the most cited color and car types, our analysis revealed that special vehicles like ambulances, golf carts, forklifts, and tankers also were subject to Los Angeles parking enforcement. Excited by the potential of what this dataset offered, we used complementary datasets to dive deeper into the socio-economic, cultural, and meteorological effects on Los Angeles parking Citations. More than just viewing the dataset at face value, we saw how parking ciations explained larger picture characteristics about the city of Los Angeles, but especially in regards to traffic and parking citaitons. At every turn, we discovered new, unique insights, which, even if they had less cohesiveness together than we had hoped, opened up even greater questions

The analysis also shows

1. Newton, Damien, et al. "Density, Car Ownership, and What It Means for the Future of Los Angeles." Streetsblog Los Angeles, 13 Dec. 2010, la.streetsblog.org/2010/12/13/density-car-ownership-and-what-it-means-for-the-future-of-los-angeles/.
2. "Parking Citations: Los Angeles - Open Data Portal." Data.lacity.org, 13 Feb. 2020, data.lacity.org/A-Well-Run-City/Parking-Citations/wjz9-h9np.3.
3. "Parking Citations: Los Angeles - Open Data Portal." Data.lacity.org, 13 Feb. 2020, data.lacity.org/A-Well-Run-City/Parking-Citations/wjz9-h9np.