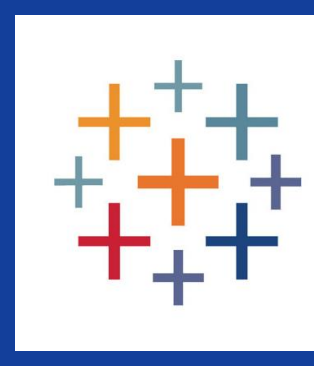# Analysis of Density and Performance of Municipal Parking Lots in the City of Hamilton

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Tools Used:

Introduction

The population of the City of Hamilton has been growing over the past few years. From 2016 to 2021 the population increased by 6%.[4] Public parking is going through changes in Hamilton with locations being repurposed for public development. Live data is produced for every transaction on municipal lots from pay stations and mobile pay through the Passport mobile app. These systems are to be expanded to every space operated by the city. While payment aren't an exact indicator of occupancy, there is correlation between payments and utilization. As the city grows, commercial space for new buildings and redevelopment is driving parking lots to be repurposed. As a result, parking in Hamilton has become scarce.

Objectives

This project focuses on:
- Identifying a subpopulation of the municipal parking lot users that are using the parking lots on a weekly basis.
- Identifying underused parking lots and parking lots with high usage.
- Finding a correlation between crime and parking lot usage.
- Making recommendations to the City of Hamilton in order to improve parking lot usage.

Data and Methodology

The data provided for the competition consisted of 11 datasets[1] that included transaction information for 2020 and 2021, datasets with information of parking lot addresses, operation times and spaces for the Passport lots and Cale terminals. Together with the datasets, a map[2] was provided a with the location of the parking lots in Hamilton.
In addition to the data provided, we requested data for occurrences of criminal activity in Hamilton for 2020 and 2021 from the Hamilton Police Department [3].

The methodology for cleaning and analyzing the data consisted of six steps as follows:

1. Clean datasets individually and merge them to obtain a final dataset with all the Parking lots and Cale terminals.
2. Write Python Scripts to: determine the fee per transaction using the rules of each parking lot, determine the average daily occupation for each lot number and the occupation density for each parking lot, and determine rules to define a subset of the population of users that can beneficiate of a weekly passport.
3. Obtain, clean, and geocode the Crime dataset.
4. Map the lots, terminals and crime data together.
5. Create visualizations to support the data analysis.
6. Analyze the results and summarize the findings.

Analysis & Results

There is a significant proportion of users using the parking lots on a weekly basis from Monday-Friday and sometimes on the weekends. That proportion is 20% in 2021. That number was determined to be 2931 out of 14,793. The users were compared to users that use the parking lots at least once at the price of the daily rate in 2021.
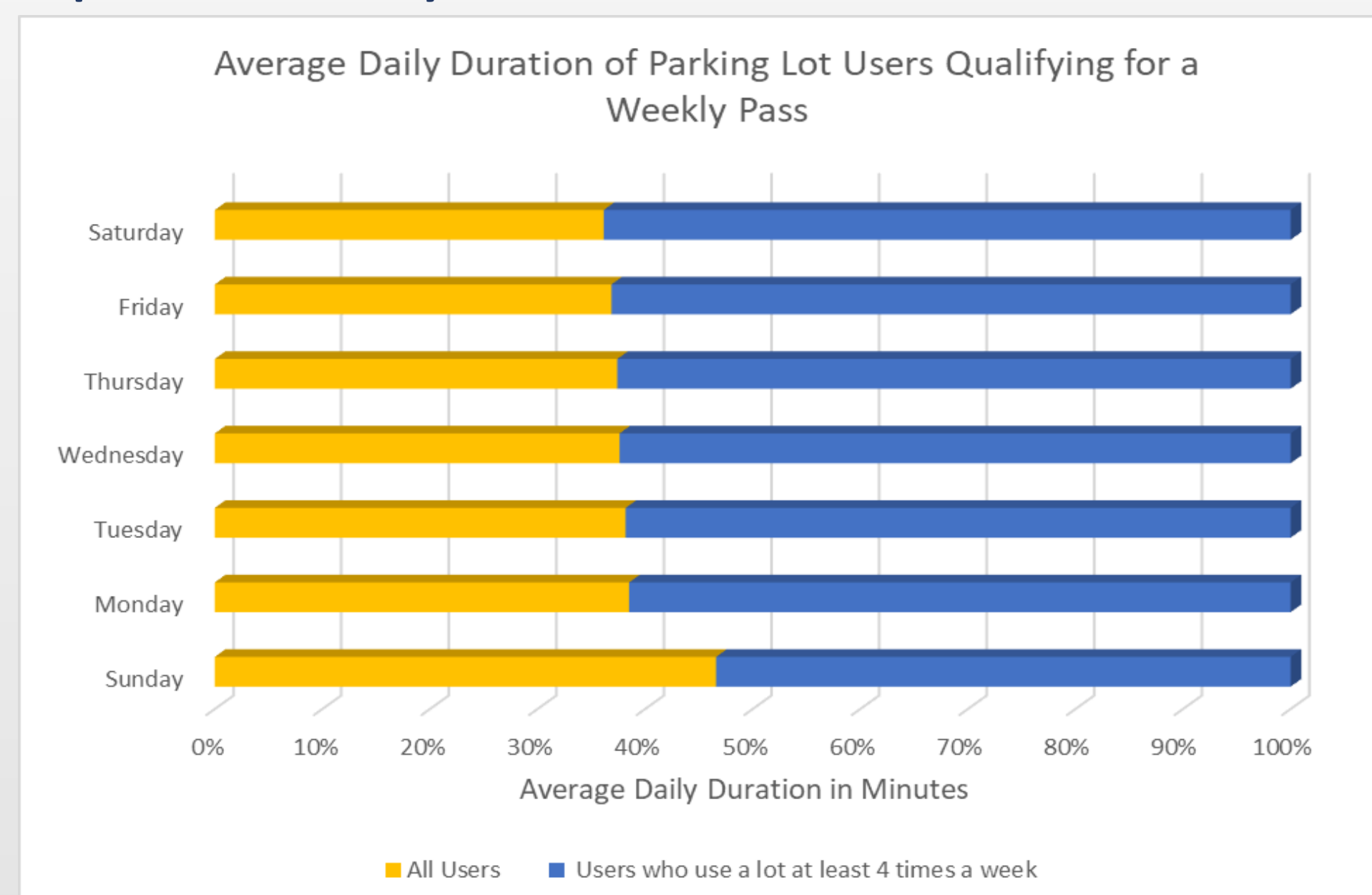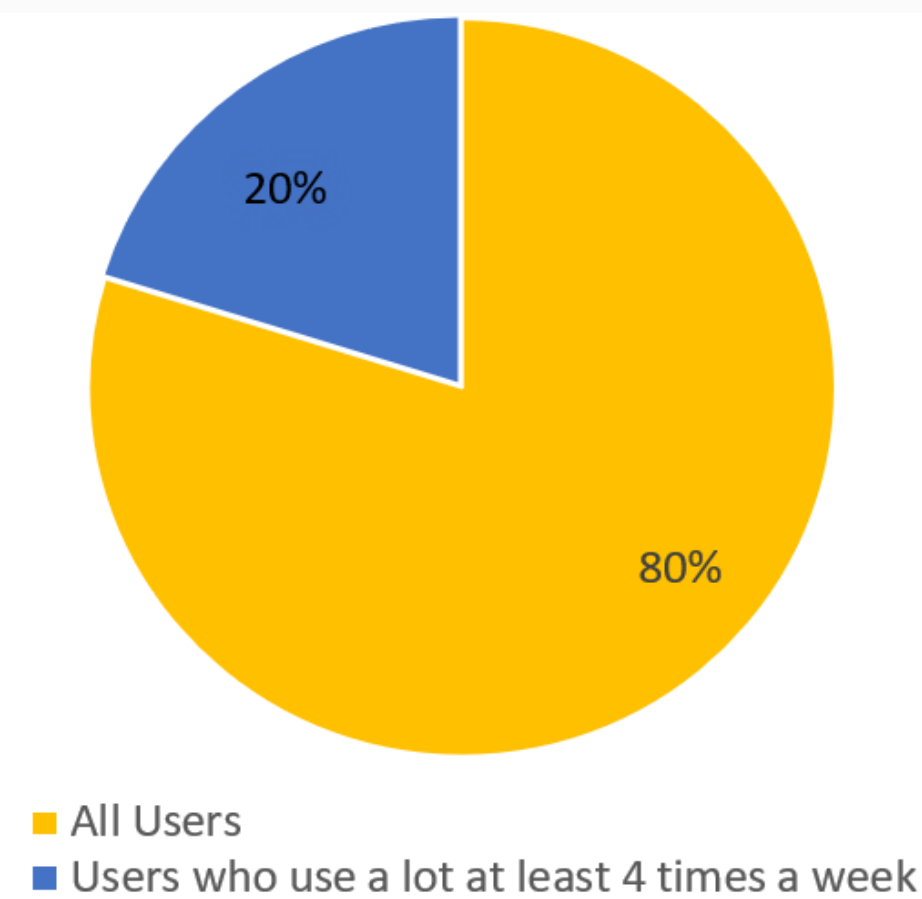
The weekly users are spending more time in the parking lots daily, especially from Monday to Saturday. On average, the weekly users are spending 171.2 minutes-Monday, 168.5-Tuesday, 175.0 -Wednesday, 177.0-Thursday, 170.6-Friday, 131.2-Saturday, 42.5-Sunday more compared to the all the users.
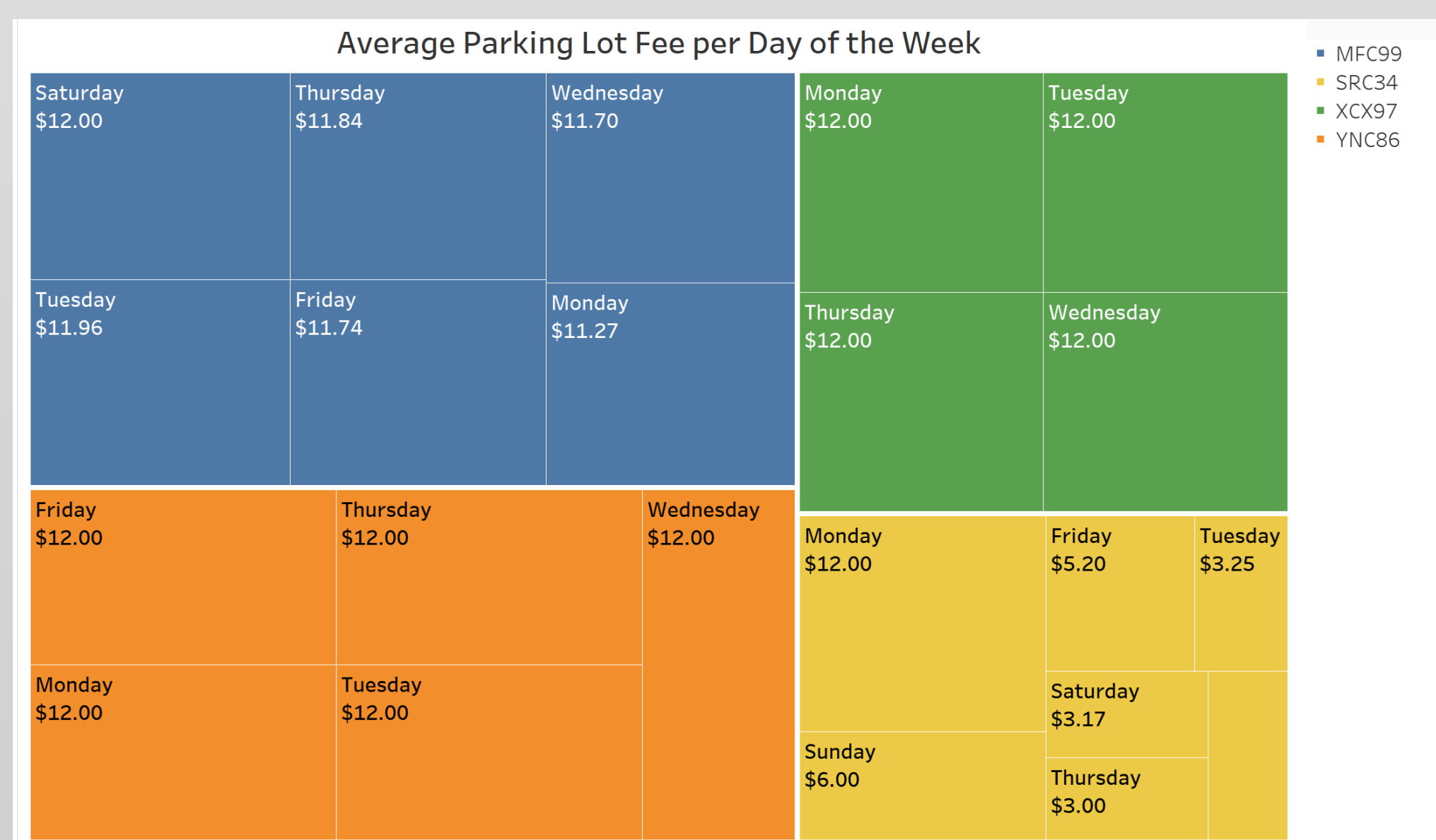
To show some examples of the weekly users, we randomly selected four users to showcase some of the behaviors of the weekly users. The graph above shows that of the four users chosen, all of them use the parking lots from Monday- Friday, three of the four users use the parking lots on Saturdays and Sundays, and two of them use the parking lots on Sundays. Furthermore, if you look at the average parking lot fee being spent, You can see that three of the four users are spending approximately $12.00 a day. It is hypothesized that these users are using the lots at such a high rate because they are going to work 9-5, Monday-Friday and sometimes Saturdays. The last user, that does not fit this profile, SRC34 is using it a lower rate but still on Monday- Sunday.

Analysis & Results

A map of the Hamilton region was generated using the Parking Lot Location map, data that was calculated to infer information about parking lot density (users entering and leaving throughout the day), and the Crime dataset to generate a heat map as well. A map of the Hamilton Downtown Core is used with a legend attached to explain occupation density of parking lots, as well as heat zones of where crime occurred.
The two major parking lots in Downtown: Lot 40 in the City Hall and Lot 62 in Vine Street, showed on average a low occupation density; this can be seen by the yellow color on the lots signifying as much.
- Both parking lots have a high number of spaces available that makes it hard for it to have high density outside of large events in the Downtown core like Hockey.
- It can be also attributed to the fact that during the last two years because of the pandemic people who worked downtown were home office and the use of those parking lots decreased. Though we did not have access to parking data prior to the pandemic so this is just an assumption.
- A trend of low occupation density in parking lots that are surrounded by parking meters is presented for lots located in the Barton Street, King Street East and others : 56,72,47,64,79 45.

Click to add text

There is a trend in high density parking lots in the Dundas area for the DU series of lots. They show a density of at least 32%, as shown by their orange color, and more particularly lot 9DU has a high density as seen by its red color signifying it's occupation density of 106-207%. This can largely be attributed to the fact that lot 9DU is small with only 7 spaces.
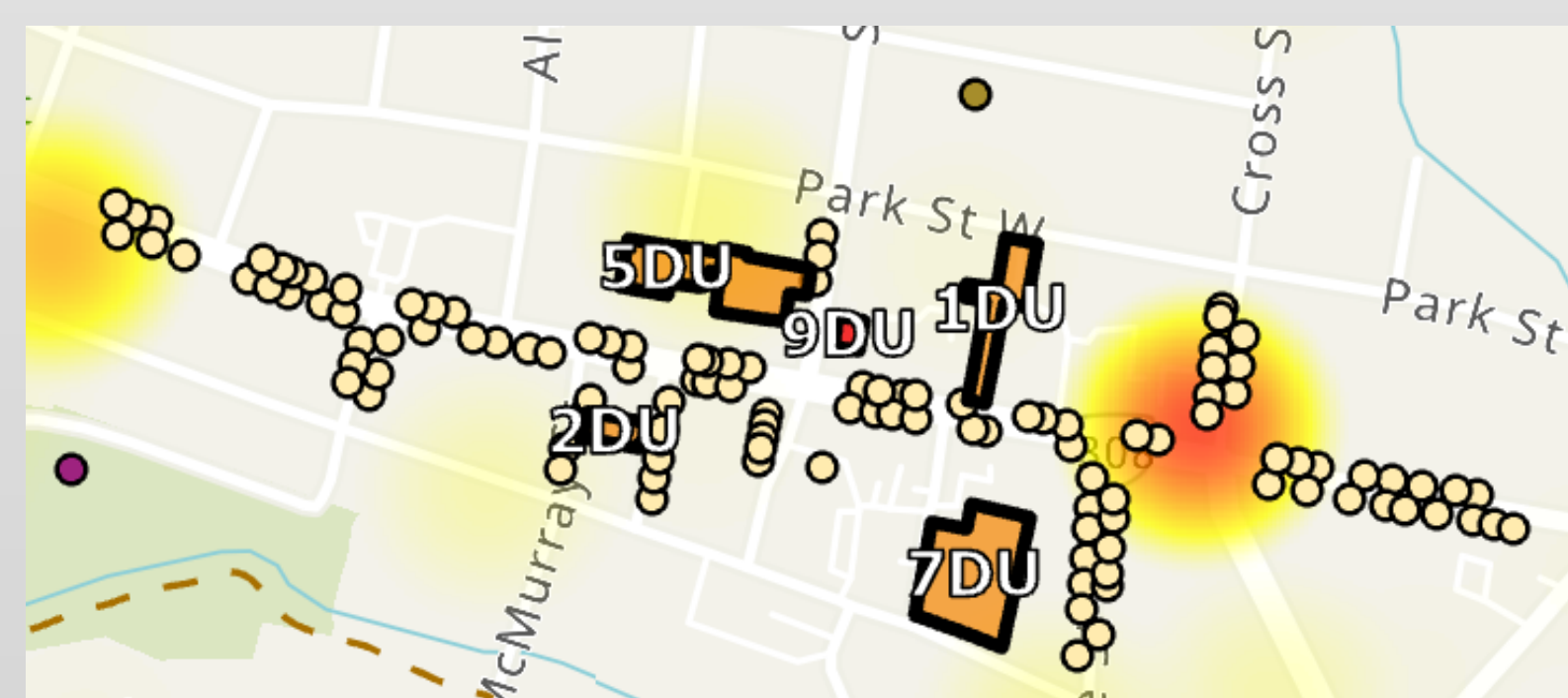

A snapshot of the Dundas area from our map outlining occupation density of lots

There are three parking lots close to Hamilton General Hospital that also presented a high occupancy density, Lot 82 shows 101% and lots 42 and 32 are around 50% occupancy density. This shows that parking lots around a major hospital in Hamilton see a lot use, however we can also see that there is a trend of light to medium criminal activity near these areas as well – but it does not seem to deter use as if people need go to the hospital, they will use the parking lot. This goes against our initial assumption and why we wanted to explore crime density as we assumed this would deter people from using a parking lot in an area with crime based on anecdotal stories we heard during our exploratory phase. Below is a snapshot of lots near Hamilton General.
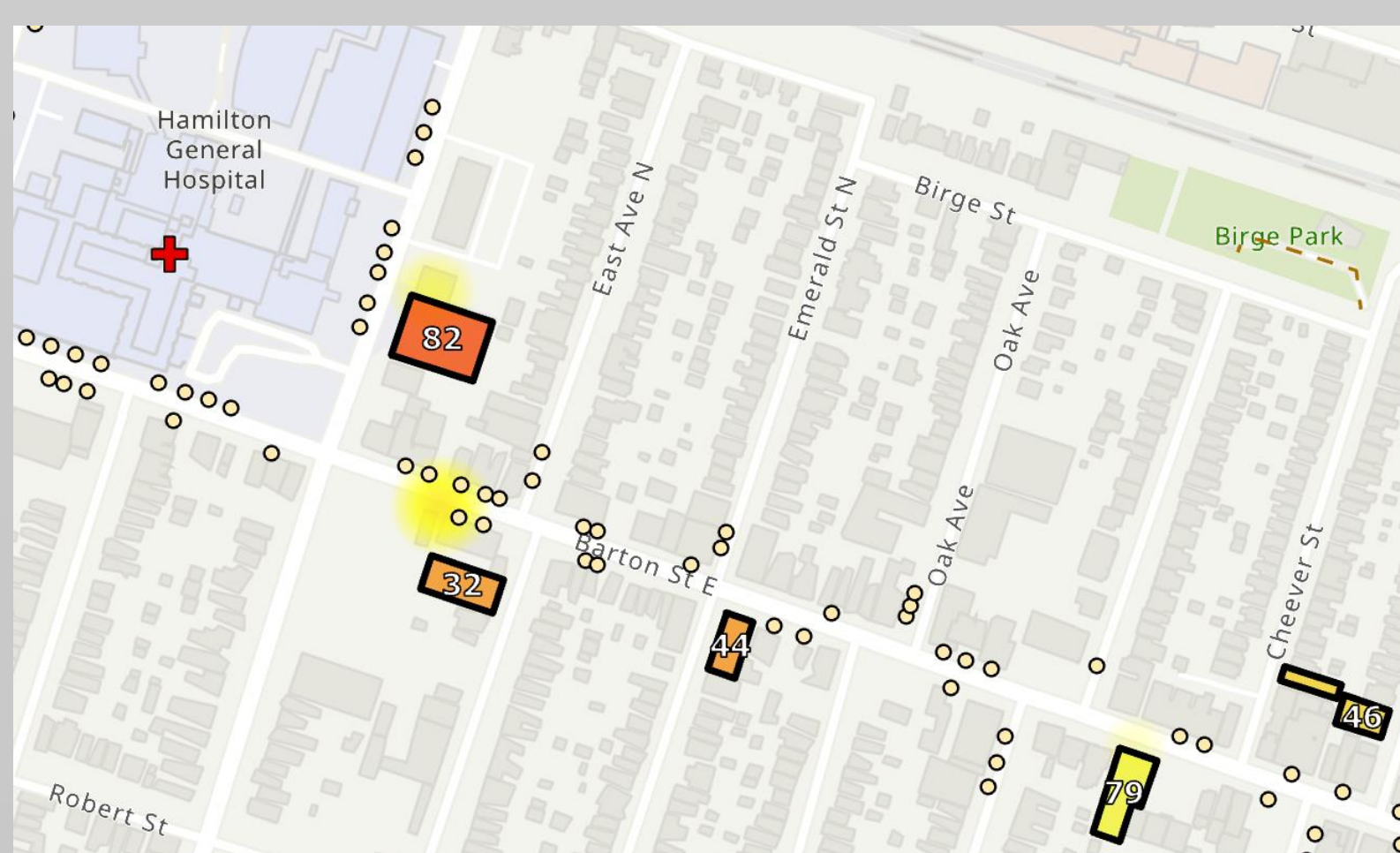
A snapshot of Barton Street E from our map outlining occupation density of lots
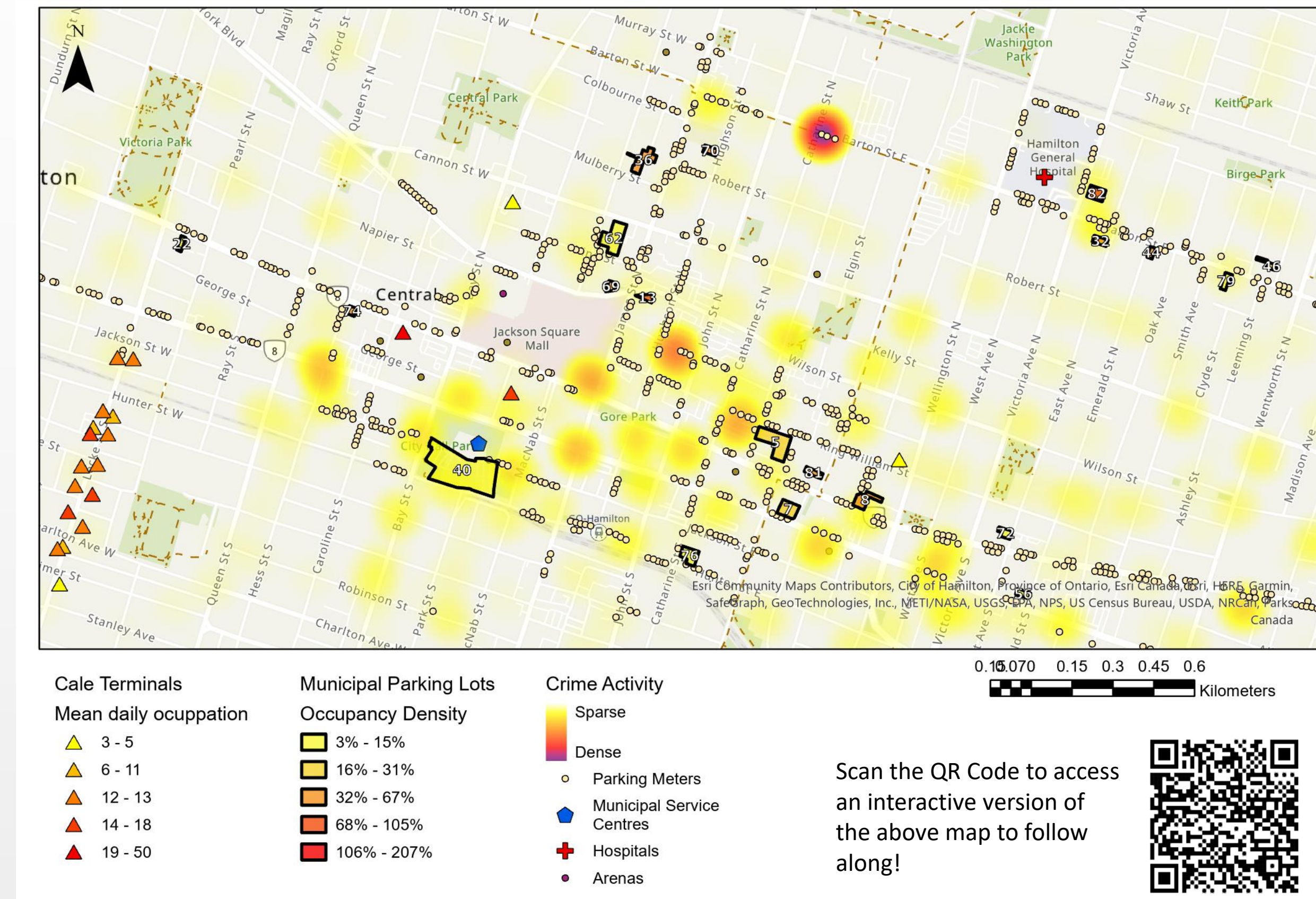
Conclusion

The proportion of users using a parking lot on at least times a week is a significant proportion. On average they are spending $165.00 a year on average compared to all other users spending an average of $5.28. These people are the City of Hamilton's' top users and deserve to be compensated for their loyalty. For this reason, we are proposing a weekly pass.

Recommendations

- Considering 20% of the current users are eligible for a weekly pass, this would be a great investment.
- Given that the Dundas Area, more specifically Municipal Lot 9DU, sees a high amount of occupancy density the possibility of expanding 9DU, adding a new lot in the Dundas area, or even adding more street parking meters are all options that should be considered.
- Similarly, lot 82 on Victoria Ave N, closest to Hamilton General, also sees a high amount of density and opportunities should also be explored here to provide more parking opportunities.
- We recommend, if it hasn't been done already, adding security cameras on major lots, particularly those around the Hamilton Downtown core. As there is criminal activity, and people use lots in areas that have crime happen, the residents of Hamilton can benefit from increased surveillance.

References

1. Competition dataset provided by the City of Hamilton, https://datacompetition.mohawkcollege.ca/2022-data-links/
2. Location of Municipal Car Parks in Hamilton. Obtained from: https://open.hamilton.ca/datasets/d56d996d4725499da2a5555aa5e5b651_5/about
3. Data requested in the Hamilton Police Department website: https://hamiltonpolice.on.ca/how-to/file-freedom-information-request
4. Census Data for Hamilton, obtained from: https://www.hamilton.ca/moving-hamilton/community-profile/census-data-hamilton