HUMBER INSTITUTE OF TECHNOLOGY

AND ADVANCED LEARNING

(HUMBER COLLEGE)

Tableau Business Analytics Report

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1.0. INTRODUCTION:

The following report aims to provide an analysis of crime activity within the GTA between the years 2017 and 2022. We have selected a data set from the official Toronto Police website. The data was cleaned and manipulated in order to be able to create visualizations using Tableau. The goal is to be able to provide the city of Toronto with a clear visualization of where and when most of the crime is taking place. This is done in order to implement the appropriate actions to make Toronto a safer city.

1.1. Data Source & Overview:

The dataset used in this analysis is obtained from Toronto Police Department(https://data.torontopolice.on.ca/datasets/major-crime-indicators-open-data/explore?location=0.056066%2C159.045806%2C1.00&showTable=true). This dataset contains information about Major Crime Indicators (MCI) incidents and related offenses from 2014 to 2022. The included MCIs are Assault, Break and Enter, Auto Theft, Robbery, and Theft Over (excluding Sexual Violations). The data can be viewed at the offense or victim level, leading to multiple rows for one occurrence due to various MCIs. The data includes REPORT_DATE and OCC_DATE in the UTC time zone. Unfounded cases are excluded. The data aims to inform communities about public safety, but it's preliminary and might not be fully verified. Crime locations are approximated to protect privacy and aren't tied to specific addresses or individuals. Below is a description of the 8 fields/columns/dimensions:

:

Column Name	Description	Data Type
EVENT_UNIQUE_ID	A unique identifier for each individual event/incident in the dataset.	Integer
REPORT_DATE	The date when the event was reported to the authorities.	Date/Time
OCCURRENCE_DATE	The date when the actual occurrence of the event took place.	Date/Time
OFFENCE	The specific criminal offense associated with the event.	String
MCI_CATEGORY	The category of Major Crime Indicator (MCI) to which the event belongs, such as Assault, Break and Enter, Auto Theft, Robbery, or Theft Over (excluding Sexual Violations).	String
DIVISION	The division within the area is covered by the Toronto Police Service where the event occurred.	String
NEIGHBOURHOOD_158	The neighborhood (larger region) is identified by a code or name where the event took place, using a 158-neighborhood classification.	String
LONG_WGS84 and LAT_WGS84	The longitude and latitude coordinates in the WGS84 geographic coordinate system, respectively, indicate the approximate location of the event.	Float

1.2. Business Problem Overview:

The Major Crime Indicators (MCI) dataset from 2014 to 2022 is now being used for public safety studies. Although this dataset has the potential to improve law enforcement tactics and neighbourhood wellbeing, there isn't yet an optimised method for thorough examination. This has an impact on law enforcement organisations and the larger society that rely on successful crime prevention techniques. The allocation of resources, the detection of criminal trends, and community involvement are all impacted by the lack of insightful analysis.

In order to address this, we suggest creating a dynamic Tableau project that incorporates the MCI information and focuses on insights related to crime category, resource allocation, and crime trend analysis. This technology will enable law enforcement to make data-driven choices, allocate resources effectively, and develop strategies to address particular types of crime. In the end, this strategy will increase public safety, help law enforcement make more informed decisions, and promote a safer neighbourhood.

1.3. Business Analytics Questions:

The following analytical questions have been designed to facilitate the extraction of relevant insights from the data provided:

1) In what hours of the day does crime become more prominent?
2) Which neighborhoods have the highest crime rate?
3) Which crimes have been the most predominant between 2017 and 2022?
4) In what locations do the most predominant crimes take place?

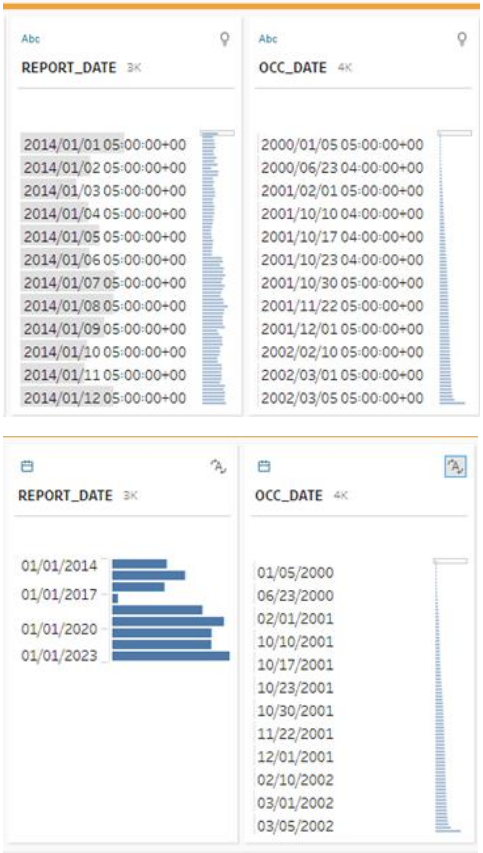
2.0. METHODOLOGY - APPROACH & REASONING

2.1. Data Cleaning and Transformation:

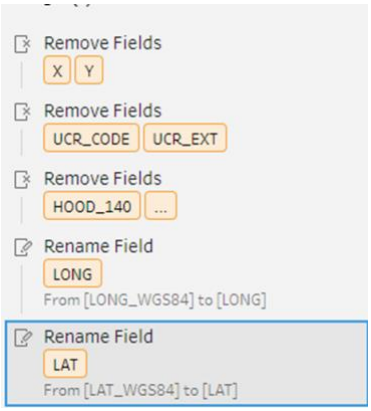
We used Tableau Prep for cleaning and transformation. FOllowing is the flow of data processing.

Steps description.

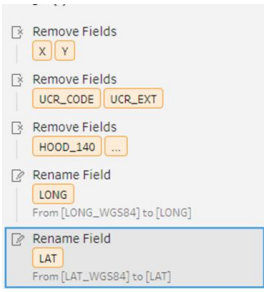
1. Import csv file and investigate what is on.
2. Transform date fields from string to date format



3. Finler dates of offence (OCC_DATE) to the 5 last years and don't keep null dates . This step got rid of multiple rows with null values in other fields.



4. Remove unnecessary columns.Rename some columns. For example, HOOD_140 and Neibourhood_140 are duplicated by HOOD_158 and Neibourhood_158 and represent earlier version of Toronto Neighbourhoods.



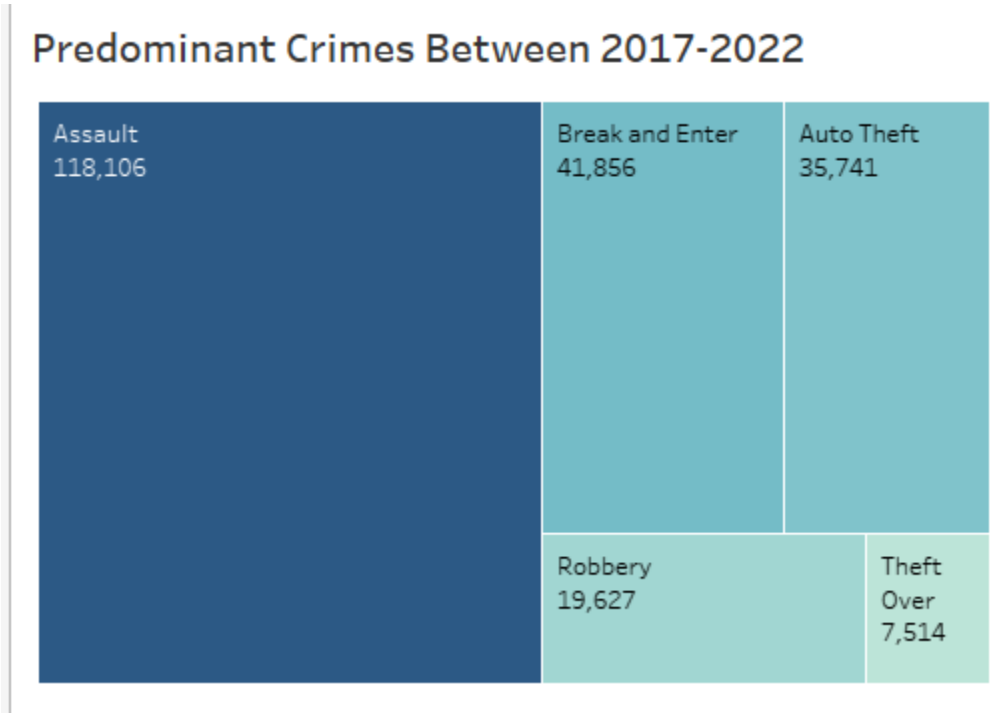
5. Decision on imputation. 1% of records has 0 Latitude and corresponding NSA Neighborhood value. We decided to keep 0 values.

6. Inside Tableau assigns LAT and LONG geographic roles , Longitude and Latitude respectively. THere no roles such as Longitude and Latitude in Tableau Prep.

7. Export into Tableau Data Extract.

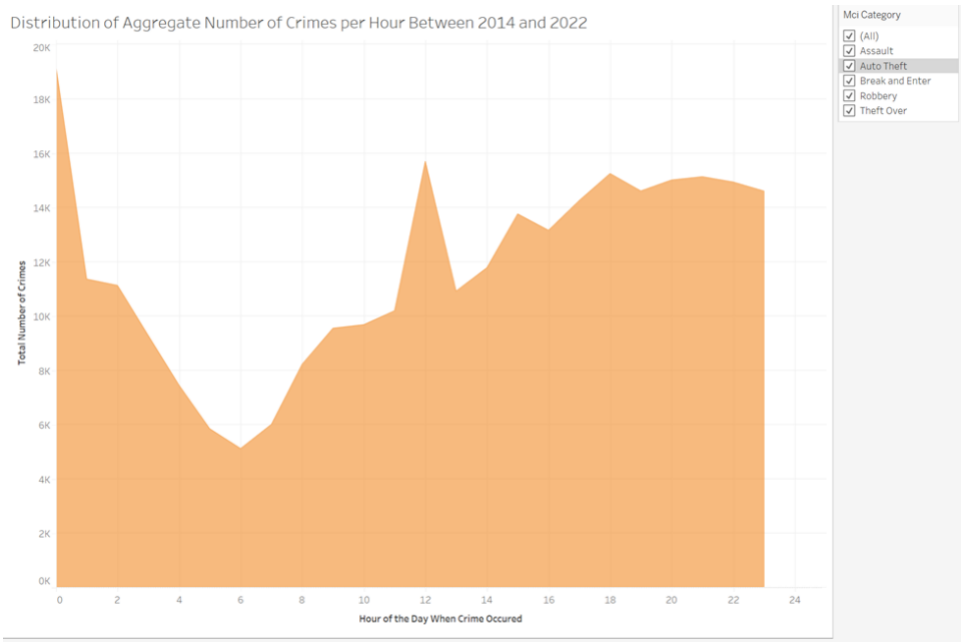
2.2. Data Visualization:

The following visualizations are directly linked to the analytical question regarding the most predominant crimes between the years 2017 and 2022:



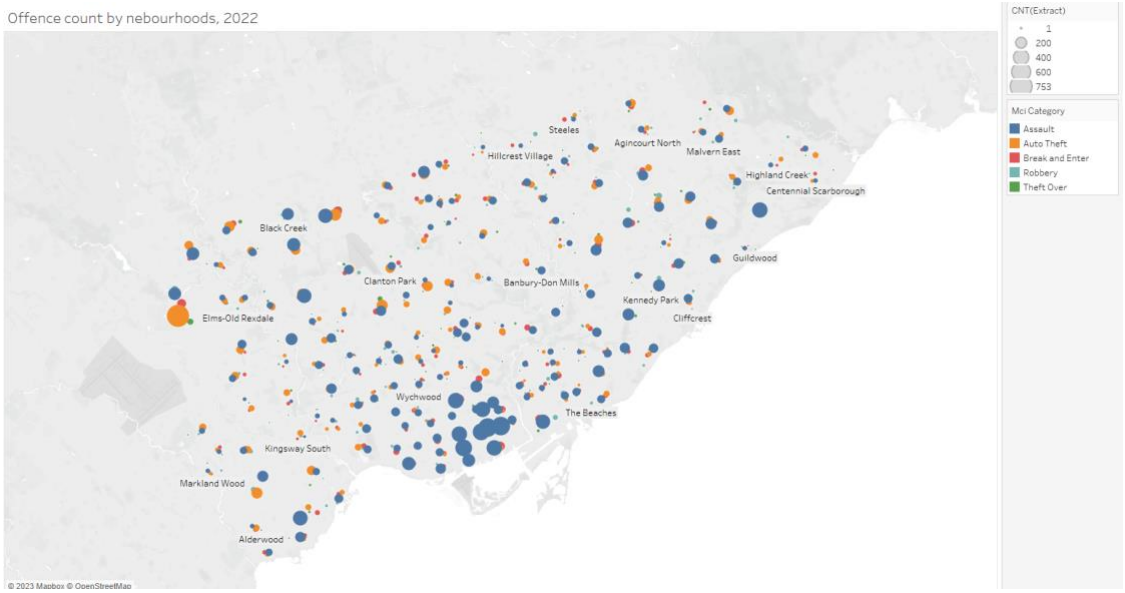
From the illustration above it is evident that the crimes that occurred the most between the years 2017 and 2023 were assaults, with a total of 118,106 cases. Second most predominant crime were break and enters with a total of 41,856 cases and lastly, auto theft, with a total of 35,741 cases.

The visualization below provides insight/answers to the initially outlined analytical questions regarding crime distribution by hours.



The visualization above shows the aggregate number of crimes for different hours of the day between 2017 and 2022. The associated slicer enables us to identify the respective hours where each crime category peaks. For example, auto theft and robbery appeared to occur mostly between 6pm and 12 midnight while 'theft over' occurred more around mid-day.

The following visualization is directly linked to the Offence count map by Neighborhood and MCI Category in 2022.

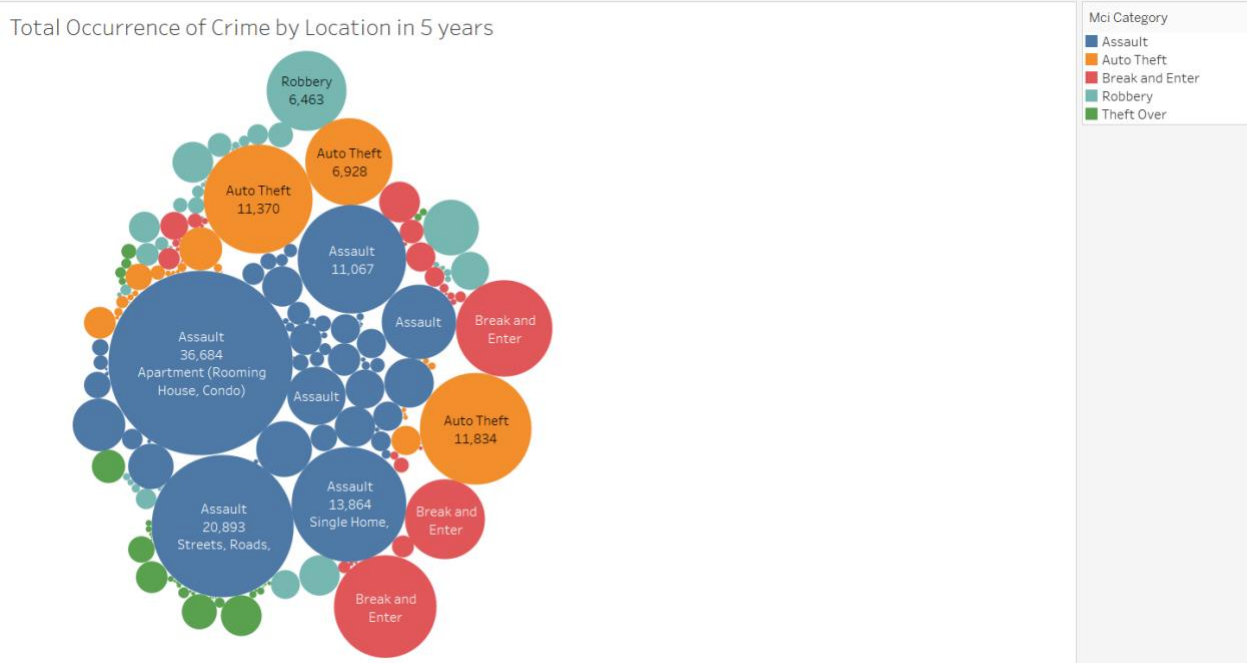


This interactive map illustrates the distribution of criminal incidents across various areas of Toronto. It's evident that some regions experience higher crime rates while others have notably lower rates of criminal activity. Notably, downtown Toronto stands out as the area with the highest number of offenses, primarily centered around Assaults. In the western-southern part of Toronto, particularly around Rexdale, Auto Theft incidents dominate, as indicated by the prominent large orange bubble on the map. Conversely, the region around Humber River (Kingsway South, Baby Point) exhibits the lowest occurrence of crimes.

By examining this map, public services can analyze potential contributing factors and formulate strategies to both prevent and mitigate offenses throughout Toronto.

- Neighborhood watch programs
- Community and youth centers
- Police allocation

This visualization provides further insight/answers to the following (initially outlined) analytical questions:



The above bubble chart illustrates the crimes that occur in various types of locations throughout Toronto spanning from 2017 to 2022. Predominantly, instances of assaults took place in Apartment settings (including Rooming Houses and Condos), followed by occurrences on Streets, Roads, and Highways (including Bicycle Paths and Private Roads), in that order. Over the span of five years, there were a total of 118,106 assault cases in Apartments.

The second most common type of crime is Auto Theft, which occurs in places such as Parking Lots (Apartments, Commercial or Non-Commercial) and Single Homes, Houses (including Attached Garages, Cottages, and Mobile Homes).

2.5. Potential Solutions & Recommendations:

- Police training plan: If there are different training requirements for investigating and handling different crime categories, this visualization can enable the Toronto Police Department to optimize how many officers are trained to tackle the respective crime categories.
- Work Scheduling: Police officers with specific training for a crime category can be intelligently scheduled for periods characterized with larger volumes of crimes for the respective categories.
- Improved Policing & Crime Decline: A proper implementation of the above points combined can optimize and improve policing by placing the right officers at the right places and time. This can very easily translate to reduced crime rates.
- Improved surveillance: The City of Toronto could work with apartment residents and property management firms to implement improved security measures like CCTV cameras, access control systems, and well-lit common areas. The City could also adopt safety technologies like GPS trackers, immobilisers, and remote security systems to deter vehicle theft attempts.

2.6. Challenges:

We encountered several challenges while analyzing this dataset due to its characteristics and considerations as follow:

1. **Data Completeness and Accuracy**: The dataset acknowledges that the data had not been entirely verified at the time of publication. This inaccuracy and incompleteness could lead to discrepancies and weaken the validity of the analysis.

2. **Time zone Alignment**: To preserve perfect anonymity, the REPORT_DATE, REPORT_HOUR, OCC_DATE, and OCC_HOUR were recorded in UTC time zone. The analysis, however, is concentrated on Toronto and the Eastern Time Zone.

3. **Data Structure Complexity**: Due to the offence and victim-level reporting, the dataset had many rows connected to a single occurrence number, which required advanced Tableau Prep technique for cleaning.

4. **Data Context and Verification**: Drawing data-driven solutions and significant conclusions required extra caution because the data was preliminary and not fully confirmed.

3.0. CONCLUSION:

Analyzing the major crime indicator's dataset can help law enforcement revise tactics and optimize resource allocation. The symbol map charts indicate that assault is most commonly occurring in specific locations in Wychwood. It may be influenced by a spatial correlation between crimes and areas of occurrence, but it doesn't describe the mechanism underlying the correlation. In order to further understand the root cause and assess alternative tactics, it is necessary to cross-relate them with other aspects of crime such as economic and demographic features, for e.g. employment levels and education levels. To improve the impact of law enforcer tactics and minimize the further increase of major crimes and keep Toronto a safe city.

4.0 Appendix:

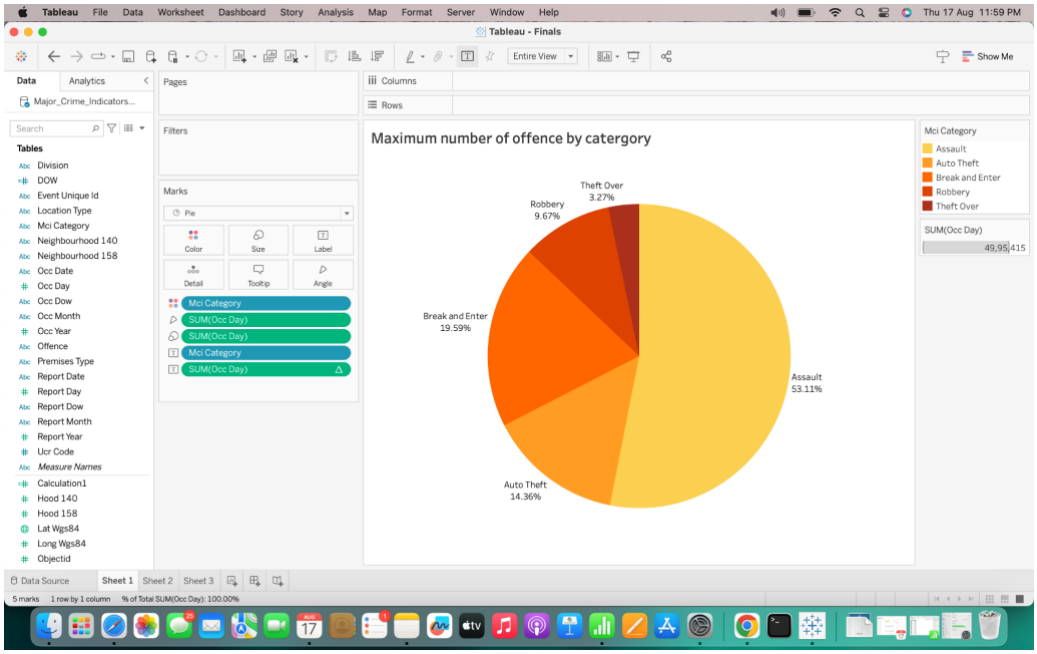
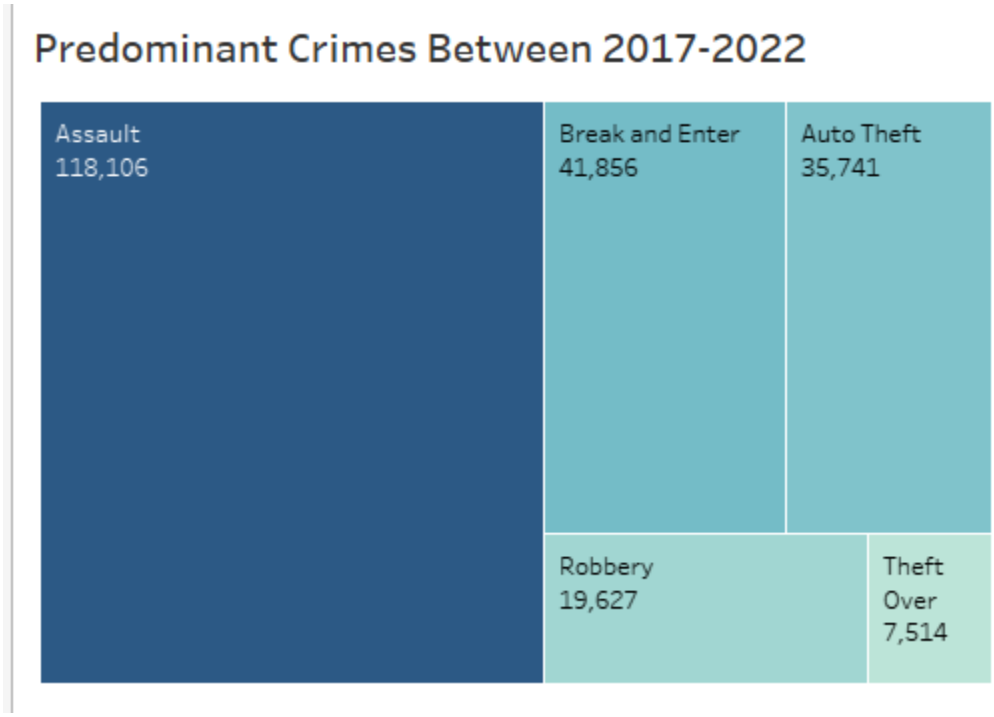


Tableau - Finals
Maximum number of offence by catergory
Theft Over 3.27%
Robbery 9.67%
Break and Enter 19.59%
Assault 53.11%
Auto Theft 14.36%
Mci Category
Assault
Auto Theft
Break and Enter
Robbery
Theft Over
SUM(Occ Day)
49,95,415


Predominant Crimes Between 2017-2022
Assault
118,106
Break and Enter
41,856
Auto Theft
35,741
Robbery
19,627
Theft Over
7,514

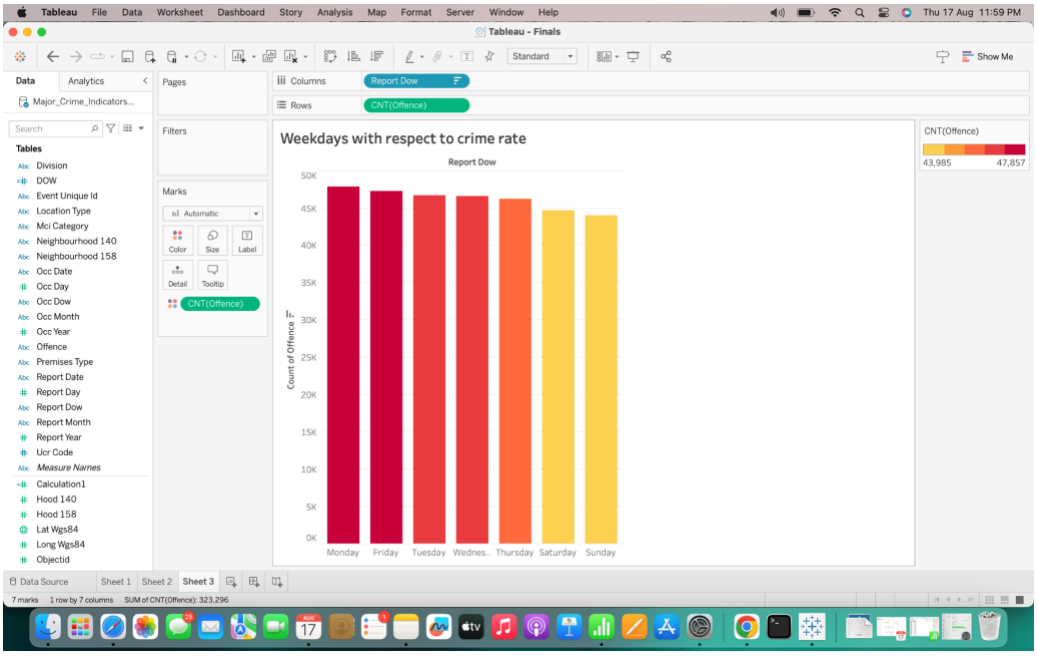
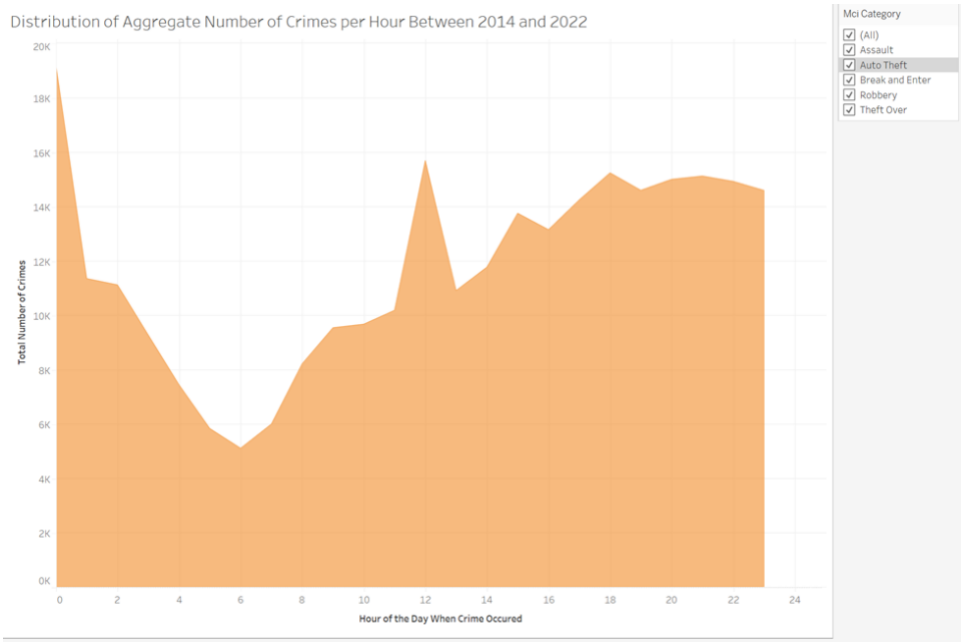


Tableau - Finals
Weekdays with respect to crime rate
Report Dow
Count of Offence
Monday
Friday
Tuesday
Thursday
Saturday
Sunday

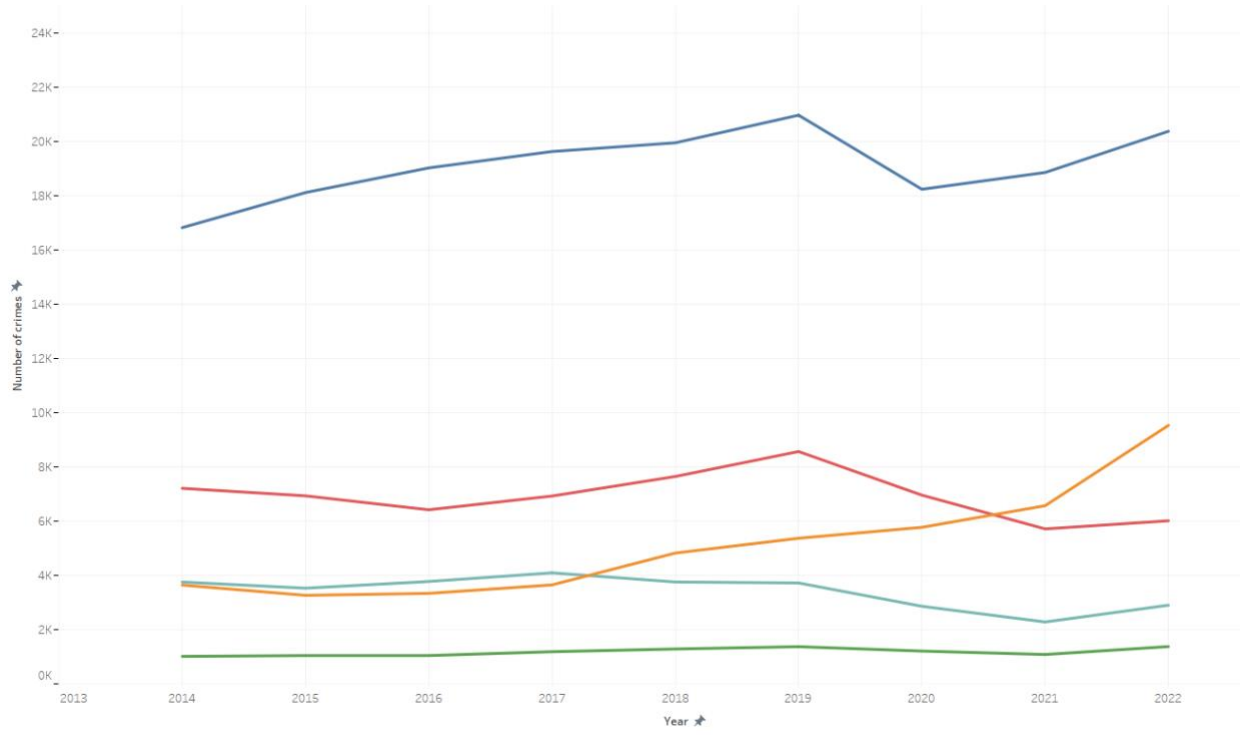

Distribution of Aggregate Number of Crimes per Hour Between 2014 and 2022
Total Number of Crimes
Hour of the Day When Crime Occured
Mci Category
(All)
Assault
Auto Theft
Break and Enter
Robbery
Theft Over

Frequency of Top Offenses in Residences based on Offense and Premises Type in 2022.

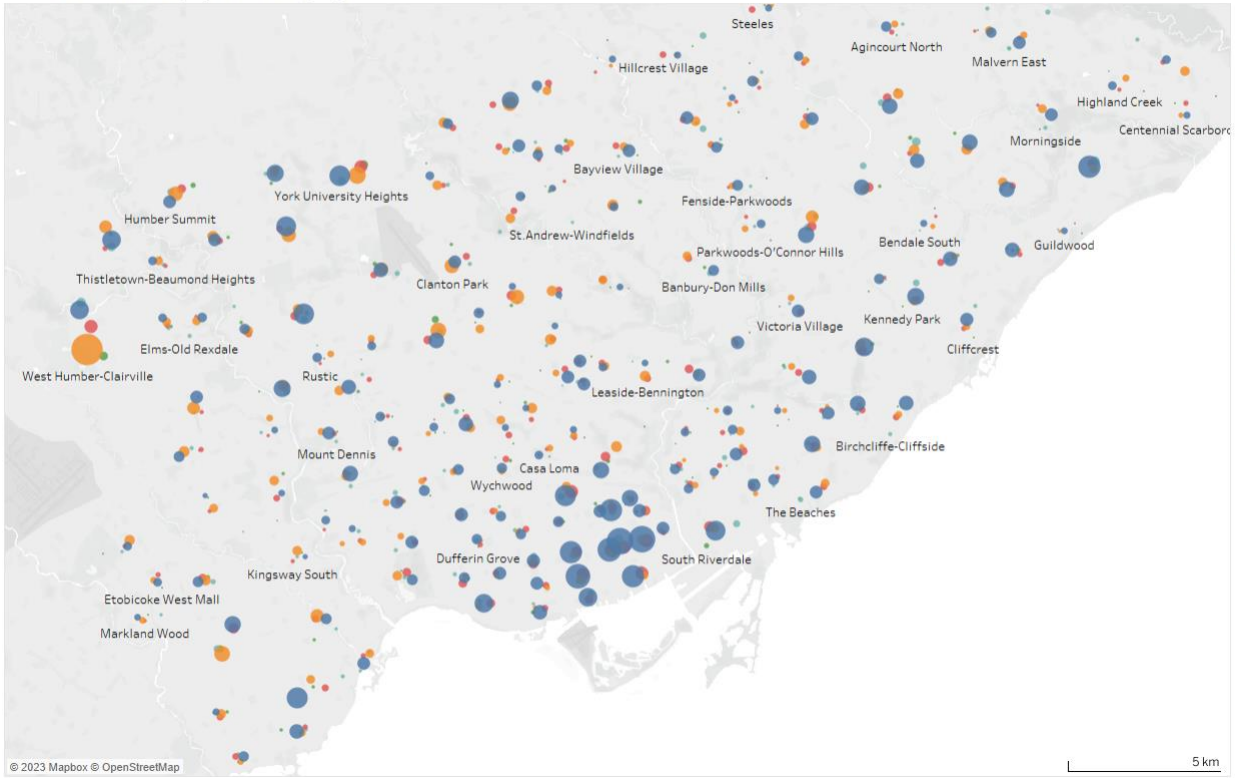
Arranged by Occurrence Frequency in Appartments

	Offence										
Premises Type	Assault	B&E	Assault With Weapon	Assault Bodily Harm	Theft Of Motor Vehicle	B&E W'Intent	Unlawfully In Dwelling-House	Theft Over	Assault Peace Officer	Theft From Mail / Bag / Key	Robbery - Other
Apartme..	4,701	1,323	1,195	295	293	163	132	131	105	104	67
Outside	3,055	5	1,109	232	4,685	5		104	205	16	262
Commercial	2,110	2,200	601	92	683	349	4	323	89	24	76
House	1,577	1,110	341	60	3,509	129	80	109	25	22	13
Transit	1,004	11	211	48	29	2		9	57		30
Other	992	354	203	66	331	49	5	52	171	11	28
Educational	520	80	69	9	8	8	1	12	3	1	16

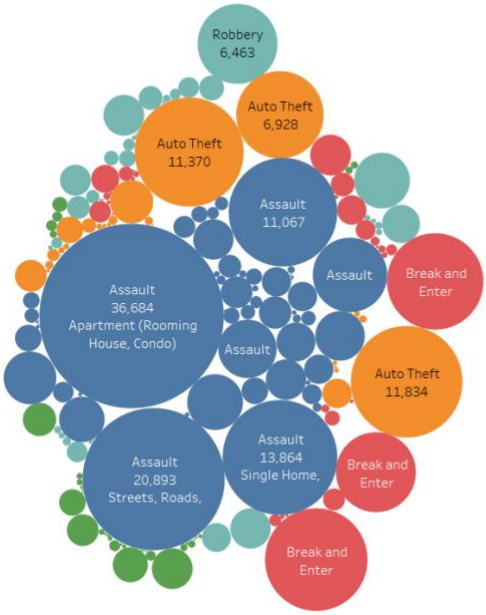
City of Toronto Crime Count Evolution (2014-2022)



Toronto Crime Map by MCI Category



Total Occurrence of Crime by Location in 5 years



Mci Category
- Assault
- Auto Theft
- Break and Enter
- Robbery
- Theft Over

References

Toronto Police Service . (2023, March 27). *Major crime indicators open data*. Toronto Police Service Public Safety Data Portal. https://data.torontopolice.on.ca/datasets/major-crime-indicators-open-data/explore?location=0.010190%2C-20.954194%2C1.00&showTable=true