

CRIME ANALYSIS

-BY MARKANA YASHVI

INDEX

SR. NO	TITLE
1.	Overview 1.1 Project Definitation 1.2 Scope 1.3 Features 1.4 Advantages 1.5 Limitations
2.	Problem Specification 2.1 Introduction 2.2 Purpose
3.	Technology And Tools
4.	Data Model 3.1 Data Dictionary 3.2 Sample Dataset
5.	Dashboards
6.	References

1. Overview

1.1 Project Definition

This project aims to analyze crime data using Tableau to help law enforcement identify patterns, trends, and high-crime areas. By creating interactive dashboards, it enables better tracking of crime over time and across locations. The analysis includes time-series trends, geographical mapping, and comparative insights to support decision-making. Ultimately, this project helps improve crime prevention strategies and resource allocation for law enforcement agencies.

1.2 Scope

- Crime Data Analysis:** Collecting and analyzing past crime data to identify patterns and trends.
- Interactive Dashboards:** Creating Tableau dashboards to visualize crime statistics and insights.
- Time-Series Analysis:** Tracking crime trends over different time periods to detect patterns.
- Geographical Mapping:** Identifying crime hotspots using location-based analysis.
- Comparative Analysis:** Comparing crime trends across different regions and timeframes.
- Decision Support:** Helping law enforcement with data-driven insights for investigations and crime prevention.
- User-Friendly Visualization:** Ensuring dashboards are easy to use for police and decision-makers.

1.3 Features

Crime Trend Analysis

- This feature helps analyze how crime rates change over time, allowing law enforcement to identify increases or decreases in specific crime types.
- It includes time-series charts that visualize crime trends over days, months, and years for better forecasting.

Geographical Mapping

- Crime incidents are mapped using geographical visualizations, making it easier to identify high-crime areas and hotspots.
- This feature enables law enforcement to focus their resources on areas with the highest crime rates.
- It supports decision-making for patrol planning and resource allocation.

Interactive Dashboards

- The dashboards allow users to explore crime data dynamically by selecting different filters such as location, time period, and type of crime.
- Users can drill down into specific areas or categories to gain deeper insights into crime trends.

Comparative Insights

- This feature helps compare crime statistics across different locations, time periods, or crime categories.
- It enables law enforcement agencies to analyze which areas have higher crime rates and what factors might be influencing crime patterns.

Real-Time Data Updates

- The dashboards are designed to incorporate real-time or periodically updated crime data, ensuring that users always have access to the latest information.
- This keeps law enforcement informed about recent incidents and trends for immediate response planning.

User-Friendly Interface

- The dashboard design ensures ease of use for police officers, crime analysts, and decision-makers with minimal technical knowledge.
- Simple navigation, clear visualizations, and intuitive filters make it accessible for all stakeholders.

Data-Driven Decision Support

- The analysis helps law enforcement agencies make informed decisions regarding crime prevention strategies.
- It supports planning for resource allocation, officer deployment, and crime reduction programs based on data insights.

1.4 Advantages:

- Helps identify crime trends and hotspots for better crime prevention.
- Enables efficient resource allocation for law enforcement.
- Provides data-driven insights for decision-making.
- Interactive and user-friendly dashboards for easy analysis.
- Supports time-series and comparative analysis of crime data.
- Geospatial mapping helps visualize high-crime areas.
- Promotes transparency and accountability in crime tracking.

1.5 Limitations:

- Accuracy depends on the quality and completeness of crime data.
- May not provide real-time crime monitoring if updates are infrequent.
- Some crime-related factors (e.g., unreported crimes) may be missing.
- Requires some analytical knowledge to interpret trends.
- Sensitive crime data requires strict security and privacy measures.
- Focuses on past data rather than predictive crime analysis.
- Data collection biases may impact analysis results.

2. Problem Specifications

2.1 Problem Specification Statement:

Crime remains a major challenge, requiring continuous analysis to identify trends and high-risk areas. Traditional methods, like manual reports, are time-consuming and lack interactivity, making resource allocation and crime prediction difficult. With large, complex crime data, advanced visualization is essential for actionable insights. A data-driven approach enables informed decisions, improving crime prevention and response.

2.2 Purpose of the Project:

The purpose of this project is to leverage Tableau to analyze crime data and create interactive dashboards that enable law enforcement agencies to gain deeper insights into crime patterns and trends. By visualizing crime incidents over time, mapping high-crime areas, and conducting comparative analyses, the project aims to support proactive policing and better decision-making.

Key objectives of the project include:

- **Identifying crime trends and patterns** through time-series analysis.
- **Mapping geographical crime hotspots** to enhance patrol planning and resource allocation.
- **Providing interactive dashboards** for real-time exploration of crime data.
- **Enabling comparative analysis** to assess crime rates across different regions and time periods.
- **Supporting data-driven decision-making** to improve crime prevention strategies.

By implementing this project, law enforcement agencies can enhance their ability to analyze crime data efficiently, improve response times, and develop more effective strategies to reduce crime and ensure public safety.

3. Technology and Tools

To effectively analyze crime data and generate actionable insights, this project utilizes Excel, SQL, and Tableau, each serving a specific purpose in data processing, analysis, and visualization.

1. Microsoft Excel

- Data Cleaning & Preparation:
 - Loaded and structured raw crime data from Excel files.
 - Handled missing values, removed duplicates, and ensured data consistency.
 - Standardized data formats (dates, crime categories, locations).
- Basic Data Analysis & Transformation:
 - Used formulas (e.g., COUNTIF, SUMIF) to generate preliminary insights.
 - Created pivot tables to summarize crime statistics before deeper analysis.
 - Saved cleaned and formatted datasets for integration into SQL and Tableau.

2. SQL (Structured Query Language)

- Advanced Data Processing & Querying:
 - Imported cleaned Excel datasets into SQL databases for efficient querying.
 - Performed filtering, grouping, and aggregation (SUM, COUNT, AVG) to analyze crime trends.
 - Used JOIN operations to merge multiple datasets for deeper insights (e.g., crime type vs. location).
- Optimized Data Management:
 - Created indexes to improve query performance for large datasets.
 - Ensured data integrity and consistency before visualization in Tableau.

3. Tableau

- Interactive Data Visualization & Dashboards:
 - Connected directly to SQL databases and Excel files for real-time analysis.
 - Created **line graphs, bar charts, heatmaps, and geospatial maps** for visual storytelling.
 - Implemented **filters and drill-downs** to allow users to explore crime trends dynamically.
- Time-Series and Trend Analysis:
 - Analyzed crime patterns over time to detect seasonal spikes and high-crime periods.
- Geographical Crime Mapping:
 - Used **choropleth maps and density plots** to highlight crime hotspots.
- Comparative Analysis:
 - Compared crime rates across different regions and timeframes to identify trends.

4. Data Model

4.1 Data Dictionary

Field Name	Description	Data Type	Example
ID	Unique identifier for each crime record.	Integer	10567
Case_Number	Police department's unique case number for the incident.	String	"HZ123456"
Date	Date when the incident occurred (may be an estimate).	Date	"2024-02-10"
Block	Partially redacted address where the incident occurred.	String	"1000 Block of Main St"
UCR	Uniform Crime Reporting code linked to the Primary Type and Description.	String	"0820"
Primary_Type	Primary classification of the crime based on UCR code.	String	"Theft"
Description	Detailed category or subcategory of the crime.	String	"Over \$500"

Location_Desc	Description of the location where the crime occurred.	String	"Gas Station"
Arrest	Indicates if an arrest was made (Yes/No).	Boolean	"Yes"
Domestic	Indicates if the crime was related to domestic violence (Yes/No).	Boolean	"No"
Beat	Smallest police geographic area where the incident occurred.	Integer	112
District	Police district where the incident occurred.	Integer	7
Ward	City council district where the incident occurred.	Integer	15
Community_Area	Community area where the incident occurred.	Integer	34
NIC_Code	National Incident Code for crime classification.	String	"0110"
X_Coordinate	X coordinate of the incident location (state plane coordinate system).	Decimal	1175003.45
Y_Coordinate	Y coordinate of the incident location (state plane coordinate system).	Decimal	1896524.67

Year	Year when the crime occurred.	Integer	2024
Updated_On	Timestamp when the record was last updated.	Date/Time	"2024-02-15 14:30:00"
Latitude	Latitude coordinate of the crime location.	Decimal	40.7128
Longitude	Longitude coordinate of the crime location.	Decimal	-74.0060
Location	Combined latitude & longitude for geographic mapping.	String	"(40.7128, -74.0060)"

4.2 Sample Dataset

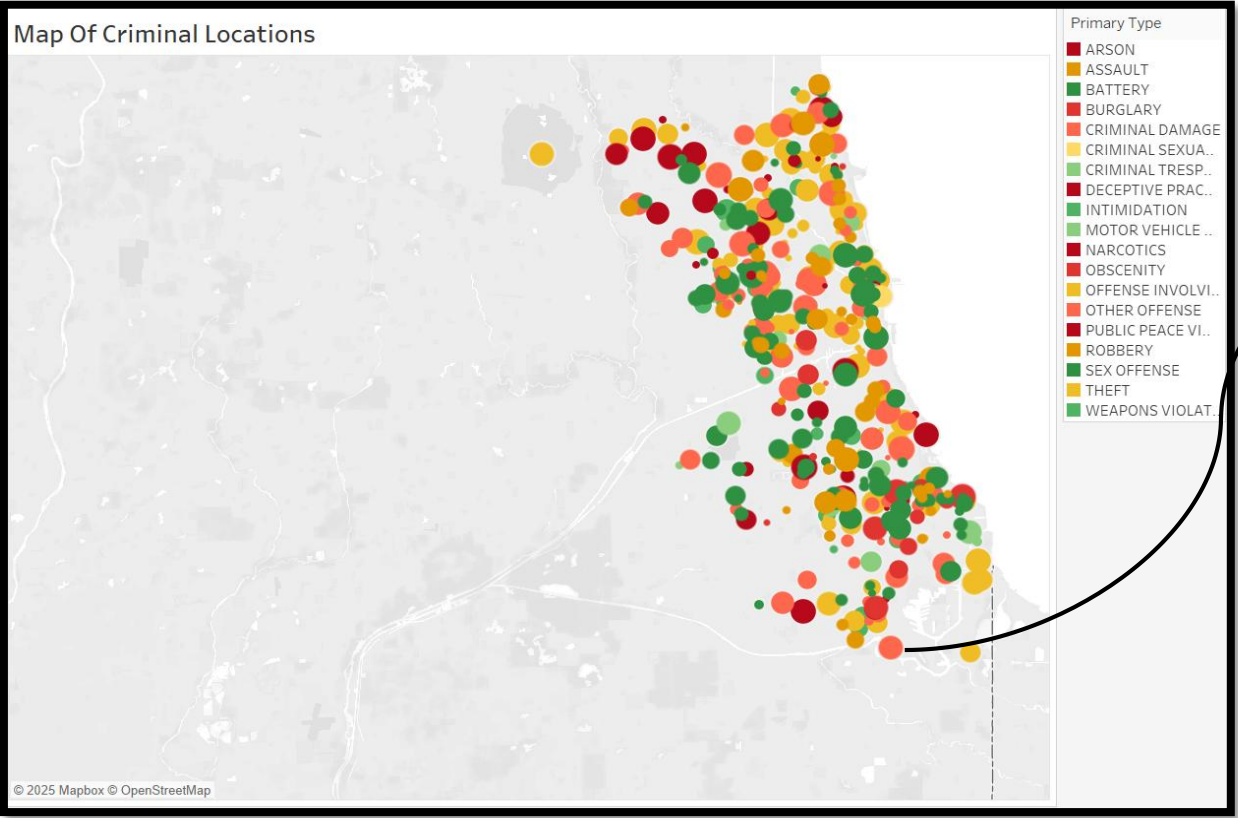
ID	Case_Number	Date	Primary_Type	Description	Arrest	District	Location_Desc	Latitude	Longitude
10123	HZ123456	2024-02-10	Theft	Over \$500	Yes	7	Gas Station	40.7128	-74.0060
10124	HZ123457	2024-02-12	Assault	Simple Assault	No	5	Residential	40.7330	-73.9876
10125	HZ123458	2024-02-14	Burglary	Unlawful Entry	Yes	3	Apartment	40.7559	-73.9682

5. Dashboards

1.. Overall Crime Statistics Dashboard

- a. For personnel and resource management, the department needs to understand the count and types of crimes reported across the city. Mark the locations on a geo-map highlighting the locations with recent criminal history.
- b. Identify the most common criminal incidents reported
- c. In this introductory dashboard, include a live crime feed to exhibit the total number of crimes reported to date for the current year and the most recently reported crimes with their time and locations

- **Geospatial Crime Analysis: Mapping Criminal Activities for Strategic Insights**



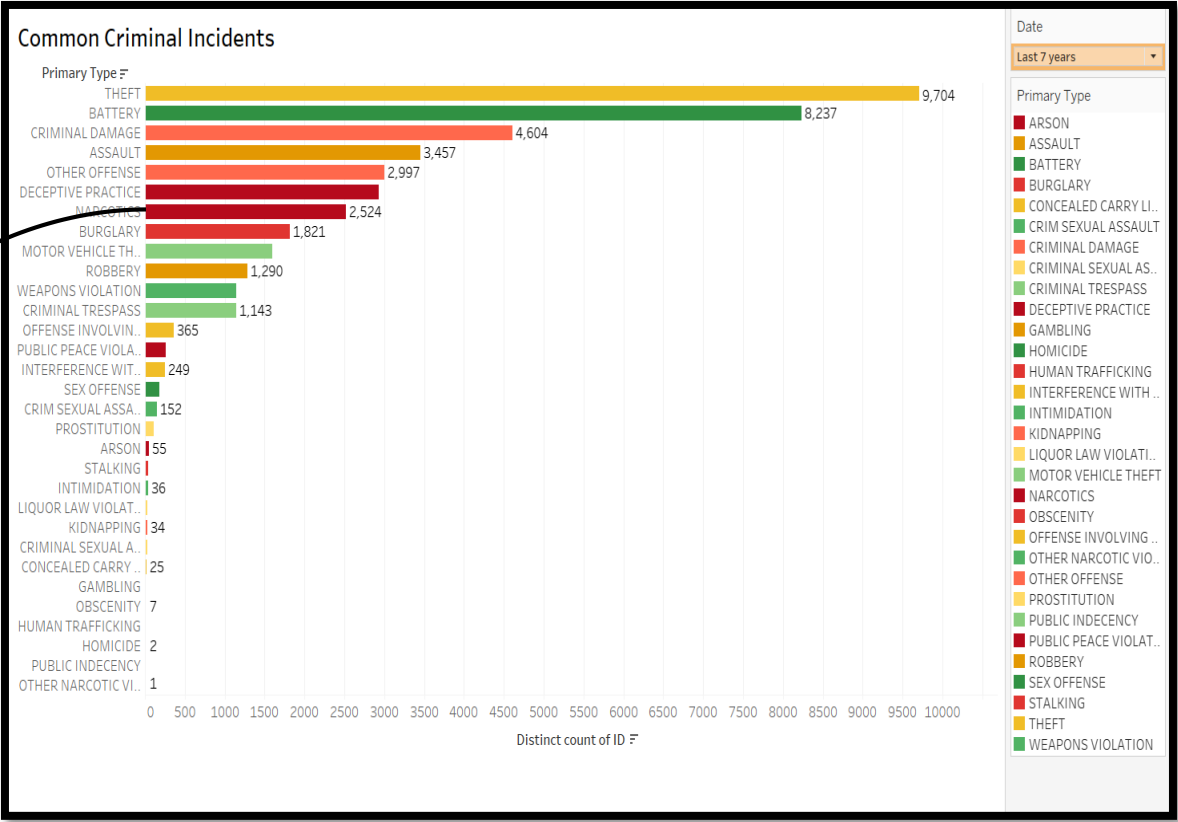
Latitude : 41.6562
Longitude : -87.6105
ID : 12447229
Primary Type : Other Offense

This **crime location map** visualizes various criminal activities across a geographic area, categorized by crime type using color-coded markers. The distribution highlights crime hotspots, with red indicating more severe crimes like **assault and burglary**, while green represents less severe offenses like **theft and robbery**. The clustering suggests higher crime concentration in urban areas

• **Crime Trend Analysis: Frequency of Criminal Incidents Over the Last 7 Years**

This chart shows the **most frequent crimes** in the past **seven years**, with **Theft (9,704 cases)** and **Battery (8,237 cases)** leading. The color-coded bars highlight crime severity, aiding law enforcement in **crime prevention and resource allocation**.

Primary Type : NARCOTICS
Distinct count of ID : 2,524

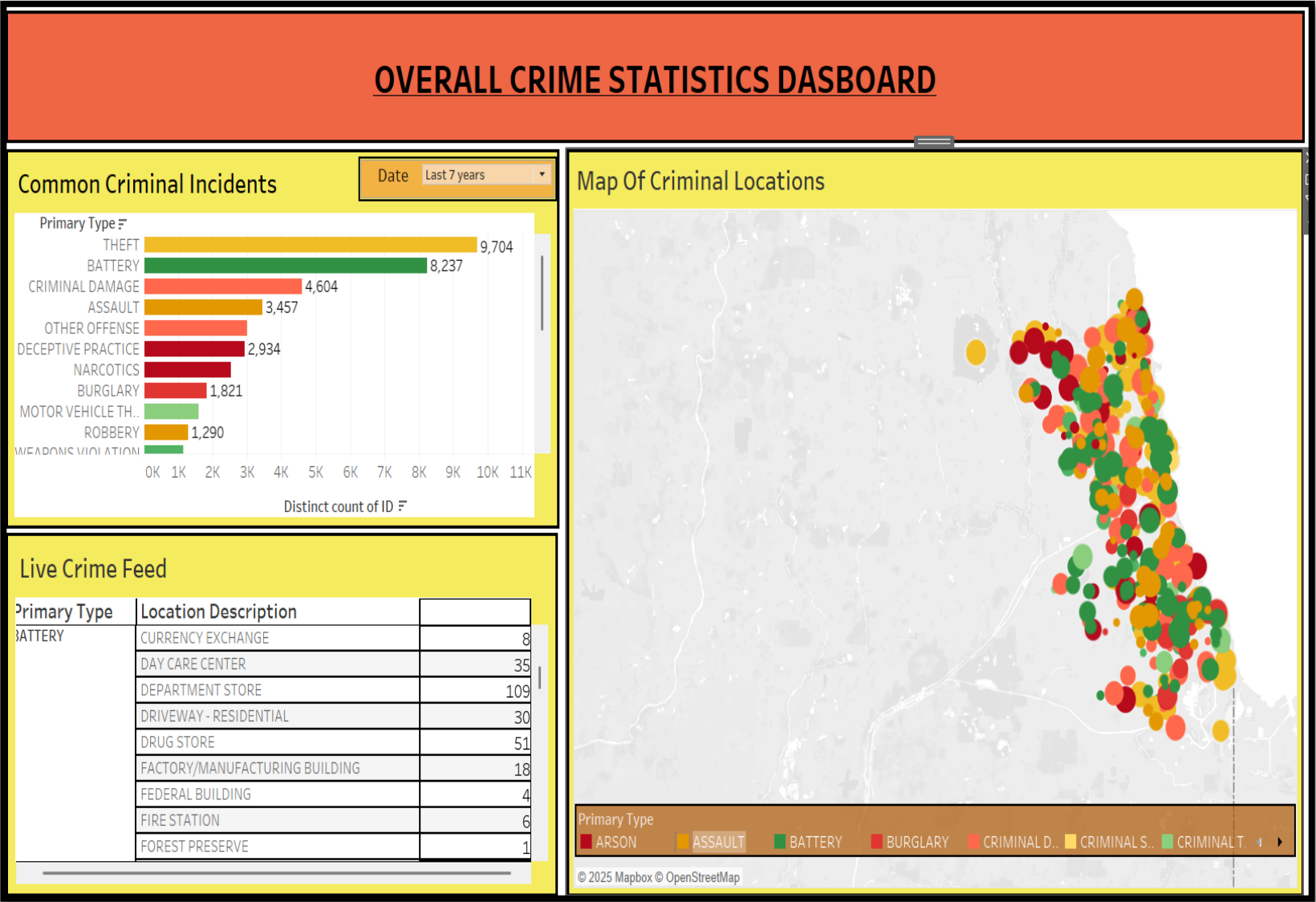


- **Crime Incidents by Type and Location**

Live Crime Feed		
Primary Type	Location Description	Count
ARSON	SCHOOL, PRIVATE, BUILDING	3
	SCHOOL, PUBLIC, BUILDING	5
	SCHOOL, PUBLIC, GROUNDS	1
	SIDEWALK	2
	SMALL RETAIL STORE	5
	STREET	29
	VACANT LOT/LAND	4
	VEHICLE NON-COMMERCIAL	90
	VEHICLE-COMMERCIAL	1
ASSAULT	ABANDONED BUILDING	3
	AIRCRAFT	3
	AIRPORT BUILDING NON-TERMINAL - NON-SEC..	3
	AIRPORT BUILDING NON-TERMINAL - SECURE A..	4
	AIRPORT EXTERIOR - NON-SECURE AREA	7
	AIRPORT EXTERIOR - SECURE AREA	
	AIRPORT PARKING LOT	
	AIRPORT TERMINAL LOWER LEVEL - NON-SECU..	
	AIRPORT TERMINAL LOWER LEVEL - SECURE AR..	
	AIRPORT TERMINAL UPPER LEVEL - NON-SECUR..	2
	AIRPORT TERMINAL UPPER LEVEL - SECURE AR..	12
	AIRPORT TRANSPORTATION SYSTEM (ATS)	1
	AIRPORT VENDING ESTABLISHMENT	2
	ALLEY	420
	ANIMAL HOSPITAL	2
	APARTMENT	2,862
	APPLIANCE STORE	8
	ATHLETIC CLUB	11
	AUTO / BOAT / RV DEALERSHIP	8
	BANK	27
	BAR OR TAVERN	64

The chart categorizes crime incidents by **Primary Type** (Arson, Assault, etc..) and **Location Description**, with corresponding case counts. **Arson** is most frequent in **non-commercial vehicles (90 cases)** and **streets (29 cases)**, while **Assault** occurs in diverse locations, including **abandoned buildings, aircraft, and various airport areas**. This data aids in identifying high-risk locations for crime prevention and law enforcement strategies.

OVERALL CRIME STATISTICS DASHBOARD



The **Overall Crime Statistics Dashboard** provides insights into crime trends through visualizations and data tables. It highlights **common criminal incidents**, showing **Theft, Battery, and Criminal Damage** as the most frequent over the last seven years. A **map of criminal locations** visualizes crime hotspots with color-coded markers for different crime types like **Arson, Assault, and Burglary**. Additionally, a **live crime feed** lists recent incidents with details on **crime type** and **location** (e.g., department stores, drug stores, and residential areas). This dashboard aids in crime analysis, helping law enforcement identify high-crime areas and trends for better public safety strategies.

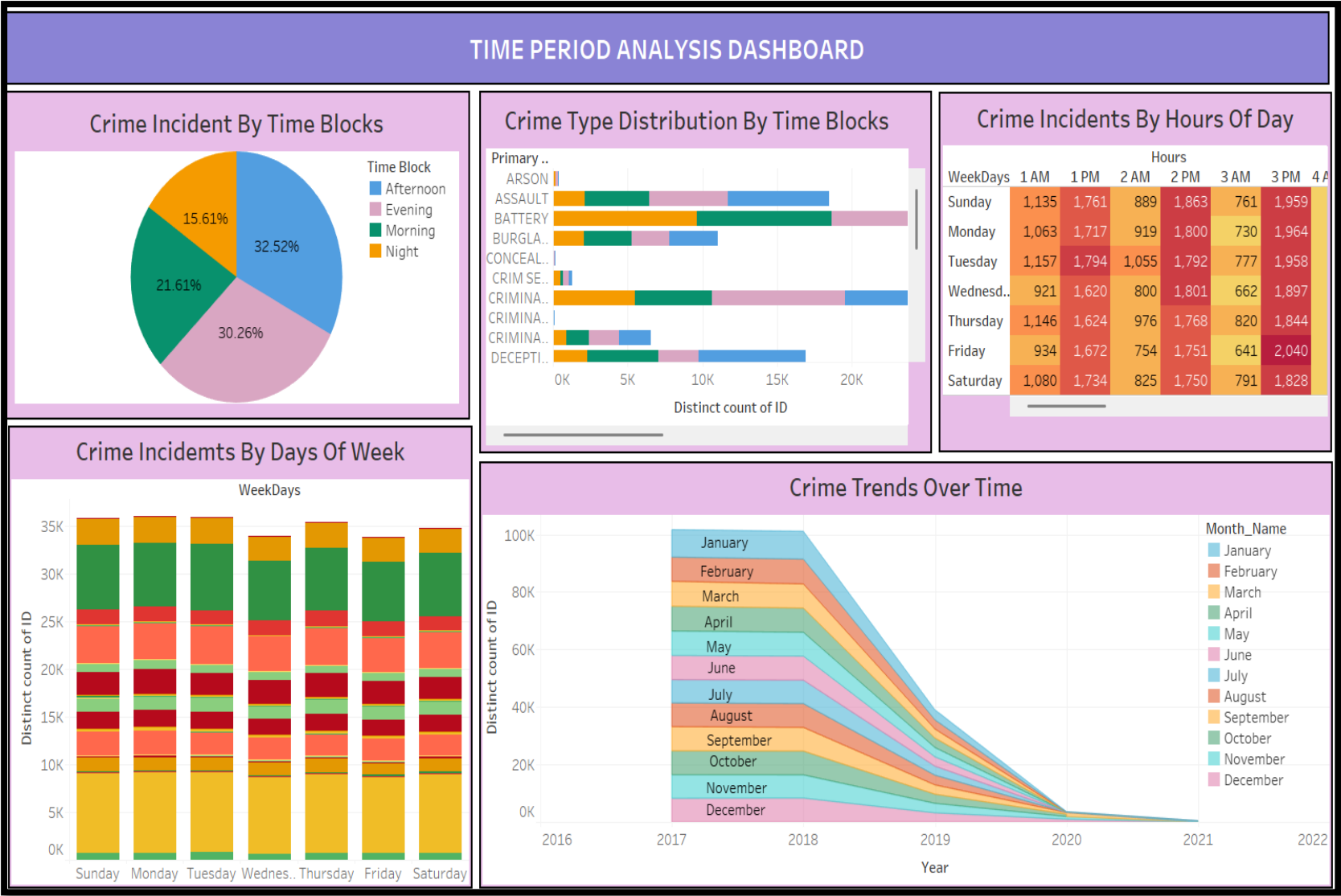
2.. Time Period Analysis Dashboard

Along with locations, the study of crime statistics across time statistics is also crucial for understanding the patterns and planning those preventive strategies.

- a. Study distribution count of crime incidents across different time periods, such as day of the week or hour
- b. Further, explore the percentage of incident reporting for several time blocks (morning, afternoon, evening, and night)

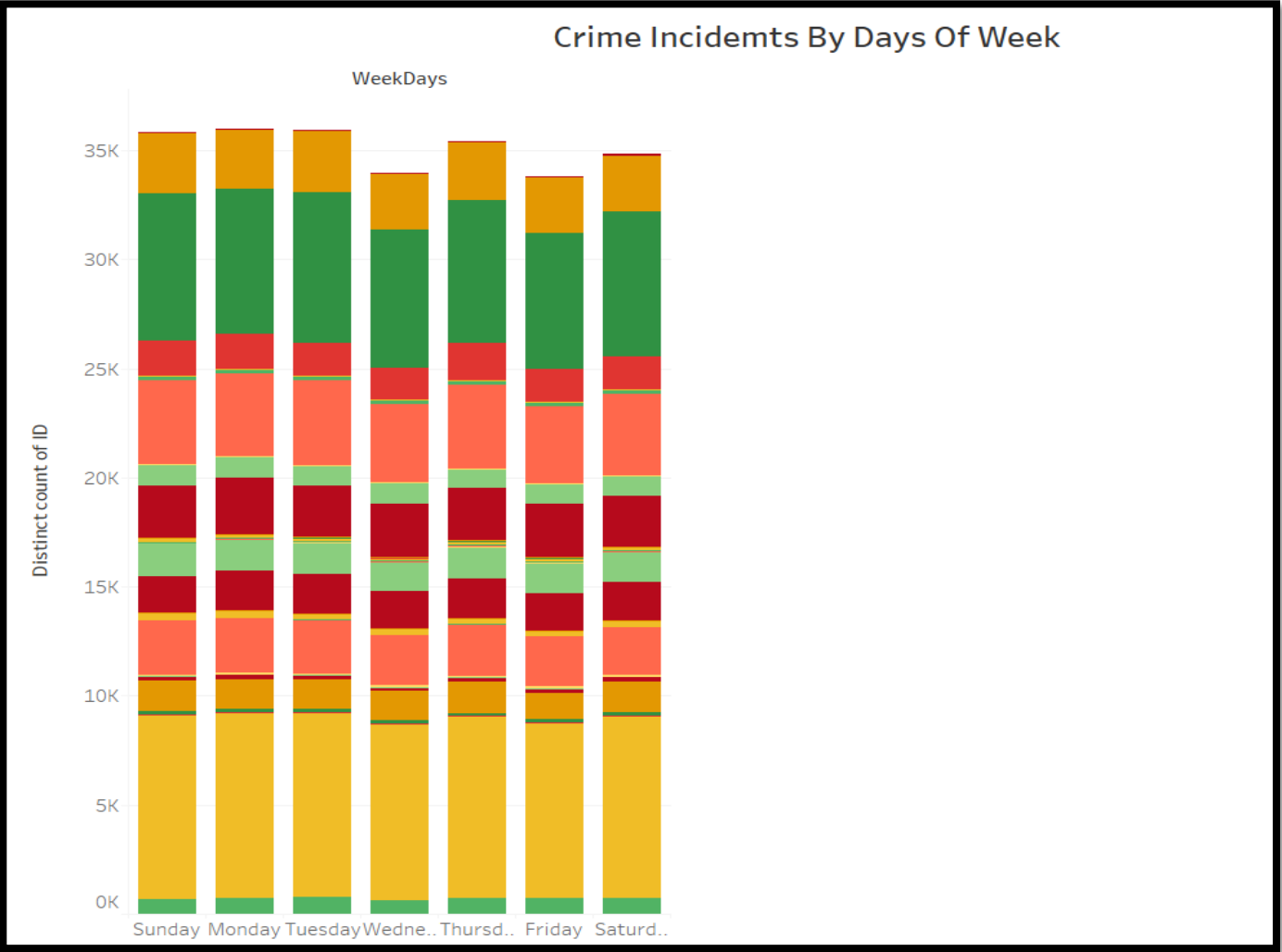
TIME PERIOD ANALYSIS DASHBOARD

The **Time Period Analysis Dashboard** highlights crime patterns based on time. Afternoon and evening see the highest crime rates, with incidents peaking late at night and early morning. Crimes are fairly consistent across weekdays. A notable decline in crime is observed after 2018. This dashboard aids in understanding crime trends for better law enforcement planning.



- **Crime Distribution Across Days of the Week**

The **Crime Incidents by Days of the Week** chart presents a stacked bar representation of crime occurrences across different days. Crime levels remain relatively consistent throughout the week, with minor fluctuations. Each bar is segmented by crime categories, indicating the distribution of various types of crimes. While no single day stands out as significantly higher or lower, crime incidents appear to be slightly lower on Thursdays and Fridays. This visualization helps in understanding crime patterns on a daily basis, aiding law enforcement in resource allocation.



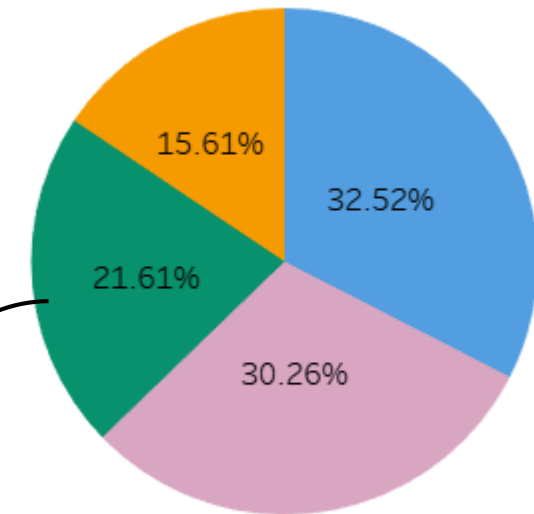
- **Crime Distribution by Year and Category**

WeekDays	1 AM	1 PM	2 AM	2 PM	3 AM	3 PM	4 AM	4 PM	5 AM	5 PM	6 AM	6 PM	7 AM	7 PM	8 AM	8 PM	9 AM
Sunday	1,135	1,761	889	1,863	761	1,959	668	1,917	556	1,941	629	2,032	867	2,071	1,184	1,846	1,642
Monday	1,063	1,717	919	1,800	730	1,964	558	1,914	517	1,987	627	2,061	886	2,074	1,274	1,937	1,783
Tuesday	1,157	1,794	1,055	1,792	777	1,958	676	1,935	556	1,998	646	2,041	861	1,918	1,249	1,883	1,616
Wednesd..	921	1,620	800	1,801	662	1,897	520	1,878	496	1,954	615	1,986	835	1,955	1,231	1,814	1,652
Thursday	1,146	1,624	976	1,768	820	1,844	605	1,853	540	1,956	643	2,015	842	2,083	1,241	1,855	1,596
Friday	934	1,672	754	1,751	641	2,040	490	1,723	485	1,873	591	1,981	897	1,888	1,305	1,748	1,548
Saturday	1,080	1,734	825	1,750	791	1,828	579	1,879	521	1,853	665	1,998	855	2,056	1,197	1,884	1,536

This heatmap visualizes crime incidents across different hours of the day for each day of the week. The intensity of the colors indicates the crime volume, with darker shades representing higher crime occurrences. Peak crime activities are observed in the early afternoon and evening hours, particularly around 7 PM and 8 PM. Additionally, early morning hours show relatively lower crime rates. Patterns suggest that certain hours, especially in the afternoon and evening, are consistently high across all days.

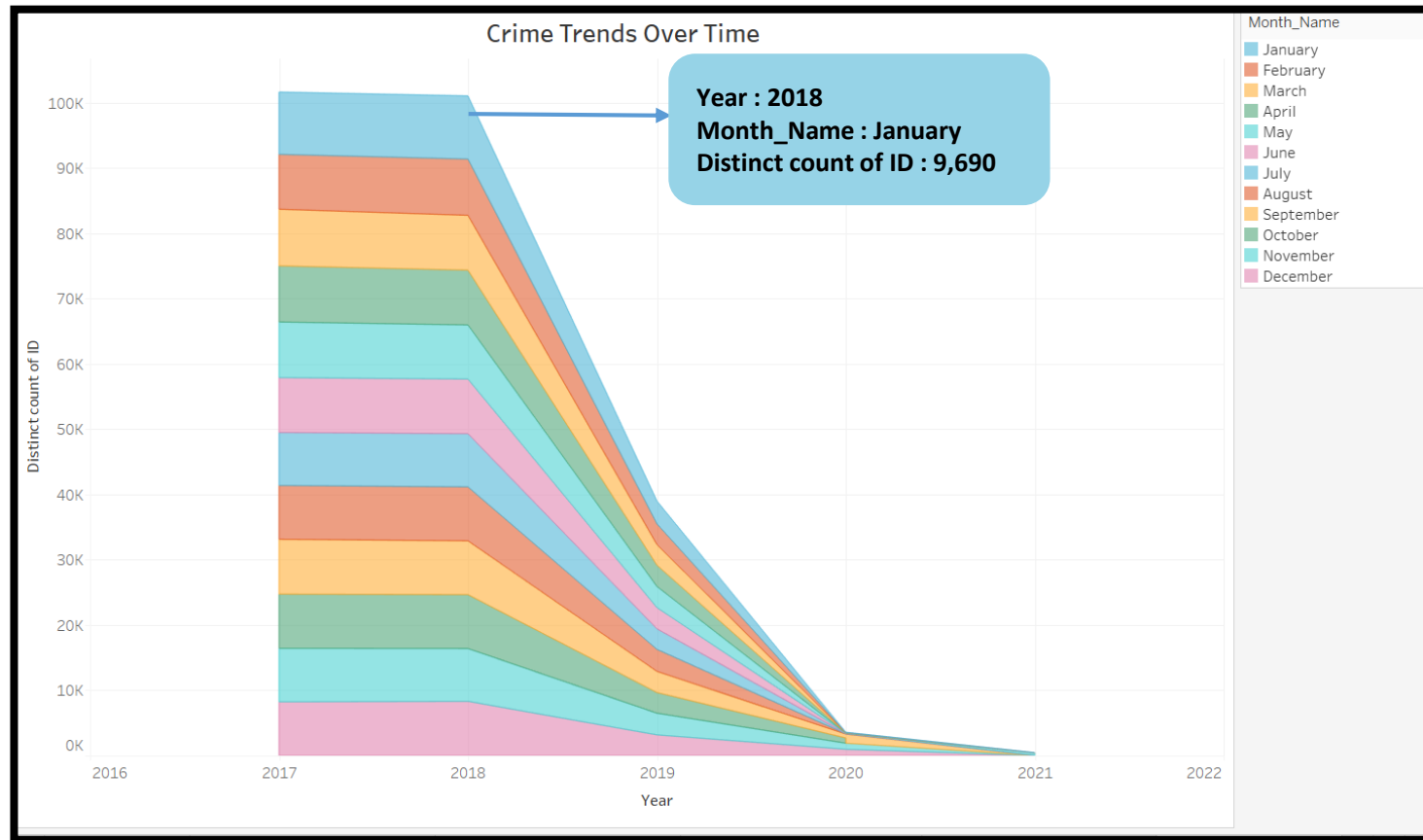
- **Crime Distribution by Category**

This pie chart represents the proportion of different crime categories or types. The largest segment accounts for 32.52% of the total incidents, followed by 30.26% and 21.61%, while the smallest category makes up 15.61%. This visualization helps in understanding the relative frequency of crime types, indicating which category is most prevalent.



Time Block : Morning
Distinct count of ID : 53,108
% of Total Distinct count of ID : 21.6056%

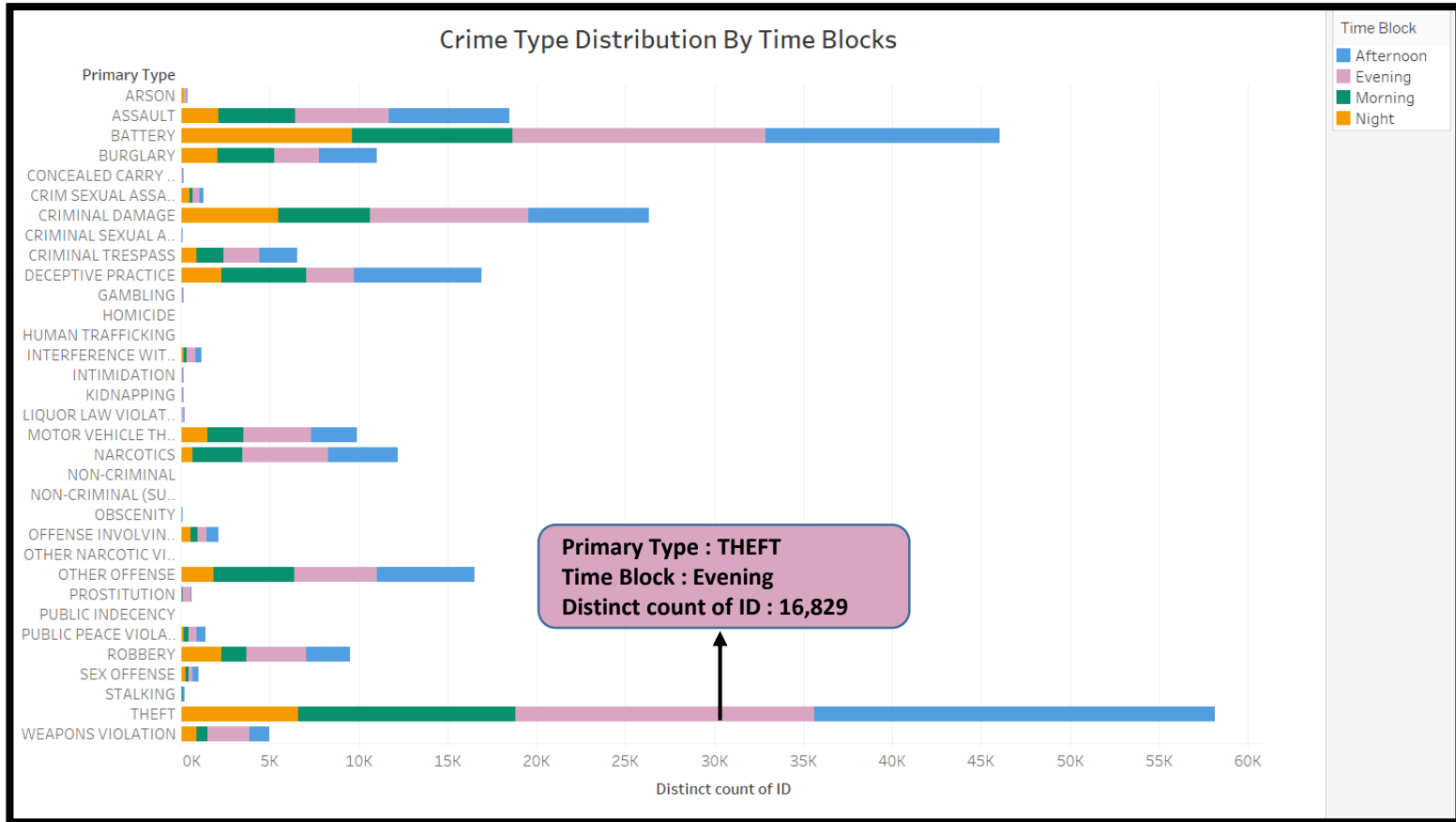
- Crime Trends Over Time



This stacked area chart illustrates the trend of crime incidents over the years, categorized by month. The data shows a peak in reported crimes around 2017, followed by a significant decline in subsequent years, reaching near-zero levels by 2021. This could indicate changes in crime reporting, law enforcement measures, or external factors affecting crime rates over time.

- **Crime Type Distribution by Time Blocks**

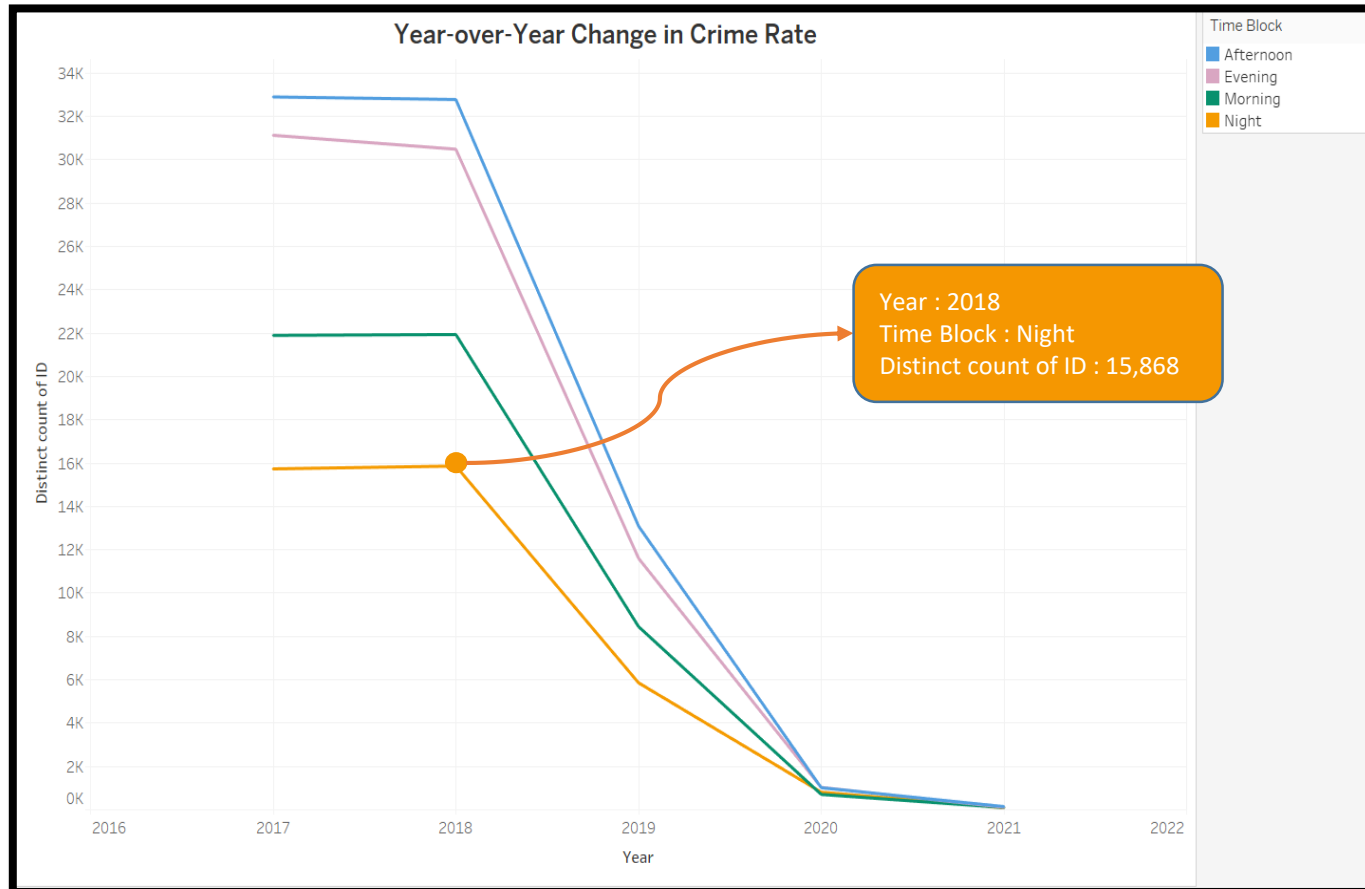
This horizontal bar chart visualizes the distribution of different crime types across four time blocks: Morning, Afternoon, Evening, and Night. Theft is the most common crime, occurring predominantly in the afternoon. Battery and assault also have high occurrences, mainly in the evening. Crimes like stalking, narcotics, and criminal sexual offenses are more frequent at night. This analysis helps identify when certain crimes are more likely to occur, aiding law enforcement in resource allocation and crime prevention strategies.



3. Trend Analysis Dashboard:

- a. Create a dashboard to study the change in crime rate over different years
- b. Compare the change in the incident reporting over the years for the same date and time

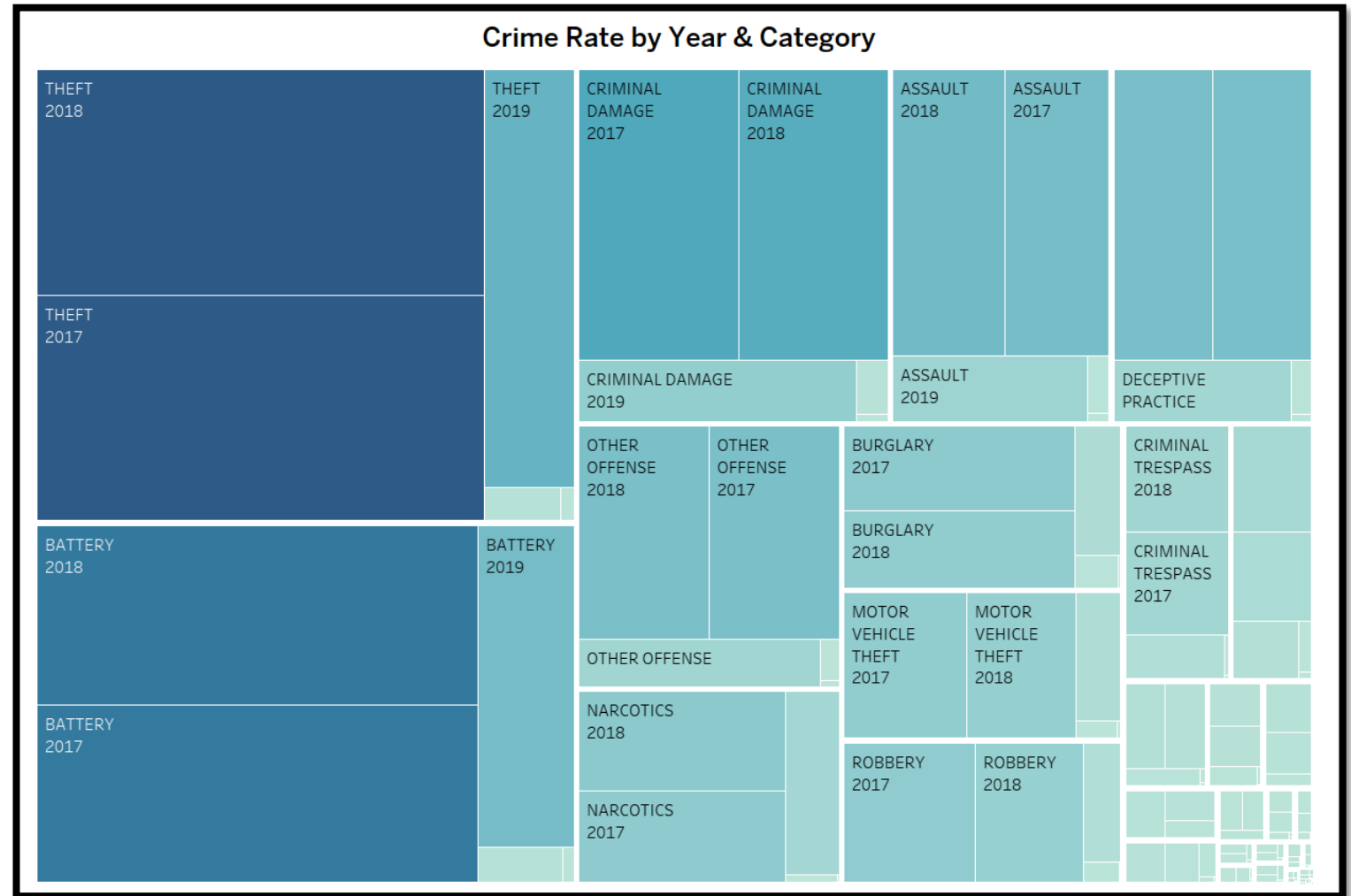
- **Year-over-Year Change in Crime Rate**



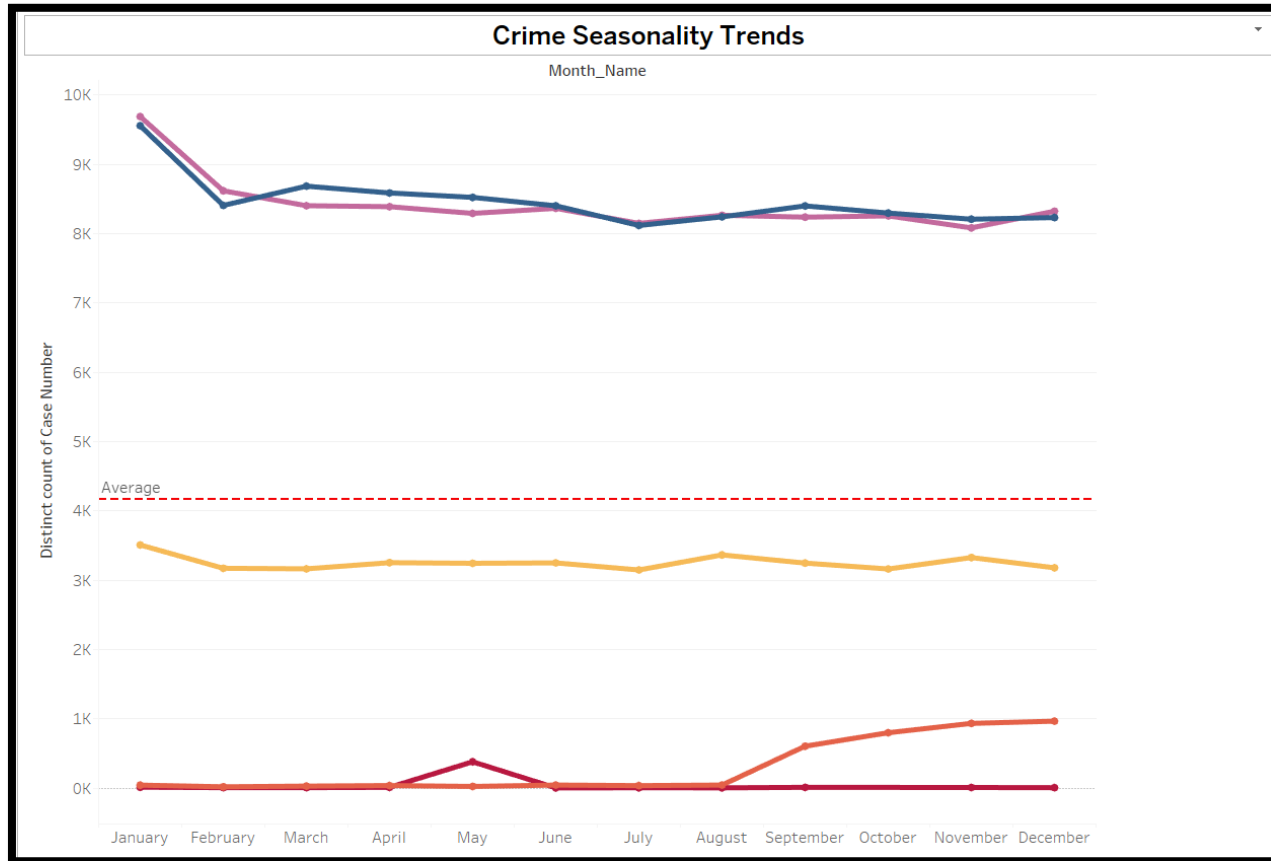
This line chart visualizes the annual crime rate trends from 2016 to 2021, categorized by different time blocks (Afternoon, Evening, Morning, and Night). Crime rates remained high from 2016 to 2018 but saw a significant decline starting in 2019, reaching minimal levels by 2020. The reduction is consistent across all time blocks, with afternoon and evening crimes initially being the most frequent. This trend suggests possible external factors affecting crime rates, such as policy changes or societal disruptions.

- **Crime Rate by Year & Category**

This line chart visualizes the annual crime rate trends from 2016 to 2021, categorized by different time blocks (Afternoon, Evening, Morning, and Night). Crime rates remained high from 2016 to 2018 but saw a significant decline starting in 2019, reaching minimal levels by 2020. The reduction is consistent across all time blocks, with afternoon and evening crimes initially being the most frequent. This trend suggests possible external factors affecting crime rates, such as policy changes or societal disruptions.



- Crime Seasonality Trends



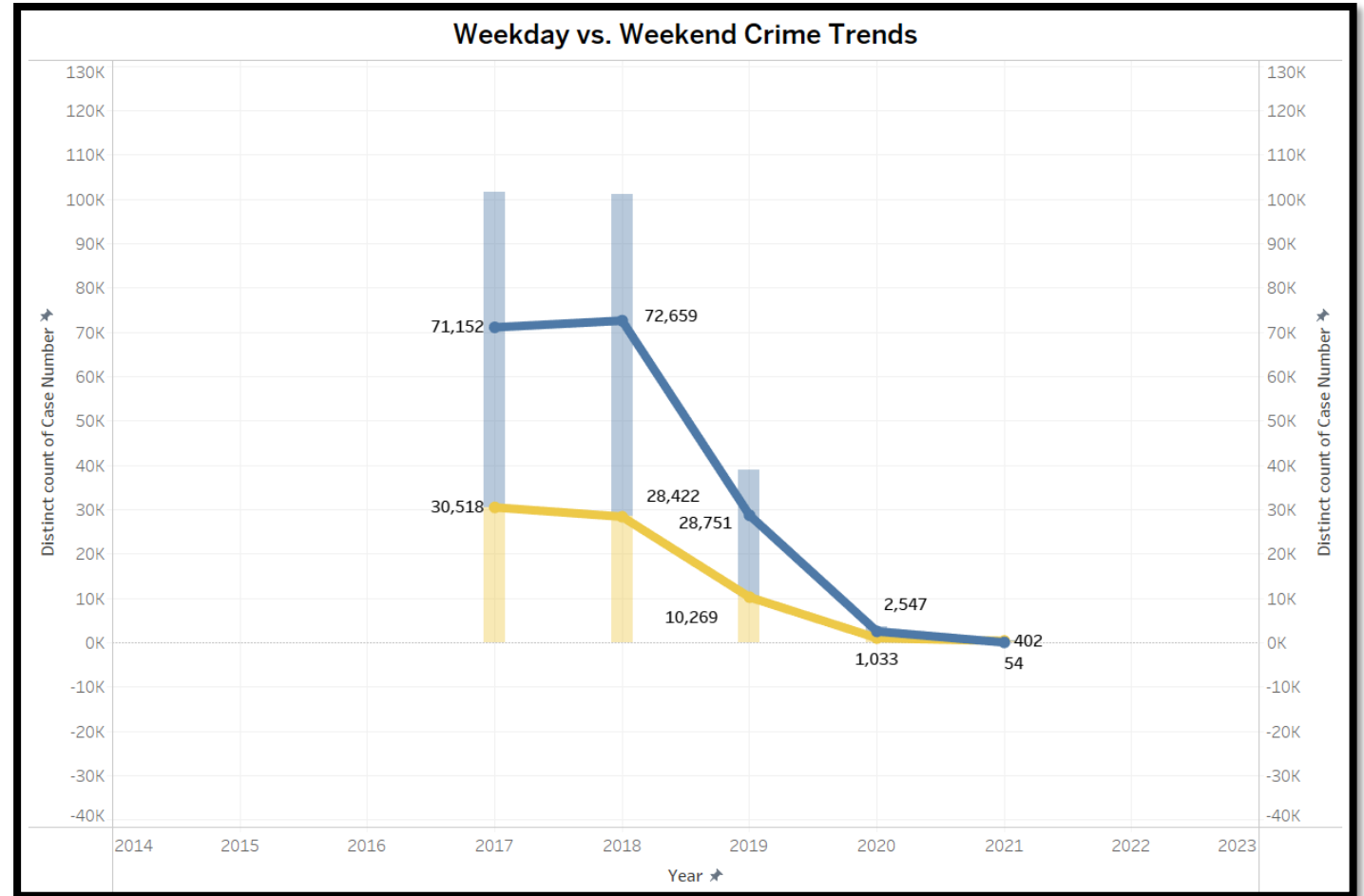
This line chart displays monthly crime trends over a year. The highest crime occurrences are observed in January, followed by a decline in February. Crime rates remain relatively stable from March to December with minor fluctuations. A red dashed line indicates the average crime rate for comparison. Some categories show seasonal spikes, such as an increase in crime cases from August to December. This visualization helps in identifying patterns and planning crime prevention strategies accordingly.

- **Weekday vs. Weekend Crime Trends**

This chart compares crime trends on weekdays (blue line) vs. weekends (yellow line) over the years. Crime rates were significantly higher on weekdays compared to weekends.

- **2017-2018:** Crime peaked, with weekday cases exceeding 70,000 and weekend cases around 30,000.
- **2019-2021:** A sharp decline in crime was observed, with both weekday and weekend crimes dropping drastically. By 2021, reported cases were minimal (402 on weekdays and 54 on weekends).

This trend may indicate policy changes, law enforcement interventions, or external factors such as COVID-19 impacting crime rates.



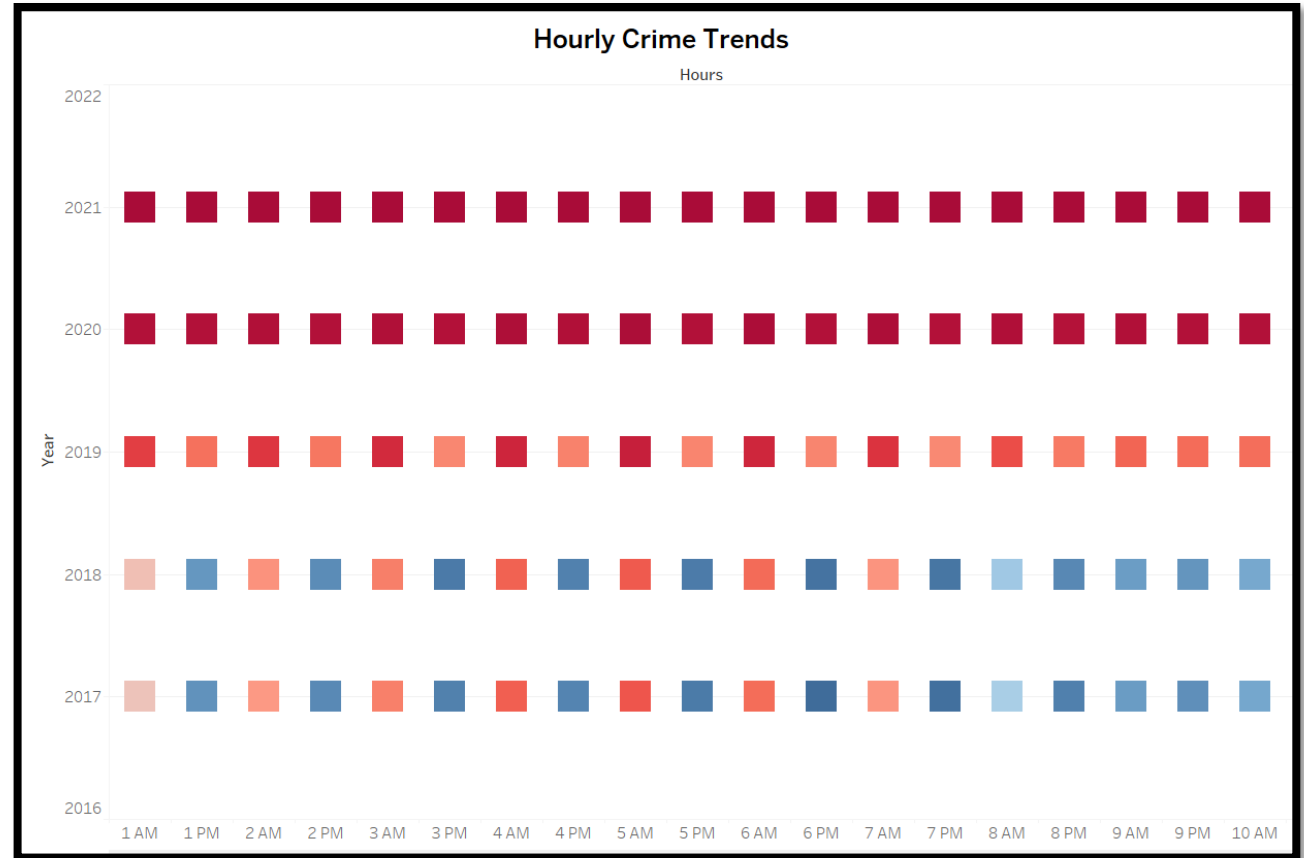
- **Crime Category % Change**



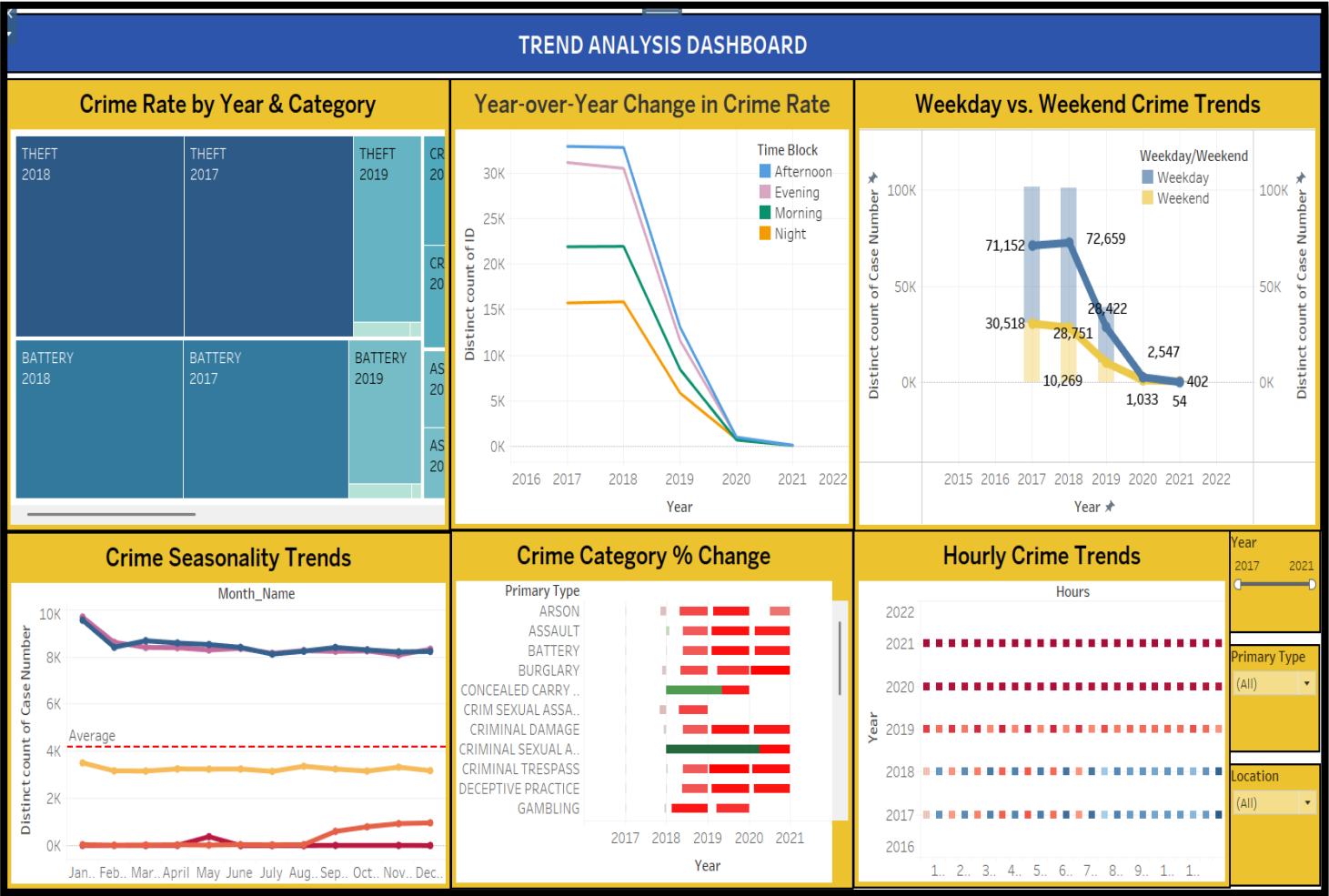
The visualization tracks the percentage change in various crime categories over the years, with red bars indicating an increase and green bars representing a decrease. From 2018 to 2019, there was a mix of rising and falling crime trends, with some categories like "Criminal Sexual Assault" and "Homicide" showing declines. However, from 2019 to 2021, most crime categories experienced a surge, particularly in "Burglary," "Theft," and "Weapons Violation," as indicated by the dominance of red bars. Few categories showed improvement during this period, suggesting that while some crimes temporarily declined, overall crime rates saw a significant rise, especially after 2019.

- **Analysis of Hourly Crime Trends Over the Years**

The visualization represents hourly crime trends across different years, using color intensity to indicate crime frequency. In earlier years (2017-2018), the crime pattern fluctuates, with a mix of blue and red tones, suggesting varying levels of incidents across different hours. However, from 2019 onward, the color shifts predominantly to red, indicating an overall increase in crime frequency across all hours. The darkest red shades in 2020 and 2021 suggest that crime remained consistently high throughout the day during these years. This trend highlights a significant rise in criminal activity in recent years, with less variation in hourly crime distribution.



TREND ANALYSIS DASHBOARD



The **Crime Trend Analysis Dashboard** offers a detailed view of crime patterns across various dimensions. It includes a **Crime Rate by Year & Category** treemap, a **Year-over-Year Crime Change** chart by time blocks, and a **Weekday vs. Weekend Crime Trends** comparison. The **Crime Seasonality Trends** chart shows fluctuations over months, while the **Crime Category % Change** visualization highlights percentage shifts in crime types. The **Hourly Crime Trends** heatmap displays incidents by hour and year. **Interactive filters** for **Year**, **Crime Type**, and **Location** enable dynamic exploration for deeper insights.