CHICAGO Traffic Accidents Analysis

Period 2019-2024

THEMES COVERED

PROJECT OVERVIEW

ANALYSIS STORY POINTS

MACHINE LEARNING MODELS

OVERVIEW

- **Chicago experiences nearly 25,000 crashes annually**, emphasizing the need for increased caution and awareness while driving.
- This project analyzes the Chicago crashes dataset to **identify patterns, high-risk areas, and contributing factors.**
- Insights from the analysis could be used for the public and assist city planners in **improving traffic safety measures**.
- Machine learning techniques are used to **predict crash likelihood**, showcasing the **power of business intelligence** in interpreting complex data.
- The findings aim to **promote safer driving practices** and **support data-driven decisions** for urban safety enhancements.

ANALYSIS STORY POINTS

1   **FACTORS OF CRASHES**

3   **PEAK TIMES FOR CRASHES**

2   **HIGH RISK AREAS FOR CRASHES**

4   **HOW PHYSICAL SITUATIONS AFFECTS CRASHES**
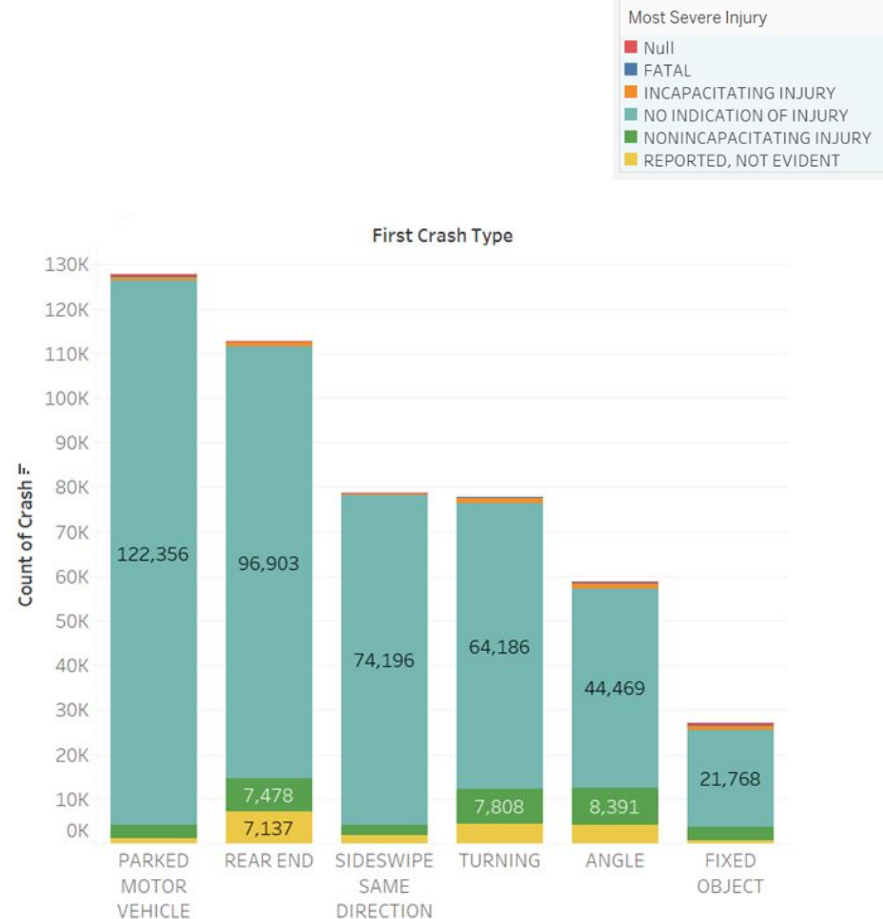
5   **ROLE OF WEATHER CONDITIONS**

Factors of Crashes

The Most Common Reason for crashes are related to experience

- Failed to yield the right of way (58000 Crashes)

- Following too closely (47000 Crashes)

- Improper Overtaking/Passing (26000 Crashes)

- Improper Backing (20000 Crashes)

- Improper lane usage (17000 Crashes)

- Improper Turning (17000 Crashes)

- Driving Skills (18000 Crashes)

Most crash types are stationary vehicles and rear end from other cars

- Parked Motor Vehicle has more crashes than active

- Followed by more active crashes such as rear-end or turning

- Worth to noted that most of them resulted in no injury

First Crash Type

Count of Crash ⬚

122,356	
96,903	
74,196	
64,186	
44,469	
21,768	
7,478	
7,137	
7,808	
8,391	

PARKED MOTOR VEHICLE · REAR END · SIDESWIPE SAME DIRECTION · TURNING · ANGLE · FIXED OBJECT

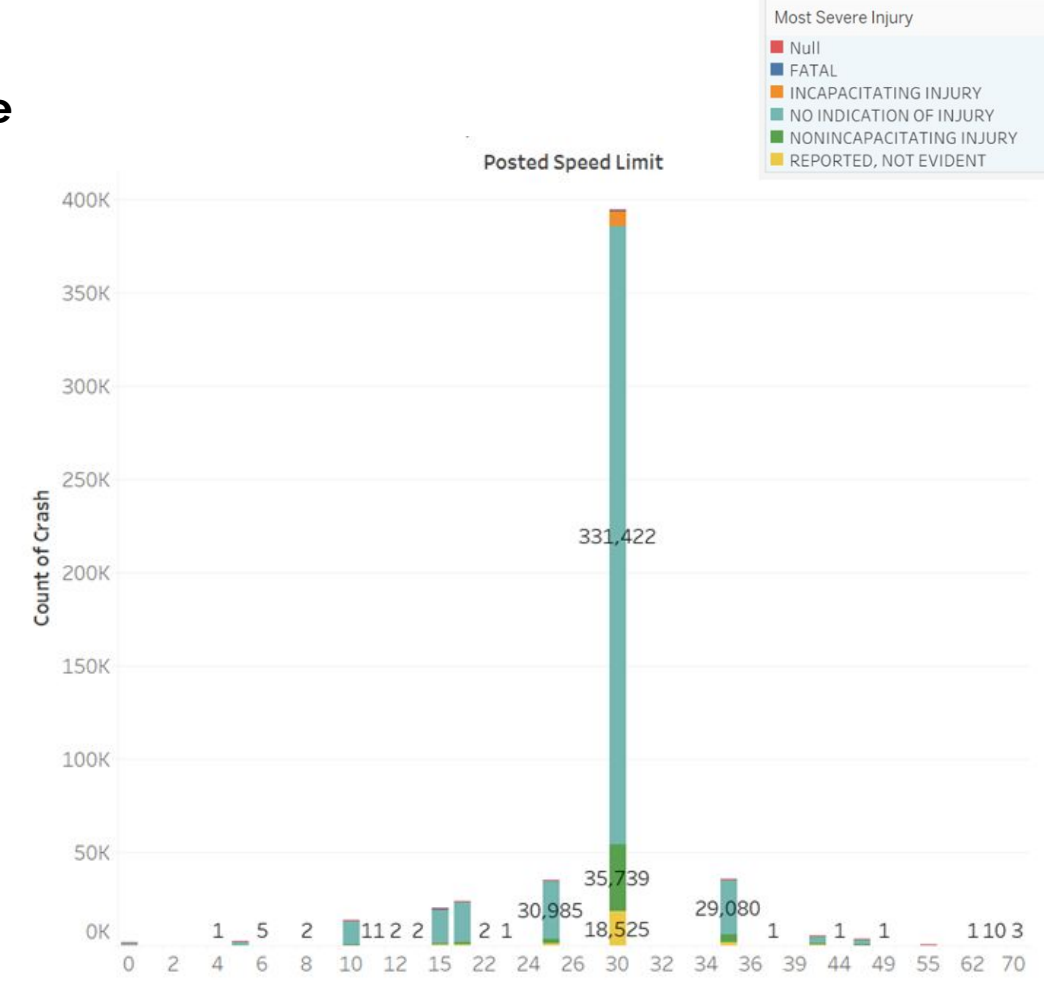# Crashes happened more in weekdays night

- Crashes occurred mainly on Fridays but lower on the weekends

- Most of them happened late at night on the weekdays

- Although most of the crashes are no indication and followed by non-incapacitating injury
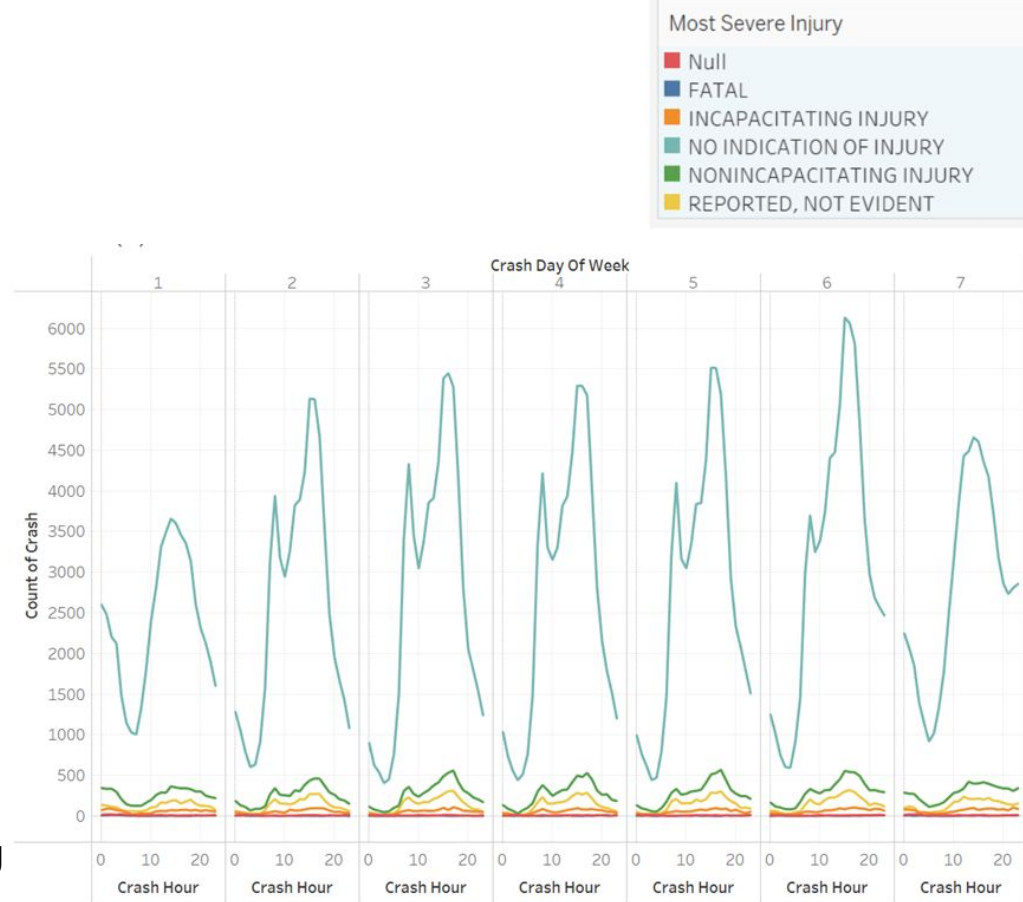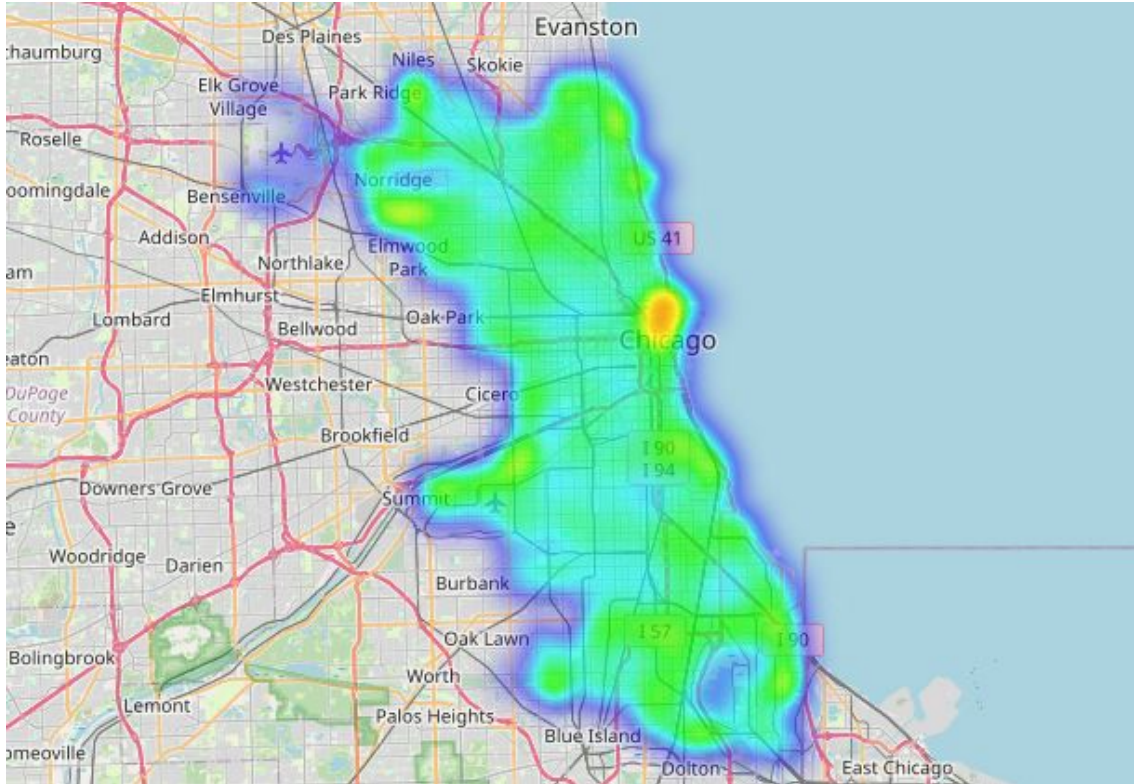
30 Mph speed limit lanes has more crashes than lower or higher

- Most crashes happened in around 30 Miles per Hour

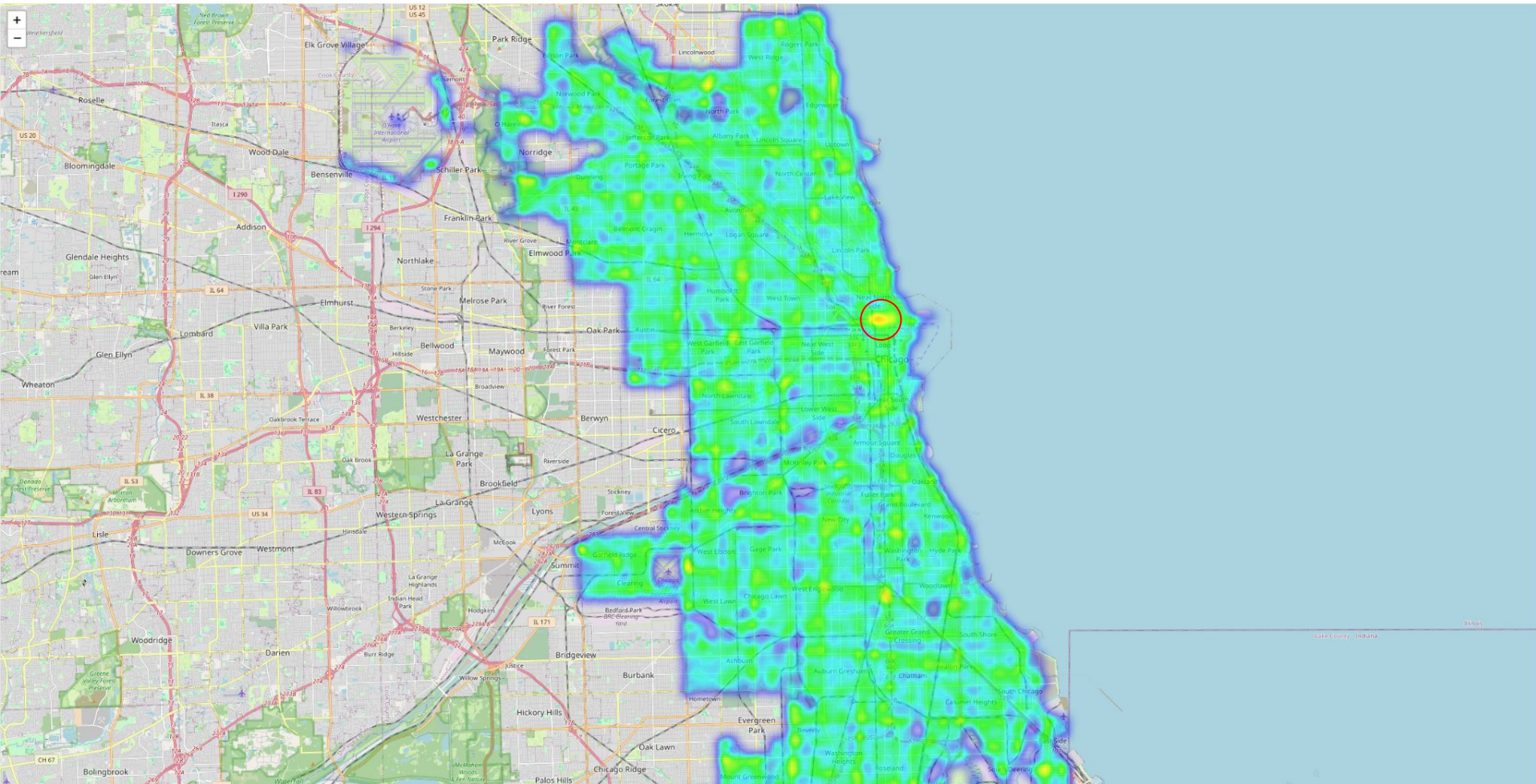- Higher speed limit has similar number to the smaller speed limit

Posted Speed Limit

Count of Crash

331,422

35,739

30,985

29,080

18,525

1 5 2 11 2 2 2 1 1 1 1 1 10 3

0 2 4 6 8 10 12 15 22 24 26 30 32 34 36 39 44 49 55 62 70

High-risk areas for Crashes

High-risk areas

- Highest crashes in downtown Chicago
- **Hypothesized reasons:**
  - **High traffic**
  - **High pedestrian density**

Streets with Most Crashes

Street Name

- Highest crashes on Western Avenue and Pulaski Rd
- **Hypothesized reasons:**
  - **Road Length**
  - **Traffic Volume**

Peak Time Crash Break Down

Crash Counts By Day Of Week
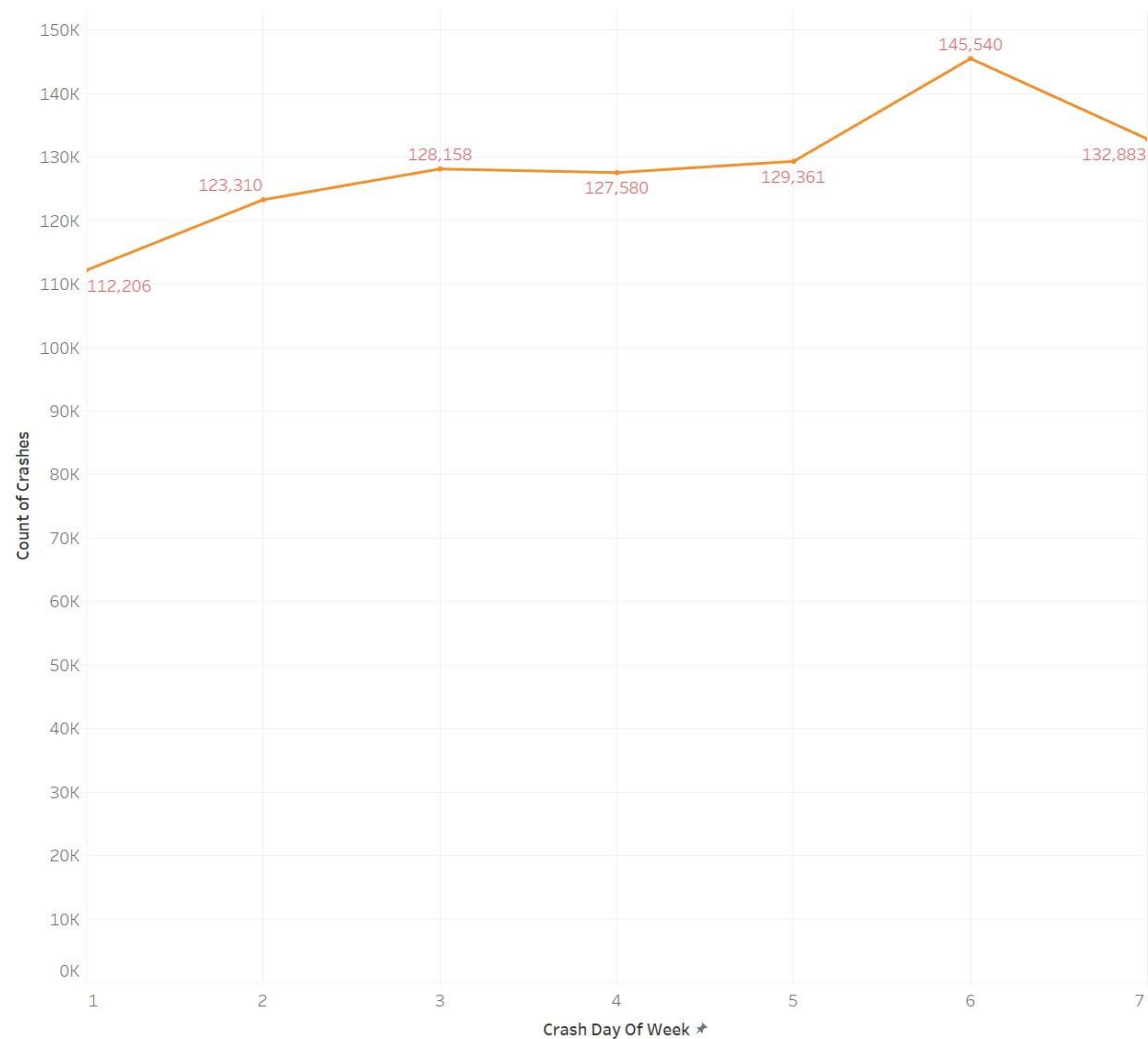
Monday to Thursday (Days 1-4):
Gradual increase in crashes. Weekday commuting patterns and increased traffic volume.

Friday (Day 5):
Highest Crash count for weekdays, influenced by end-of-week fatigue, increased traffic, and evening social activities.

Weekend(Day 6 and 7):
Highest crash count, driven by leisure travel, late-night activities, and more vehicles on the road.

Traffic Crashes By Hour of Day(0:00 to 23:00)

Afternoon Commute (14:00 to 17:00): Crash numbers are significantly higher during this period, with the peak observed around 14:00-15:00.

Early Morning Hours (00:00 to 05:00):Reduced traffic volume and low crash count.

Morning Commute (06:00 to 09:00): rise in traffic count.

Midday (10:00 to 13:00): Increased overall road activity and incline in crash count

Evening and Late-Night Hours (18:00 to 23:00): Crash numbers decline steadily after 17:00, likely due to decreasing road activity.
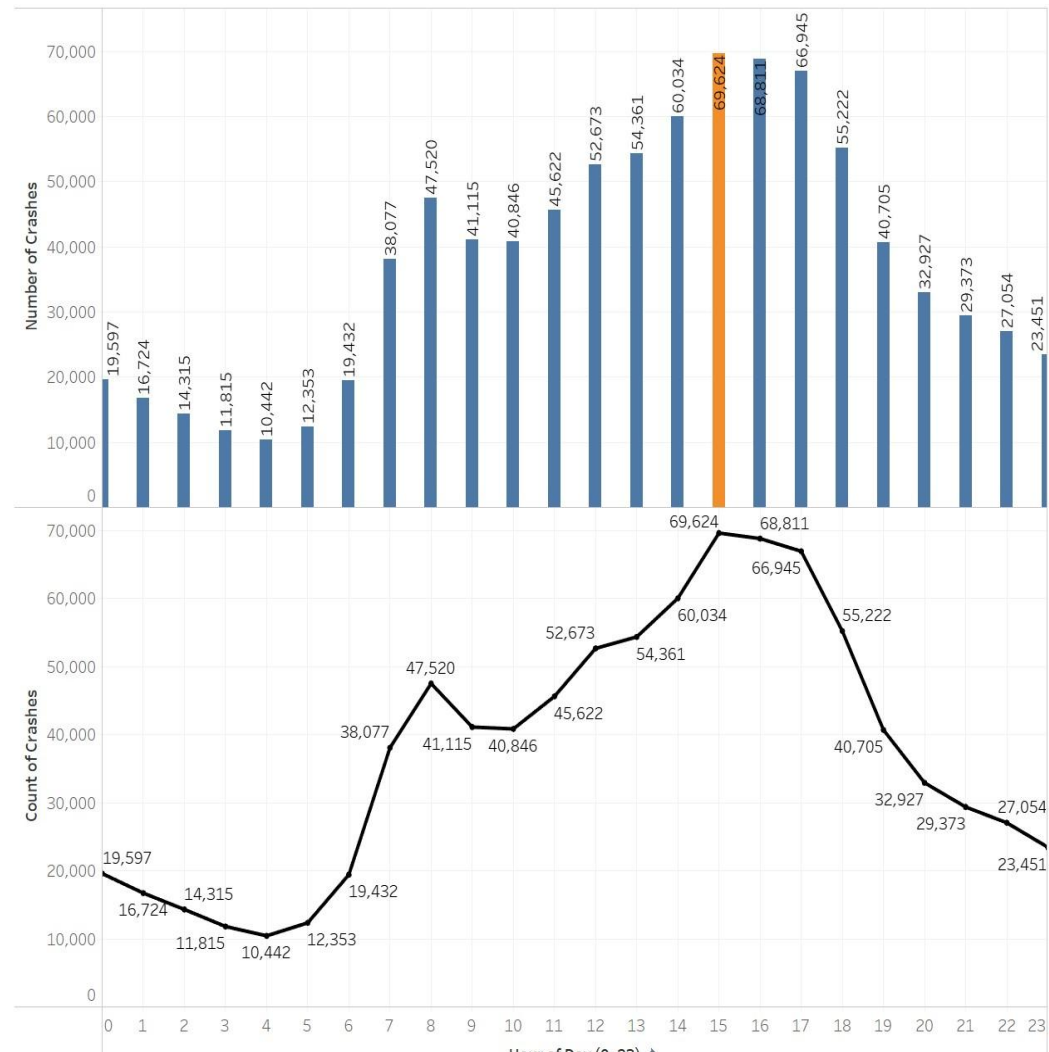
Crash Counts By Month

January to April (Months 1-4):
Crash counts are relatively stable, with a slight dip in February. Lower traffic volume in winter months and fewer outdoor activities.

May to August (Months 5-8):
Crash counts steadily increase, peaking in August.Summer travel, vacation driving, and higher pedestrian/cyclist activity in warm weather.

September to October (Months 9-10):
The highest crash counts occur in October. School reopenings, increased commuting traffic, and shorter daylight hours starting to affect visibility.

November to December (Months 11-12):
Crashes decline as the year ends. Holiday travel calming traffic, weather-related caution, and less outdoor road activity
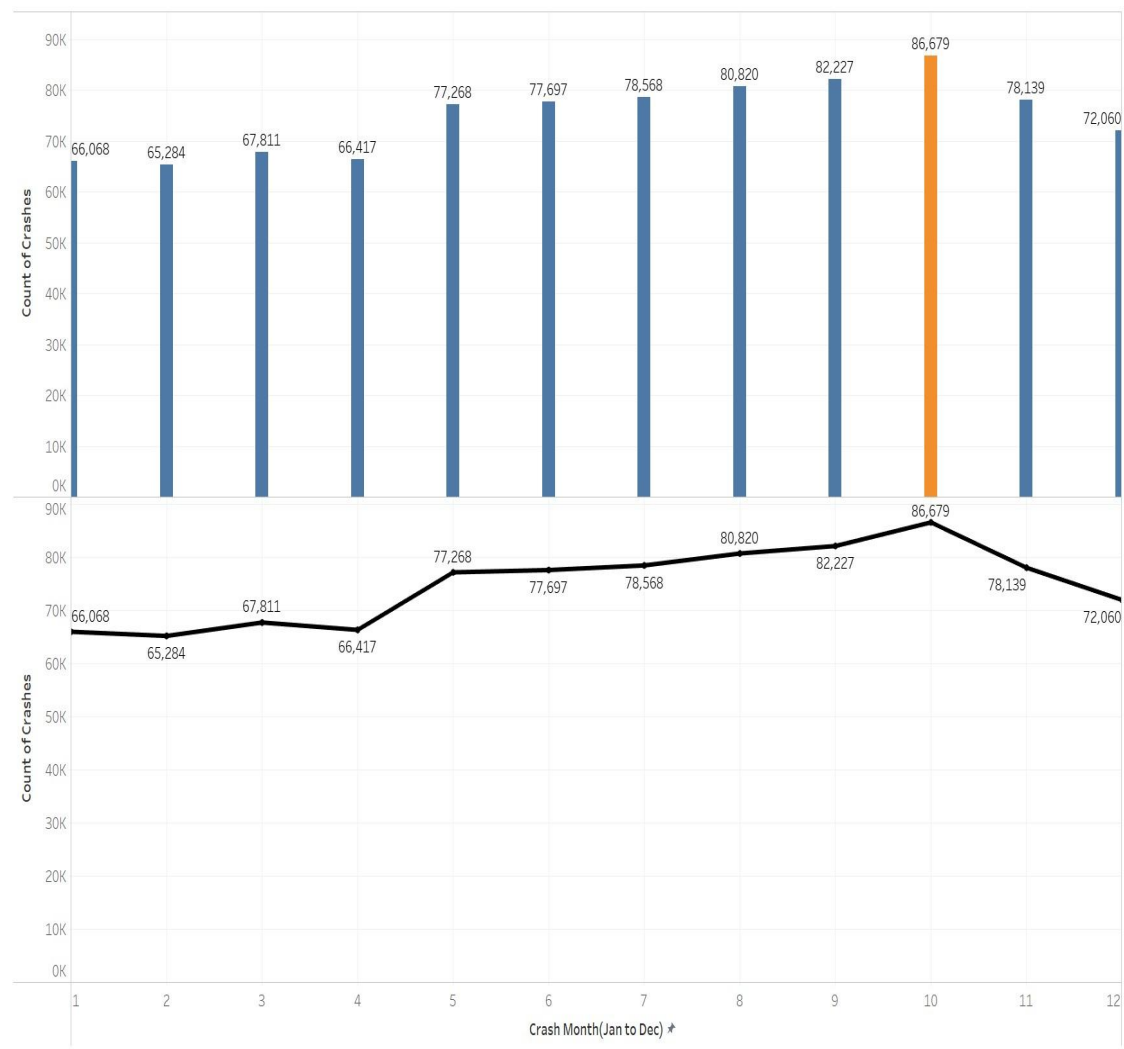
Traffic Gadgets and Road Condition Affecting Crashes

# Safety Devices and Their Influence on Crash Results

Key Insights:

- **No Controls**: Over 350K crashes occurred without any safety controls, the highest category.
- **Functioning Devices**: Properly functioning devices also account for a significant number of crashes, suggesting other influencing factors.
- **Data Gaps**: Many crashes have unknown device conditions, highlighting the need for better reporting.
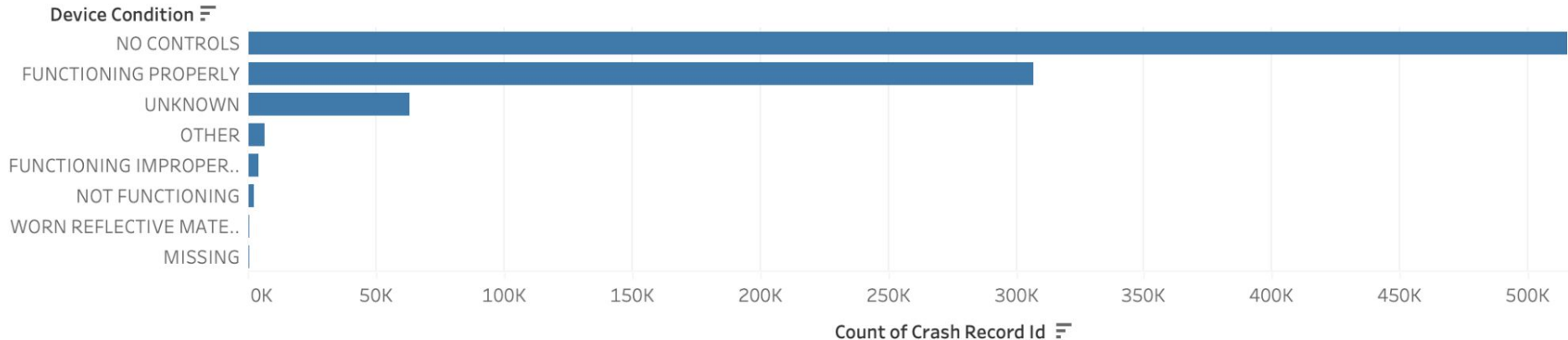
# Crash Incidents by Month for the Past 3 Years

- Crashes show consistent seasonal pattern across years

- Highest crash counts observed in winter months

- 2023 has the peak crash count at around 10,143 in May

- 2024 projects lower overall crash counts compared to prior years

- Data enables identification of high-risk crash periods

Crashes over the years and months
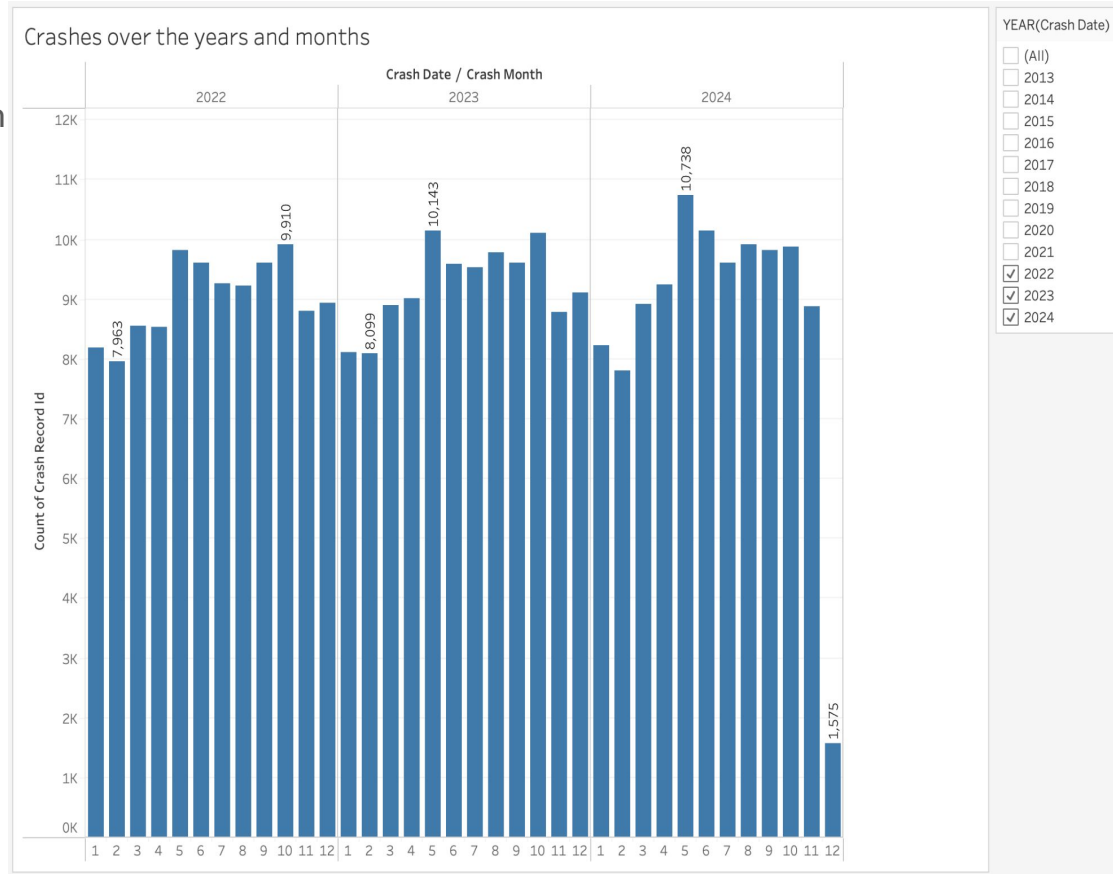
Impact of Road Conditions on Traffic

- Pie chart shows road condition impact on crashes

- Largest slice is "DRY" - most common crash scenario

- Other conditions include snow, ice, unknown

Impact of Road Conditions on Crashes

Roadway Surface Cond
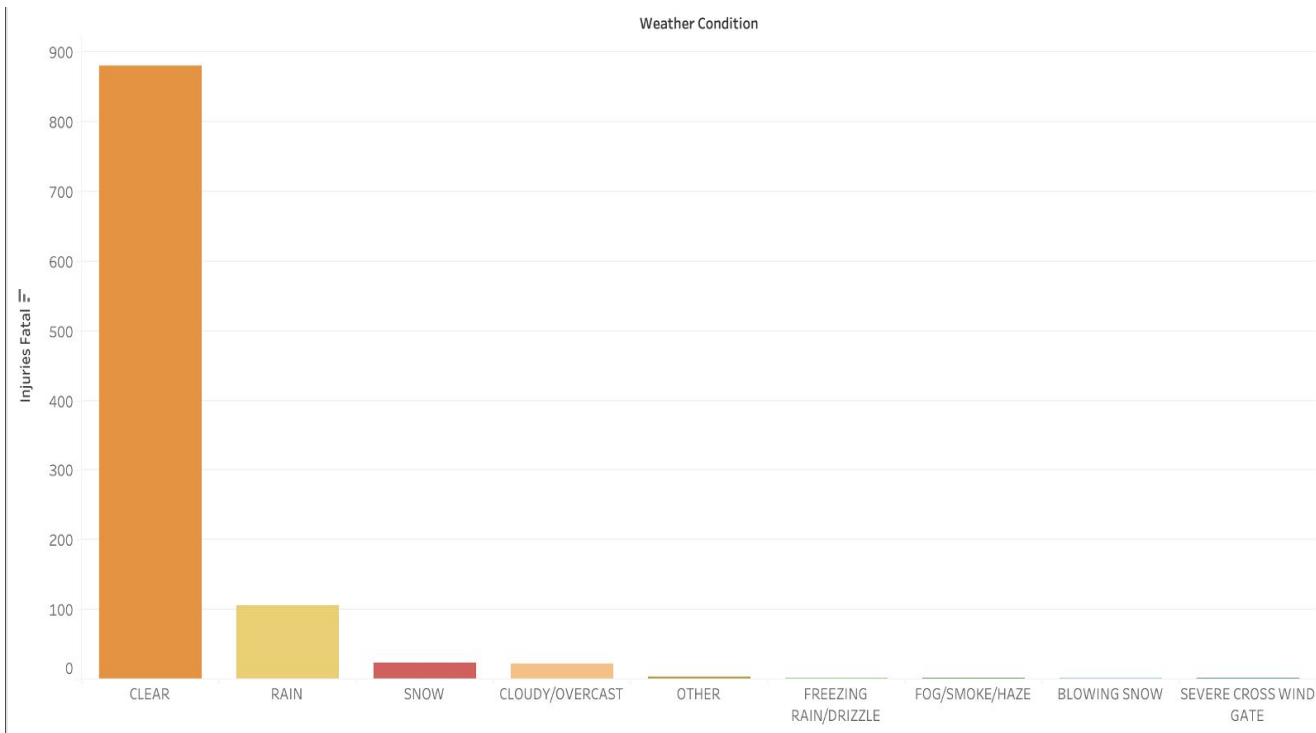- DRY
- ICE
- OTHER
- SAND, MUD, DIRT
- SNOW OR SLUSH
- UNKNOWN
- WET
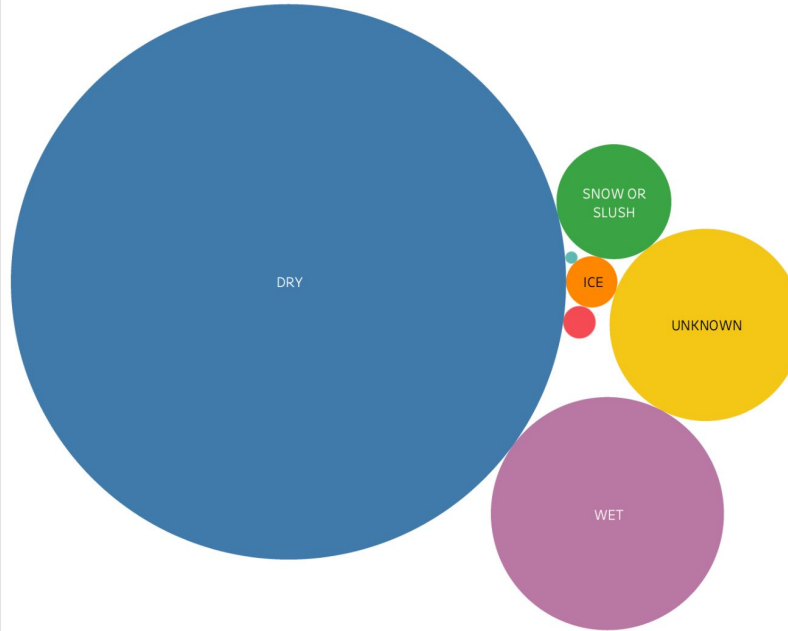
Role of weather condition

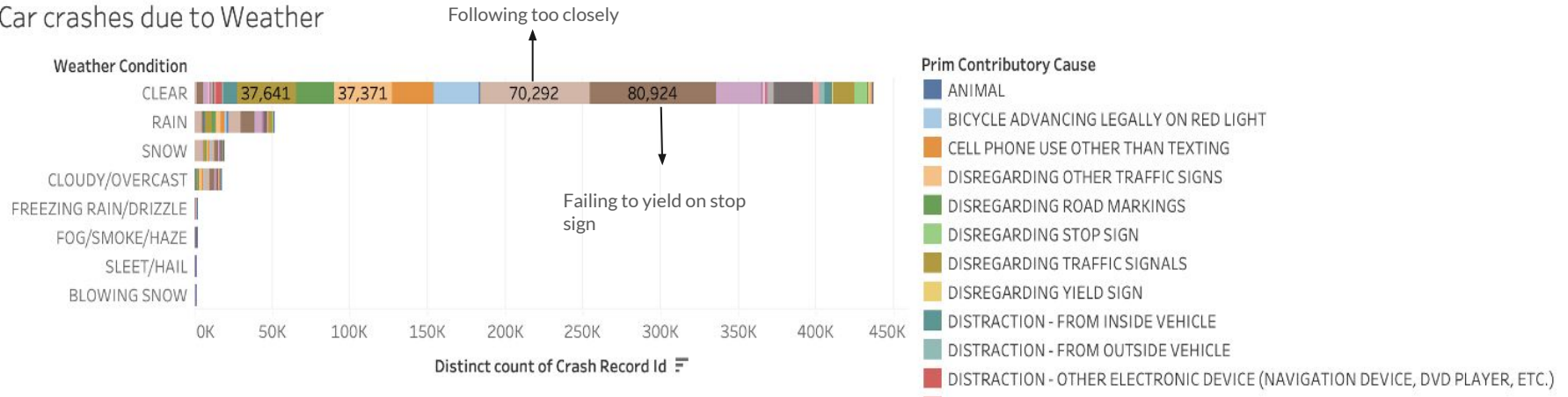# Fatal injuries by Weather Conditions

Weather Condition

- High Fatalities in Clear Weather

- Lower Fatalities in Adverse Weather Conditions
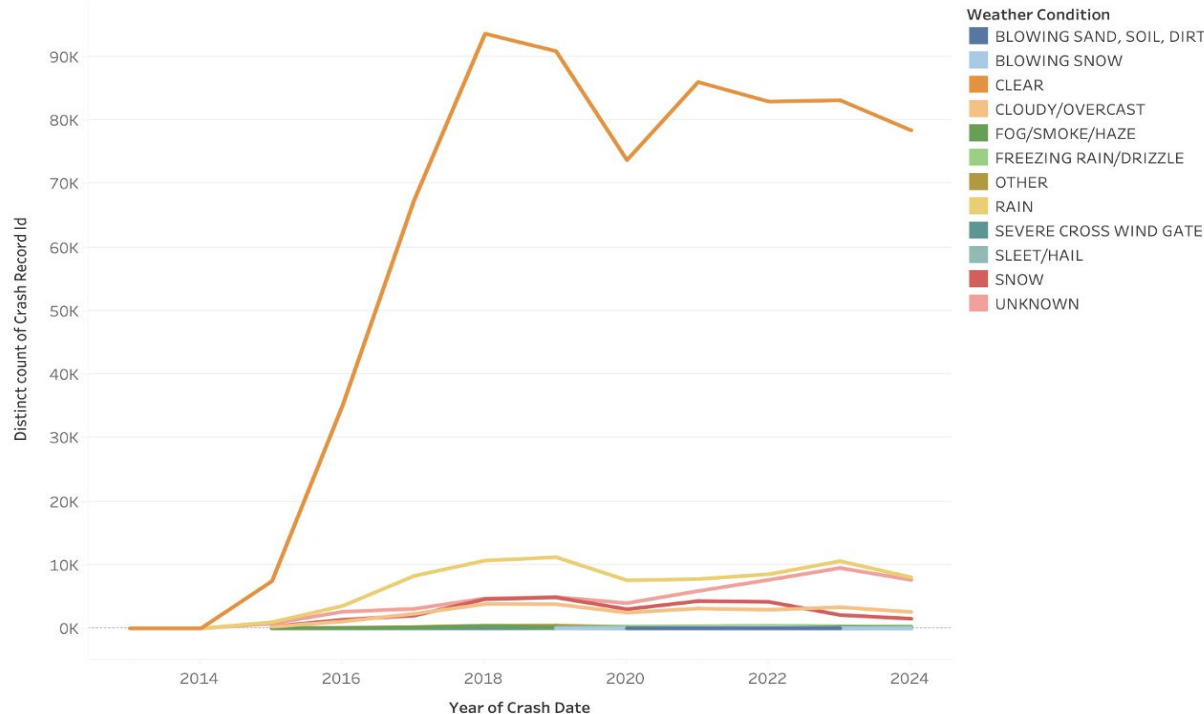
Number of crashes due to weather

Car crashes due to Weather

- The largest share of crashes occurs during clear weather conditions. Overspeeding and ignoring stop signs dominate as primary causes

- Adverse weather (e.g., rain, snow, fog) accounts for a significantly smaller number of crashes. The reasons, however, are similar to that of clear weather.

Temporal analysis of crashes by weather

Time Analysis by weather

Weather Condition
- BLOWING SAND, SOIL, DIRT
- BLOWING SNOW
- CLEAR
- CLOUDY/OVERCAST
- FOG/SMOKE/HAZE
- FREEZING RAIN/DRIZZLE
- OTHER
- RAIN
- SEVERE CROSS WIND GATE
- SLEET/HAIL
- SNOW
- UNKNOWN

The trend of distinct count of Crash Record Id for Crash Date Year. Color shows details about Weather Condition. The data is filtered on Location, which excludes Null and POINT (0 0).

- A significant drop in crashes during clear weather is observed during 2019-2021 period. Other weather conditions also show slight decreases.

- Crashes in adverse weather remain low and stable, likely due to reduced traffic and cautious driving.

Machine Learning Models to Predict Fatality in Crashes

Data Preparation Steps

- Handling Null Values
- Ensuring Proper Formatting of our Predictors
- Factorising categorical predictors in our analysis

Dependent Variable:
Injuries_Fatal

Independent Variables:
Weather_Condition, Road_Defect, Roadway_Surface_Cond, Alignment, Trafficway_Type, Device_Condition, Posted_Speed_Limit

Logistic Regression | # Random Forest

Accuracy: 0.9984517127927723

Accuracy: 0.9983549448422683

IMPORTANT FEATURES

	Feature	Coefficient	Odds Ratio
39	cat__TRAFFICWAY_TYPE_PARKING LOT	0.864019	2.372678
25	cat__ALIGNMENT_STRAIGHT AND LEVEL	0.839986	2.316334
49	cat__DEVICE_CONDITION_NO CONTROLS	0.499037	1.647135
37	cat__TRAFFICWAY_TYPE_ONE-WAY	0.464085	1.590559
47	cat__DEVICE_CONDITION_FUNCTIONING PROPERLY	0.442862	1.557157
15	cat__ROAD_DEFECT_UNKNOWN	0.436122	1.546698
2	cat__WEATHER_CONDITION_CLOUDY/OVERCAST	0.365711	1.441539
9	cat__WEATHER_CONDITION_SNOW	0.349105	1.417799
20	cat__ROADWAY_SURFACE_COND_SNOW OR SLUSH	0.338262	1.402508

THANK YOU!
ANY QUESTIONS?

Data Source

Chicago, C. of (2024) *Traffic crashes - crashes: City of chicago: Data Portal*, *Chicago Data Portal*. Available at: https://data.cityofchicago.org/Transportation/Traffic-Crashes-Crashes/85ca-t3if/about_data (Accessed: 10 December 2024).