Title : AI Applications using Open Road Crash Data
Meeting date : 8th Sep 2024
Executive Summary: **A concise summary of the project, key findings, and recommendations & Risks**
Model Binaries Submit the model binaries with the GitHub repo :
https://github.com/Rajan232/TeamCentelon_GovHack24/tree/master

Core message / purpose.

Using Open Road Crash Data, we identified key patterns in road accidents, particularly during peak hours in 60 km/hr urban zones across Melbourne, Casey, and Geelong. Most accidents involve cars, station wagons, motorcyclists, and pedestrians, with over 75 % occurring in clear weather on dry roads, often in areas lacking traffic control. Victoria, Australia has recorded a total of 171,099 accidents, with an average severity of 2.60 on a scale of 1-4, and an average speed zone for accidents of 133.02 km/h. Fatalities account for 1.64% of these accidents, which are slightly more frequent mid-week, with "ROAD" being the most common road type involved. To address these issues, we recommend implementing dynamic traffic management systems, revising speed limits, redesigning intersections for safer crossings, and improving infrastructure such as street lighting and drainage. Additionally, we advocate for targeted driver education and the adoption of advanced vehicle safety technologies, alongside rural-specific strategies like better signage. These insights support policy changes that integrate both technological solutions, like real-time data analysis and AI-driven systems, and non-technical measures, including regulatory updates and public awareness campaigns, to enhance road safety effectively.

Recommendation/s

Time-Based Traffic Management:
Implement dynamic traffic management systems during peak hours (2-6 PM and morning rush). Consider flexible work hours policies to reduce peak traffic congestion.
Urban Infrastructure Improvements:
Redesign complex intersections in high-risk urban areas. Increase dedicated lanes and safe crossings for cyclists and pedestrians. Enhance street lighting, especially in areas with high nighttime accident rates.
Speed Management:
Review and potentially revise speed limits in 80-100 km/hr zones with high accident rates. Implement variable speed limits that adjust based on traffic and weather conditions.
Targeted Driver Education:
Develop comprehensive programs for the 30-49 age group, focusing on common risk factors. Create engaging, tech-savvy safety campaigns for young drivers (18-25). Offer regular refresher courses for older drivers to address age-related risks.
Vehicle Safety Promotion:
Encourage adoption of advanced driver assistance systems (ADAS) in cars and station wagons. Promote motorcyclist safety through specialized training and gear requirements.

Environmental Adaptations:
Improve road drainage systems to reduce risks during rainy conditions. Implement seasonal awareness campaigns, with particular focus on autumn and summer risks.
Traffic Control Enhancements:
Conduct a comprehensive review of areas lacking traffic control, prioritizing high-risk zones. Upgrade existing traffic light systems with smart, adaptive technologies.
Rural Road Safety:
Develop specific strategies for rural Victoria, addressing unique challenges like wildlife crossings and long, monotonous drives. Improve signage and road markings on rural roads.
Data-Driven Approach:
Establish a real-time accident data analysis system to enable rapid response and prevention. Use predictive modelling to identify and proactively address potential accident hotspots.
Public Awareness and Education:
Launch campaigns to challenge the perception that good weather conditions are inherently safe for driving. Educate the public on the risks of distracted driving, particularly during seemingly safe conditions.

Immediate Actions

Speed management:
Given the high average speed zone for accidents, immediate attention is required to enforce speed limits and reduce the risk of high-speed accidents.

Multi-vehicle accident prevention:
Strategies to address the involvement of multiple vehicles in accidents should be prioritized to mitigate the impact of such incidents on road safety.

Further Investigation:
Further investigation is needed to understand the factors contributing to the high average speed of vehicles involved in accidents and to identify specific locations and circumstances where speed management measures can be most effective.

Attachments

A :
B :

Key information

From our accident data analysis, we discovered some key patterns about when and where crashes happen most often. Here's what we found:

Most car accidents occur during the busiest driving times - in the afternoon when people are heading home from work, and in the morning during the rush to work. These crashes frequently happen on city roads with speed limits of 60 km/h or higher. Drivers aged 30 to 39 are involved in accidents more than any other age group. Interestingly, most crashes take place when the road is dry, which many people think is safer for driving. This information shows us that even in what seems like good driving conditions, there's still a high risk of accidents. It's particularly important for drivers in their 30s to stay alert when driving in the city during busy times, even when the roads look safe and dry.

Road Safety Summary:

Timing and Location Details:

Peak accident hours are between 2 PM and 6 PM. There's also a notable increase during morning rush hours. 60 km/hr zones see many accidents, indicating urban/suburban concentration. Melbourne, Casey, and Geelong have the highest accident rates. Roads with street lighting (likely urban areas) show high accident numbers.

Vehicle and Road User Information:

After cars, station wagons and utility vehicles are commonly involved. Motorcyclists, bicyclists, and pedestrians are significantly represented in accidents. Vehicle-to-vehicle collisions are the most common type.

Environmental Factors:

Over 75% of accidents occur in clear weather. Rain is the second most common weather condition for accidents. Autumn has slightly more accidents, followed closely by summer. Most accidents happen on dry road surfaces.

Road and Traffic Control:

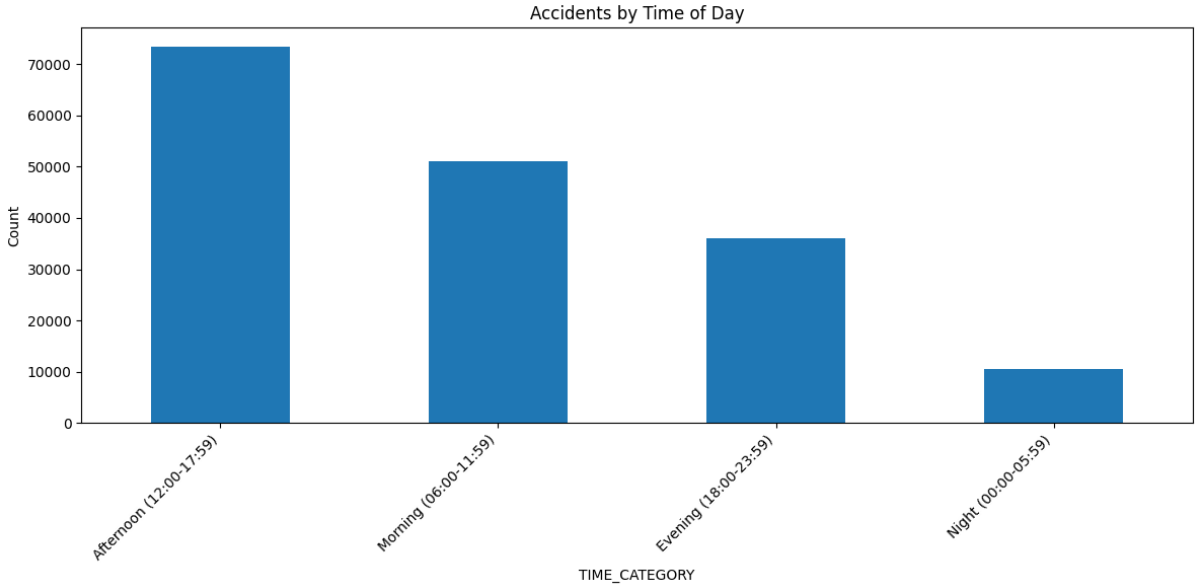
Over 70% of accidents occur on roads and streets, as opposed to highways or freeways. A striking majority of accidents happen in areas with no traffic control. Areas with stop-go lights are the second most common for accidents with traffic control.

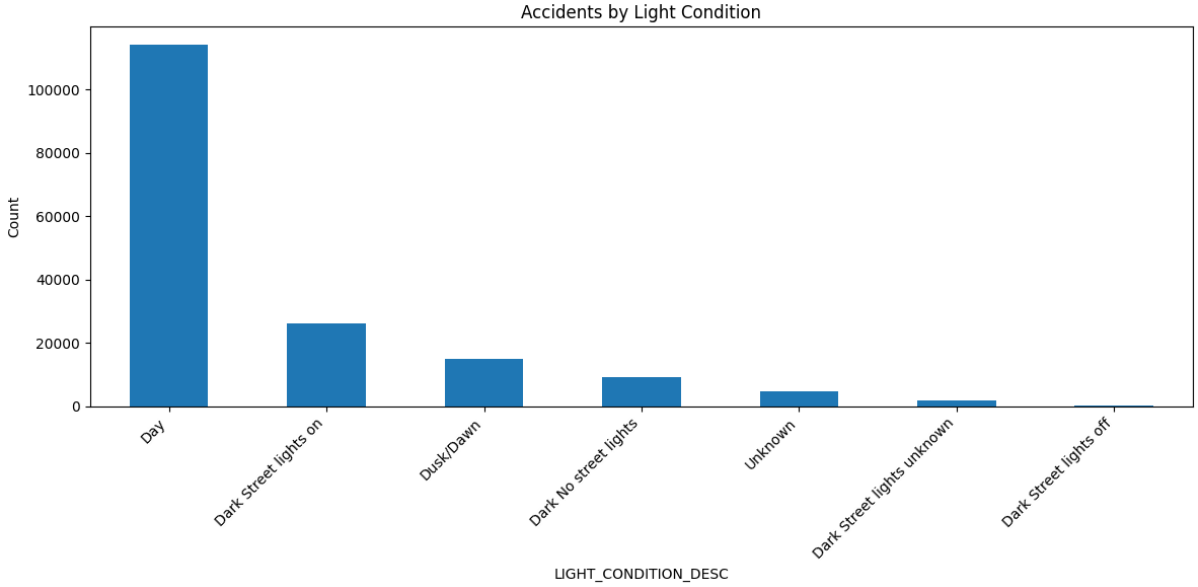
Age and Severity Distribution:

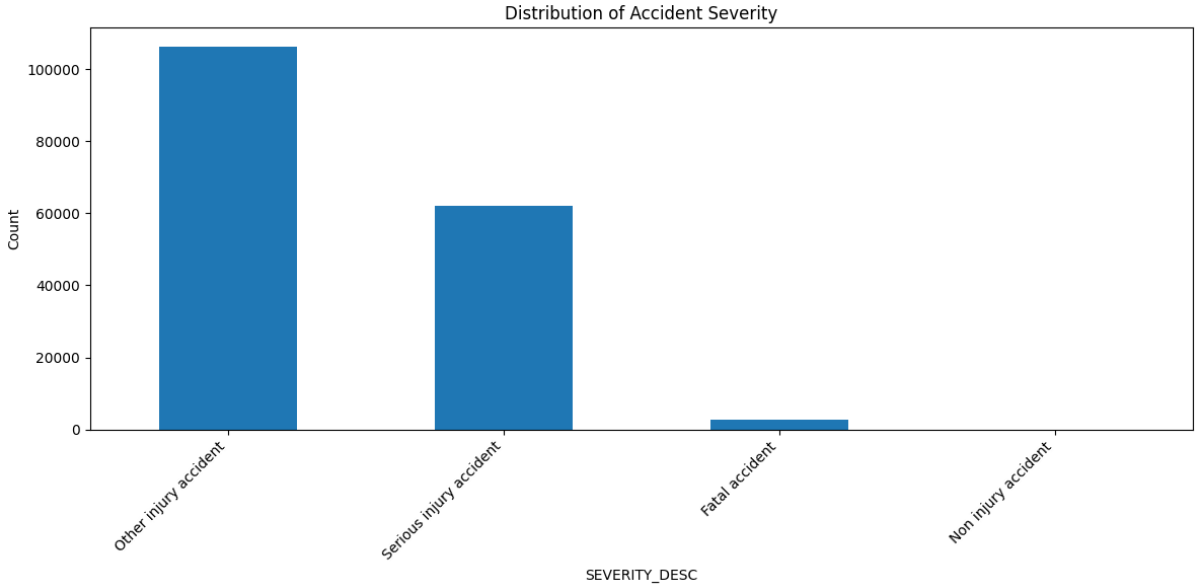
The 30-39 age group is most frequently involved, closely followed by 40-49. There's a gradual decline in accident involvement for ages over 50. While most accidents result in injuries, the majority are not classified as severe. Fatal accidents, though less frequent, occur across all light conditions.

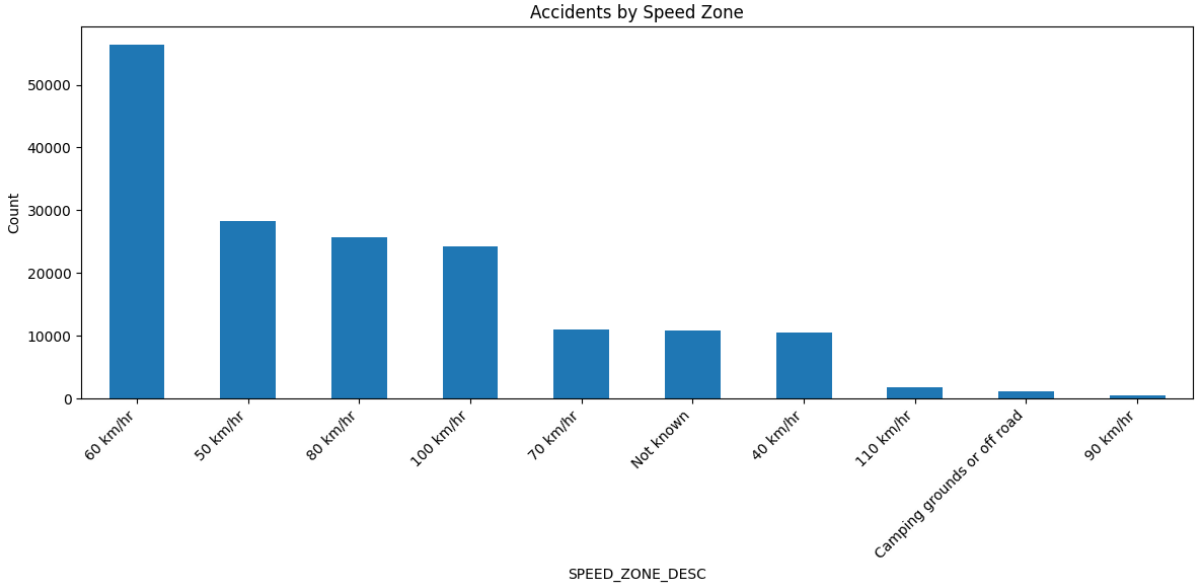
Urban vs. Rural Patterns:

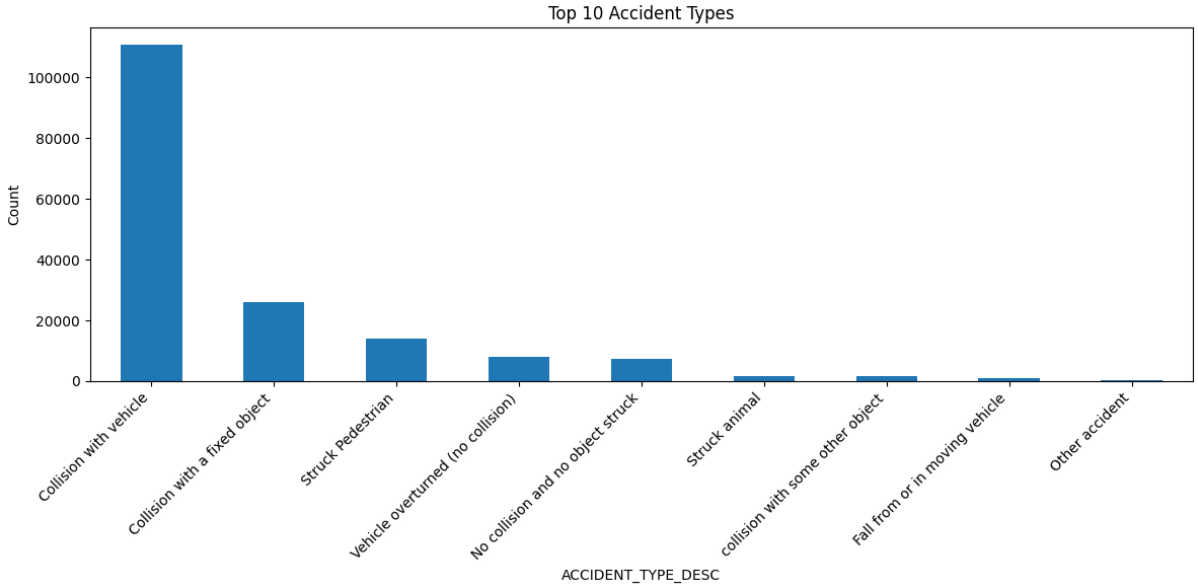
Melbourne urban area accounts for the vast majority of accidents without traffic control. Rural Victoria has the second-highest number of no-control accidents.

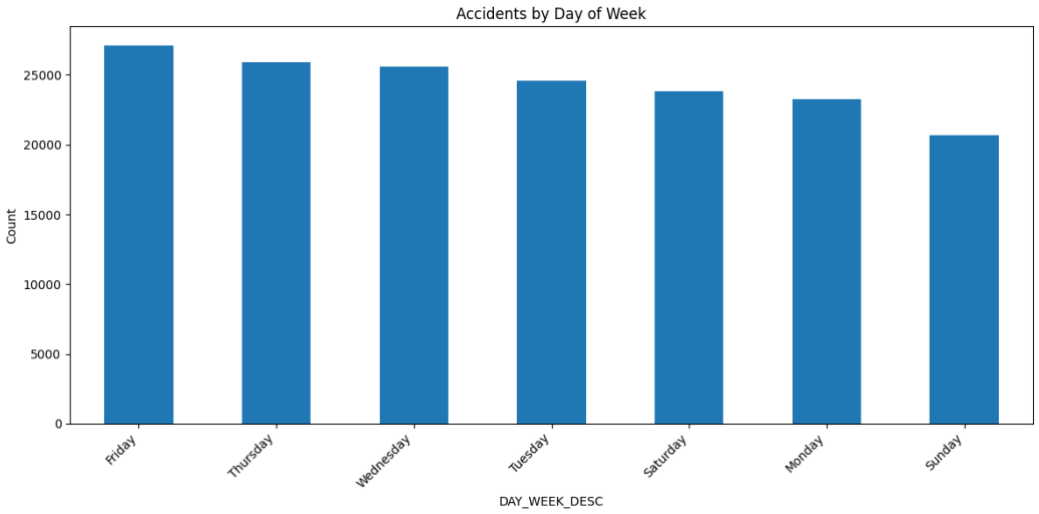

Accidents by Time of Day
Count
0
10000
20000
30000
40000
50000
60000
70000
Afternoon (12:00-17:59)
Morning (06:00-11:59)
Evening (18:00-23:59)
Night (00:00-05:59)
TIME_CATEGORY

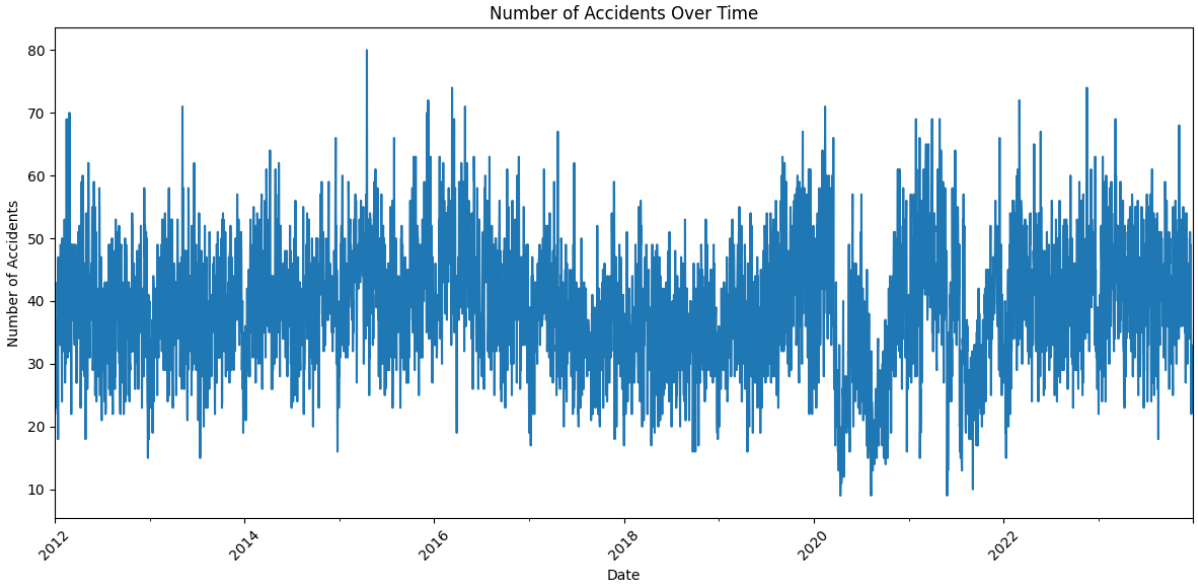

Accidents by Light Condition
Count
0
20000
40000
60000
80000
100000
Day
Dark Street lights on
Dusk/Dawn
Dark No street lights
Unknown
Dark Street lights unknown
Dark Street lights off
LIGHT_CONDITION_DESC

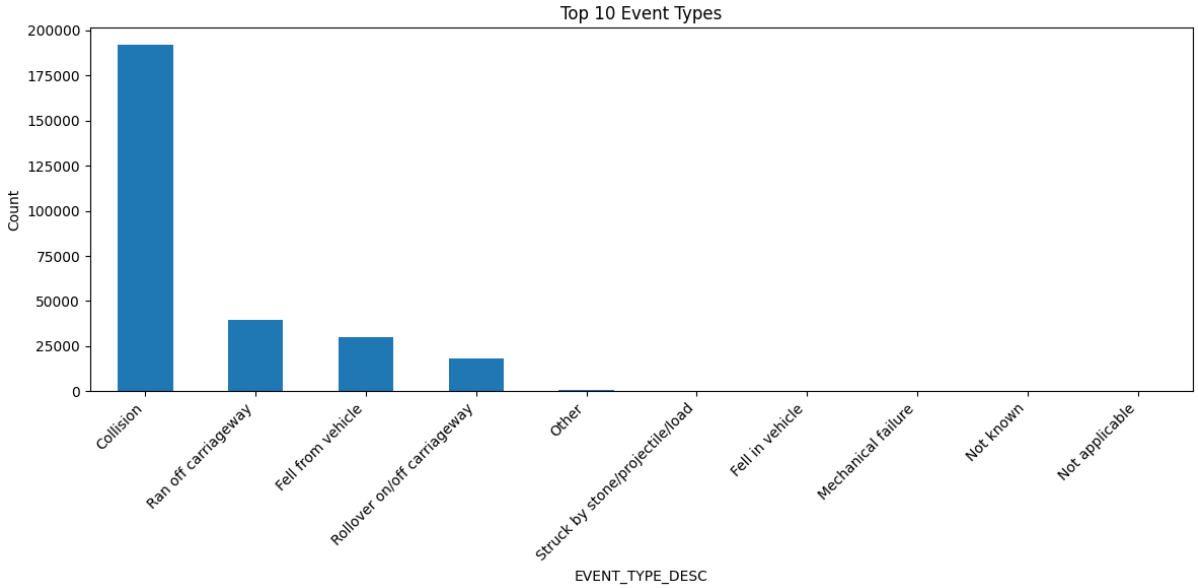

Distribution of Accident Severity
Count
100000
80000
60000
40000
20000
0
Other injury accident
Serious injury accident
Fatal accident
Non injury accident
SEVERITY_DESC

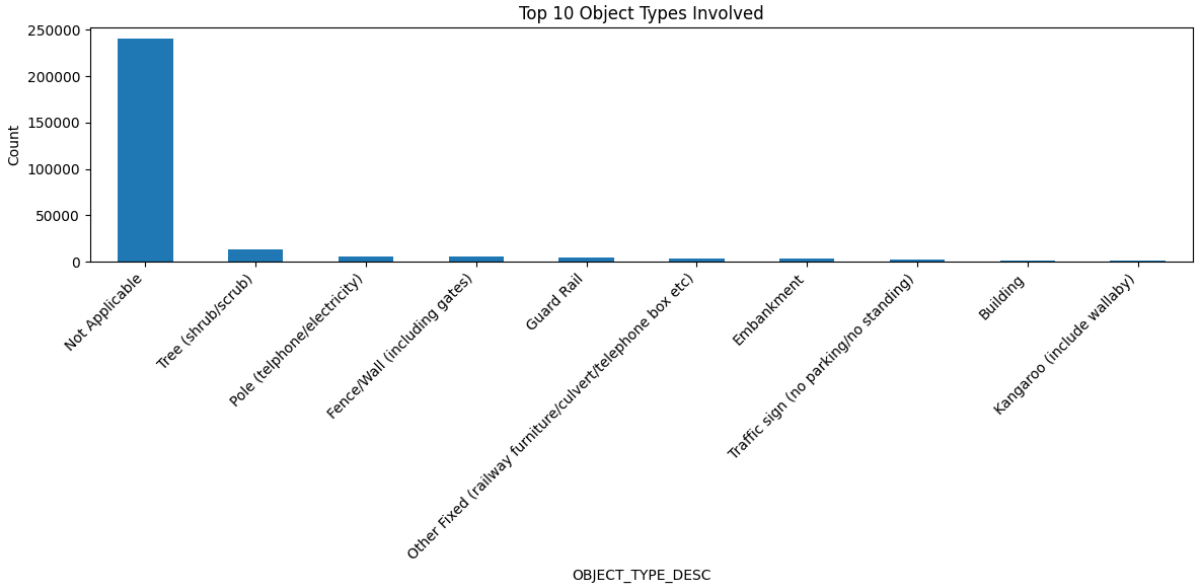

Accidents by Speed Zone
Count
50000
40000
30000
20000
10000
0
60 km/hr
50 km/hr
80 km/hr
100 km/hr
70 km/hr
Not known
40 km/hr
110 km/hr
Camping grounds or off road
90 km/hr
SPEED_ZONE_DESC

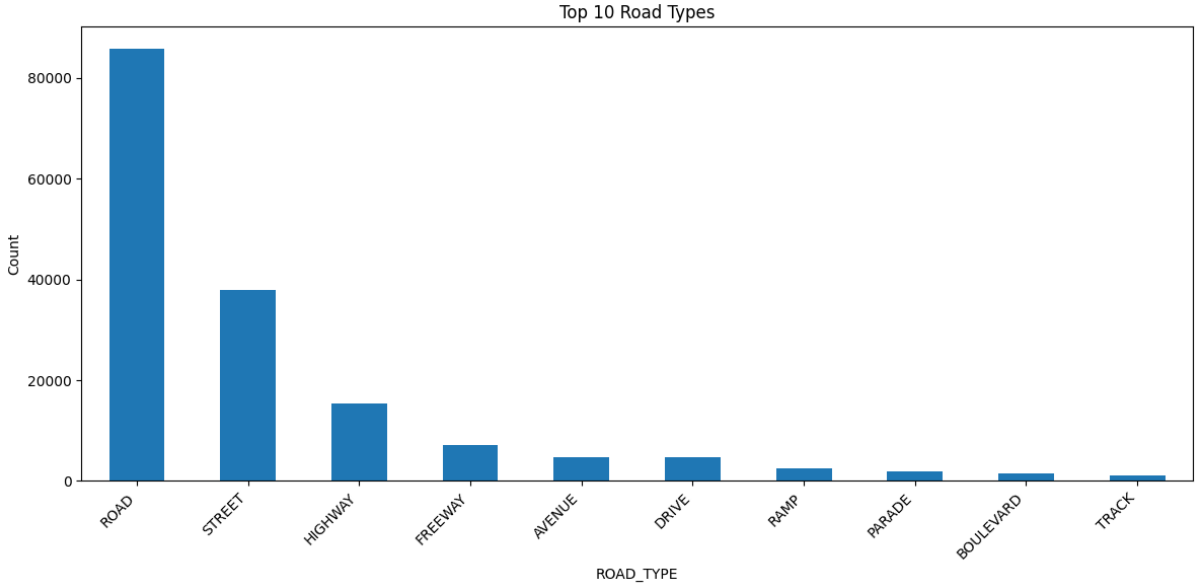

Top 10 Accident Types
Count
100000
80000
60000
40000
20000
0
Collision with vehicle
Collision with a fixed object
Struck Pedestrian
Vehicle overturned (no collision)
No collision and no object struck
Struck animal
collision with some other object
Fall from or in moving vehicle
Other accident
ACCIDENT_TYPE_DESC

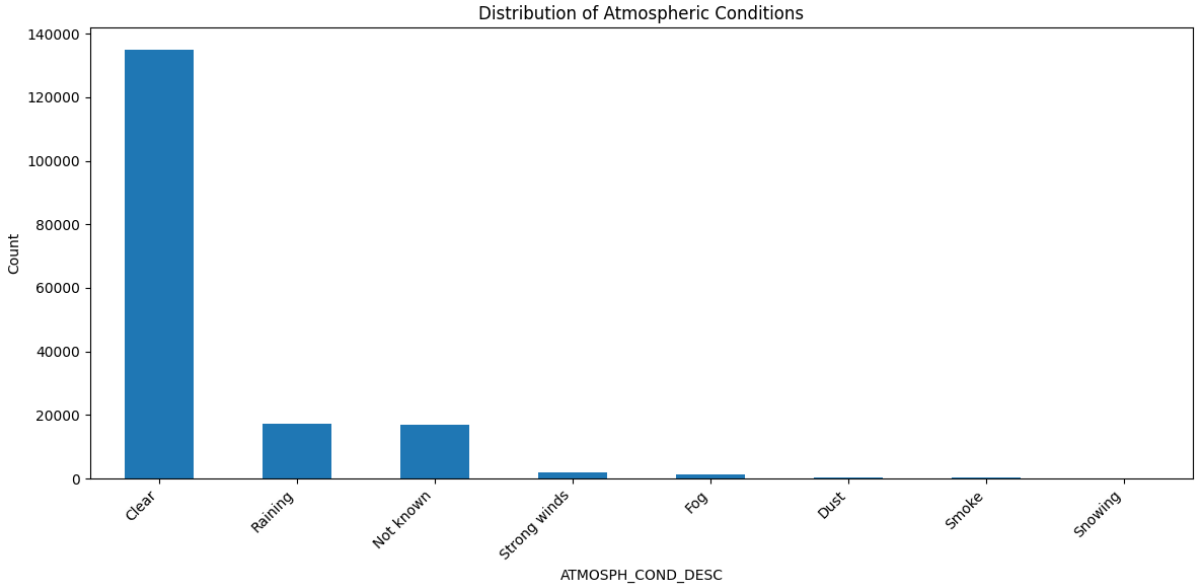

Accidents by Day of Week
Count
25000
20000
15000
10000
5000
0
Friday
Thursday
Wednesday
Tuesday
Saturday
Monday
Sunday
DAY_WEEK_DESC

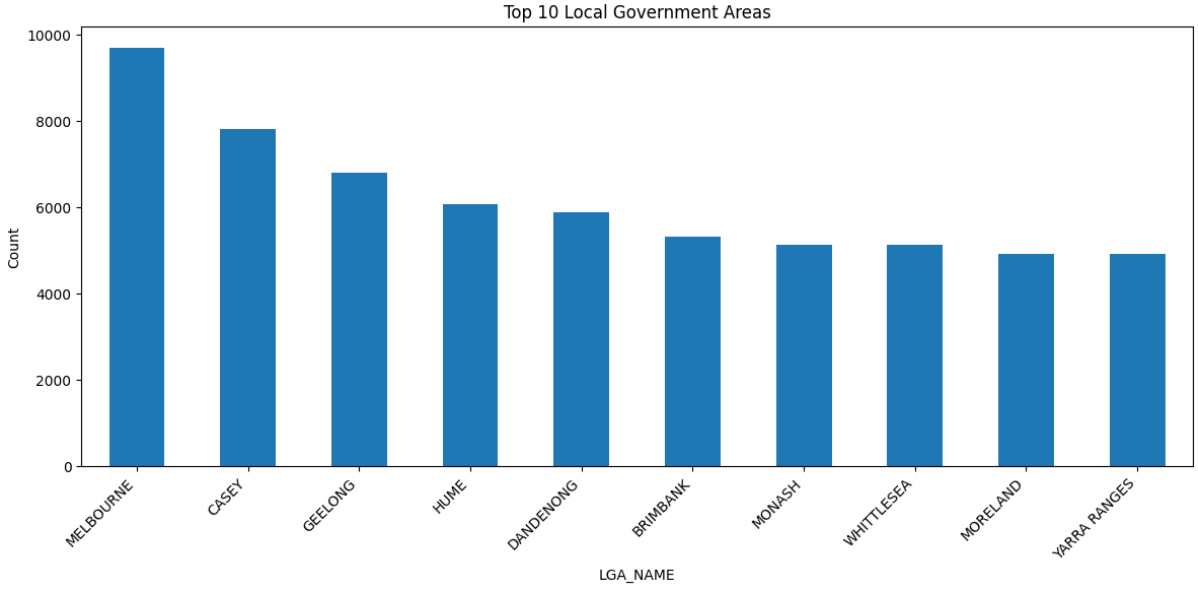

Number of Accidents Over Time
Number of Accidents
80
70
60
50
40
30
20
10
2012
2014
2016
2018
2020
2022
Date

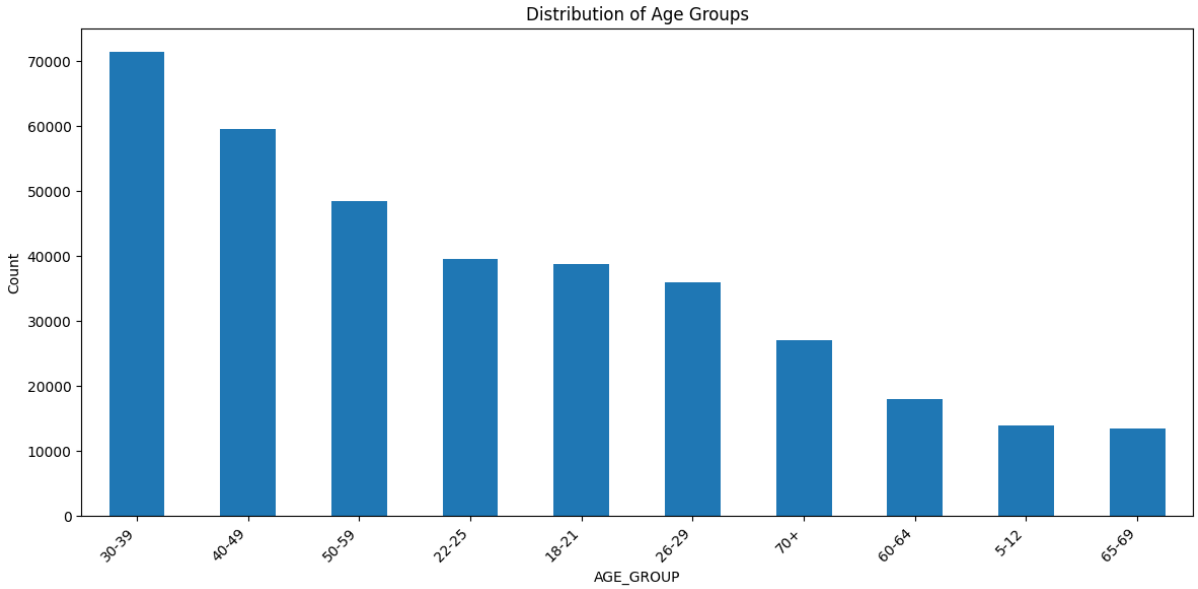

Top 10 Event Types
Count
200000
175000
150000
125000
100000
75000
50000
25000
0
Collision
Ran off carriageway
Fell from vehicle
Rollover on/off carriageway
Other
Struck by stone/projectile/load
Fell in vehicle
Mechanical failure
Not known
Not applicable
EVENT_TYPE_DESC

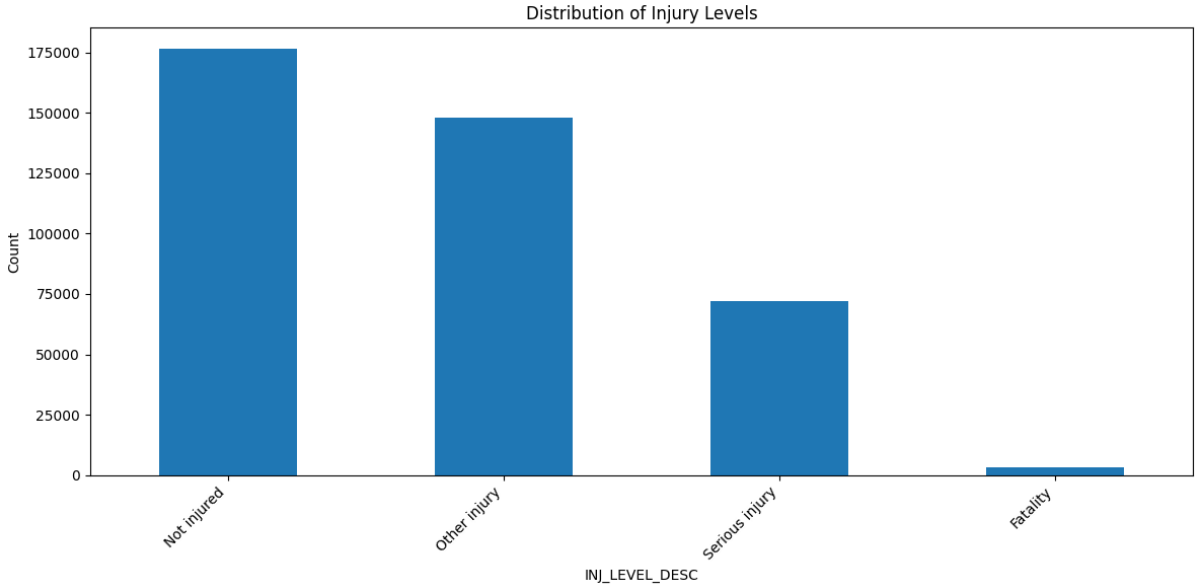

Top 10 Object Types Involved
Count
250000
200000
150000
100000
50000
0
Not Applicable
Tree (shrub/scrub)
Pole (telphone/electricity)
Fence/Wall (including gates)
Guard Rail
Other Fixed (railway furniture/culvert/telephone box etc)
Embankment
Traffic sign (no parking/no standing)
Building
Kangaroo (include wallaby)
OBJECT_TYPE_DESC

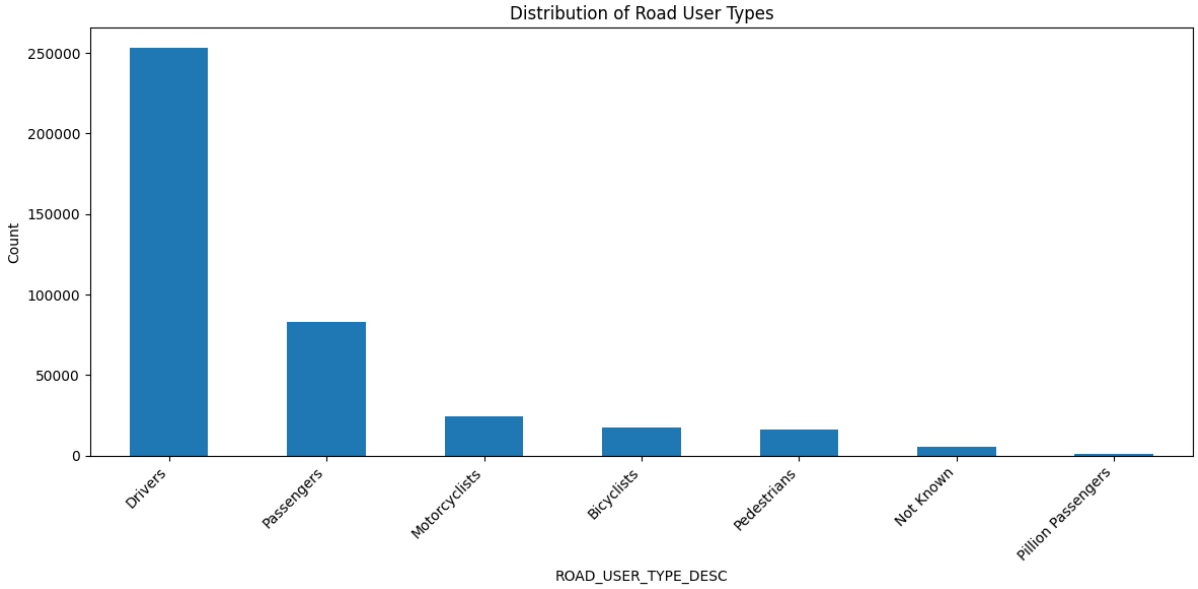

Top 10 Road Types
Count
80000
60000
40000
20000
0
ROAD
STREET
HIGHWAY
FREEWAY
AVENUE
DRIVE
RAMP
PARADE
BOULEVARD
TRACK
ROAD_TYPE

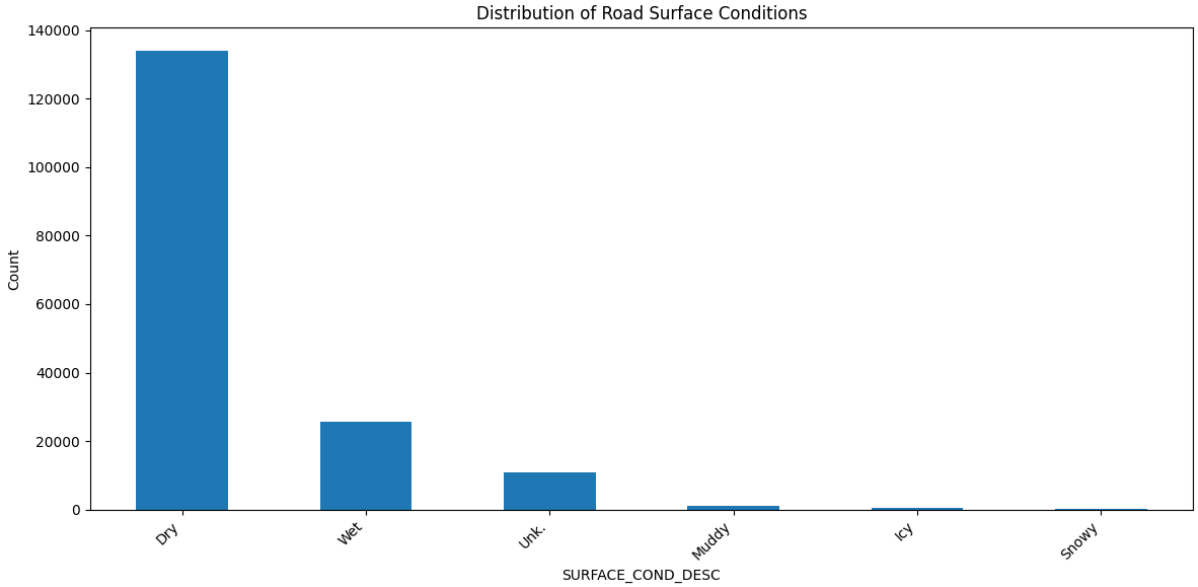

Distribution of Atmospheric Conditions
Count
ATMOSPH_COND_DESC
Clear
Raining
Not known
Strong winds
Fog
Dust
Smoke
Snowing

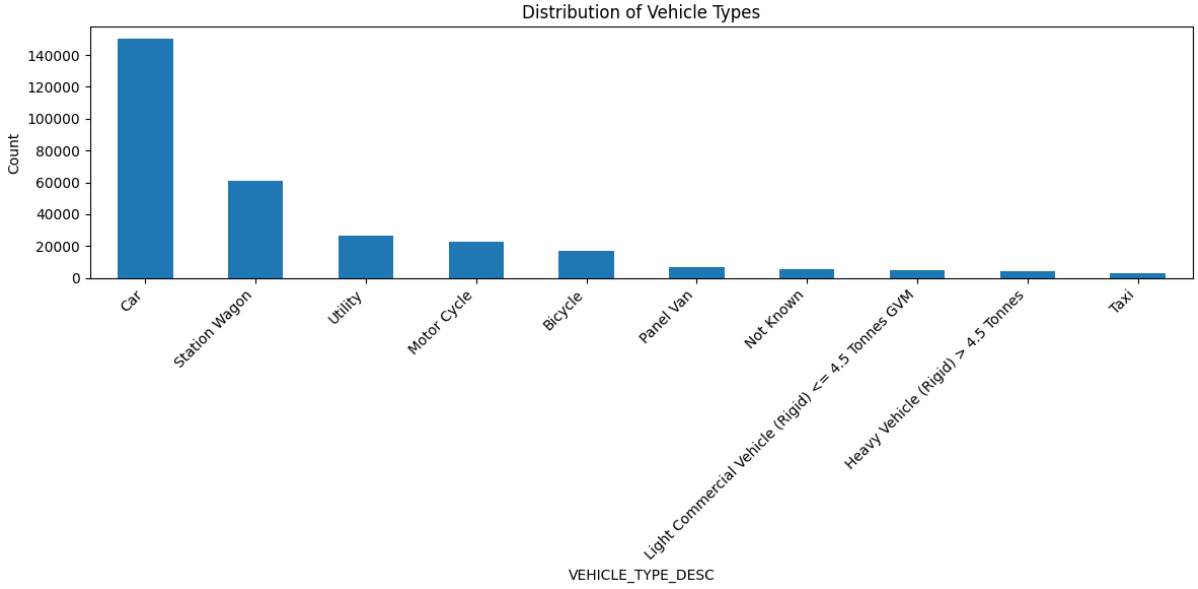

Top 10 Local Government Areas
Count
LGA_NAME
MELBOURNE
CASEY
GEELONG
HUME
DANDENONG
BRIMBANK
MONASH
WHITTLESEA
MORELAND
YARRA RANGES

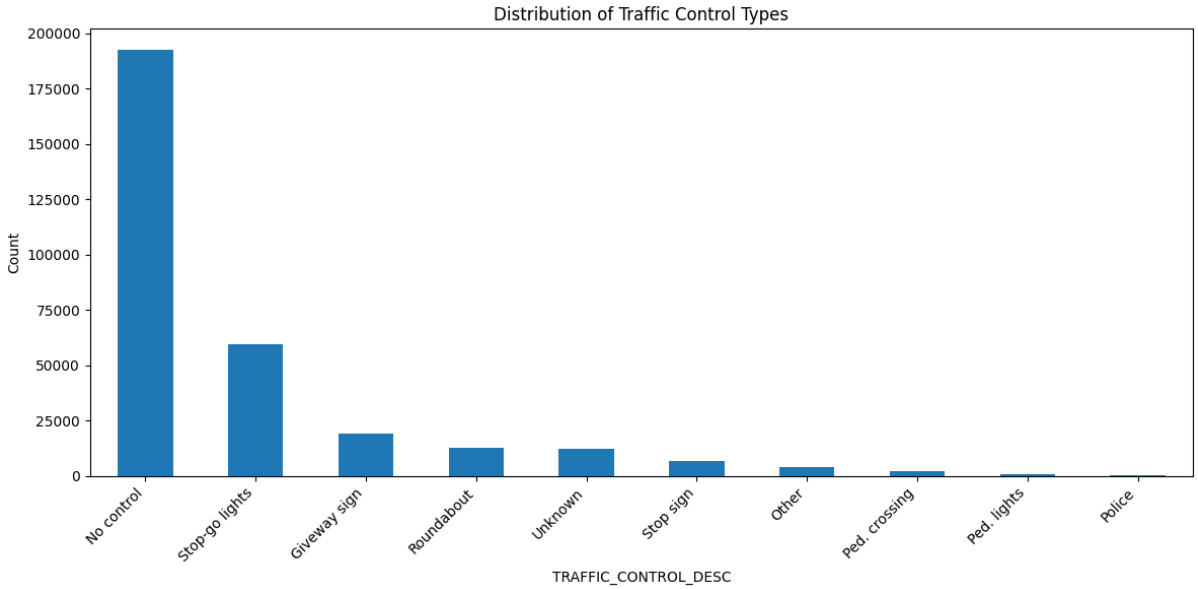

Distribution of Age Groups
Count
AGE_GROUP
30-39
40-49
50-59
22-25
18-21
26-29
70+
60-64
5-12
65-69

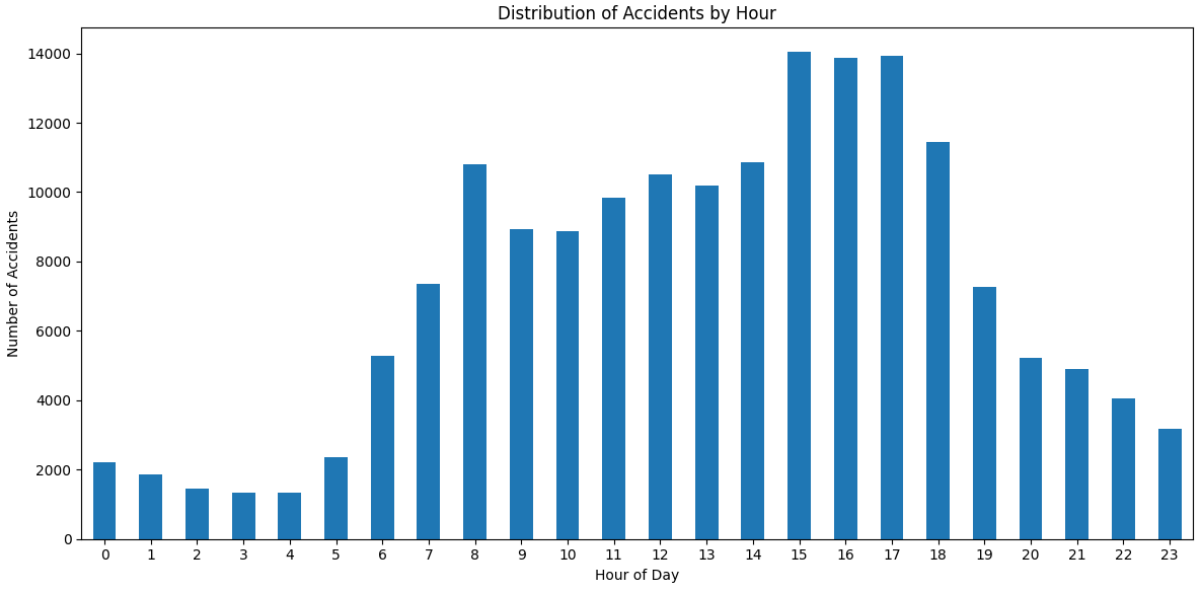

Distribution of Injury Levels
Count
175000
150000
125000
100000
75000
50000
25000
0
Not injured
Other injury
Serious injury
Fatality
INJ_LEVEL_DESC

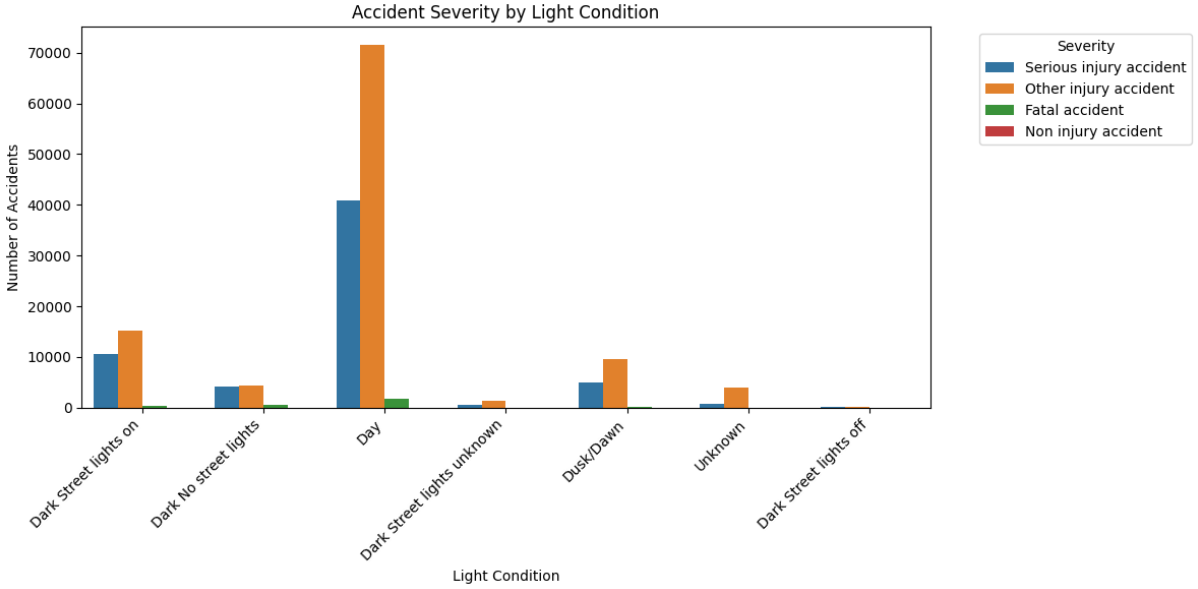

Distribution of Road User Types
Count
250000
200000
150000
100000
50000
0
Drivers
Passengers
Motorcyclists
Bicyclists
Pedestrians
Not Known
Pillion Passengers
ROAD_USER_TYPE_DESC

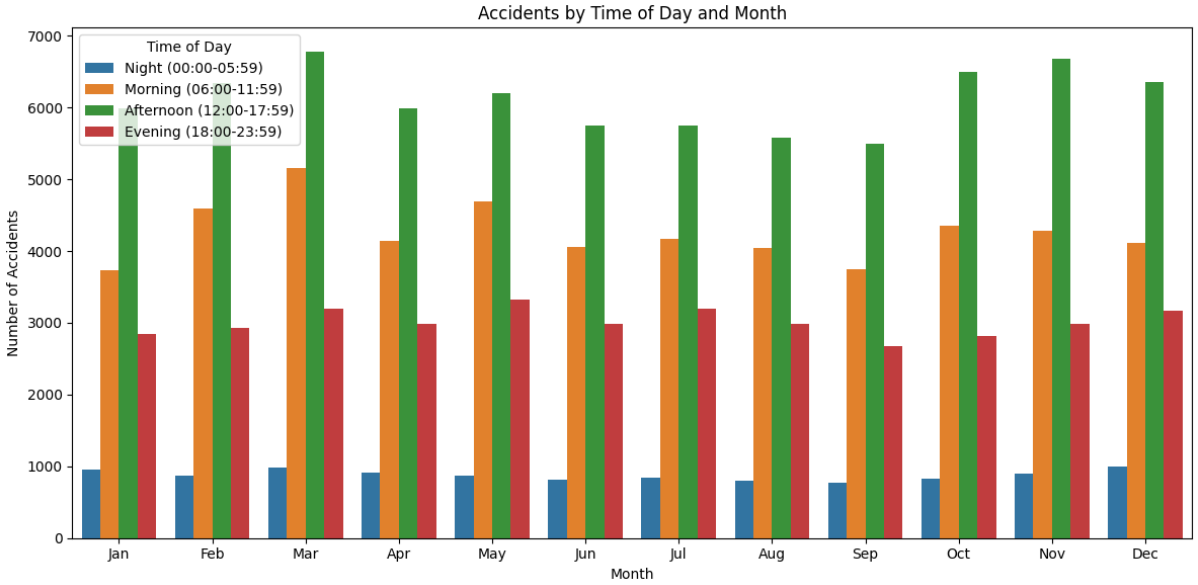

Distribution of Road Surface Conditions
Count
0
20000
40000
60000
80000
100000
120000
140000
Dry
Wet
Unk.
Muddy
Icy
Snowy
SURFACE_COND_DESC

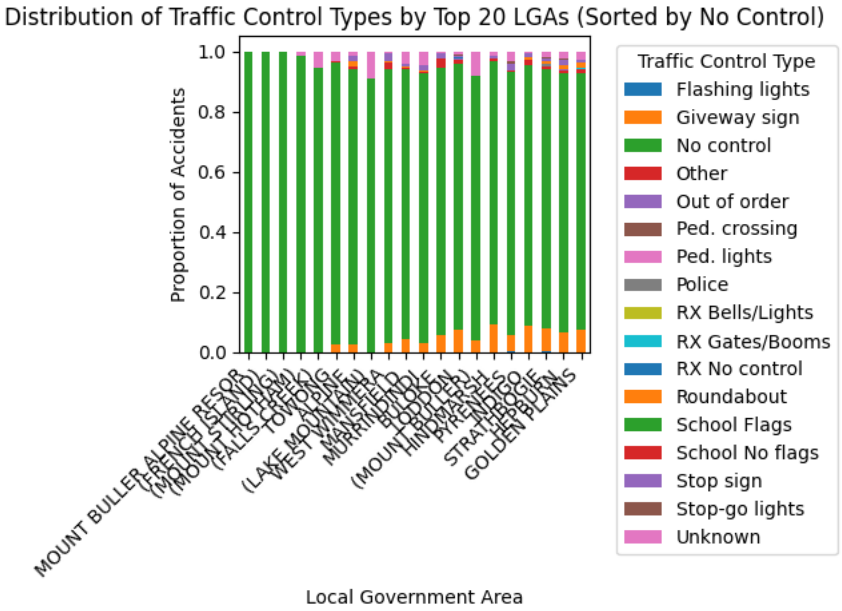

Distribution of Vehicle Types
Count
0
20000
40000
60000
80000
100000
120000
140000
Car
Station Wagon
Utility
Motor Cycle
Bicycle
Panel Van
Not Known
Light Commercial Vehicle (Rigid) <= 4.5 Tonnes GVM
Heavy Vehicle (Rigid) > 4.5 Tonnes
Taxi
VEHICLE_TYPE_DESC

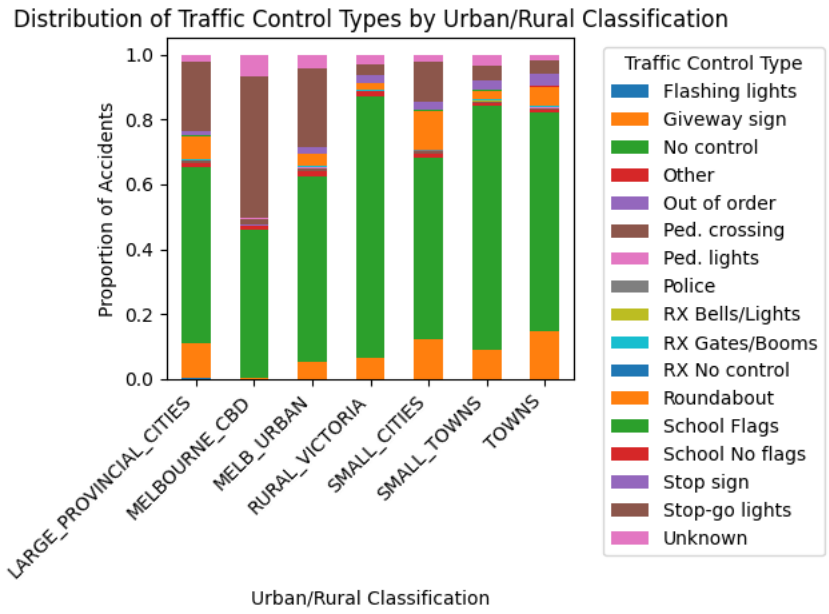

Distribution of Traffic Control Types
Count
0
25000
50000
75000
100000
125000
150000
175000
200000
No control
Stop-go lights
Giveway sign
Roundabout
Unknown
Stop sign
Other
Ped. crossing
Ped. lights
Police
TRAFFIC_CONTROL_DESC

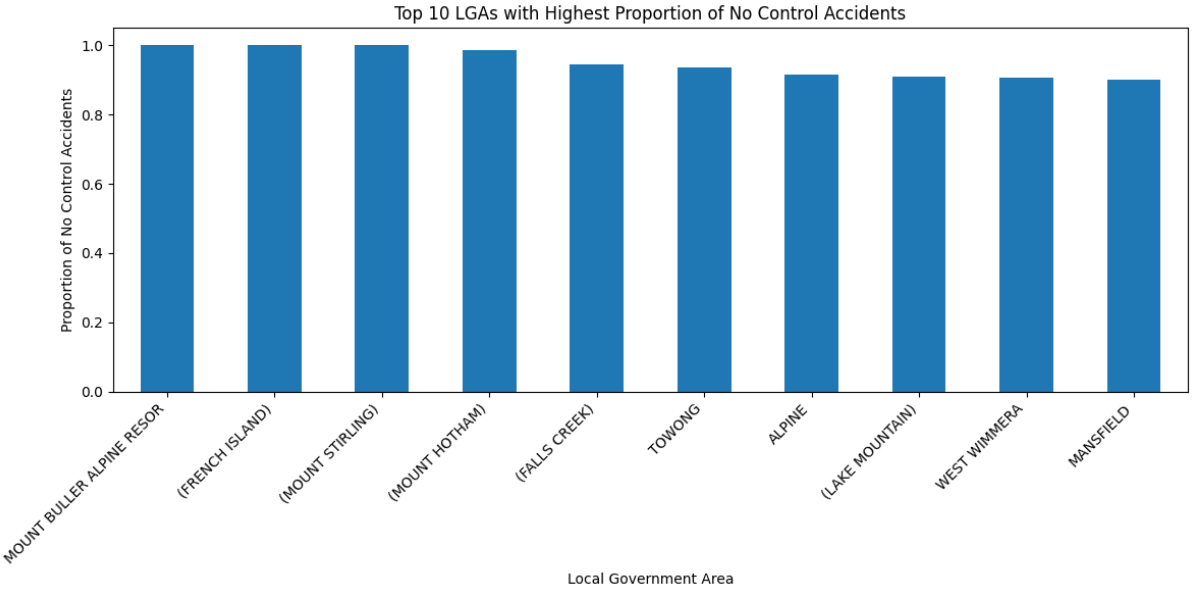

Distribution of Accidents by Hour
Number of Accidents
Hour of Day
0
2000
4000
6000
8000
10000
12000
14000
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

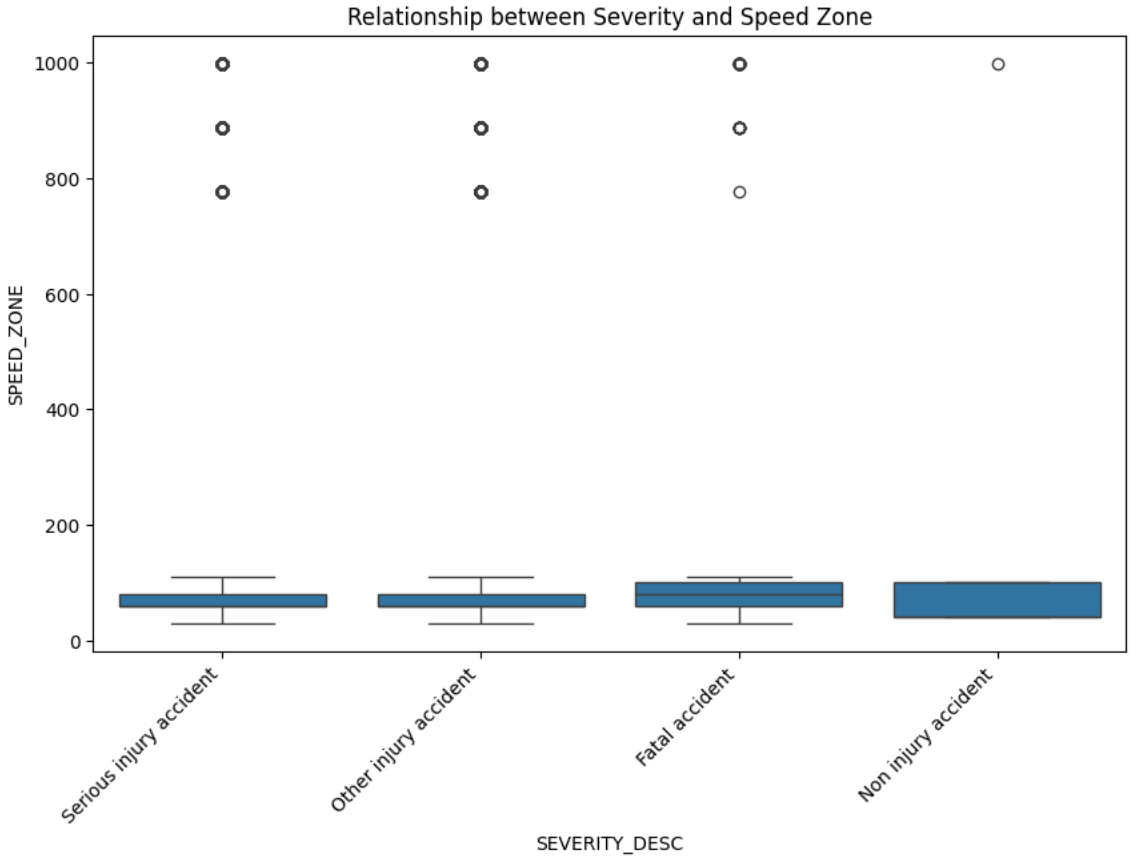

Accident Severity by Light Condition
Number of Accidents
Light Condition
Severity
Serious injury accident
Other injury accident
Fatal accident
Non injury accident
0
10000
20000
30000
40000
50000
60000
70000
Dark Street lights on
Dark No street lights
Day
Dark Street lights unknown
Dusk/Dawn
Unknown
Dark Street lights off

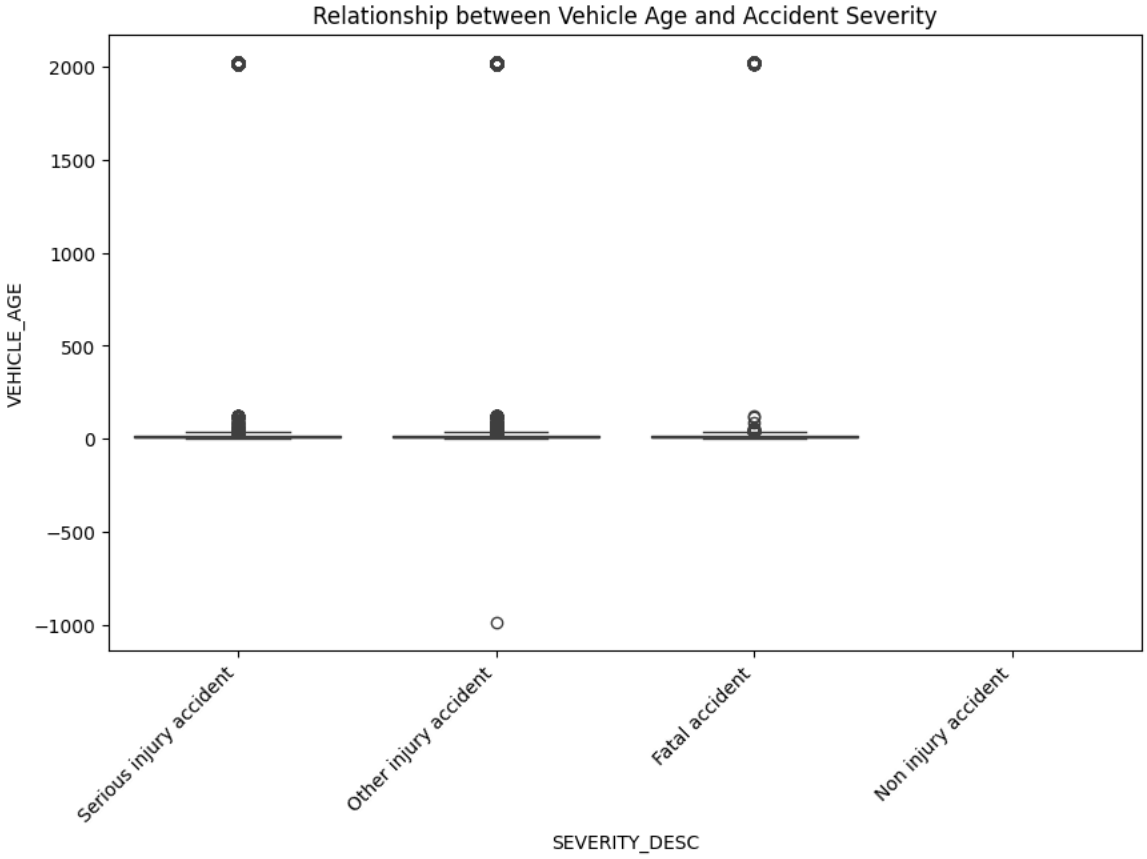

Accidents by Time of Day and Month
Time of Day
Night (00:00-05:59)
Morning (06:00-11:59)
Afternoon (12:00-17:59)
Evening (18:00-23:59)
Number of Accidents
0
1000
2000
3000
4000
5000
6000
7000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month


Distribution of Traffic Control Types by Top 20 LGAs (Sorted by No Control)
Proportion of Accidents
0.0
0.2
0.4
0.6
0.8
1.0
Traffic Control Type
Flashing lights
Giveway sign
No control
Other
Out of order
Ped. crossing
Ped. lights
Police
RX Bells/Lights
RX Gates/Booms
RX No control
Roundabout
School Flags
School No flags
Stop sign
Stop-go lights
Unknown
Local Government Area


Distribution of Traffic Control Types by Urban/Rural Classification
Proportion of Accidents
1.0
0.8
0.6
0.4
0.2
0.0
LARGE_PROVINCIAL_CITIES
MELBOURNE_CBD
MELB_URBAN
RURAL_VICTORIA
SMALL_CITIES
SMALL_TOWNS
TOWNS
Urban/Rural Classification
Traffic Control Type
Flashing lights
Giveway sign
No control
Other
Out of order
Ped. crossing
Ped. lights
Police
RX Bells/Lights
RX Gates/Booms
RX No control
Roundabout
School Flags
School No flags
Stop sign
Stop-go lights
Unknown


Top 10 LGAs with Highest Proportion of No Control Accidents
Proportion of No Control Accidents
1.0
0.8
0.6
0.4
0.2
0.0
MOUNT BULLER ALPINE RESOR
(FRENCH ISLAND)
(MOUNT STIRLING)
(MOUNT HOTHAM)
(FALLS CREEK)
TOWONG
ALPINE
(LAKE MOUNTAIN)
WEST WIMMERA
MANSFIELD
Local Government Area


Relationship between Severity and Speed Zone
SPEED_ZONE
1000
800
600
400
200
0
Serious injury accident
Other injury accident
Fatal accident
Non injury accident
SEVERITY_DESC


Relationship between Vehicle Age and Accident Severity
VEHICLE_AGE
2000
1500
1000
500
0
−500
−1000
Serious injury accident
Other injury accident
Fatal accident
Non injury accident
SEVERITY_DESC

Risk

Lack of Data-Driven Infrastructure Policies

- **Risk:** Without smart sensors, traffic cameras, and IoT devices, there will be insufficient real-time data on vehicle movement, pedestrian activity, and road conditions. This data gap can lead to inaccurate risk predictions and suboptimal safety measures, resulting in higher accident rates and reduced effectiveness of AI-based safety systems.

Absence of Regulations on Vehicle Telemetry Sharing

- **Risk:** Without legislation requiring automakers to share anonymized vehicle telemetry data, AI models will lack critical information needed to enhance accuracy in risk predictions. This can lead to less effective safety alerts, potentially increasing the risk of accidents due to insufficient personalized driver information.

No Mandate for Real-Time Road Safety Alerts

- **Risk:** Without a framework for integrating real-time safety alerts into navigation systems and mobile apps, road users will miss timely warnings about hazards, dangerous intersections, or sudden weather changes. This lack of immediate information can increase the likelihood of accidents and unsafe driving conditions.

Failure to Integrate Crowdsourced Reporting

- **Risk:** Without incentivizing crowdsourced reporting of road hazards, accidents, or unsafe conditions, there will be a lack of real-time, on-the-ground information. This omission reduces the effectiveness of AI predictions and slows response times to emerging road safety issues, leaving gaps in immediate hazard management.

Inadequate Data Privacy and Security Measures

- **Risk:** Without stringent data privacy and security regulations, there is a high risk of misuse or unauthorized access to personal information of drivers and pedestrians. This can lead to a lack of trust in AI-powered safety solutions, potential legal issues, and lower adoption rates due to privacy concerns.

Absence of AI-Driven Traffic Management Policies

- **Risk**: Without policies supporting AI-based traffic management systems, traffic authorities will lack advanced tools for optimizing signal timings, road closures, and emergency responses. This can result in increased congestion, ineffective management of high-risk areas, and a higher number of traffic incidents.