KAPLAN BUSINESS SCHOOL AUSTRALIA

Traffic Accidents in South Australia

How can historical trends and seasonality be used effectively?

A Literature review

T1 2025 Capstone DATA6000

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1. Executive Summary

According to a report of Government agency, there are thousands of road crashes per year in Australia, leading to loss of lives, serious injuries and financial hardships. This report investigates traffic accident data in South Australia to identify key factors contributing to severe injuries and fatalities. Leveraging historical trends and seasonal patterns, I apply data analytics techniques to uncover actionable insights. The insights may help improve road safety policies and reduce the impact of accidents.

2. Industry Background

After analyzing related datasets and based on supporting research, South Australia's road safety faces several critical challenges:

Dangerous driving behaviors

A significant portion of serious crashes involves drivers exceeding speed limits or driving under the influence. Speeding, drug and alcohol use and distracted driving especially mobile phone use are leading causes of crashes. These behaviors not only increase the likelihood of collisions but also significantly raise the severity of injuries sustained.

Vulnerability of young drivers and mature road users

Young drivers (under 25) are overrepresented in crash statistics, it is often due to inexperience and risk-taking behavior. On the other end, mature road users, particularly those aged 50+ also at heightened risk. This group is more allowing to injury due to age-related factors such as slower reflexes and reduced physical resilience.

High rates of severe injuries and fatalities

South Australia has a consistently high road death rate per 100,000 people. While rural areas often see fatal crashes due to high speeds and being far from emergency help, many serious injuries and deaths also happen on busy city roads. These are often caused by traffic jams, too many vehicles, and poor driving choices during peak times. This shows there’s an urgent need for better road safety, improved road design, and driver awareness campaigns.

A. Traffic Accident

Traffic accidents are a significant concern, affecting public safety, economy and society. While advancements in vehicle safety, road design and enforcement have contributed to a decline in road deaths over the past decades, road accident remains a major challenge for society.

"Thousands of Australians are injured or lose their lives in transport-related accidents, 10% of all injury deaths"[1]

Figure 1 shows the total number of traffic accidents, injuries, and fatalities in South Australia over five-year period from 2019 to 2023. As shown, approximately 40% of people involved in accidents sustained injuries, and around 2% of those injured resulted in fatalities.

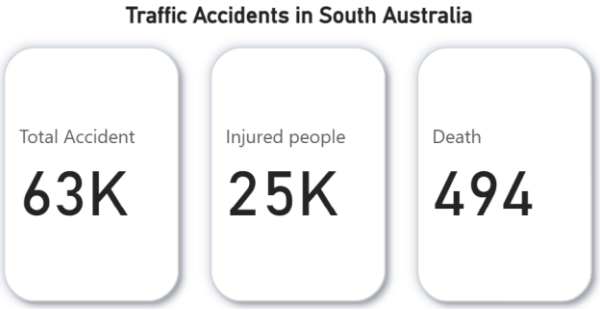

Figure 1: Total traffic accidents, injuries and fatalities in South Australia (2019–2023)

This graph (Figure 2) below shows total traffic accidents and injury counts monthly in 5 years (2019-2023). While accident totals remain relatively stable across years, injury counts fluctuate gradually. A notable drop during early 2020 (due to Covid-19 restrictions) is followed by a gradual rise, indicating persistent safety challenges.

[1] AIHW, 2024, Injury in Australia: Transport Accidents, https://www.aihw.gov.au/reports/injury/transport-accidents

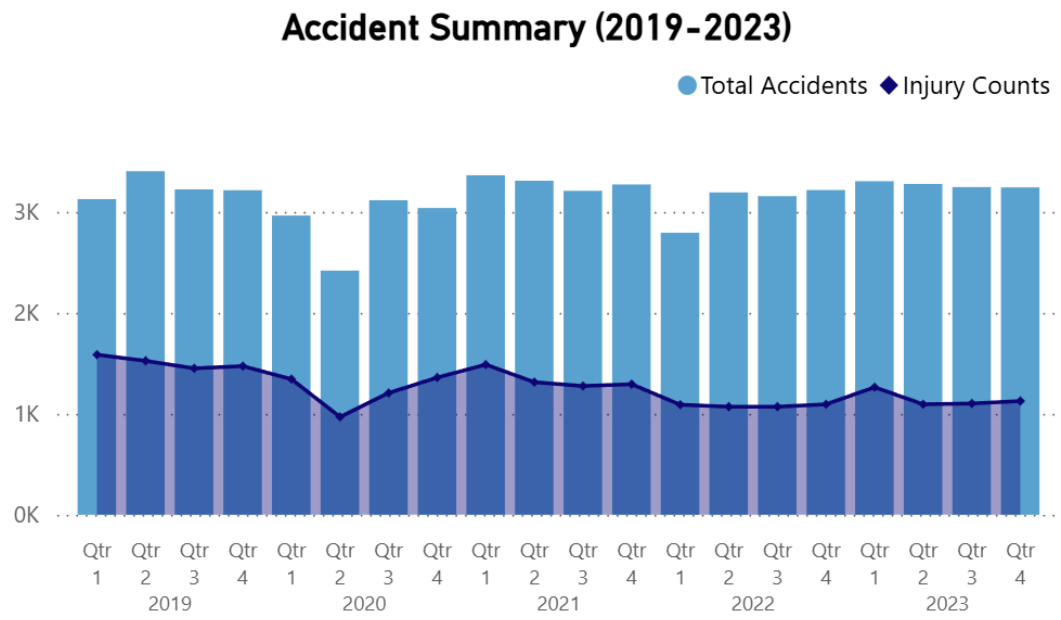

Figure 2: Monthly traffic accidents and total injuries in South Australia

The next graph (Figure 3) breaks down total injury counts into minor and severe injuries. Although minor injuries are more frequent, severe injuries are consistently present across the months, indicating a continued risk of serious trauma on South Australian roads.

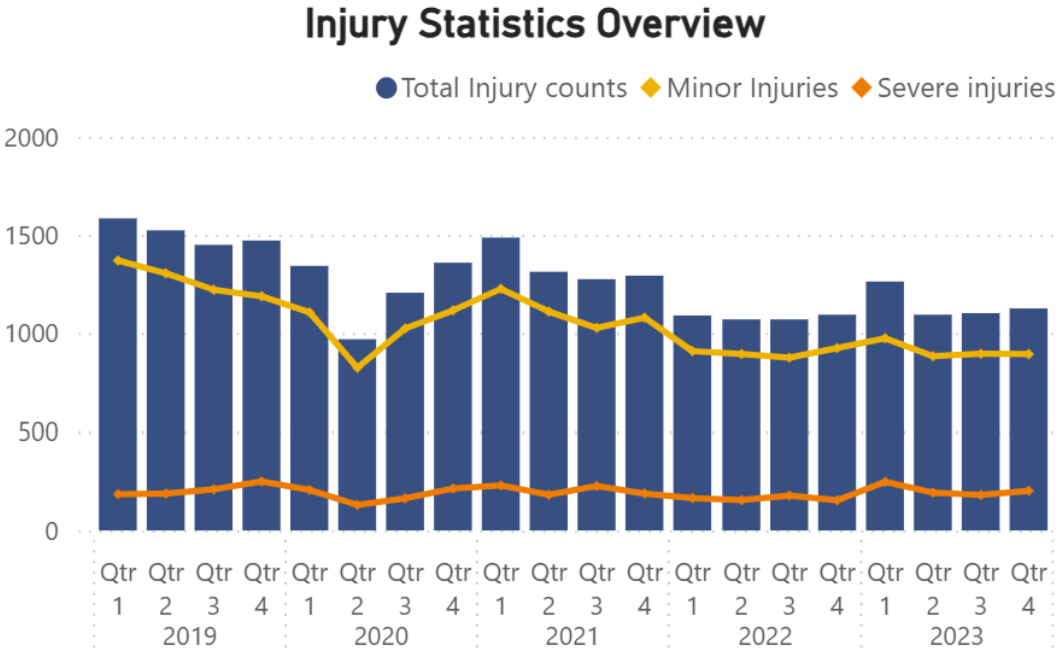

Figure 3: Monthly minor and severe injuries in South Australia

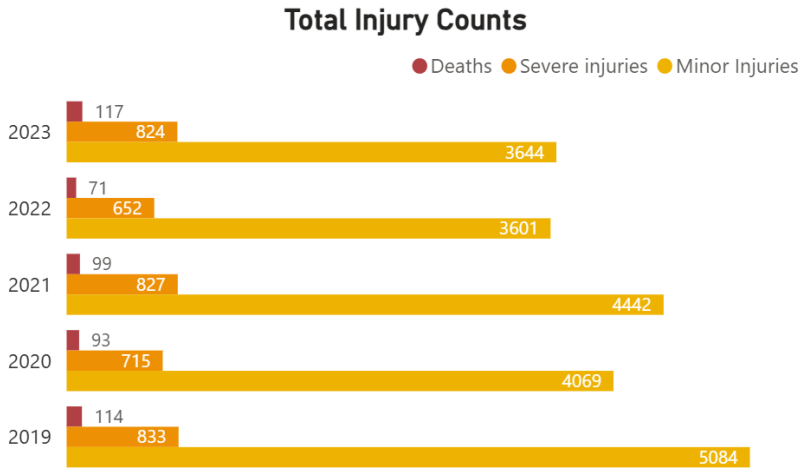

Figure 4: Annual fatalities, minor injuries, and severe injuries in South Australia

Causes of traffic accidents are varied, including speeding, driver fatigue and experience, impaired driving and distractions such as using mobile phone. Additionally, road and weather conditions and high-risk locations contribute to accident frequency and severity.

The line graph (Figure 5) shows traffic crashes in South Australia from 2019 to 2023 by region. Metropolitan areas had the most crashes, likely due to heavy traffic and congestion. Country areas had a moderate and steady number of crashes, while city areas had the fewest, possibly because of lower speed limits and better traffic control. Figure 6 illustrates percentage of total accidents that occurred during daytime and nighttime. Daytime accidents consistently account for the highest proportion, ranging between 75-77% over the five-year period. This may be related to higher traffic volumes during daytime hours.

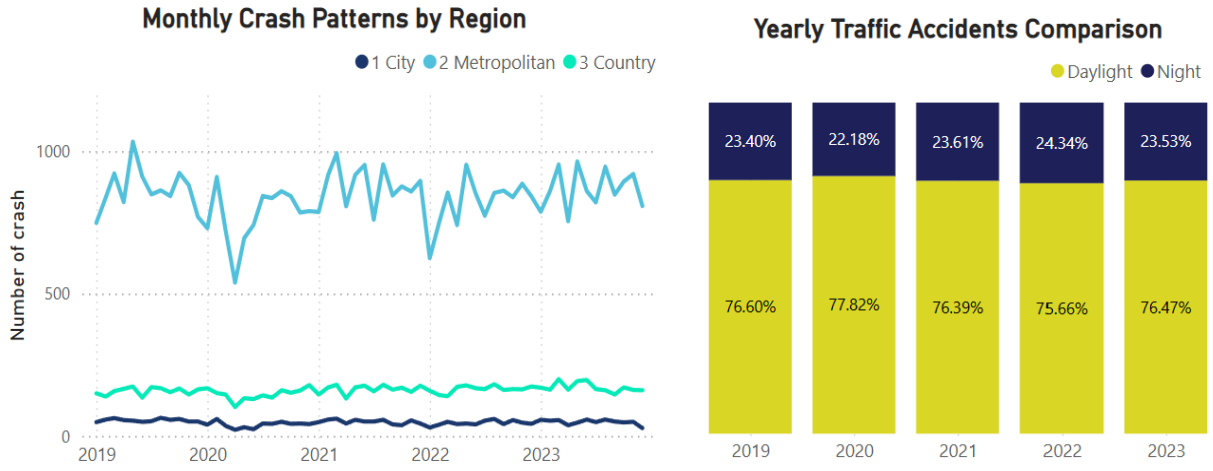

Figure 5: Monthly traffic accident pattern by region in South Australia (2019-2023)

Figure 6: Annual traffic accidents by Day time vs Night time in South Australia (2019-2023)

Figure 7 shows crash frequency by day of the week, with highest number of crashes occurring on Thursdays and Fridays. Figure 8 compares crash occurrences on weekdays vs weekends. Since most people drive more frequently during weekdays, crash occurrences are relatively higher on weekdays than on weekends.

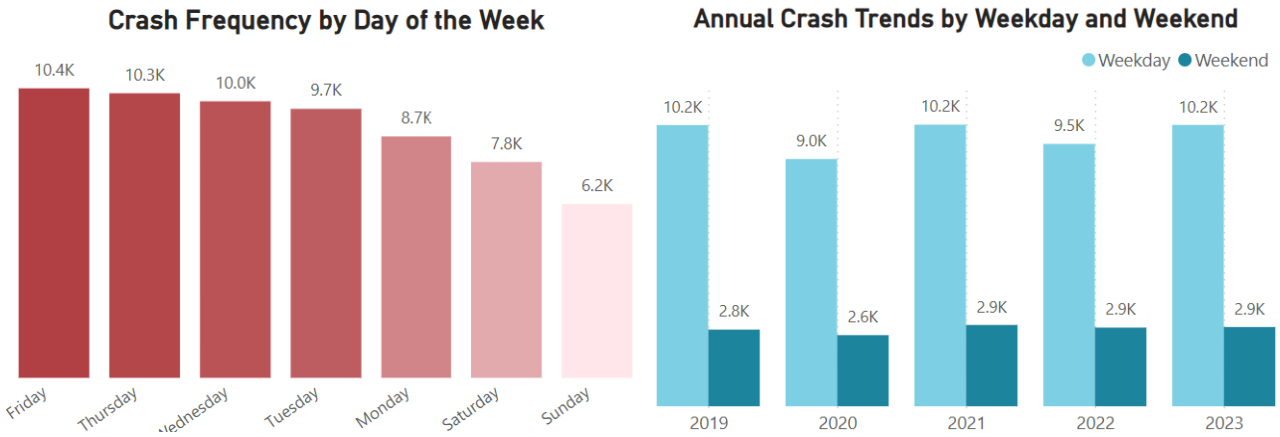

Figure 7: Total crash frequency by day of the week (2019-2023)

Figure 8: Total crash occurrence by weekday and weekend (2019-2023)

Figure 9 shows total number of crashes by road condition, with the highest number occurring on dry roads. Figure 10 illustrates crash occurrences by speed zone. Since most roads are in the 50–60 km/h range, crash numbers are relatively higher in these standard speed areas.

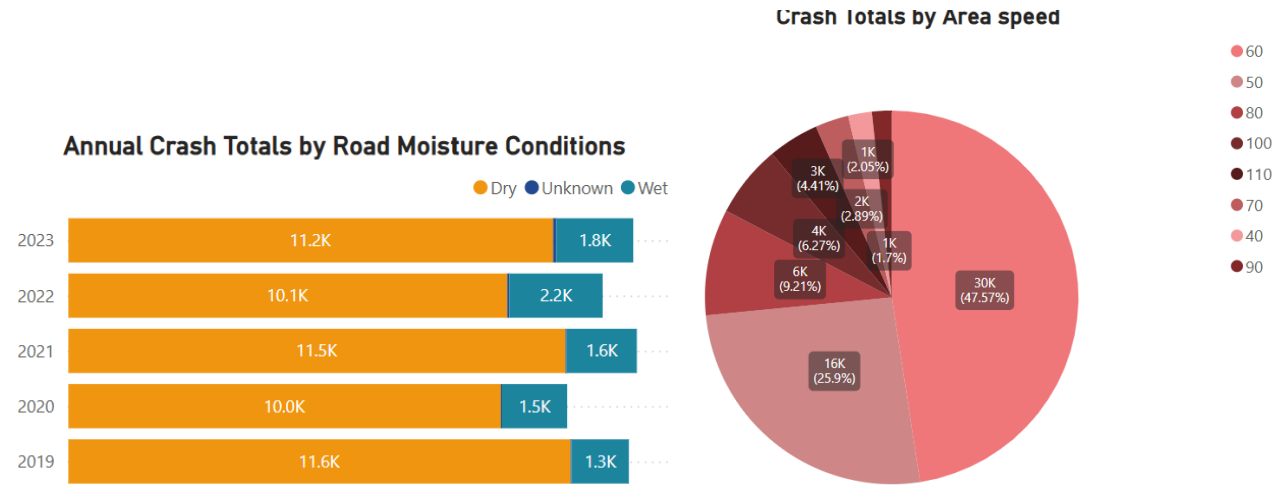

Figure 9: Annual crash totals by road condition (2019-2023) **Figure 10:** Crash totals by area speed (2019-2023)

From a financial perspective, road accidents put pressure on healthcare and emergency services and insurance companies. South Australian government aim to encourage drivers, cyclists and pedestrians to reflect on their behaviours and actions on the road.

Figure 11 shows the total number of crashes by time of day, with highest number occurring during daytime hours (9 am–4pm), likely due to higher traffic volumes during business hours.

Figure 12 presents the number of people involved in crashes by age group, with the "40 to 59" age group accounting for the highest number, followed closely by the 25 to 39 age group. Insurance companies may charge higher fees for these two age groups due to their higher involvement in traffic incidents.

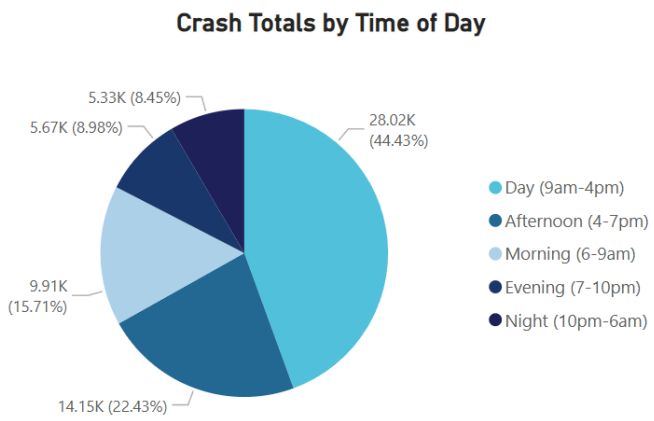

Figure 11: Crash totals by time of day (2019-2023)

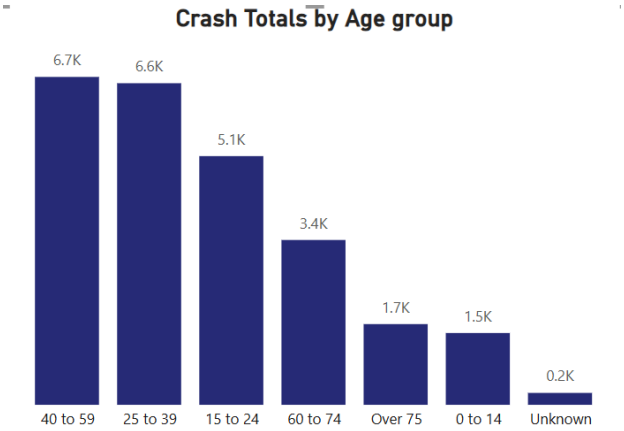

Figure 12: Crash totals by age group (2019-2023)

Figure 13 below presents the types of medical treatment received by injured individuals. Figure 14 shows the total number of crashes by driver's license type.

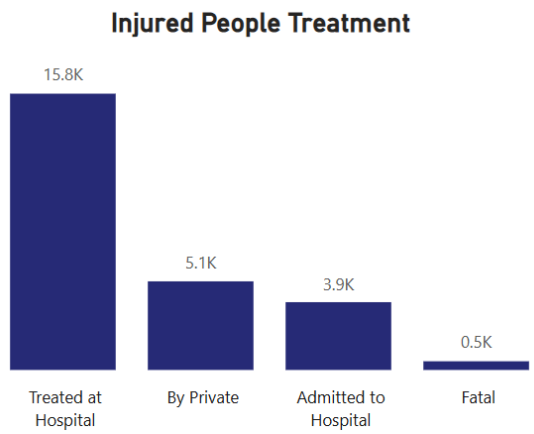

Figure 13: Total injured people treatment (2019-2023)

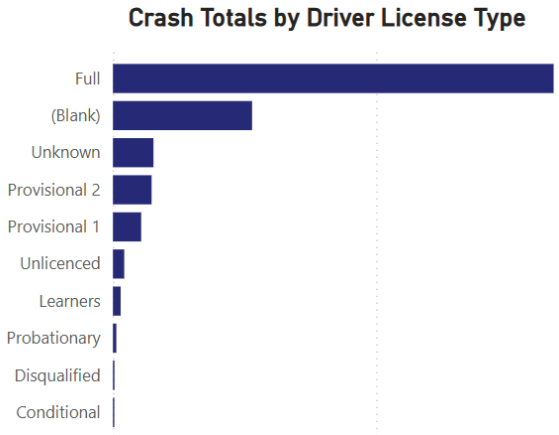

Figure 14: Crash totals by license type (2019-2023)

As shown in Figure 15, most accidents happened on roads with "No control," with over 42,000 incidents. This was followed by roads with "Traffic signals." More than 4,000 accidents occurred at roads with "Give Way" signs, followed by roundabouts and roads with stop signs, each with over 2,000 incidents.

Figure 16 shows the number of accidents by road type. Most accidents occurred on "Not Divided" roads, followed by T-junctions, crossroads, and divided roads. Accidents were less common on other types of roads.

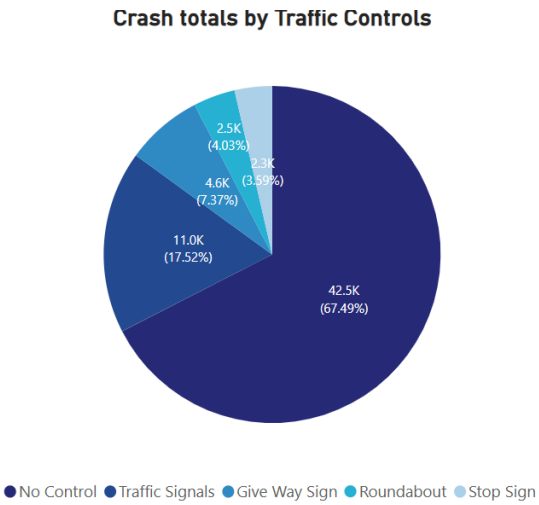

Figure 15: Crash totals by Traffic controls (2019-2023)

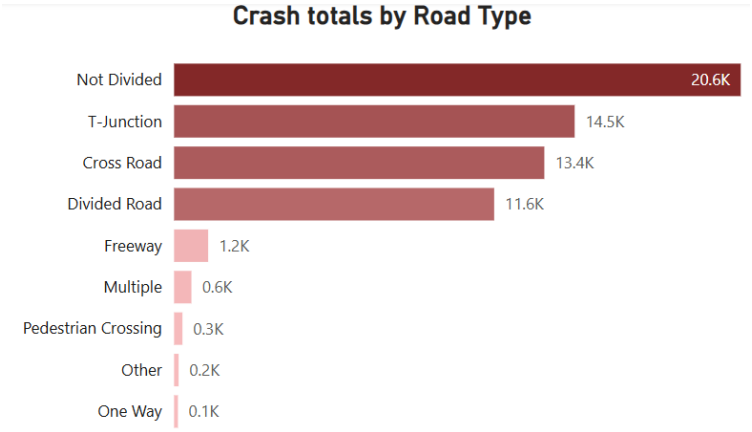

Figure 16: Crash totals by Road type (2019-2023)

A. Road Deaths

South Australian government is investing in a range of road safety initiatives, including increasing the number of traffic cameras, adjusting road rules, launching public awareness campaigns, improving infrastructure and raising fines all aimed at reducing accidents.

"Zero lives lost and zero serious injuries on our roads by 2050"[2]

Despite these efforts, road accidents continue to impact individuals, families and businesses. Data analysis can provide better insights on trends, high-risk areas and potential preventive measures. By leveraging data analytics, Government agencies can develop more effective strategies to improve road safety and reduce accident-related fatalities, severe injuries.

This line graph (Figure 17) below compares road deaths across Australian states. NSW and Queensland accounted consistently high numbers, with some fluctuations over the years. South Australia, shows moderate

[2] Think Road Safety, n/a, Action plan 2023-2025, https://www.thinkroadsafety.sa.gov.au/road_safety_strategy/road-safety-action-plan

but steady road fatalities. Notably, South Australia's trend did not significantly decline, highlighting persistent traffic safety issue in the state.

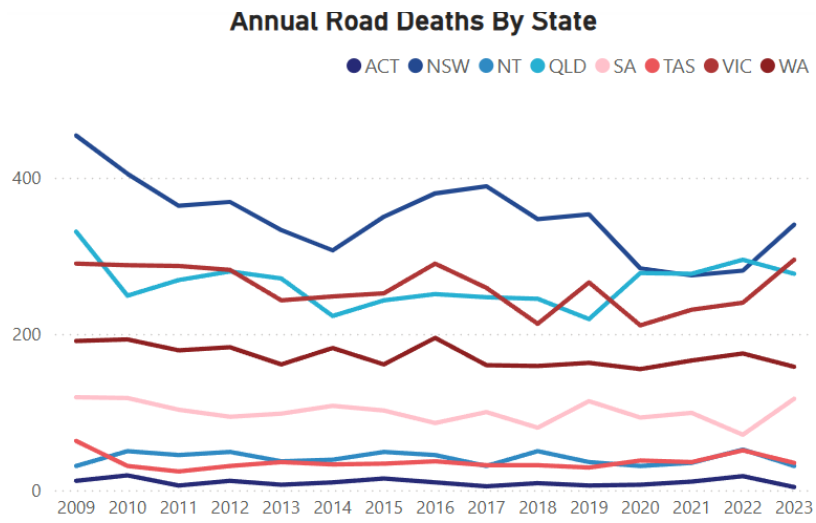

Figure 17: Annual Road death trend by State over last 15 years (2009-2023)

The bar chart (Figure 18) shows that male fatalities significantly outnumber female deaths each year. This suggests that males are more frequently involved in fatal accidents.

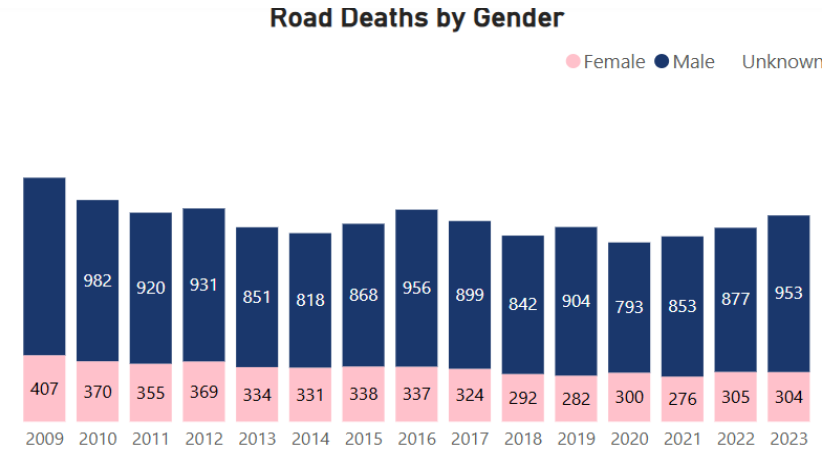

Figure 18: Road deaths by gender (2009-2023)

The pie chart (Figure 19) reveals that drivers accounted the highest proportion of road deaths with 47%, followed by passengers with 18.85% and motorcycle riders with 17.16%. Pedestrians and cyclists also make noticeable portions. This breakdown highlights vulnerability of all road users.

The donut chart (Figure 20) shows the total number of road deaths by age group. The 40–64 age group accounted for the highest proportion at 31%, followed by the 17–25 and 26–39 age groups, each with 20%.

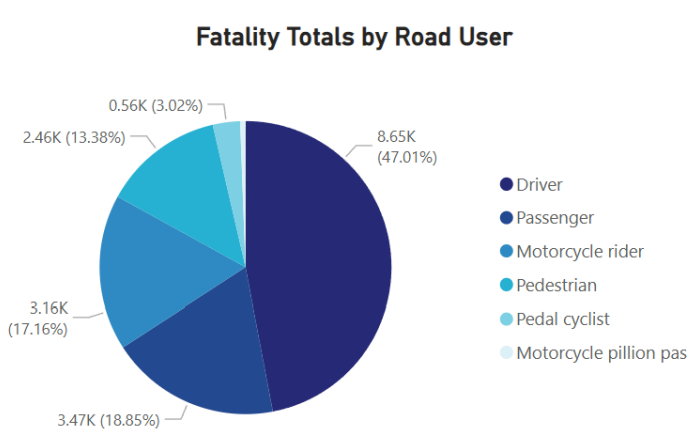

Figure 19: Road deaths by Road user (2009-2023)

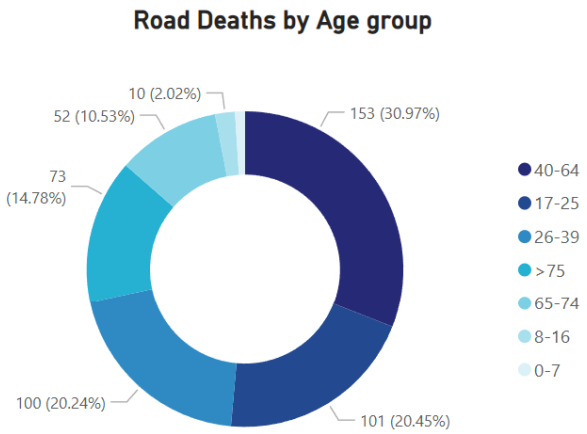

Figure 20: Road deaths by Age group (2009-2023)

3. Existing Analysis and Methodologies

A research article titled *"Comparing Fatal Crash Risk Factors by Age and Crash Type Using Machine Learning Techniques"* investigates factors contributing to road deaths, focusing on across different driver age groups and types of crashes. By applying advanced machine learning algorithms, the study aims to enhance the understanding of crash risk factors, thereby informing more effective traffic safety policies.

The team used supervised machine learning algorithms including XGBoost, CatBoost, LightGBM and Random Forest. The study employed a dataset from Jeddah city, encompassing various factors related to traffic incidents, including driver demographics, vehicle positioning and environment conditions.

The machine learning models demonstrated high accuracy in predicting fatal crash risk factors. In the algorithms tested, LightGBM achieved the highest accuracy at 94.9%, followed closely by XGBoost at 95.4% and CatBoost at 94%. These results underscore effectiveness of machine learning techniques in analyzing complex traffic data.

4. Data Sources

The proposed data sources include:

- https://data.sa.gov.au/data/dataset/road-crash-data
- https://www.bitre.gov.au/statistics/safety/fatal_road_crash_database
- https://www.officeofroadsafety.gov.au/data-hub?_gl=1*lbe452*_ga*MTM1MjI5MjcyOC4xNzQzMjQ4NTM2*_ga_XV4JMWELH5*MTc0NDYzMjQyOS4xLjEuMTc0NDYzMjUzMy4wLjAuMA..
- https://www.aihw.gov.au/reports/injury/transport-accidents

These data sources offer detailed information on traffic accidents in South Australia, including how often crashes happen, their causes, how serious they are, who is involved and the injuries caused. Using these official and trusted data helps make sure the analysis is accurate, supports reliable findings and helps identify important patterns and risk factors behind road accidents.

5. Selecting Business Problem

South Australia continues to have high number of crashes and road deaths. Most accidents happen on metropolitan roads, often due to traffic jams, exceeded cars and poor driver decisions during peak times. These ongoing issues show the need for better safety measures, improved road design and driver awareness campaigns. That's why I aim to find answers to the following questions:

- How do historical trends and seasonal patterns influence the occurrence and severity of traffic accidents in Australia, and what factors contributing to fatalities or severe injuries?
- How do traffic accidents impact insurance company's profitability?
- Which demographic groups (age, sex) are most at risk for transport-related injuries, and how has this changed over time?

Data sources: I will use the data sources as highlighted in the Data Source section above.

Reference

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