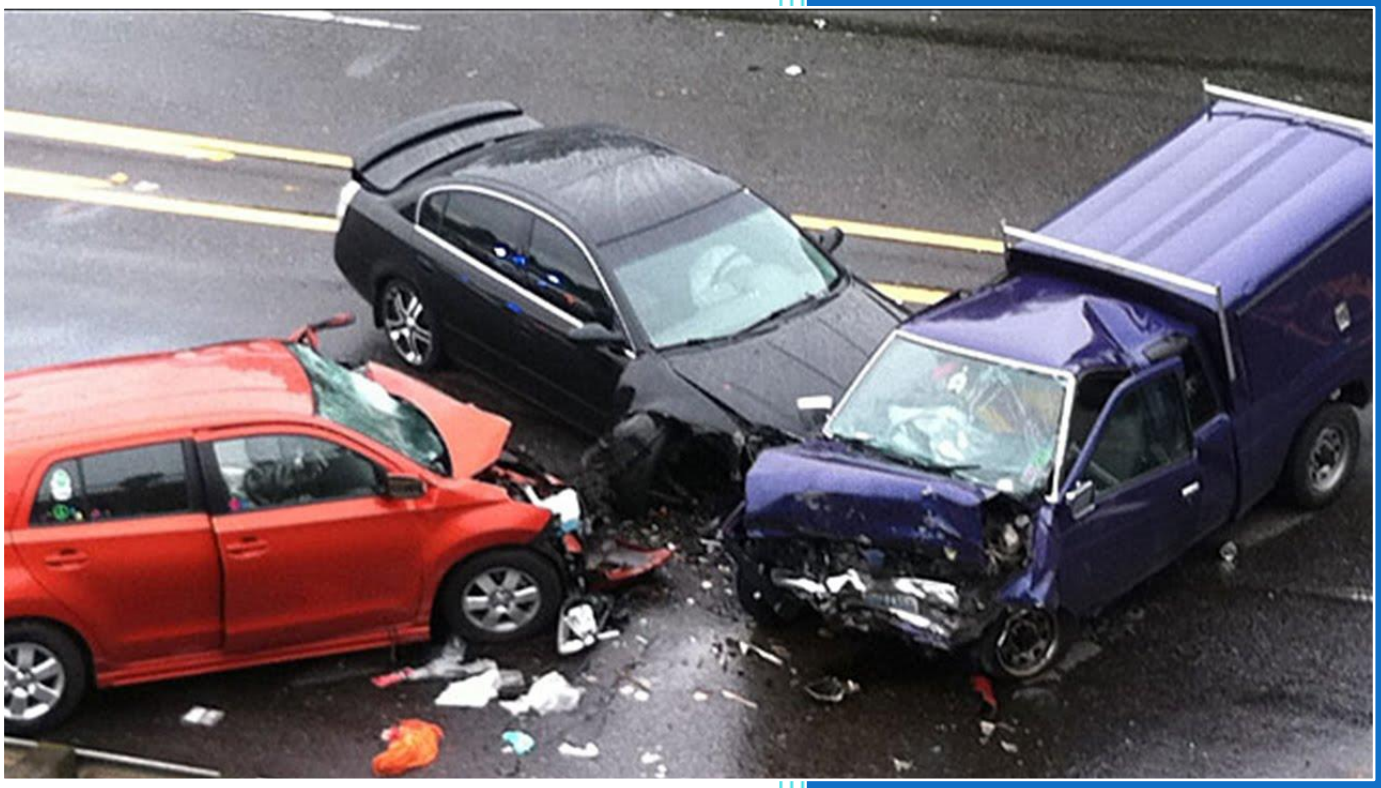
DATA ARCHIETECTURE REPORT ON ANALYTIC SOLUTION



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DATASET – GLOBAL ROAD ACCIDENTS

2/19/2025

OBJECTIVES

Dataset Description

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DATASET DESCRIPTION:

The Road Accident dataset used in this project was sourced from Kaggle.com, an open source data repository that houses millions of publicly available data. The records in this dataset shows road accidents occurrence across five continents over a period of twenty-four years and has a comprehensive coverage across multiple accident related factors.

PURPOSE/ GOALS

The Selected dataset aims to provide insights into accident trends, fatalities, and key contributing factors across different regions. With set goals which include;

- Identifying accident trends over time.
- Understanding regional and global distribution of fatalities.
- Analyzing accident severity and causes to prioritize safety interventions.
- Supporting data-driven decision-making for policy enforcement, emergency response improvements, and infrastructure development.

KEY QUESTIONS

1. What is the accident occurrence rate over time?
2. What are the trends in accident occurrences over the years?
3. Which regions have the highest number of fatalities?
4. What is the severity of injury in accidents?
5. Which countries have the highest accident- related fatalities?
6. What are the leading causes of fatalities in road accidents?

KPI's

1. Total Number of Fatalities: indicates the overall impact of accidents, in terms of lives lost. Emphasizing the urgent need for safety measures, enforcement, and emergency response improvements to reduce fatalities.

2. Total Number of Accidents: Highlights the frequency of road incidents, providing insights into accident patterns, risk factors, and the effectiveness of traffic regulations and safety initiatives.

3. Accident Trends: Reveals fluctuating accident rates over the years, highlighting periodic spikes and the need for consistent, long-term interventions to reduce road accidents.

4. Fatalities by Region: Shows a relatively even distribution of fatalities across continents, confirming that road safety is a global issue requiring international collaboration and region-specific policies.

5. Average Fatalities by Accident Cause: Behavioral factors such as speeding, distracted driving, and DUI among other factors contribute to over 60% of fatalities, stressing the importance of stricter regulations, driver education, and enforcement.

DATA MODEL

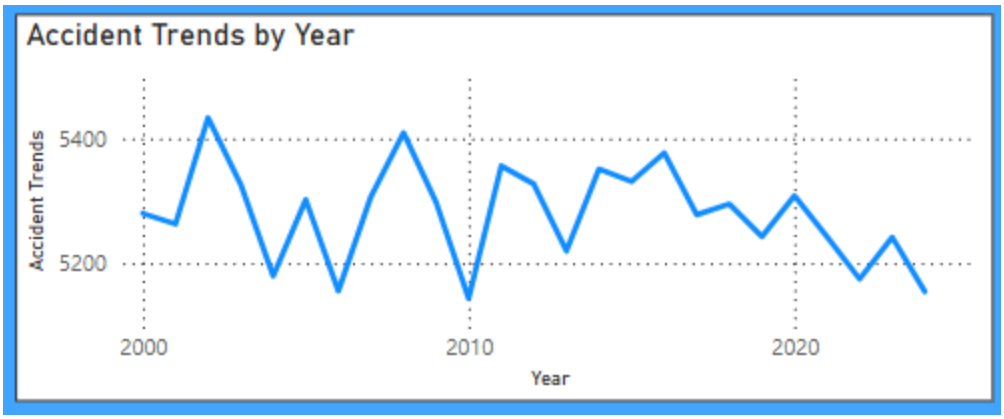
The dataset was originally in a flat table and data was extracted in its native from the flat table because it lacks the ability to represent complex relationships between entities and enforce constraints between data. Unlike relational databases, flat tables may not have the capability to enforce constraints such as primary or foreign keys which are essential for maintaining integrity. As is the case with the dataset used in this project.

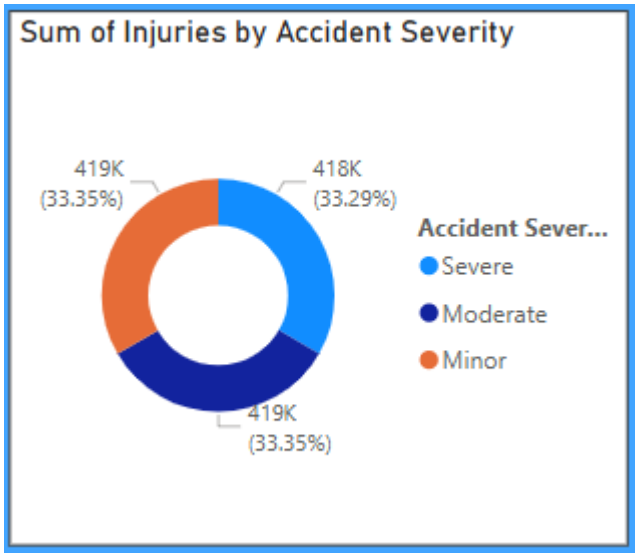
RESULTS

1. **Total Number of Fatalities Card**: Card visualization has been created to highlight the total number of fatalities which is updated based on a selected metric.

2. ACCIDENT TRENDS:

The line chart shows accident trends over the years. With only minor deviations, the total number of fatalities seemed consistent between the years 2020-2022. In the year 2023,it was slightly higher, showing a temporary increase in the number of fatal accidents. In 2024 there was a remarkable decrease indicating a sharp decline in fatalities in relation to the years.





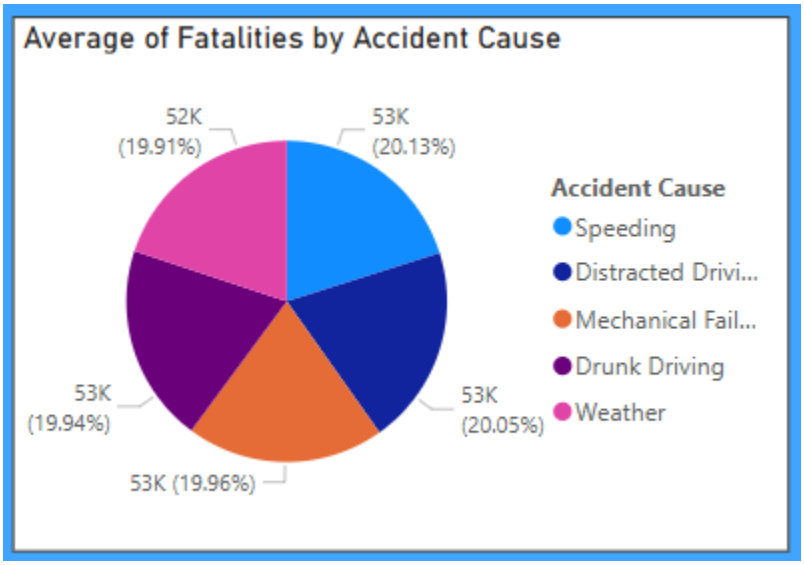
3. ACCIDENT SEVERITY: The donut chart illustrates the distribution of injuries based on accident severity. The three levels of severity identified in the dataset; Severe, Moderate and Minor are nearly equal, with each individually contributing about a third of the total injuries sustained.

4. NUMBER OF FATALITIES BY REGION

Region	Total Number of Fatalities by Region
South America	52289
Asia	52450
North America	52770
Europe	52844
Australia	53045
Total	**263398**

The table presents the total number of fatalities by region, summing to 263,398. Australia reports the highest fatalities, while South America records the lowest. The differences across regions are minimal, indicating a relatively uniform distribution of fatalities. This data suggests that accident-related fatalities are a global concern, requiring region-specific safety measures.

5. AVERAGE OF FATALITIES BY ACCIDENT CAUSE



The pie chart illustrates the average number of fatalities by various accident causes: Speeding, Distracted Driving, Mechanical Failure, Drunk Driving, and Weather. They

contribute nearly equally to the total fatalities, with percentages ranging between 19.91% and 20.13%, indicating no single significantly outstanding factor. The visual highlights the dynamic nature of accident causes, pointing to the need for comprehensive traffic safety measures addressing all these risk factors to mitigate fatalities effectively.

6. FATALITIES BY COUNTRY

The geographic visualization represents the number of fatalities by country using spatial distribution. Each blue marker signifies fatality concentration. The distribution spans all continents; most importantly highlighting the fact that traffic-related death is a global issue. This visual makes it easy to in identify regions of higher risks, stressing on the need for targeted interventions, policy improvements, and infrastructure enhancements to reduce fatalities worldwide.

RECOMMENDATIONS

1. Strengthen Law Enforcement & Traffic Regulations

- Increase penalties for high-risk behaviors (speeding, distracted driving, DUI).
- Deploy AI-powered traffic monitoring for automated violation detection.
- Implement a license point reduction program for recurring offenders.

2. Improve Vehicle Safety & Maintenance Standards

- Mandate Advanced Driver-Assist Systems (ADAS) (e.g., automatic braking, lane departure warning).
- Require compulsory vehicle inspections to prevent mechanical failures.
- Offer incentives to manufacturers for integrating smart safety technologies.

3. Enhance Public Awareness & Driver Education

- Launch nationwide campaigns on the dangers of distracted driving and DUI.
- Introduce mandatory defensive driving courses for new drivers.
- Collaborate with rideshare companies and fleet services for continuous driver training.

4. Optimize Emergency Response & Medical Infrastructure

- Use AI-based accident prediction models to reduce emergency response times.
- Equip ambulances with real-time traffic data for quicker navigation.
- Enhance trauma care facilities in high-risk accident zones.

5. Implement Data-Driven Policy Making

- Use predictive analytics to identify accident-prone areas.
- Conduct road safety audits and re-engineer hazardous roads.
- Develop region-specific strategies tailored to local challenges.

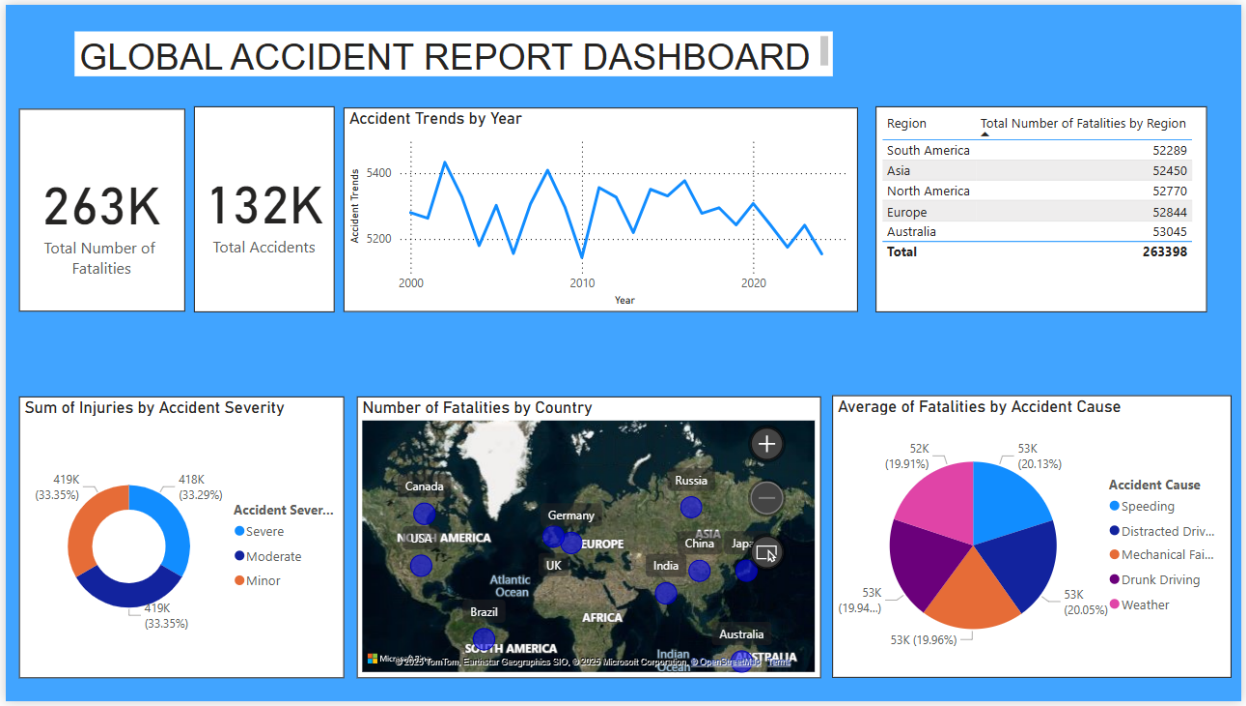
CONCLUSION

The dashboard highlights the urgent need for strategic interventions in traffic safety, driver behavior, and vehicle standards. Key insights reveal that most fatalities result from preventable causes, with behavioral factors playing a dominant role.

By leveraging data-driven enforcement, advanced vehicle safety measures, improved emergency response, and targeted awareness programs, global accident rates can be significantly reduced. This will lead to safer roads, lower fatality rates, reduced economic losses, and enhanced public well-being.

APPENDIX

Here is an overview of the Power dashboard.



THANK YOU