Chapter 1

Introduction

Road accidents remain a major public safety concern in the United Kingdom, with thousands of incidents occurring annually due to a variety of environmental, human, and vehicular factors. Analyzing these incidents can help identify critical patterns and risk factors that contribute to accidents, thereby informing strategies to reduce their occurrence and severity.

This project focuses on the development of an interactive dashboard using Power BI to analyze road accident data in the UK. The dashboard is designed to visually represent accident trends, geographic hotspots, and contributing factors such as vehicle type, weather, road conditions, and light conditions. By transforming raw data into meaningful visuals, the dashboard supports better decision-making for policymakers, researchers, and road safety authorities.

Power BI's intuitive, no-code interface allows for drag-and-drop functionality to build dynamic visuals, ensuring ease of use without requiring advanced programming or DAX formulas. The result is a powerful analytical tool that brings clarity and accessibility to complex road safety data.

1.2 Objectives:

The primary aim of this project is to design a user-friendly and informative dashboard that provides actionable insights into road accident patterns in the UK. The specific objectives are:

- To visualize the severity and frequency of road accidents over time.
- To identify geographic hotspots of road accidents using map visuals.
- To examine the impact of environmental factors (weather, road surface, light conditions) on accident severity.
- To analyze accident trends by vehicle type, road type, and year.
- To enable interactive filtering for deeper exploration of the data based on selected criteria.
- To build the entire dashboard using Power BI's drag-and-drop features without relying on DAX formulas.

Chapter 2

Data Overview

The data used in this project is sourced from a publicly available dataset on **Kaggle**, which compiles official UK road accident records. It contains detailed information about reported traffic incidents, providing a rich foundation for analysis and visualization. It encompasses a wide range of attributes that contribute to understanding the nature and circumstances of each accident.

The dataset includes the following key columns:

- **Accident Severity**: Indicates the seriousness of the accident, categorized as *Slight*, *Serious*, or *Fatal*.
- **Number of Victims**: Represents the total number of people injured or killed in each incident.
- **Number of Vehicles Involved**: Counts how many vehicles were part of each accident.
- **Weather Conditions**: Describes weather during the time of the accident (e.g., *Fine*, *Raining*, *Snowing*).
- **Light Conditions**: Captures lighting at the time (e.g., *Daylight*, *Darkness with street lights*, *Darkness without street lights*).
- **Road Surface Conditions**: Records road surface status (e.g., *Dry*, *Wet*, *Icy*).
- **Geographic Information**: Includes *Latitude*, *Longitude*, and *District* to identify the exact location of each accident.
- **Vehicle Type**: Identifies the type of vehicle involved (e.g., *Car*, *Motorcycle*, *Van*).
- **Year**: Indicates the calendar year in which the accident occurred.

To prepare the data for visualization, minimal preprocessing was required. Fields such as latitude and longitude were used directly in the Power BI map visual to plot accident locations accurately. Categorical fields were leveraged to create slicers and filters, enhancing interactivity and allowing for multidimensional analysis.

Chapter 3

Dashboard Design

The dashboard was designed in Power BI with a focus on clarity, interactivity, and ease of use. Its layout is organized into clearly defined sections that allow users to explore different aspects of the road accident data. Each visual component was created using Power BI's drag-and-drop interface, without the use of DAX formulas, making the development process more accessible and efficient.

Layout Structure:

The dashboard is divided into thematic sections that align with the key analytical objectives:

1. Key Metrics (KPIs)

At the top of the dashboard, three primary indicators are displayed:

- Total Accidents
- Total Victims
- Total Vehicles Involved
  These KPIs provide an at-a-glance summary of the overall impact of road accidents.

2. Accidents by District Area (Map Visual)

An interactive map uses latitude and longitude data to display the geographical distribution of accidents. District areas are color-coded based on the number of incidents, allowing users to quickly identify accident hotspots across the UK. The map was constrained to the UK region to ensure focus and usability.

3. Accidents by Road Type & Surface (Bar Chart)

This bar chart presents the number of accidents categorized by road type (e.g., single carriageway, dual carriageway) and segmented by road surface conditions (e.g., dry, wet, icy). This visual helps analyze how road type and surface interact to affect accident rates.

4. Accident Severity Breakdown (Bar Chart)

Accidents are grouped by severity levels: *Slight*, *Serious*, and *Fatal*. This bar chart helps users understand the proportion of accidents by severity and compare the frequency of each category.

5. Top 3 Vehicles by Accident Count (Bar Chart)

This chart highlights the three vehicle types most frequently involved in accidents: *Cars*, *Motorcycles*, and *Vans*. The comparison emphasizes how vehicle usage correlates with accident involvement.

6. Accidents by Light Condition (Line Chart)

This line chart tracks the number of accidents under various lighting conditions, such as daylight and different types of darkness. It reveals trends in visibility-related risks.

7. Total Accidents per Year (Line Chart)

A time-series line chart displays how accident numbers have changed over the years, offering insights into long-term trends or the effectiveness of road safety initiatives.

8. Accidents by Weather Condition (Line Chart)

Weather-related trends are explored in this chart, which shows how accident counts vary across different weather scenarios like *fine*, *raining*, and *snowing* conditions.

Interactivity

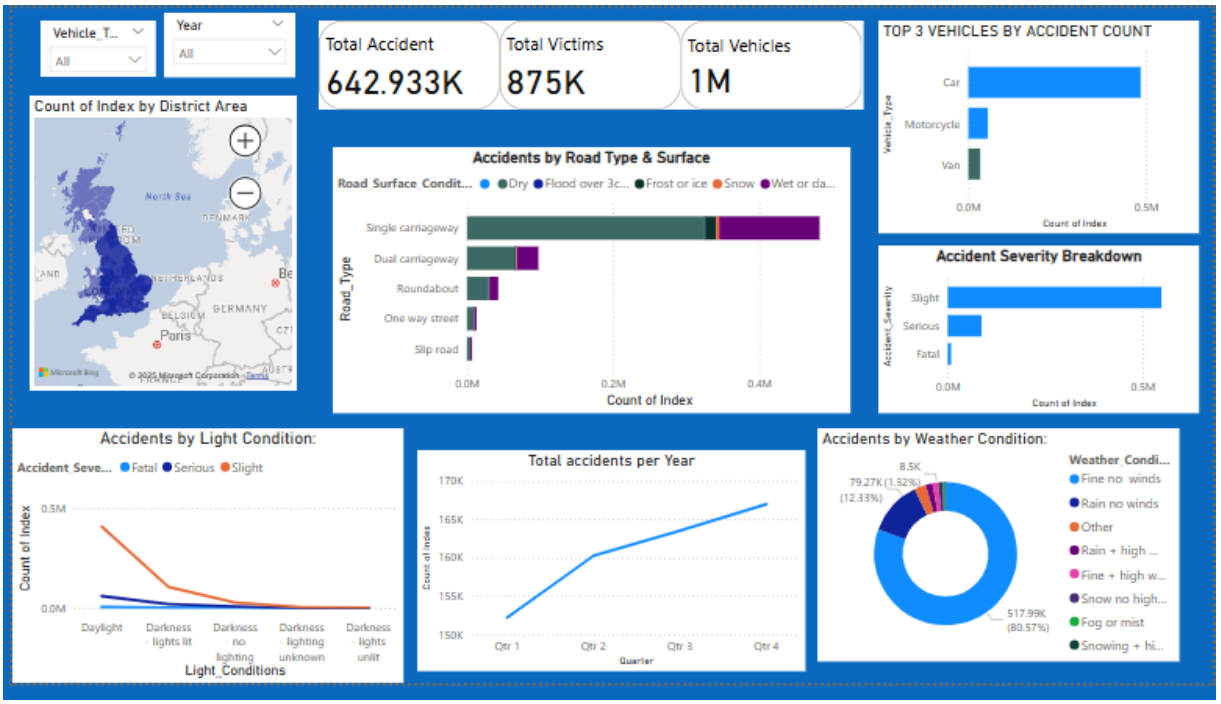
To enhance user control and allow for targeted analysis, the dashboard includes the following slicers:

- Vehicle Type
- Year
- Road Surface Condition

These filters enable users to interactively explore subsets of the data based on specific criteria.

Chapter 4

Analysis



The Power BI dashboard provides a comprehensive visual analysis of road accident data across the UK. By interacting with the visuals and applying filters, users can uncover meaningful patterns and relationships among variables such as accident severity, vehicle types, road and weather conditions, and geographic distribution.

Key Insights Derived from the Dashboard

1. **Single Carriageway Roads Have the Most Accidents**
   The bar chart depicting road type and surface condition shows that **single carriageway roads** account for the majority of accidents, significantly more than dual carriageways, roundabouts, or other types. This suggests a need for targeted safety interventions on these road types.

2. **Urban Districts Are High-Risk Zones**
   The interactive map visual reveals that **urban areas** experience a denser concentration of accidents. This aligns with higher traffic volumes and complex driving environments typically found in cities.

3. **Dry Road Conditions Dominate Accident Scenarios**
   Contrary to common assumptions, the data shows that most accidents occur on **dry roads**, which may be due to higher road usage under such conditions, or overconfidence in safe driving when the roads appear less hazardous.

4. **Cars Are the Leading Vehicle Type Involved in Accidents**
   The vehicle breakdown clearly identifies **cars** as the most frequently involved vehicle type, followed by **motorcycles** and **vans**, which reflects the prevalence of cars on the road.

5. **Slight Accidents Are Most Common**
   According to the severity breakdown, **slight accidents** represent the largest category. While this indicates a majority of non-critical incidents, serious and fatal accidents still pose significant risks and must be minimized.

6. **Light Conditions Influence Severity**
   While more accidents occur in **daylight**, the severity increases in **darker conditions**, especially where there is limited or no street lighting. This insight underlines the importance of adequate lighting infrastructure for night-time road safety.

7. **Fine Weather Correlates with More Accidents**
   Surprisingly, the majority of accidents occur in **fine weather with no winds**. This may be explained by increased vehicle movement during good weather. In contrast, accidents that occur in **rain or snow** tend to be more severe.

8. **Downward Trend in Accident Frequency Over Time**
   The line chart tracking yearly data suggests that road accidents have been **declining year by year**, indicating possible improvements in safety regulations, driver behavior, or a decrease in road traffic volume.

9. **Roundabouts Show Lower Accident Rates**
   Compared to other road types, **roundabouts** appear to have fewer accidents, potentially due to their inherently lower speed limits and traffic-calming effects.

10. **Severity Correlates with More Victims and Vehicles**
    As the severity of an accident increases, so does the **number of victims and vehicles involved**, as shown by the KPIs. This emphasizes the importance of mitigating factors that lead to high-severity accidents.

Chapter 5

Conclusion

The Road Accident Analysis Dashboard offers a powerful and user-friendly platform for understanding the patterns and contributing factors behind traffic accidents in the UK. Through interactive visuals and key metrics, the dashboard highlights critical areas of concern such as accident-prone locations, vehicle types most involved in incidents, and the influence of weather, lighting, and road surface conditions on accident severity. The data-driven approach enables users to explore accident trends across multiple dimensions without the need for complex calculations, making it accessible to a wide range of stakeholders.

The insights gained from this analysis are valuable for informing road safety initiatives, policymaking, and public awareness campaigns. Notably, the findings emphasize the need for targeted safety improvements on single carriageway roads, enhanced lighting in dark areas, and continued focus on high-risk zones in urban districts. As accident rates show a declining trend over recent years, this dashboard serves as an important tool to support further progress in reducing road accidents and improving overall traffic safety in the UK.