Road Safety Analysis Dashboard – Power BI

Summary Report

Project Objective:

The goal of this project is to explore and analyze real-world road accident data using Power BI. By cleaning and transforming the dataset, I aimed to uncover meaningful insights about accident trends, severity levels, and contributing factors like weather and road conditions. The dashboard I created helps users easily understand when, where, and why accidents happen, using interactive visuals and KPIs. Overall, this project shows how data analysis and visualization can support safer road planning and smarter decision-making.

1. Data Preparation:

The first step in this project involved importing and preparing the given dataset for analysis in Power BI.

1.1. Importing the data set

- I received the dataset as an Excel file attached via email.
- I opened Power BI and selected **"Excel Workbook"** under the *Get Data* option.
- I then browse to my laptop and imported the dataset xlsx file into Power BI to begin the analysis.

1.2. Data cleaning in power query (Transforming data)

- I entered the **Transform Data** window to launch the Power Query Editor.
- **Empty Rows:** Removed any completely empty rows across all columns.

Accident Severity Column:

- Fixed a spelling mistake where **"FETAL"** was incorrectly spelled and replaced it with **"FATAL"**.

Accident Date:

- Created a new column called **"Accident Date Fixed"** to resolve formatting issues in the original date column.

Junction Control Column:

- Cleaned up spelling inconsistencies. (For example, Auto traffic signal was misspelt as auto traffic sigl,)
- Improve the formatting of the text by using uppercase.
- For any missing values, I added a default entry as **"Missing"** to avoid nulls in visualizations.
- I then clicked to close and apply button to save all my transformed data and loaded it

Junction Detail Column:

- Created a new cleaned-up version of this column to improve clarity and consistency of naming.
- To avoid manually transforming data in power query I have successfully created a cleaned version of junction detail column in main data table by using DAX formula

```
Clean_Junction_Detail =
SWITCH(TRUE(),
   Data[Junction_Detail] = "Mini-roundabout", "Mini-Roundabout",
    Data[Junction_Detail] = "More than 4 arms (not roundabout)", "Complex Junction (Not Roundabout)",
     Data[Junction_Detail] = "Not at junction or within 20 metres", "Not at Junction",
   Data[Junction_Detail] = "Private drive or entrance", "Private Drive",
   Data[Junction_Detail] = "Tor staggered junction", "T or Staggered Junction",
   Data[Junction_Detail] = "Other junction", "Other Junction",
   Data[Junction_Detail] = "Slip road", "Slip Road",
   Data[Junction_Detail]  -- keep original if no match
)
```

Carriage Hazard Column:

- Marked missing values where necessary to ensure completeness and also performed cleaning for whether-condition column.
- After completing all these cleaning steps, I clicked **Close & Apply** to load the cleaned data into Power BI for further processing.

2. Data Transformation & Modeling

Once the data was clean, I began transforming and modeling it to enable time-based analysis and accurate relationships.

2.1. Creating a calendar table

- I enabled **"Auto Date/Time for New Files"** from the *Data Load* settings.
- Then I went to the **Modeling** section and created a new table using the following DAX function:

```
Calendar = CALENDAR(MIN(Data[Accident_Date]), MAX(Data[Accident_Date]))
```

- This created a Calendar table that sorted dates from **1st January 2021** to **31st December 2022**.

2.2. adding time columns

- Added a **Year** column using:

```
Year = YEAR(Calendar [Date])
```

- Added a **Month** column using:

```
MonthName = FORMAT(Calendar [Date], "MMM")
```

- Ensured correct month sorting using Sort by Column → MonthNum.

```
MonthNum = MONTH(Calendar[Date])
MonthName = FORMAT(Calendar[Date], "MMM")
```

2.3. Creating Relationships

- Created a **Many-to-One relationship** from Data[Accident_Date] to Calendar[Date] to allow accurate date filtering across visuals.
- I have done many to one cordiality just to ensure that every row of date column in calendar table consist of distinct unique values.
- By using a Calendar table, it ensures time-intelligent features (like monthly, quarterly comparisons).

2.4. Creating Weekday Table

- I created a new table named DayTable using DATATABLE() in DAX to ensure weekdays (Monday–Sunday) display in proper order.
- Established a **Many-to-One relationship** between Data[Day_of_Week] and DayTable[Weekday] for consistent and sorted day-based analysis.

```
DayTable = DATATABLE(
    "Weekday", STRING,
    "SortOrder", INTEGER,
    {
        {"Monday", 1},
        {"Tuesday", 2},
        {"Wednesday", 3},
        {"Thursday", 4},
        {"Friday", 5},
        {"Saturday", 6},
        {"Sunday", 7}
    }
)
```

2. Exploratory Data Analysis (EDA)

The EDA phase helped me better understand the structure of the dataset and uncover key trends, patterns, and relationships among the variables.

2.1 Understanding Variable Distribution

- **Accident Severity:** I reviewed the distribution of severity levels—**Fatal, Serious, and Slight**—and found that *Slight accidents* were the most common, with *Fatal ones being rare but critical*.

- **Accident Dates:** The dataset spans across two years — **2021 and 2022**. I confirmed the consistency of date formats by creating a Fixed Accident Date column.
- **Day of the Week:** Accidents were spread across all days, with **Fridays and Saturdays** showing slightly higher frequencies.
- **Weather Conditions:** Most accidents occurred during **fine weather**, but patterns showed increased severity during poor weather (e.g., fog, rain, snow).
- **Road Surface Condition:** Conditions like *wet or damp* surfaces contributed noticeably to more serious accidents.
- **Junction Control & Detail:** Many accidents occurred at **"Give Way / Uncontrolled"** junctions, suggesting a possible risk factor.

2.2 Pattern & Trend Identification

During EDA, I identified several important trends:

- **Time-Based Trends:** Accidents peaked in mid-year months like **July and August**, while **winter months showed slight dips**.
- **Weekly Trends:** A clear weekly pattern emerged, with higher accidents toward the **weekend**.
- **Weather & Road Conditions:** Poor weather and slippery road surfaces were linked to more **serious or fatal**accidents.
- **Junction Type:** Certain junction types were more prone to accidents—especially **roundabouts, T-junctions, and uncontrolled crossings**.

2.3 KPI Selection Based on Analysis

Based on the above findings, I selected the following Key Performance Indicators (KPIs) for dashboard visualization:

KPI No.	KPI Title	Insight Focus
KPI 1	**Accident Severity Distribution**	Overview of fatal, serious, and slight accidents
KPI 2	**Number of Accidents Over Time**	Trends over months and comparison by year
KPI 3	**Accidents by Day of the Week**	Weekly accident patterns

KPI No.	KPI Title	Insight Focus
KPI 4	**Top Junction Controls**	Which junction types contribute most to accidents
KPI 5	**Weather Conditions vs. Severity**	Impact of different weather on accident severity
KPI 6	**Road Surface Conditions vs. Severity**	Severity breakdown across various surface types

This EDA phase was essential in guiding the visualizations and layout choices in the dashboard, ensuring it highlights the **most meaningful and actionable insights** from the data.

3. Dashboard Design

The goal of the dashboard was to present meaningful insights from the road safety data in a way that is visually engaging, interactive, and easy to navigate. I designed the dashboard in Power BI using multiple pages and a variety of charts, maps, and filters to support deep and flexible analysis.

3.1 Visual Elements Included

To ensure a comprehensive and engaging user experience, I incorporated the following visual elements:

Visual Type	Purpose
Bar Charts	To show accident severity, junction types, and road conditions
Line Charts	To display monthly and yearly trends in accidents
Stacked Column Charts	To compare accident severity across weather and road types
Pie Chart	For quick summary of accident severity distribution
Map Visualization	To locate accident hotspots by region/district
Cards	To highlight key figures (e.g., total accidents, fatal % etc.)
Slicers	For filtering data by Year, Junction Control, Weather etc.

3.2 Dashboard Layout and Pages

The dashboard is structured across two key pages for clarity and ease of use:

Page 1: Overview & Key KPIs

- Displays **six core KPIs**.
- Each KPI section includes titles, interactive visuals, and tooltips with extra context.
- Users can filter data using **slicers for Year, Junction Control, and Weather Condition**.

Page 2: Advanced Insights & Maps

- Includes **a filled map** to show regional accident distribution.
- Slicers for road type, lightning condition and vehicle type.
- It consist of pie chart which shows accidents by lightning condition
- A **bar chart** breaks down accident severity by road type

3.3 Interactivity Features

- **Slicers** allow users to interact with the dashboard by selecting specific years, weather types, or junction controls.
- **Drill-down** capabilities are enabled on certain visuals (e.g., Day of Week → Severity) for deeper exploration.
- **Tooltips** display percentage of total accidents and key attributes when hovering over any chart element.
- Visuals are cross-filtered so clicking on one element updates related charts in real time.

3.4 Design Choices

- **Consistent color coding** (pink and blue) across all severity visuals.
- Clear **titles, legends, and labels** on all visuals to make interpretation easy.
- Optimized layout with aligned charts and balanced spacing to ensure the dashboard is **clean and not cluttered**.
- Used **grouping and section titles** to visually separate KPI categories and guide the user's navigation.

4. **Key performance indicators:**

This phase presents six key performance indicators (KPIs), each supported by visuals, slicers, and tooltips for detailed exploration.

KPI 1: Distribution of Accidents by Severity

- **Visuals Used:**
  - **Pie Chart** showing percentage split across *Fatal*, *Serious*, and *Slight* categories.
  - **Cards** showing the actual number of accidents for each severity type.
  - **Clustered Column Chart** comparing accident severity across **2021 and 2022**.
- **Slicers:** Year and Junction Control, Road surface, Whether condition is
- **Insight:** Slight accidents are most common; fatal accidents are minimal and relatively constant.

KPI 2: Accidents Over Time

- **Visual:**
  - **Line Chart**
    - X-Axis: MonthName from Calendar table
    - Y-Axis: Count of Accident_Index
    - Legend: Year (2021 and 2022)
- **Insight:** Mid-year months (June- Sept) show higher accident counts; December sees a slight dip.

KPI 3: Accidents by Day of the Week

- **Visual:** Column Chart
  - X-Axis: Weekdays (sorted from Monday to Sunday using a separate weekday table)
  - Y-Axis: Count of accidents
- **Insight:** Fridays and Saturdays show the highest number of accidents.

KPI 4: Top Junction Controls Causing Accidents

- **Visual:** Ribbon Chart
  - X-Axis: Count of accidents
  - Y-Axis: Clean_Junction_Control
- **Tooltip:** % of total accidents using a DAX measure.
- **Insight:** "Give Way/Uncontrolled" and "Traffic Signals" contribute most to accidents.

KPI 5: Weather Condition vs. Accident Severity

- **Visual:** Stacked Column Chart
  - X-Axis: Clean_Weather_Condition
  - Legend: Accident_Severity
  - Y-Axis: Count of accidents
- **Insight:** Most accidents happen in fine weather, but severe accidents rise in snow, rain, and fog.

KPI 6: Road Surface Conditions vs. Accident Severity

- **Visual:** Stacked Bar Chart
  - X-Axis: Road_Surface_Condition
  - Legend: Accident_Severity
- **Tooltip:** Shows accident count, severity, and % of total.
- **Insight:** Dry surfaces show higher proportions of serious accidents.

Page 2 – Advanced Insights

Map: Accident Hotspots by Location

- **Visual:** Filled Map
  - Location: Local Authority District (calculated with average lat-long)
  - Tooltips: Accident Severity, Road Type, Weather, Surface Condition, and Vehicle Type.
- **Insight:** High density of accidents in metropolitan and urban areas.

Pie chart: Accidents by lightning condition

- **Visual:** pie chart
- **Legend:** light condition
- **Values: count of accident index**
- **Insight:** most of the accident occur in daylight, followed by darkness-lights lit minimum in darkness-light unlit.
- **Slicer:** added lightning condition slicer.

Clustered bar chart: Accidents by road type

- **Visual:** clustered bar chart
- **Y axis:-Road type**
- **X axis: on count by accident index**
- **Legend:** year to compare 2021 versus 2022
- **Values: count of accident index**
- **Insight:** most of the accident occur in single carriage way, followed by dual carriage waylit minimum in slip road
- **Slicer:** added road type slicer.

Conclusion

Working on this road safety dashboard reminded me that behind every data point is a real person — a life impacted by something that could happen to any of us. This project wasn't just about creating visuals or cleaning data; it was about using information to understand real-world problems and hopefully contribute to something meaningful.

By exploring accident trends, weather patterns, road conditions, and more, I've built a dashboard that can help others see where and when accidents are most likely to happen and, more importantly, why. My goal was to make the data easy to understand and explore, so that the insights can lead to better decisions, safer roads, and greater awareness.

Submitted by

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