Comprehensive Analysis of Road Traffic Accident

~ For CoreTech Lab

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Introduction

- Road accidents continue to pose a major threat to public safety, leading to injuries, fatalities, and economic loss.
- Understanding the contributing factors behind accidents is critical for developing effective prevention strategies.
- However, existing accident data is often unstructured and lacks standardisation, limiting its usefulness for analysis.
- This project leverages data science techniques to analyse accident trends and create an interactive dashboard for better decision-making and policy development.

Problem Statements

- **High Accident Rates from Multiple Factors**
  Weather, road conditions, speed limits, and traffic control systems heavily influence road accidents.

- **Unstructured and Inconsistent Data**
  Accident data often exists in raw, unorganised formats, making actionable insights difficult to derive.

- **Limited Use of Data-Driven Decisions**
  The absence of structured analysis reduces the ability of stakeholders to make proactive road safety improvements.

- **Need for Effective Visualisation Tools**
  An interactive dashboard is essential to simplify accident trends and support targeted safety interventions.

Dataset Overview

The dataset contains a total of **307,973 accident records** from the years **2021 and 2022**. A closer inspection reveals **197,644 unique accident index values**, and **26 accident index values that appeared more than once**; suggesting that some accident indices are associated with multiple rows of data— due to additional details such as accident date, type vehicle, casualty information etc.

Casualty Statistics

- **Maximum** casualties recorded in a single accident: **48**
- **Average** casualties per accident: **1.3**
- **Median** and **Mode**: **1**, indicating that most accidents involved **only 1 casualty**.
- **Skewness**: **0.8**, implying a **moderate right skew**. This suggests the presence of some accidents with a relatively high number of casualties.

Data Cleaning, Wrangling/Enhancements

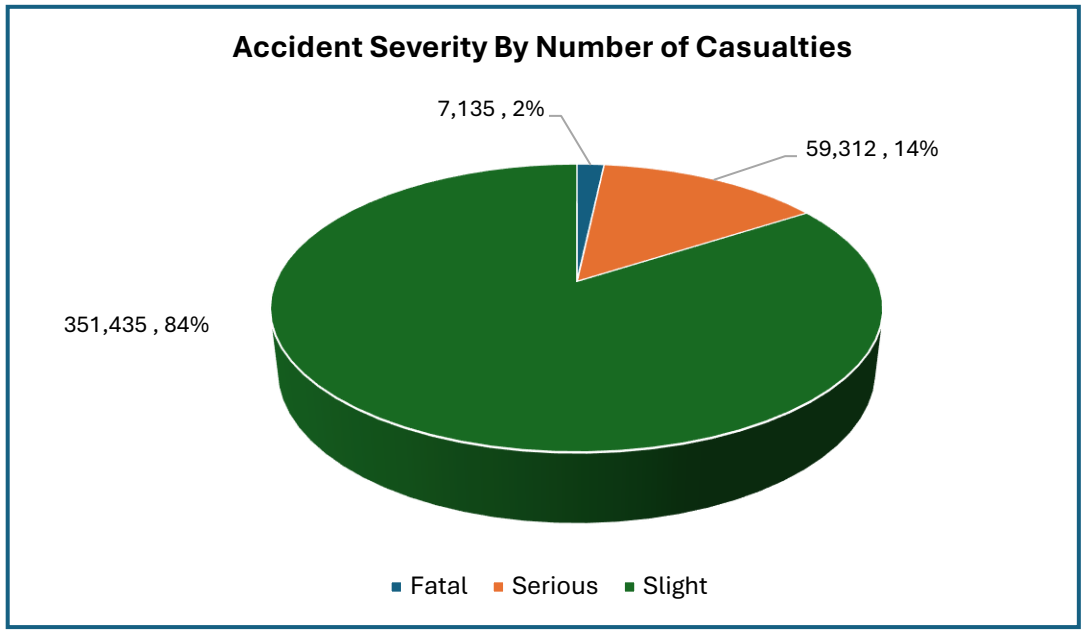
To facilitate more granular analysis, the following additional columns were added:

- **Day of Week:** Extracted the correct day of the week from the original date column by using the "Text" formula to extract the weekday from the date
- **Grouped Time of Day:** Categorized accidents based on specific time intervals/range within the entire day.
- **Grouped Light Conditions:** Categorized lighting conditions into *"Daylight"*, *"Darkness With No Lights"* & *"Darkness with Lit Lights"* to indicates the lighting condition during the accident.
- **>20 Casualties:** A binary indicator to flag locations *(Local Authority Districts)* recording more than 20 casualties in an accident.

Analysis Insights

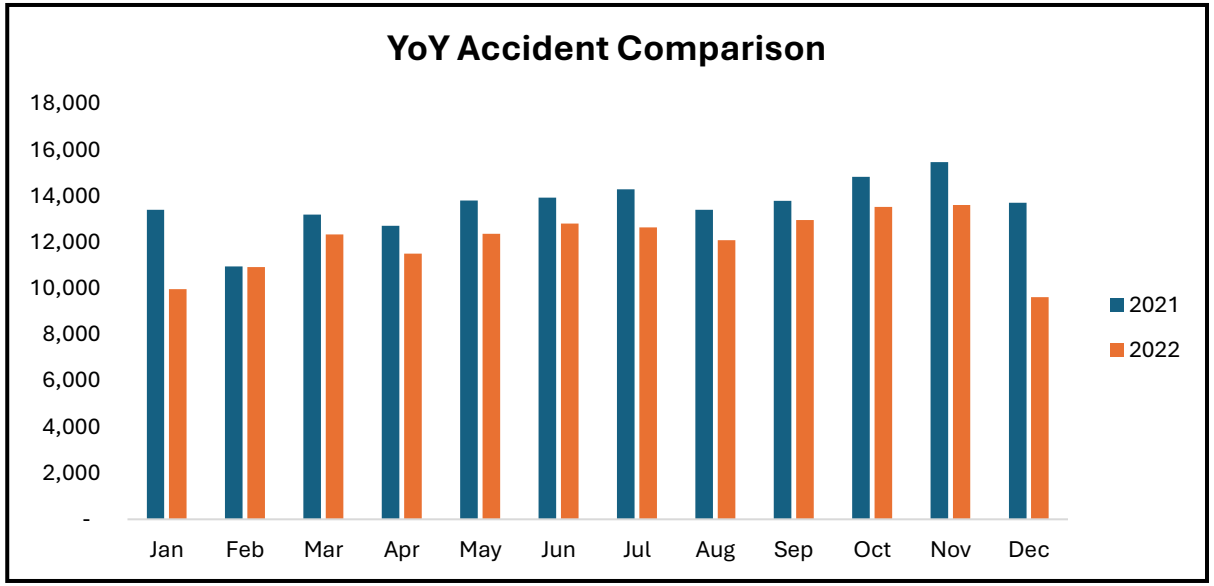
During 2021 and 2022, a total of **307,972 accidents** were reported, resulting in **417,882 casualties**. Of these casualties:

- **Slight casualties** accounted for **315,435 cases** (approximately **84%**)
- **Serious casualties** made up **14%**
- **Fatal casualties** constituted **2%**



YoY Accident Analysis

- There was a decline of **19,134 accidents** between 2021 and 2022, representing **11.7% decrease YoY.** The **lowest MoM decrease** was observed in **January**, with a reduction of **3,449 accidents**.



Temporal Distribution

- Most accidents occurred between **15:00 and 17:59**
- **Saturday** recorded the **highest number of accidents**, totalling **50,529** for the period under review.

Year

2021 | 2022

Accident_Severity

fatal | Serious | Slight

Month

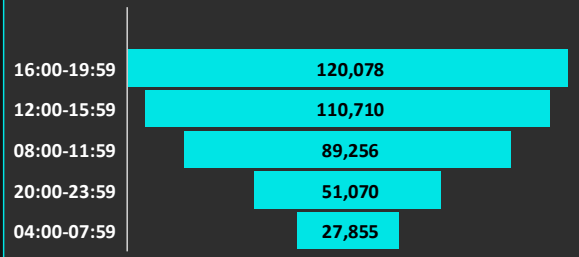
Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec

CORETECH LAB ACCIDENT ANALYSIS

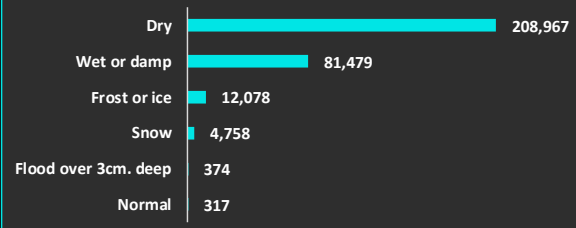
TOP 10 Most Affected Areas

307,973	417,883	1.46	15	30 mph	Dry
TOTAL ACCIDENTS	CASUALTIES	CASUALTIES PER ACCIDENT	UNIQUE VEHICLES INVOLVED	TOP RISK SPEED	MOST COMMON WEATHER CONDITION

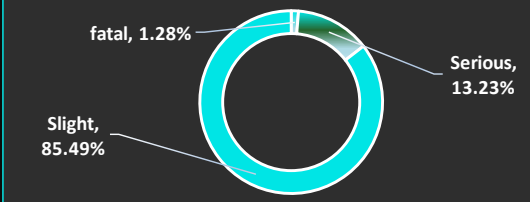
Time Impact on Casualties



Weather Impact on Accidents



Severity Distribution



TOP 5 VEHICLES INVOLVED


245,337

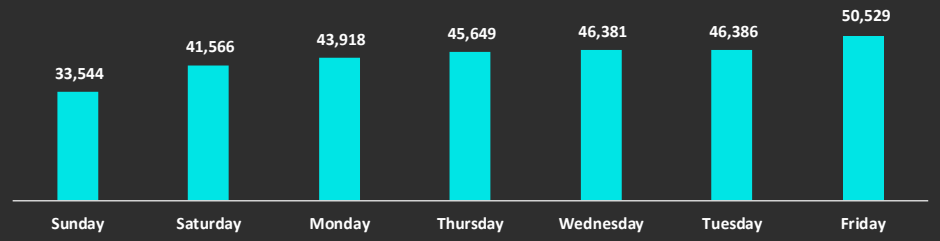

25,066


24,729

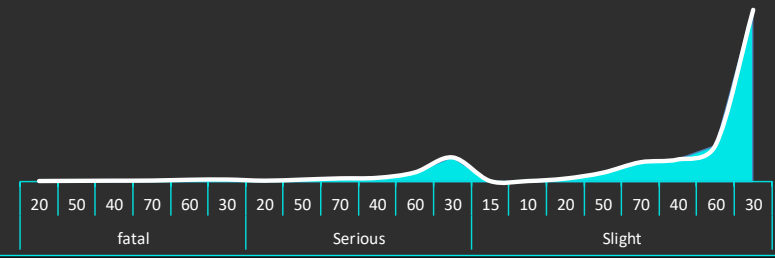

9,507


2,516

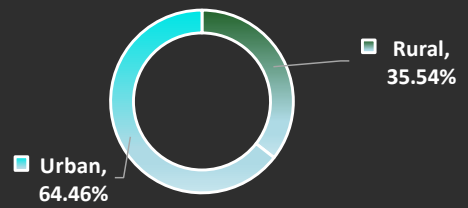
Accidents by Day of the Week



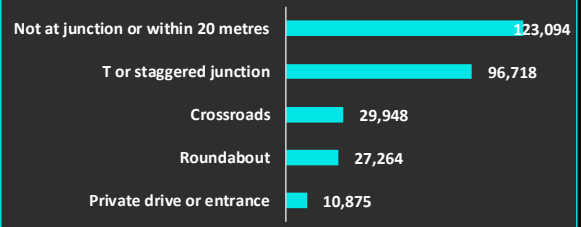
Speed Limit Impact on Severity



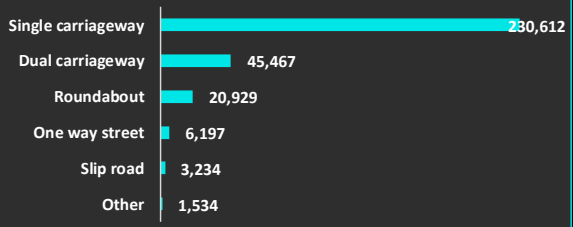
Urban vs Rural



Accidents by Junction Type



Accidents by Carriage Way



Analysis Insights *Contd.*

Vehicle Type Involvement

- **Car accidents** were the most common, accounting for **245,336 incidents**, or approximately **65%** of all reported accidents.

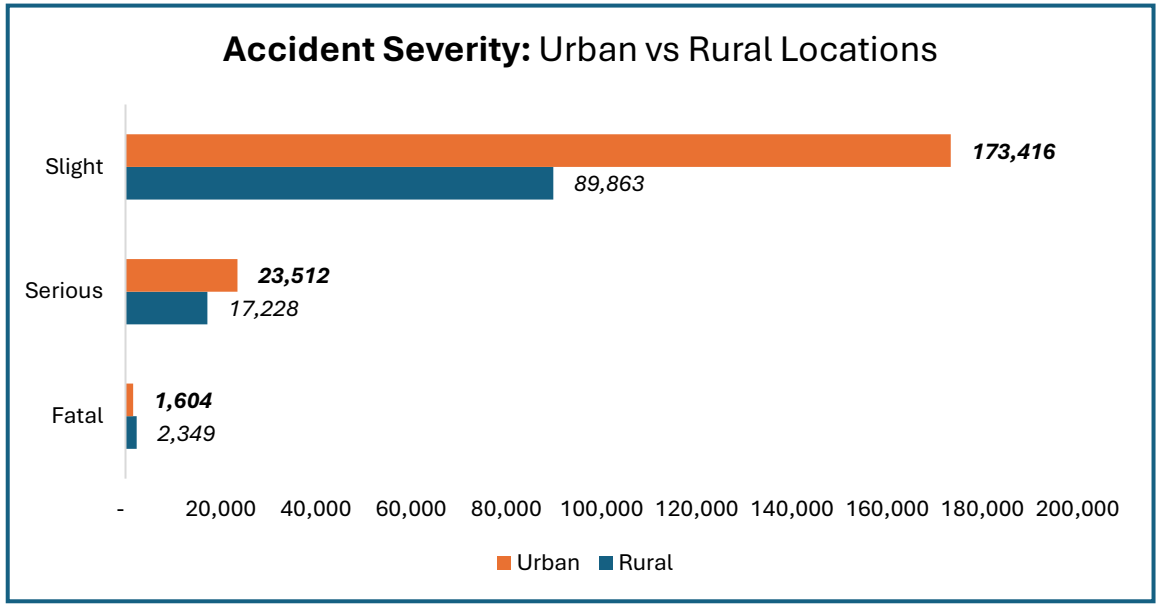
Environmental and Road Conditions

Most accidents occurred in:

- **Urban areas**
- **Dry road surface**
- **Daylight hours**
- **Fine weather, no wind**
- **Road speed limits between 30 – 49 mph**

Geographical Insights

- **The majority of total accidents** occurred on **Urban roads**, but **rural roads** were linked to the **highest number of fatal crashes**.
- **Birmingham** reported the **highest number of accidents and casualties** across both years; however, 12 locations experienced **over 20 casualties on specific dates**, highlighting high-risk hotspots.
- In **Purbeck**, a total of **32 vehicles** were involved in a single accident that occurred in a rural area on a **70-mph speed limit** road, during **frost or icy weather conditions.**



Conclusion & Recommendations

Conclusion

- Accidents are concentrated in urban areas during peak hours and good weather.
- **Birmingham**, **single carriage way** and **rural roads** require targeted safety interventions.
- Preventive strategies should consider **time of day**, **road type**, and **vehicle involvement**.

Recommendations

- ✓ Install more speed cameras in 30 mph zones.
- ✓ Improve street lighting in urban accident hotspots.
- ✓ Increase public awareness for wet weather driving risks.
- ✓ Regular road maintenance to prevent slippery conditions.
- ✓ Erect roadway barriers and pedestrian overpasses in areas having over 20 casualties on specific days. E.g. Cornwall, Allerdale, Swansea etc.
- ✓ Implement traffic calming measures (speed bumps) at key T-junctions and deploy additional active patrols during peak hours (15:00–17:59).

Thank You!