

ROAD SAFETY & INFRASTRUCTURE STABILITY

**INTERACTIVE DATA
ANALYTICS**

Domain – Transport and Infrastructure



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EXECUTIVE SUMMARY

TOTAL CASUALTIES

13,522

SINGLE CARRIAGEWAY

73%

RURAL RISK MULTIPLIER

1.16×

FATAL INCIDENTS

238

13,522 casualties (2021–2022) concentrated on specific road types and seasonal windows — pointing to structural vulnerabilities, not random events.

10,000 records . Dynamic dashboard built with Pivot Tables and interactive slicers for stakeholder-ready reporting.

Single Carriageways account for 73% of all casualties (9,888) individuals). Rural zones are 1.16× more dangerous per incident than urban areas.

PROBLEM STATEMENT & OBJECTIVES

Systematic analysis of UK road accident trends (2021-2022) to identify structural patterns of instability across road types, speed limits, and lighting conditions.

OBJECTIVES

1

Quantify total casualty magnitude and severity distribution across Fatal, Serious, and Slight tiers.

2

Assess Rural vs. Urban risk multipliers and identify geographic concentration of incidents.

3

Identify high-risk environmental clusters — road surface, lighting, and speed limit combinations.

4

Build an executive-level interactive dashboard with measurable KPI framework.

DATA OVERVIEW & CLEANING

RECORDS
10,000

COLUMNS
23

PERIOD
2021-2022

DATASET SOURCE

SOURCE: UK Road Accident Dataset — Kaggle

COLUMNS INCLUDE: ACCIDENT_SEVERITY, ROAD_TYPE, URBAN_OR_RURAL_AREA, NUMBER_OF_CASUALTIES, LIGHT_CONDITIONS, ROAD_SURFACE_CONDITIONS, VEHICLE_TYPE, SPEED_LIMIT, DATE

TOOL: Google Sheets (Pivot Tables, Interactive Filters)

CLEANING LOG (GOOGLE SHEETS)

- 1 RANDOMLY REDUCED DATASET FROM 300K+ TO 10K ROWS FOR FASTER, STABLE TRAINING.
- 2 DROPPED CARRIAGEWAY_TYPE DUE TO HIGH MISSING VALUES AND LOW RELEVANCE.
- 3 STANDARDIZED ACCIDENT_SEVERITY BY CORRECTING "FATAL" TO "FATAL" FOR CONSISTENCY.
- 4 REDUCED COLUMNS FROM 9.942 TO 9.771 AFTER REMOVING BLANK/IRRELEVANT COLUMNS.
- 5 REMOVED ROWS WITH MISSING VALUES IN KEY COLUMNS (JUNCTION_CONTROL, ROAD_SURFACE_CONDITION, ROAD_TYPE, WEATHER_CONDITION).

KPI & METRIC FRAMEWORK

13,522
Total Casualties

SUM(Number_of_Casualties)

1.76%

Fatal Rate

238 fatal incidents

13.6%

Serious Rate

1,834 serious incidents

84.7%

Slight Rate

11,450 slight incidents

1.16×

Rural Multiplier

Rural avg ÷ Urban avg casualties

73%

Single Carriageway

9,888 of 13,522 casualties

66.7%

Dry Surface %

Accidents on dry roads

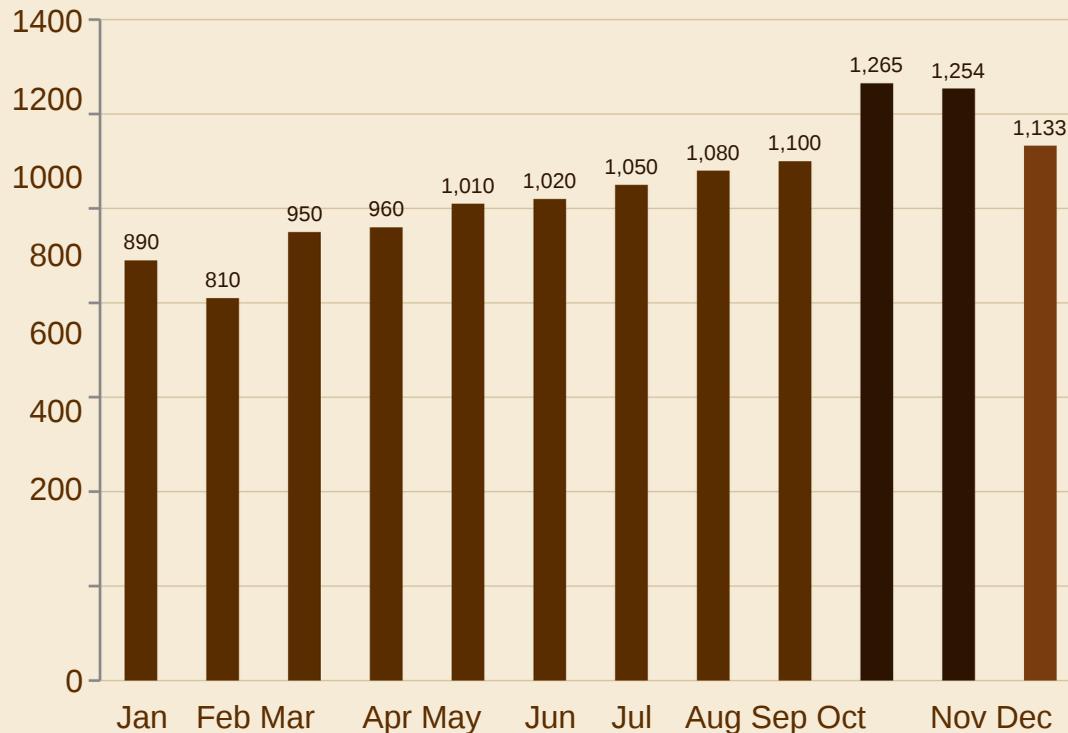
Oct 1,265

Peak Month

Highest monthly casualty count

EXPLORATORY DATA ANALYSIS – TRENDS

Monthly Casualty Count (2021–2022)



KEY FINDINGS

Q4 Peak

Oct(1,265) & Nov (1,254) are the deadliest months — driven by reduced daylight & wet roads.

Dry Surface

66.7% of casualties on dry roads. Behavior & speed are bigger risks than weather.

Daylight Risk

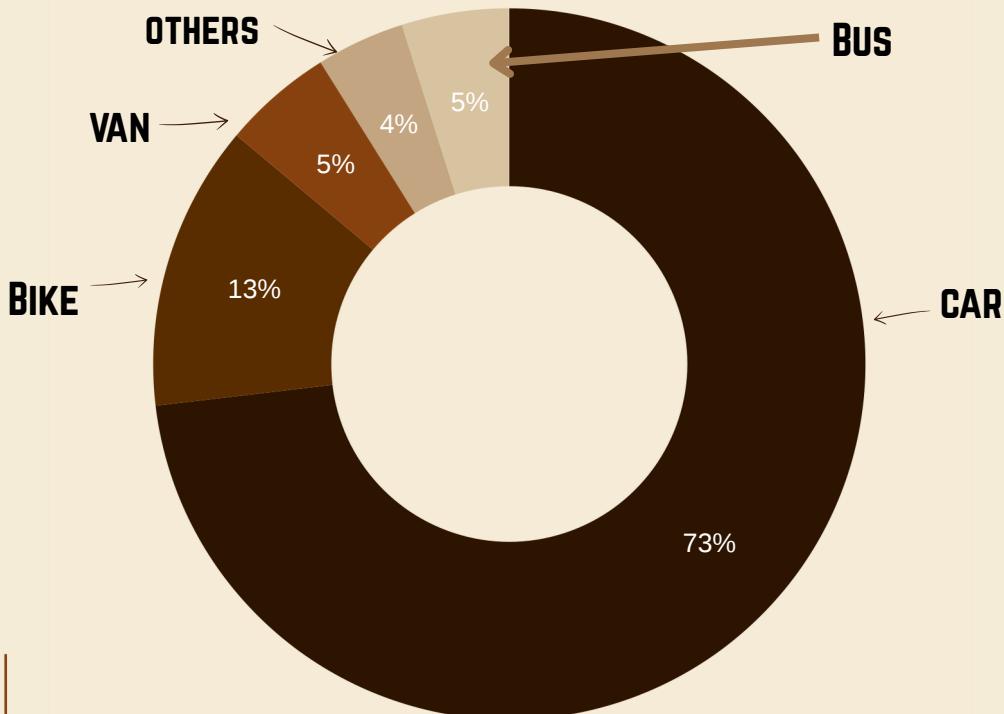
9,899 accidents in daylight — visibility alone does not prevent incidents.

Q1 Low Point

Jan–Feb record lowest casualty volumes, confirming strong seasonal cycle.

ROAD TYPE & RISK ANALYSIS

Casualty Distribution by Road Type



URBAN vs RURAL DYNAMICS

URBAN

1.28 casualties/accident



RURAL

1.49 casualties/accident



SPEED LIMIT CORRELATION

30 mph zones: Highest frequency of accidents.

60 mph zones: Higher fatality intensity per incident.

Single Carriageway Crisis: 9,888 casualties — 73% of total.

DASHBOARD DESIGN

TOOL: GOOGLE SHEETS | INTERACTIVE DASHBOARD

KPI Cards

Total Casualties — 13,522

Fatal Rate — 1.76%

Rural Multiplier — 1.16x

Peak Month — Oct 1,265

Visual Mix

Donut chart — Severity split

Bar graph — Road type risk

Line chart — Monthly trend

Pivot-driven trend analysis

Interactive Slicers

Year filter: 2021 / 2022

Urban or Rural Area

Accident Severity tier

Road Type drill-down

RECOMMENDATIONS

1 Seasonal Resource Allocation

Align safety patrol schedules with Q4 peak (Oct-Dec). Pre-deploy mobile speed enforcement on rural single carriageway corridors.

2 Infrastructure Audit

Prioritize single carriageway safety barrier installations. Commission stage-adjusted audits for rural roads with speed limits $\geq 50\text{ mph}$.

3 Regional Risk Mitigation

Develop early-warning indicator dashboards for high-risk rural corridors. Install smart lighting on top 200 at-risk rural segments.

4 Data-Driven Planning

Transition from reactive repairs to analytics-backed resilience planning. Build real-time monitoring connected to police reporting systems.

CONCLUSION

ROAD ACCIDENTS ARE STRUCTURAL PATTERNS — NOT ISOLATED INCIDENTS. THE CONCENTRATION OF 73% OF CASUALTIES ON SINGLE CARRIAGEWAYS, COMBINED WITH A 1.16× RURAL RISK MULTIPLIER AND A PREDICTABLE Q4 SEASONAL PEAK, POINTS CONCLUSIVELY TO A SYSTEMIC SAFETY CRISIS THAT DEMANDS DATA-DRIVEN POLICY INTERVENTION. BY TRANSFORMING 10,000 RAW RECORDS INTO AN INTERACTIVE KPI DASHBOARD, THIS PROJECT ENABLES A DECISIVE SHIFT — FROM REACTIVE FIXES TO PREDICTIVE SAFETY STRATEGIES. WITH TARGETED IMPLEMENTATION OF THE FOUR RECOMMENDATIONS, A 10–15% REDUCTION IN REACTIVE SAFETY COSTS AND AN 8–12% REDUCTION IN FATAL INCIDENT RATES ARE ACHIEVABLE WITHIN 2–3 YEARS, REPRESENTING A MEANINGFUL, DATA-JUSTIFIED RETURN ON PUBLIC SAFETY INVESTMENT.

THANK YOU!

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