Road Accident Analysis (2021-2022) — SQL

1. Introduction

The analysis of road accident data is crucial for understanding the factors that contribute to accidents and for developing effective strategies to improve road safety. This report presents an analysis of road accident data, focusing on key metrics, trends, and contributing factors, with the aim of providing actionable insights to reduce the number and severity of accidents. The analysis utilizes SQL to extract and analyze data from a comprehensive road accident dataset.

2. Objectives of the Report

This report aims to:

- Identify key factors influencing the occurrence and severity of road accidents.
- Analyze trends in road accidents, including year-on-year and seasonal variations.
- Evaluate the impact of different road conditions, environmental factors, and vehicle types on accident rates.
- Provide data-driven recommendations for policymakers, road safety organizations, and other stakeholders to enhance road safety and reduce casualties.

3. KPIs: Fatal, Serious, Slight Casualties & Other Key Metrics

The key performance indicators (KPIs) provide insights into accident severity and their distribution:

- Total Fatal Casualties: 7,135
- Total Serious Casualties: 59,312
- Total Slight Casualties: 351,436
- Total Car Casualties: 333,485
- Total Urban Casualties: 255,864
- Total Rural Casualties: 162,019

SQL Query:

```sql
-- Retrieve key accident statistics such as total fatalities, serious, and slight casualties.
SELECT
    SUM(CASE WHEN accident_severity = 'Fatal' THEN number_of_casualties ELSE 0 END) AS total_fatal_casualties,
    SUM(CASE WHEN accident_severity = 'Serious' THEN number_of_casualties ELSE 0 END) AS total_serious_casualties,
    SUM(CASE WHEN accident_severity = 'Slight' THEN number_of_casualties ELSE 0 END) AS total_slight_casualties,
    SUM(CASE WHEN vehicle_type IN ('Car', 'Taxi/Private hire car') THEN number_of_casualties ELSE 0 END) AS car_casualties,
    SUM(CASE WHEN area = 'Urban' THEN number_of_casualties ELSE 0 END) AS urban_casualties,
    SUM(CASE WHEN area = 'Rural' THEN number_of_casualties ELSE 0 END) AS rural_casualties
FROM road_accidents;
```

Table:

total_fatal_casualties	total_serious_casualties	total_slight_casualties	car_casualties	urban_casualties	rural_casualties
7135	59312	351436	333485	255864	162019

4. Total Casualties by Vehicle Type

This bar chart illustrates the total number of casualties by vehicle type. Cars contribute the most to accidents, while agricultural vehicles and horses have minimal involvement.

- Cars contribute to the highest number of casualties.
- Motorbikes and bicycles are involved in a considerable number of accidents.
- Agricultural vehicles and horse-related accidents are minimal.

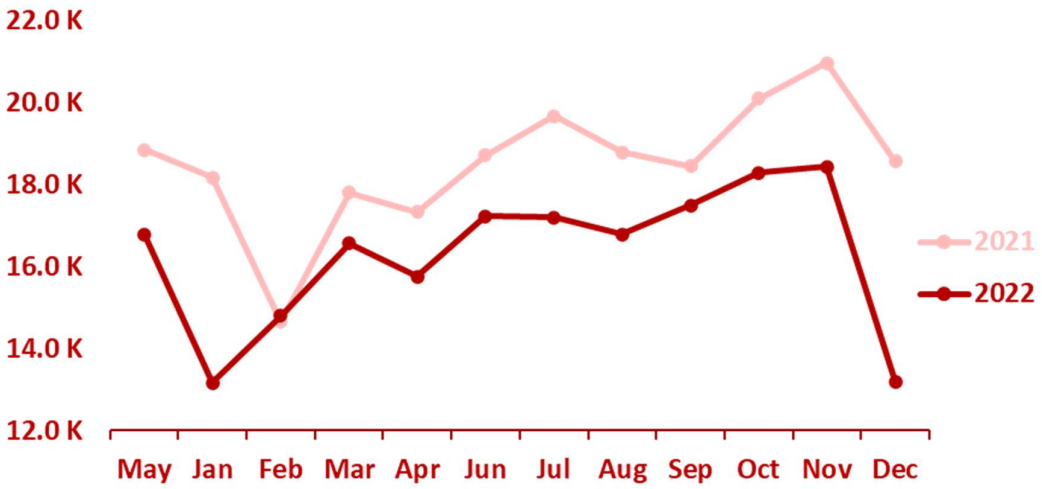
SQL Query:

```sql
-- Categorize vehicle types and compute total casualties for each category.
SELECT
    CASE
        WHEN vehicle_type = 'Agricultural vehicle' THEN 'Agricultural'
        WHEN vehicle_type IN ('Bus or coach (17 or more pass seats)', 'Minibus (8 - 16
passenger seats)') THEN 'Bus'
        WHEN vehicle_type IN ('Car', 'Taxi/Private hire car') THEN 'Car'
        WHEN vehicle_type IN ('Goods 7.5 tonnes mgw and over', 'Goods over 3.5t. and
under 7.5t', 'Van / Goods 3.5 tonnes mgw or under') THEN 'Van'
        WHEN vehicle_type IN ('Motorcycle 125cc and under', 'Motorcycle 50cc and under',
'Motorcycle over 125cc and up to 500cc', 'Motorcycle over 500cc', 'Pedal cycle') THEN
'Bike'
        WHEN vehicle_type = 'Ridden horse' THEN 'Horse'
        ELSE 'Other'
    END AS vehicle_category,
    SUM(number_of_casualties) AS total_casualties
FROM road_accidents
GROUP BY vehicle_category
ORDER BY total_casualties DESC;
```

Table:

vehicle_category	total_casualties
Car	333485
Bike	33764
Van	24702
Bus	12798
Other	12099
Agricultural	1032
Horse	3

5. Year-on-Year Monthly Trend of Casualties (2021 vs 2022)



This line graph depicts the fluctuations in casualties on a monthly basis, comparing 2021 to 2022. The declining trend in 2022 suggests improved safety measures or changes in traffic patterns.

- Overall, there was a decline in casualties from 2021 to 2022.
- The most significant reduction occurred in January (-27.57%) and December (-28.94%).
- February was the only month with an increase in casualties.

SQL Query:

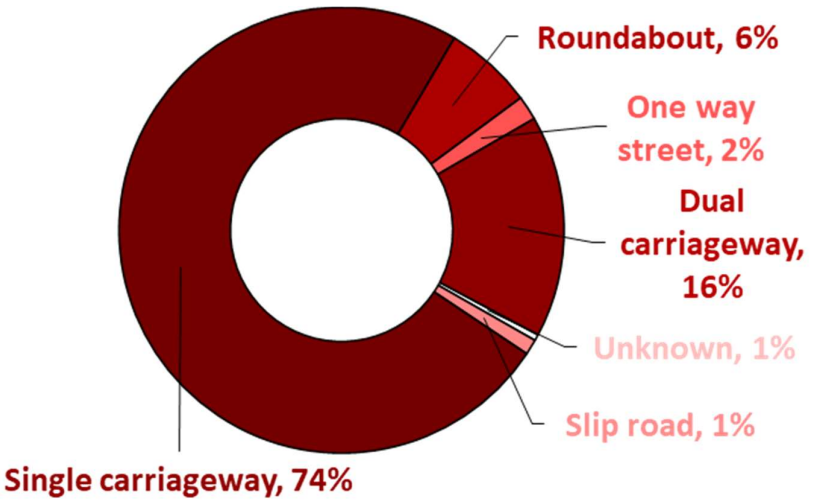
```sql
WITH yearly_casualties AS (
    -- Aggregate casualties for each year and month
    SELECT
        year,
        month,
        SUM(number_of_casualties) AS total_casualties
    FROM road_accidents
    WHERE year IN (2021, 2022)
    GROUP BY year, month
),
month_order AS (
    -- Create a reference table to order months correctly
    SELECT unnest(ARRAY['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun',
                        'Jul', 'Aug', 'Sep', 'Oct', 'Nov', 'Dec']) AS month,
           generate_series(1, 12) AS month_num
)
```

```sql
SELECT
    m.month,
    y2021.total_casualties AS casualties_2021,
    y2022.total_casualties AS casualties_2022,
    -- Calculate percentage change with proper formatting
    CASE
        WHEN y2021.total_casualties = 0 THEN NULL
        ELSE CONCAT(
            ROUND(((y2022.total_casualties - y2021.total_casualties)::numeric /
            NULLIF(y2021.total_casualties, 0) * 100)::numeric, 2), '%'
        )
    END AS percentage_change
FROM month_order m
LEFT JOIN (SELECT * FROM yearly_casualties WHERE year = 2021) y2021 ON m.month =
y2021.month
LEFT JOIN (SELECT * FROM yearly_casualties WHERE year = 2022) y2022 ON m.month =
y2022.month
ORDER BY m.month_num;
```

Table:

month	casualties_2021	casualties_2022	percentage_change
Jan	18173	13163	-27.57%
Feb	14648	14804	1.06%
Mar	17815	16575	-6.96%
Apr	17335	15767	-9.05%
May	18852	16775	-11.02%
Jun	18728	17230	-8.00%
Jul	19682	17201	-12.61%
Aug	18797	16796	-10.65%
Sep	18456	17500	-5.18%
Oct	20109	18287	-9.06%
Nov	20975	18439	-12.09%
Dec	18576	13200	-28.94%

6. Total Casualties by Road Type



This pie chart breaks down total casualties by road type. Single carriageways dominate the data, confirming their high risk for accidents.

- Single carriageways contribute to the majority of accidents.
- Roundabouts and one-way streets have fewer accidents in comparison.

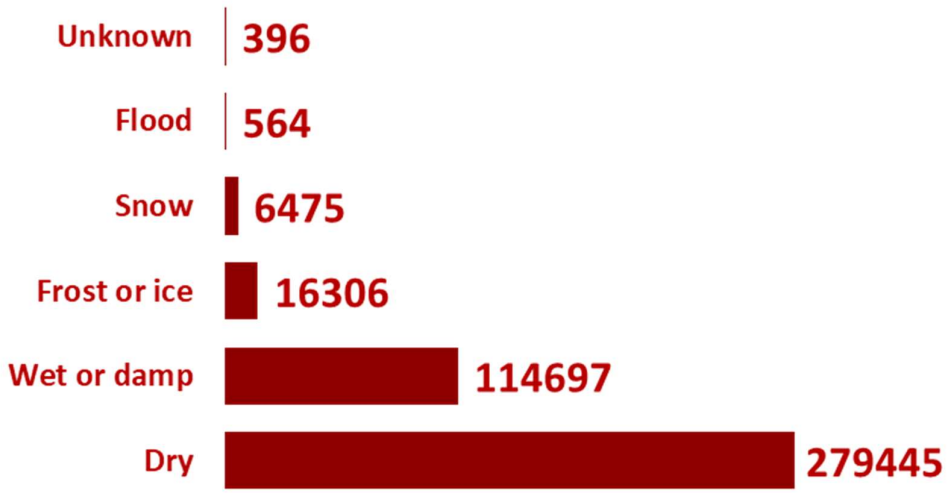
SQL Query:

```sql
WITH road_casualties AS (
    -- Aggregate casualties per road type
    SELECT
        road_type,
        SUM(number_of_casualties) AS total_casualties
    FROM road_accidents
    GROUP BY road_type
)
SELECT
    road_type,
    total_casualties,
    -- Calculate percentage of total casualties
    ROUND((total_casualties * 100.0) / SUM(total_casualties) OVER(), 2) || '%' AS
percentage_of_total
FROM road_casualties
ORDER BY total_casualties DESC;
```

Table:

road_type	total_casualties	percentage_of_total
Single carriageway	309698	74.11%
Dual carriageway	67368	16.12%
Roundabout	26828	6.42%
One way street	7389	1.77%
Slip road	4679	1.12%
Unknown	1921	0.46%

7. Total Casualties by Road Surface Conditions



This bar chart highlights the influence of road surface conditions on accidents. Dry roads account for the most accidents, likely due to higher traffic volume.

- Dry conditions contribute to the most accidents, likely due to higher traffic volume.
- Wet or damp roads significantly increase accident risks.
- Snow, frost, and floods account for a smaller fraction of accidents.

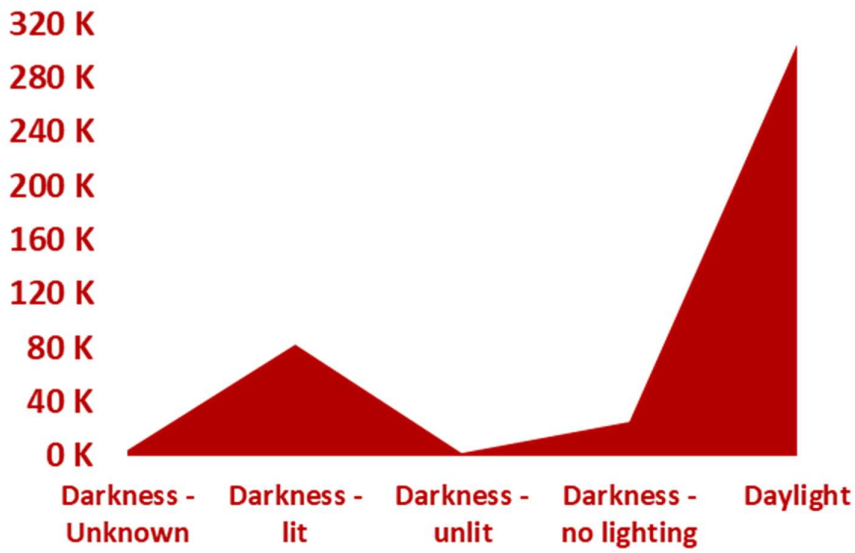
SQL Query:

```sql
-- Get total casualties grouped by road surface conditions.
SELECT
    road_surface_conditions,
    SUM(number_of_casualties) AS total_casualties
FROM road_accidents
GROUP BY road_surface_conditions
ORDER BY total_casualties DESC;
```

Table:

road_surface_conditions	total_casualties
Dry	279445
Wet or damp	114697
Frost or ice	16306
Snow	6475
Flood over 3cm. deep	564
Unknown	396

8. Total Casualties by Light Condition



This area chart represents casualties by light conditions. Most accidents occur during daylight, but significant incidents still happen under artificial lighting.

- Most accidents occur during daylight hours, likely due to high traffic volumes.
- Accidents in well-lit areas indicate that lighting is not the driving factor behind these accidents.

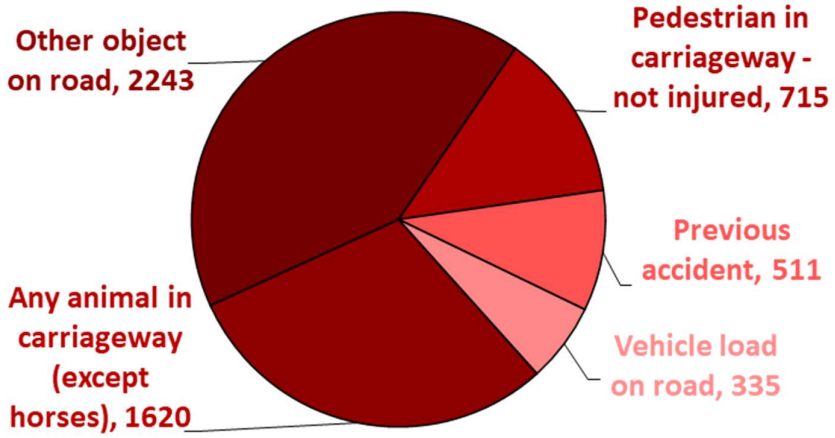
SQL Query:

```sql
WITH light_casualties AS (
    -- Aggregate casualties per light condition
    SELECT
        light_conditions,
        SUM(number_of_casualties) AS total_casualties
    FROM road_accidents
    GROUP BY light_conditions
)
SELECT
    light_conditions,
    total_casualties,
    -- Calculate percentage share of each light condition
    ROUND((total_casualties * 100.0) / SUM(total_casualties) OVER(), 2) || '%' AS
percentage_of_total
FROM light_casualties
ORDER BY total_casualties DESC;
```

Table:

light_conditions	total_casualties	percentage_of_total
Daylight	304963	72.98%
Darkness - lights lit	82167	19.66%
Darkness - no lighting	25386	6.07%
Darkness - lighting unknown	3829	0.92%
Darkness - lights unlit	1538	0.37%

9. Count of Police Forces by Carriageway Hazards



This pie chart displays the count of police-reported carriageway hazards. The vast majority of cases reported no hazards, while objects, animals, and previous accidents made up minor contributions.

- The majority of incidents did not involve hazards.
- Road obstructions such as objects, animals, and previous accidents contribute to a small percentage.

SQL Query:

```sql
-- Count number of police force interventions per carriageway hazard type and calculate
percentage.
SELECT
    carriageway_hazards,
    COUNT(police_force) AS police_forces,
    CONCAT(
        ROUND((COUNT(police_force) * 100.0) / SUM(COUNT(police_force)) OVER (), 2), '%'
    ) AS percentage_of_total
FROM road_accidents
GROUP BY carriageway_hazards
ORDER BY COUNT(police_force) DESC;
```

Table:

carriageway_hazards	police_forces	percentage_of_total
None	302549	98.24%
Other object on road	2243	0.73%
Any animal in carriageway (ex	1620	0.53%
Pedestrian in carriageway - n	715	0.23%
Previous accident	511	0.17%
Vehicle load on road	335	0.11%

10. Findings

- Car accidents account for most casualties.
- The rate of accidents has declined within a year. However, the number of accidents peak in November
- Accidents on single carriageways are significantly higher.
- Dry road conditions contribute to a large number of accidents, followed by damp roads.
- Most accidents occur in daylight and in well-lit roads during the dark.

11. Recommendations

- **Enhance Vehicle Safety Measures:** Promote the use of advanced driver-assistance systems (ADAS) and ensure stricter vehicle maintenance checks, especially for cars, as they contribute the most to accidents.
- **Improve Road Infrastructure on Single Carriageways:** Implement speed reduction measures, better road markings, and additional safety barriers on high-risk single carriageways.
- **Increase Awareness of Driving in Dry Conditions:** Educate drivers about the risks of speeding on wet roads and distractions on dry roads, which account for the most accidents.
- **Strengthen Traffic Regulations:** Introduce stricter penalties for reckless driving, speeding, and traffic violations, particularly on high-risk roads.
- **Optimize Road Safety Campaigns:** Focus on awareness campaigns that emphasize responsible driving in both urban and rural settings, targeting high-accident periods.

12. Conclusion

This report has provided a comprehensive analysis of road accident data, highlighting key trends, risk factors, and areas for improvement. The findings and recommendations presented in this report can serve as a valuable resource for stakeholders committed to enhancing road safety and reducing the devastating impact of road accidents. Continued efforts in data analysis, proactive interventions, and collaboration among relevant parties are essential to creating safer roads for all.

See also:

1. **Road Accident Analysis Dashboard (2021-2022) — MS Excel**
   https://github.com/sabbirrahmanleon/Road-Accident-Dashboard-MS-Excel
2. **Road Accident Analysis (2021-2022) — PostgreSQL**
   https://github.com/sabbirrahmanleon/Road-Accident-Analysis-2021-2022-SQL