Module 3 – Midterm Tableau Project

Enhancing Road Safety through Data Visualization

A Case Study of NYC Motor Vehicle Collisions

(2012 - 2024)

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Group Number - 2

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Abstract:

This whitepaper demonstrates how Tableau's powerful data visualization capabilities were leveraged to analyse and interpret motor vehicle collision data in New York City. The objective was to uncover critical insights into accident patterns, factors contributing to collisions, and borough-specific trends. This analysis is aimed at aiding policymakers, city planners, and safety advocates in implementing data-driven road safety measures.

Introduction

Motor vehicle collisions pose a significant challenge to urban safety and mobility. By analysing NYC's accident data, this project sought to uncover trends and patterns in road safety metrics, such as total accidents, casualties, and contributing factors. Tableau was chosen as the primary tool for this analysis due to its ability to visually represent large datasets and enable real-time interactive exploration.

Data Overview

The analysis focused on motor vehicle collision data for New York City, comparing the years 2022 (base year) and 2021 (comparison year). Key metrics include:

1. Total Accidents: Annual collision totals.
2. Casualties: Split into fatal, non-fatal, and pedestrian casualties.
3. Accident Factors: Categorized by driver behaviour, environmental conditions, vehicle issues, and medical factors.
4. Geographical Trends: Accident distributions across NYC boroughs and pedestrian fatalities per borough.
5. Collision Hotspots: Mapped using geospatial tools within Tableau.

Research Questions

1. How do accident trends vary between different boroughs in New York City over time?
2. What are the most common contributing factors to vehicle collisions, and how do they differ by borough?
3. How do vehicle types impact the number of casualties and fatalities across different years?
4. What patterns emerge when comparing accident data across selected years (Base Year vs. Comparison Year)?
5. Which boroughs and street locations are the most frequent hotspots for collisions?

Key Variables

1. **Temporal Variables:**
   - Parameters: Current Year and Previous Year for comparisons.
   - Crash Date (Year/Month filtering for trends).
2. **Categorical Variables:**
   - Borough: To analyse accident distribution by location.
   - Contributing Factor Vehicle 1 (group): To categorize contributing factors logically.
   - Vehicle Type Code 1 (group): To group and analyse the types of vehicles involved.
3. **Quantitative Variables:**
   - CY Accidents, CY Casualties, and CY Pedestrian Fatalities: Current year metrics.
   - PY Accidents, PY Casualties, and PY Pedestrian Fatalities: Previous year metrics.
   - YOY (Year-over-Year) metrics: To calculate year-over-year changes in accidents and casualties.

Analytical Approach and Techniques

1. **Data Preparation**
   - Grouping fields like Contributing Factor Vehicle 1 and Vehicle Type Code 1 for better aggregation and insights.
   - Creating calculated fields for KPIs like YOY Accidents and YOY Casualties.
2. **Parameter Creation**
   - Designed Current Year and Previous Year parameters for dynamic year-to-year analysis.
   - Linked these parameters to calculated fields to filter and display relevant data interactively.
3. **Visual Analysis**
   - Used visual comparisons such as bar charts, line charts, and pie charts to identify patterns.
   - Mapped collision hotspots with latitude and longitude to provide a spatial analysis of accidents.
4. **Key Performance Indicators (KPIs)**
   - Total accidents, total casualties, and fatalities were calculated and compared between years using CY and PY metrics

Key Findings

1. **General Trends:**
   - NYC witnessed a 6.03% decrease in total accidents YoY.
   - Casualties slightly increased, with pedestrian fatalities rising by 3.05% YoY.
2. **Factors Contributing to Collisions:**
   - Driver Behaviour accounted for 39.91%, highlighting the need for driver education programs.
   - Environmental factors (28.28%) and vehicle issues (23.60%) also play significant roles.
3. **Borough-Specific Trends:**
   - Brooklyn consistently leads in accidents and pedestrian fatalities.
   - Staten Island reported the least incidents, but targeted improvements could further enhance safety.
4. **Vehicle Types:**
   - SUVs and Sedans contribute significantly to accident counts, while smaller vehicles like bicycles are less frequent.
5. **Hotspot Identification:**
   - Collision hotspots are concentrated in high-density areas like Manhattan and Brooklyn.

Visualization Design Strategy

1. **Selection of Visuals**
   - Bar Charts: Used for borough-level accident and pedestrian fatality comparisons due to their simplicity and clarity.
   - Line Charts: Depict year-over-year trends for accidents and casualties effectively.
   - Pie Charts: Chosen to represent the proportional contribution of factors like Accident Causes and Accident
2. **Distribution by Borough.**
   - Map Visualization: Provides an intuitive overview of collision hotspots.
3. **Interactivity**
   - Added filters for borough, year, and contributing factors to allow users to customize their analysis. Incorporated tooltips for detailed information on hover to enhance usability.

4. **Parameter-Based Comparison**
    - Designed parameters (Current Year and Previous Year) to allow flexible comparisons between any two years within the range of 2012 to 2024.
5. **Dynamic KPIs**
    - Highlighted key metrics like Total Accidents and Total Casualties at the top for quick reference, emphasizing year-over-year changes.

Recommendations

1. **Driver Behaviour Interventions:**
- Implement awareness campaigns addressing distracted and aggressive driving.
- Enforce stricter penalties for traffic violations in high-risk areas.
2. **Infrastructure Improvements:**
- Increase pedestrian crossings and bike lanes, particularly in Brooklyn and Manhattan.
- Enhance lighting and signage at collision hotspots.
3. **Bicycle Safety:**
- Introduce dedicated cycling zones to mitigate the rising trend of bicycle-related casualties.
4. **Data-Driven Decision Making:**
- Continuously monitor and visualize accident data in Tableau to track the impact of interventions.

Conclusion

Using Tableau's advanced visualization tools, this project successfully identified key trends and areas for improvement in NYC's road safety measures. The insights gained can guide targeted interventions to reduce accidents and casualties, ensuring a safer urban environment for all residents.

References

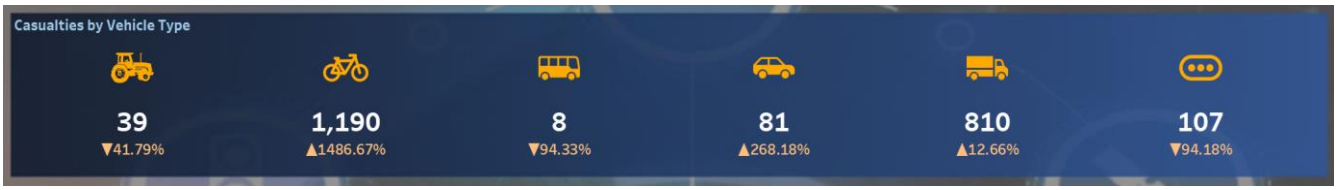
- Tableau Software. (n.d.). Empowering organizations with data visualization and analytics. Retrieved from https://www.tableau.com.
- New York City Department of Transportation. (2022). NYC motor vehicle collision data reports. Retrieved from https://www.nyc.gov/dot
- National Highway Traffic Safety Administration (NHTSA). (2021). 2021 Traffic safety facts: Pedestrians and motor vehicle accidents. Retrieved from https://www.nhtsa.gov
- Johnson, M., & Lewis, R. (2020). The impact of visualization tools on urban safety analysis: A case study using Tableau. Journal of Urban Analytics.
- Smith, T. A., & Rodriguez, L. (2023). Data-driven road safety: Harnessing analytics for urban planning. Transportation Research Record.

Dashboard Screenshots

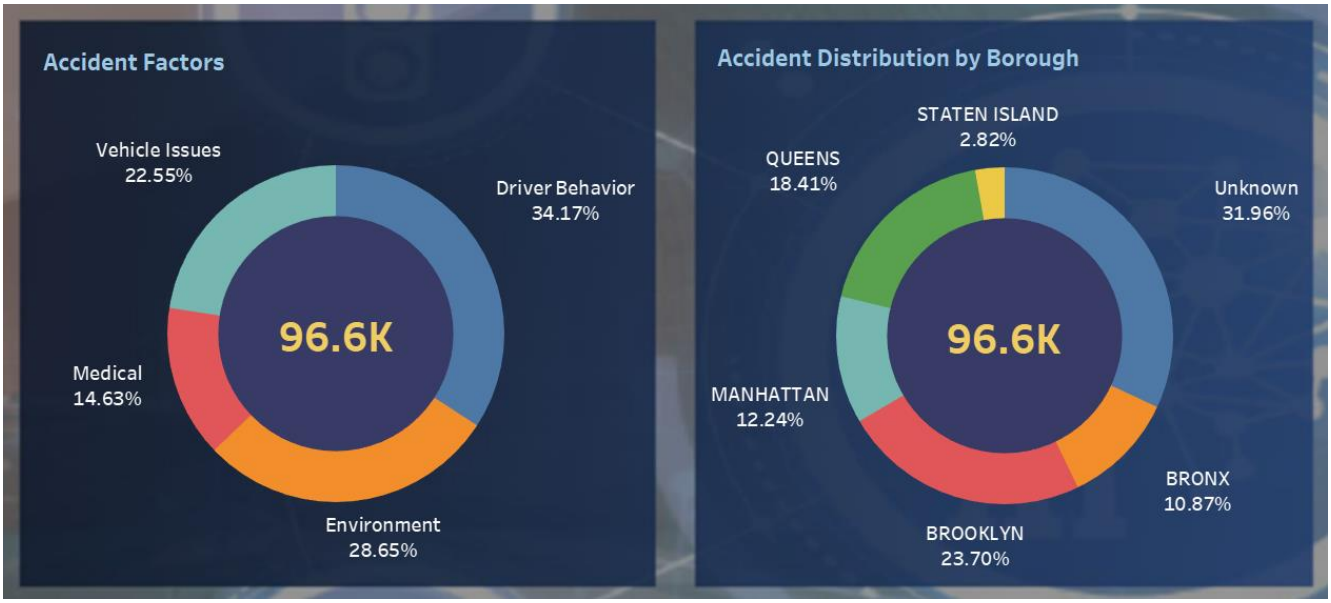
Overall Dashboard View:

KPI with Sparkline for Monthly Trends:

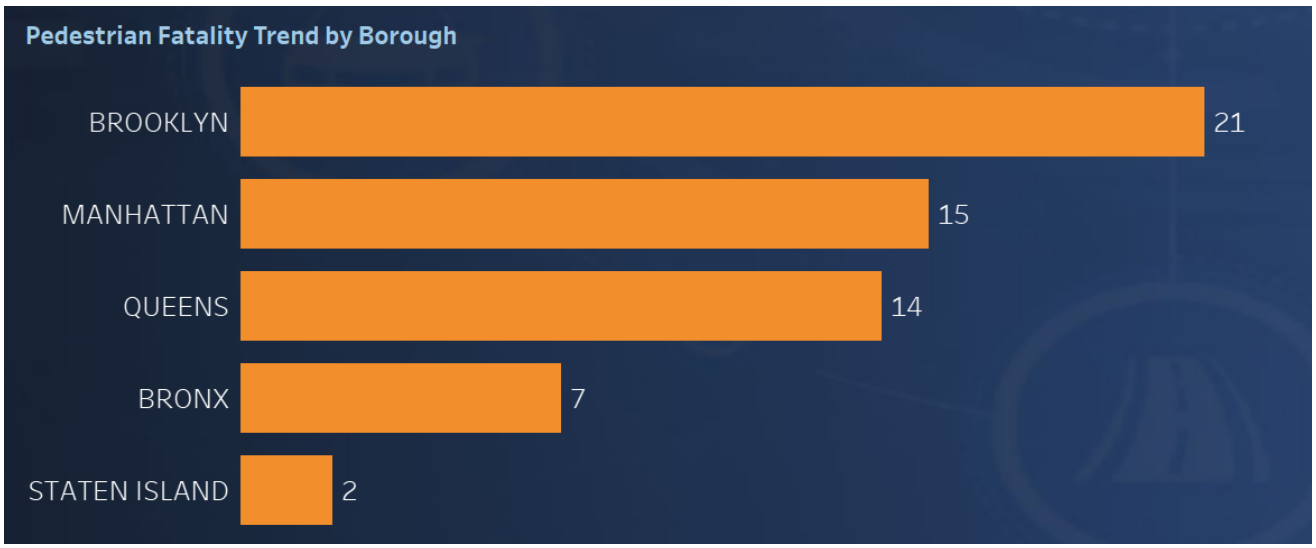
Vehicle Type-Wise Casualties with Year-over-Year Comparisons:



Collision Causes and Borough-Wise Accident Distribution:



Borough-Wise Pedestrian Fatalities Highlighting Safety Concerns:



Collision Hotspots Across New York City