Geospatial Analysis of Traffic Accidents in Auckland region

Luis Vieira . 23012096@massey.ac.nz

TE KUNENGA KI PŪREHUROA
MASSEY UNIVERSITY
UNIVERSITY OF NEW ZEALAND
TE WĀHANGA PŪTAIAO
COLLEGE OF SCIENCES

Introduction

This project analysed the Auckland region's road network to identify areas with the highest frequency of traffic accidents and investigate the attributes most correlated with these accidents. Leveraging GIS, I performed spatial and statistical analyses to uncover significant patterns and insights into traffic accident occurrences. The objective is to provide actionable insights that can inform targeted interventions to improve road safety in the Auckland region.

Methods

• **Data Collection:** The project utilised datasets from multiple sources, including NZTA Crash Analysis System (CAS) for accident data, LINZ road network data, Auckland Transport traffic volume data, StatsNZ census data for socio-economic factors, and OSM data for detailed road networks and POIs.

• **Data Preprocessing:** Data cleaning, merging, and reprojecting to the same CRS (EPSG:2193), form accidents reported to the NZ Police from 2018 onwards. Missing values were addressed using Python and QGIS.

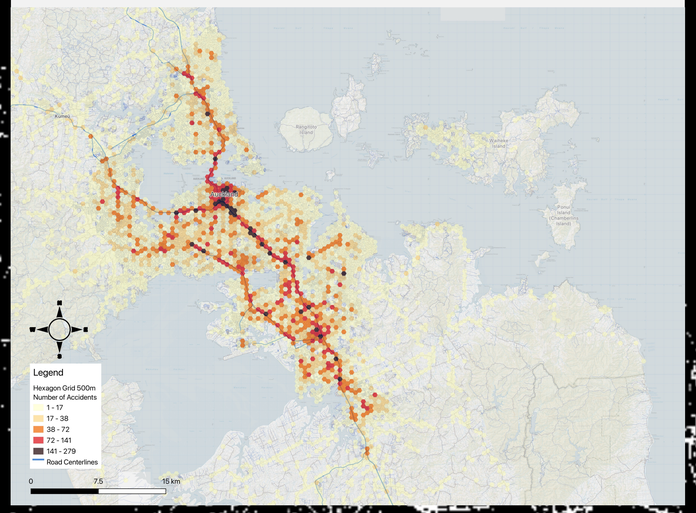
• **Analysis Techniques:**

- A novel severity index was created by combining Belgian and Australian methods to better reflect crash severity.
- Geospatial analysis methods included hexagon grid analysis to map accident frequency, KDE to create heatmaps of accident density, and Getis-Ord Gi* analysis to identify statistically significant accident cluster hotspots, Blackspot analysis using accidents normalised by traffic volume.
- Traffic volume normalisation was performed to highlight road sections with higher accident probabilities relative to traffic volume (blackspots).

Geovisualisation Analysis

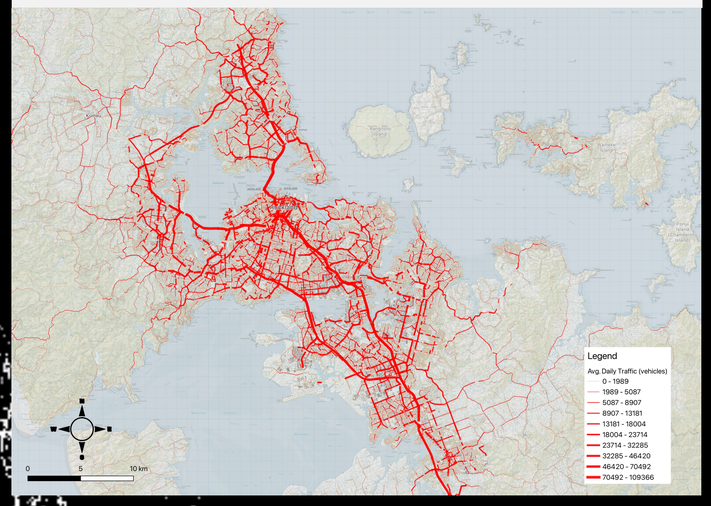
Road Accident frequency by location

Hexagon 500m grid map showing accident frequency



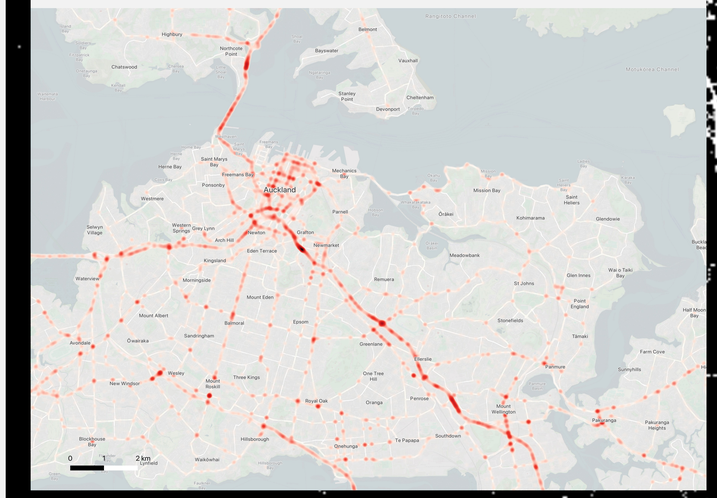
Road Network Traffic Density

Map showing traffic volume by road section.



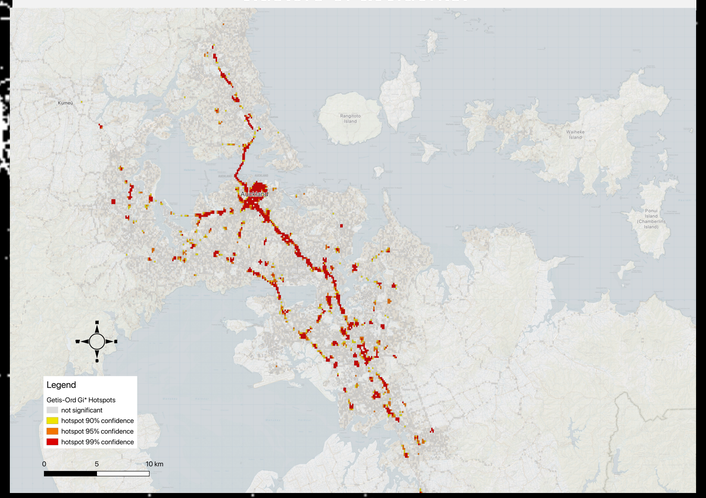
KDE Road Accidents Heatmap

KDE heatmap showing accident density, colour graduated



Hotspot Analysis

Getis-Ord Gi* hotspot map showing statistically significant clusters of accidents.



Findings & Discussion

Key Findings:
• High-risk areas include intersections in Auckland CBD and specific road sections like Old Wairoa Rd intersection.
• Motorcycles and bicycles are more likely to be involved in severe accidents compared to cars and station wagons.
• Areas with high traffic volumes correlate with higher accident severities.
Implications:
•Targeted interventions are needed to improve road safety, especially for vulnerable vehicle types, high-risk intersections such as on/off Hwy ramps.

Challenges:
• Data quality issues such as missing values and inconsistent entries in CAS dataset.

Blackspot

Road section with highest probability of accidents. Avoid driving around peak time 17h00!

Conclusion

Summary:
This project demonstrates the powerful capabilities of GIS in analysing and visualising traffic accident data. The findings highlight critical areas for targeted road safety interventions in Auckland region, on the ”Road to Zero”.
Future Work:
• Acquiring more detailed temporal data and demographic information.
• Integration of machine learning models for predictive analysis.
• Development of interactive geovisualisation tools for dynamic data exploration and stakeholder engagement.

Acknowledgements

Course: 158741 Location Data

Software
• Python 3.11.2
• QGIS 3.36.2-Maidenhead

Maps CRS
• EPSG:2193 NZGD2000