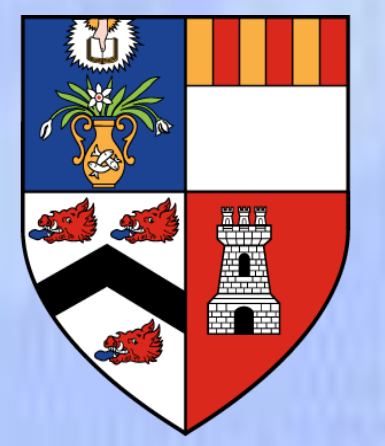


# Spatial - Temporal Traffic Accident Analysis in relation to EMS Response Time

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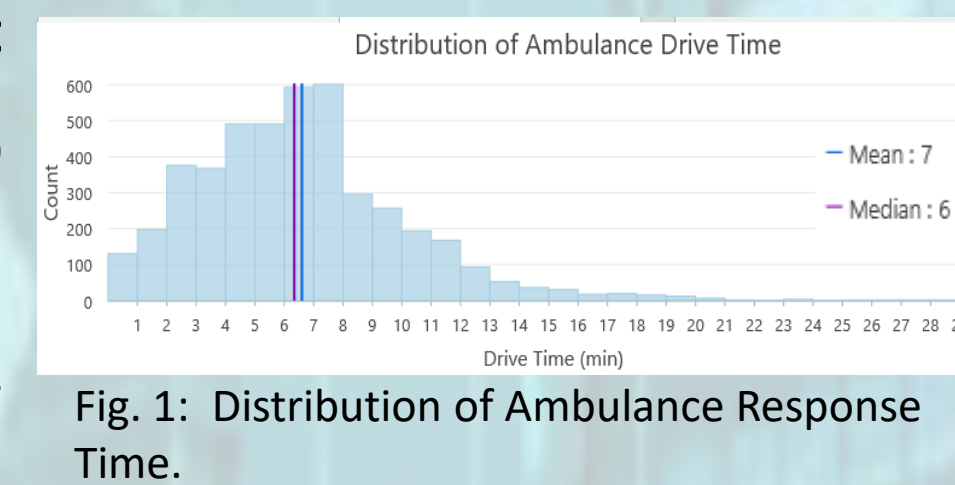


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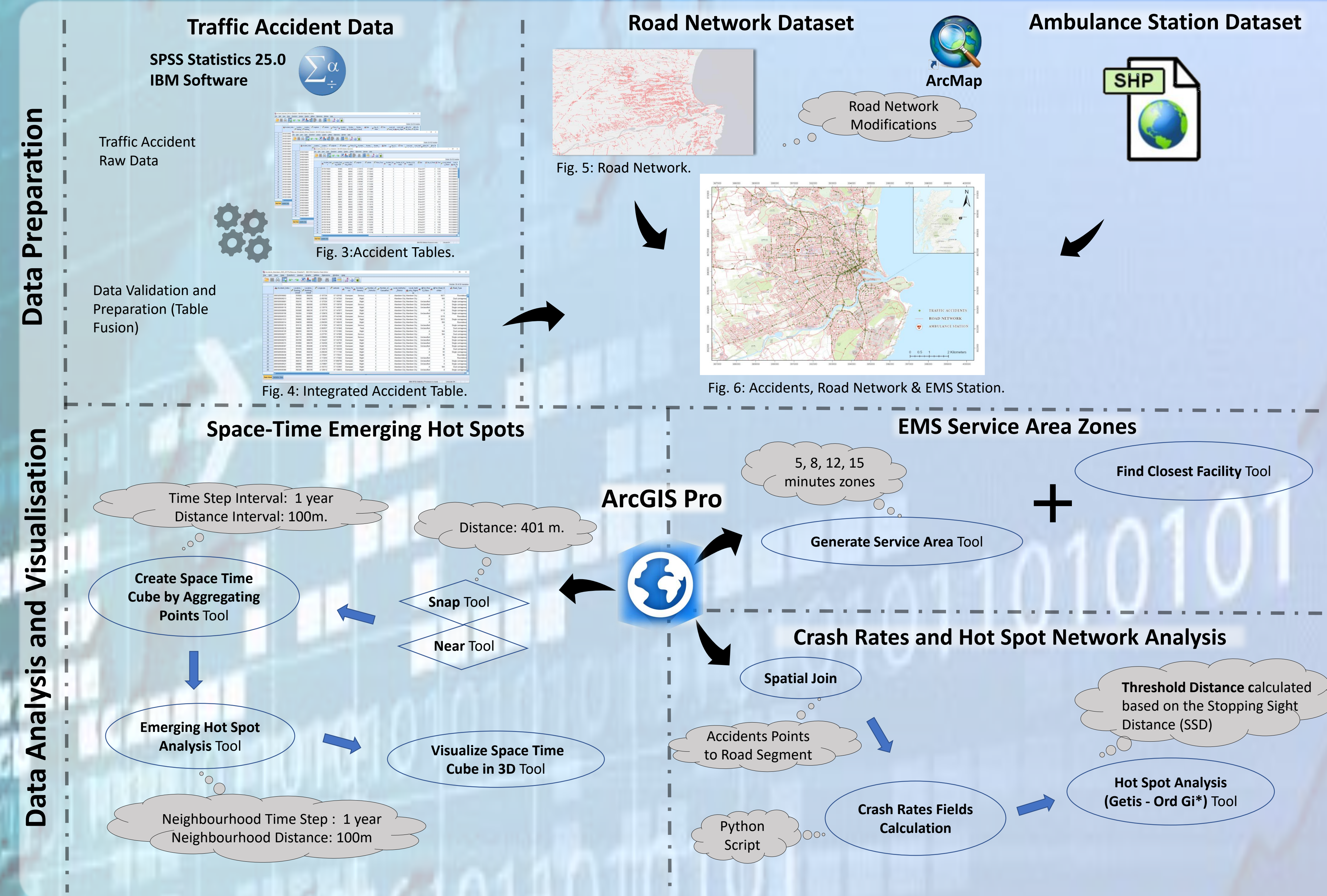
## Introduction

Traffic Accidents constitute one of the leading causes of death globally, resulting in more than 1.25 million fatalities, annually. Geospatial Technologies can play a significant role in the prediction and as a result in the prevention and decrease of traffic accidents. The purpose of this study is to analyse and examine a 13-year accident sample for the city of Aberdeen using hot spot cluster analysis methods based on the road network. Additionally, the analysis will be performed in regards to both space and time aspects and in relation to the EMS response time.

Aberdeen City is considered as one of the most congested cities in the UK (Simmons, 2019) with over an average of 180 accidents per year. The main target of the Scottish Government is to reach 75% of the category A emergency calls in less than 8 minutes (HEAT Standard) (www2.gov.scot, 2019).



## Methodology



## Discussion

The integration of both spatial and temporal distribution of accidents and the collation with the EMS response time revealed interesting patterns:

- 24 new, 14 sporadic and 2 diminishing hot spots were identified in Aberdeen.
- Two high peaks between 7-9 am and 4-6 pm during the day and two high peaks in May and between October-November were discovered.
- The comparison between the accident rates revealed new high-density accident areas, most of which are located near to the city centre, major roads and to roundabouts.
- EMS response time is highly correlated with the accident severity since 38%, 43% and 53% of 'Accidents', 'Casualty Accidents' and 'Serious Injuries – Deaths', respectively, are situated outside the 8 minutes zone.

## Conclusion

The project is considered that met the aim and the objectives that mentioned above as the results indicate that:

- New accident areas have been identified as problematic showing a high density of accidents.
- Some road sections are appeared to be prone to crashes.
- There is a strong connection between accident sites and EMS response time, since the more you move away from the HEAT Standard zone, the more devastating the accident's consequences will be.
- Specific hours and months present a high concentration of traffic accidents.

## Aim and Objectives of the Project

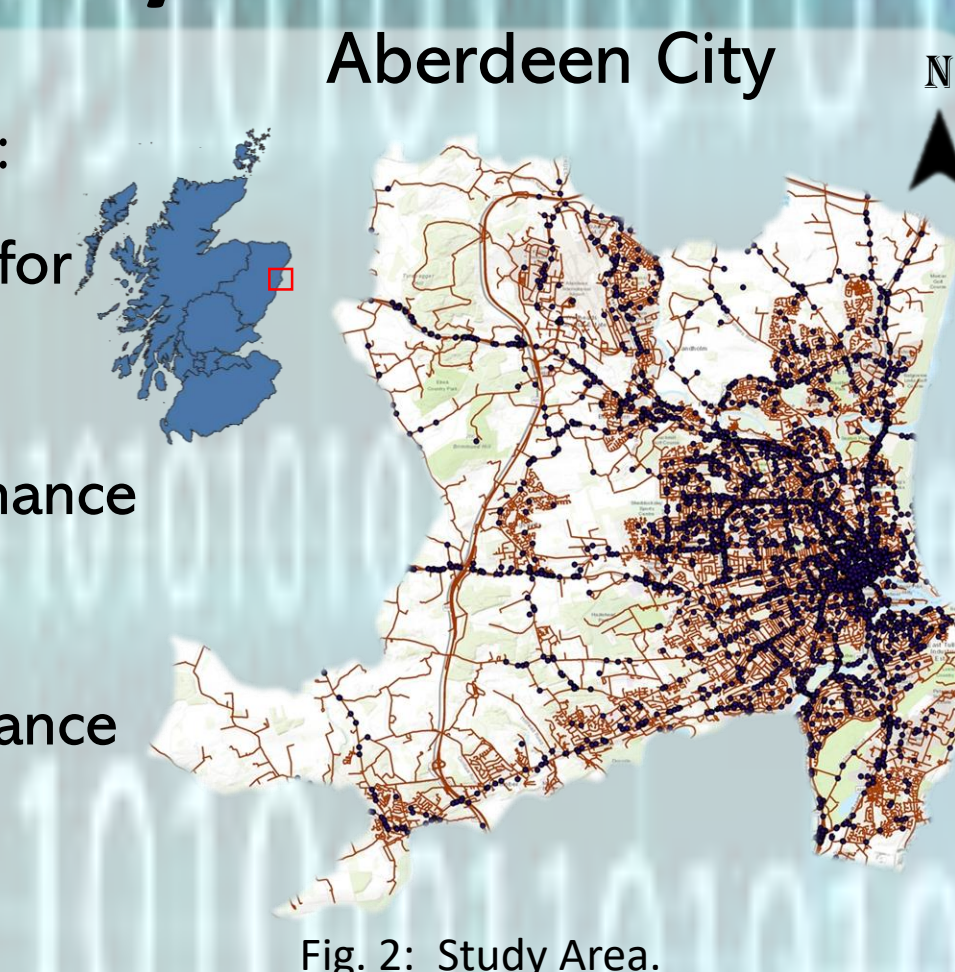
The main aim of this project is to identify the most prone to accident areas on the road network in relation to the EMS response time using space-time cluster analysis. Four objectives are carried out and are presented below:

- Definition of the persistent problematic areas in Aberdeen city regarding traffic accidents.
- Identification of the roads sections which have the highest crash rates and are prone to accidents.
- Description of the connection between the accident site and the EMS response time and how the spatial distribution of casualties and serious injuries-deaths differ from the accidents in general.
- Determination of the most hazardous time periods during the day and year.

## Datasets & Study Area

Three datasets were deployed during this study:

- Road traffic accidents (Source: Department for Transport).
- Road Network (Source: Edina Digimap Ordnance Survey Service).
- Ambulance Station (Source: Scottish Ambulance Service).



## References

1. Simmons, M. (2019) *INRIX Europe*. Available at: <http://inrix.com/press-releases/traffic-congestion-cost-uk-motorists-more-than-30-billion-in-2016/> (Accessed: 2 April 2019).
2. www2.gov.scot. (2019). *Ambulance Response*. [online] Available at: <https://www2.gov.scot/About/Performance/scotPerforms/partnerstories/NHSScotlandperformance/ambulanceStandard> [Accessed 19 Jul. 2019].

## Results

### Space-Time Hot Spot Analysis

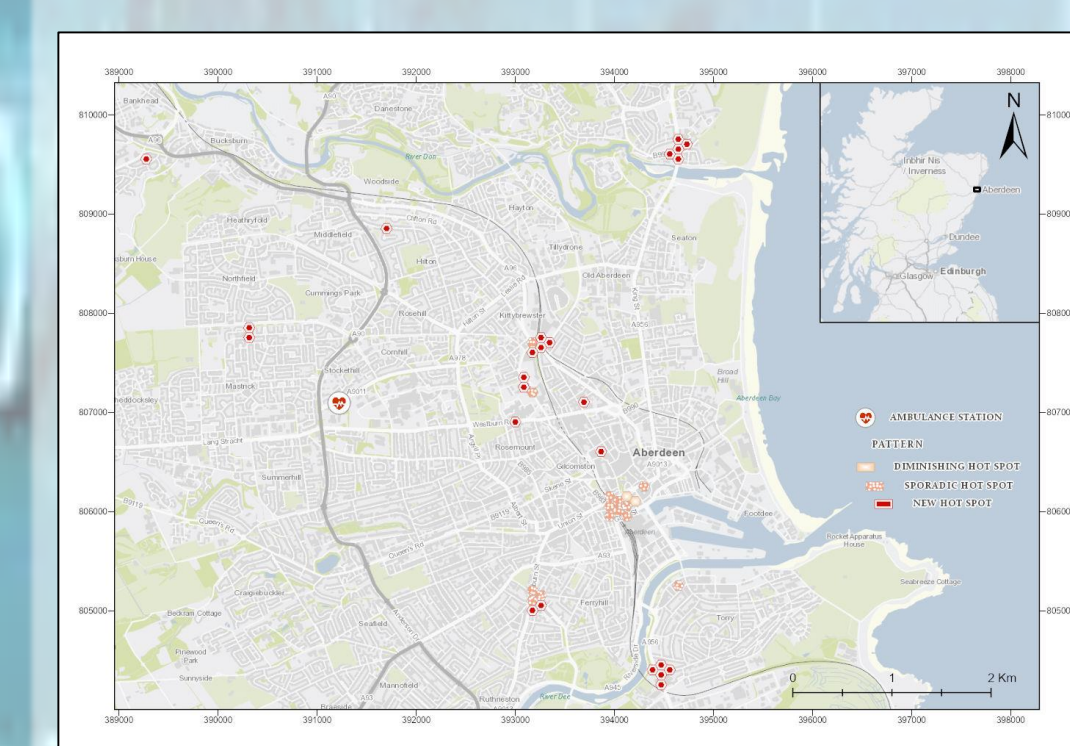


Fig. 7: Space-time hot spots.

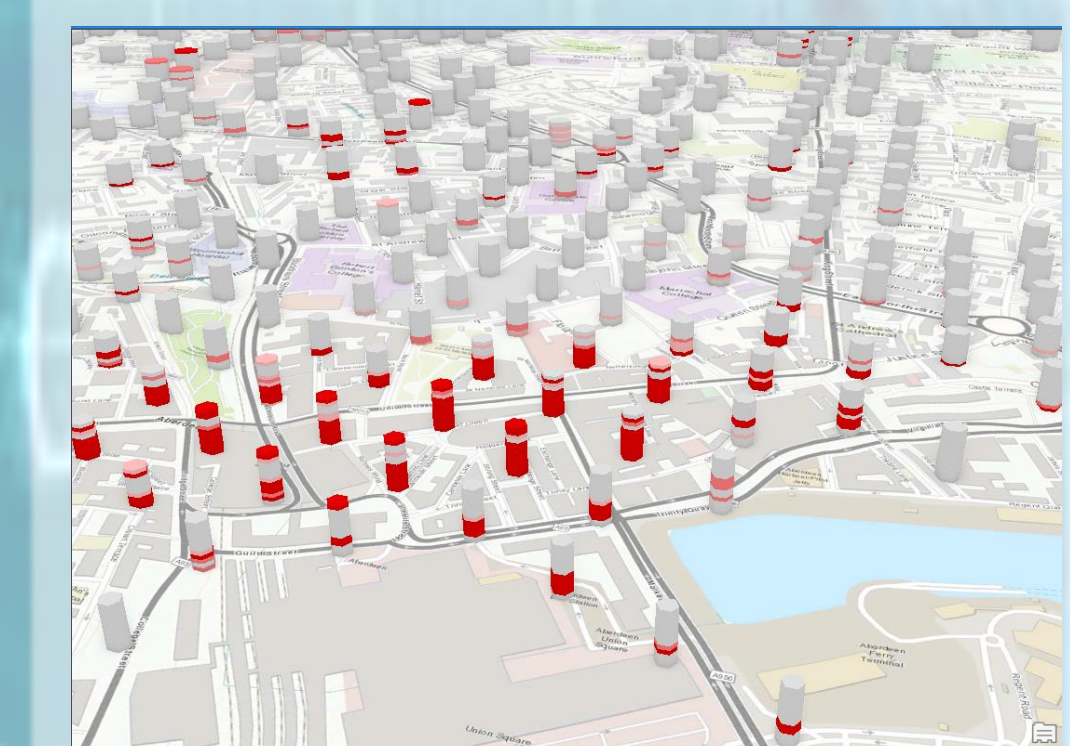


Fig. 8: Space-time hot spots 3D Visualisation.

### Accident Rates and EMS Service Area Zones

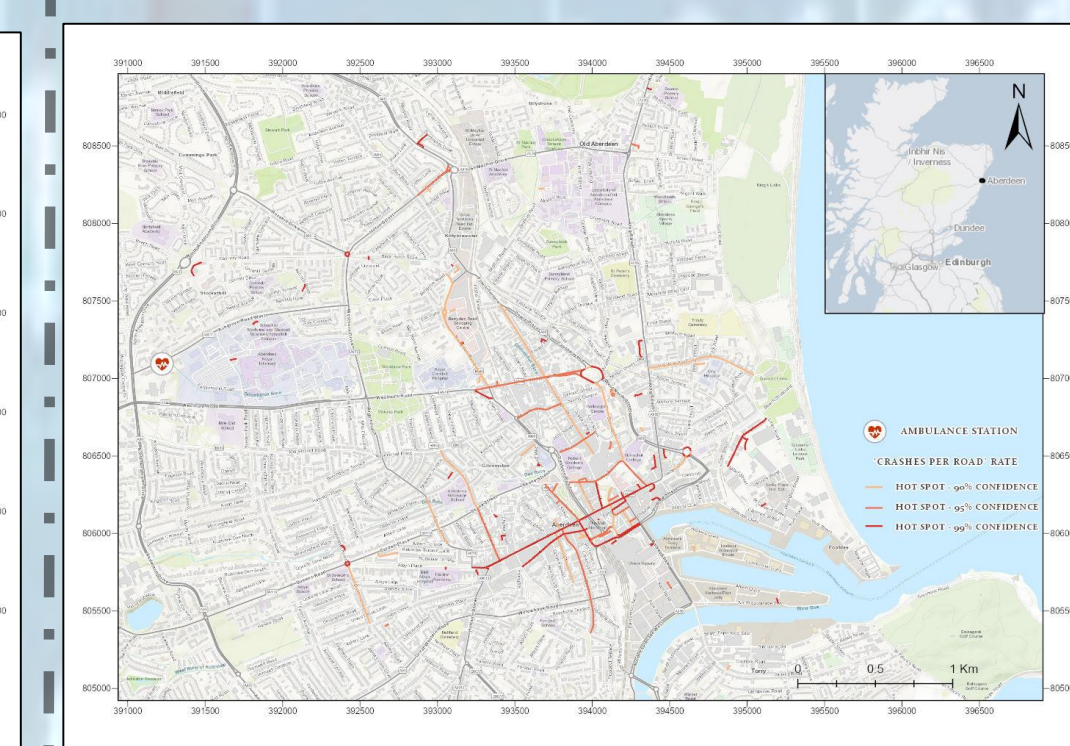


Fig. 9: 'Crashes per Road' Rate.

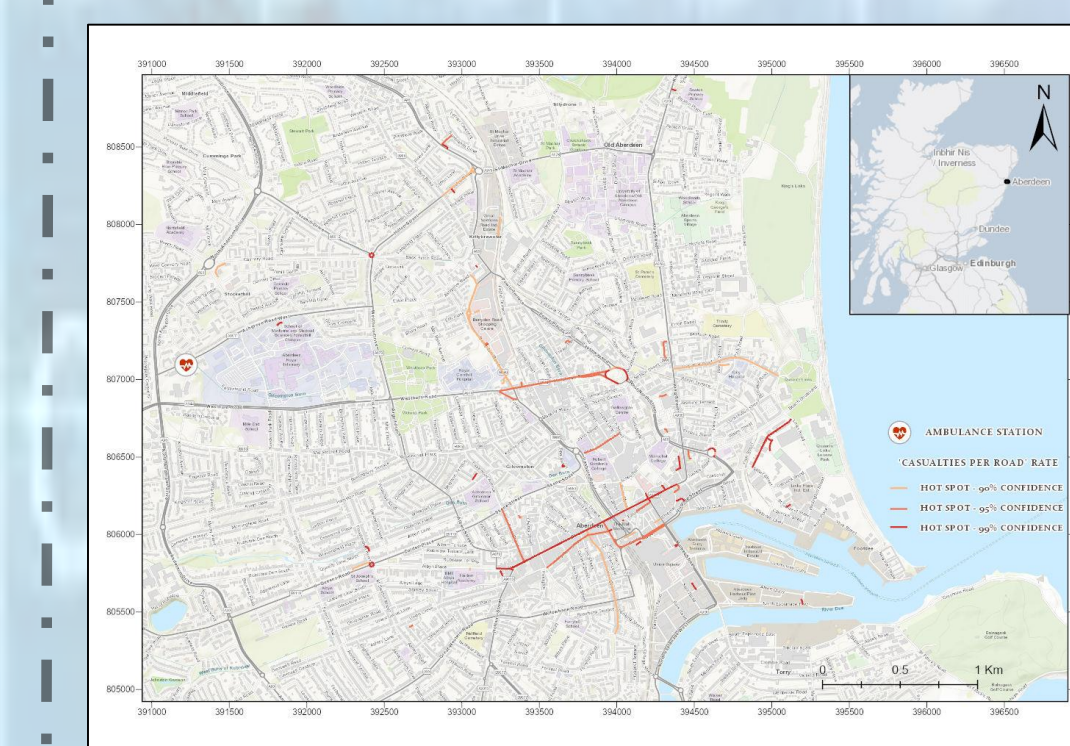


Fig. 10: 'Casualties per Road' Rate.

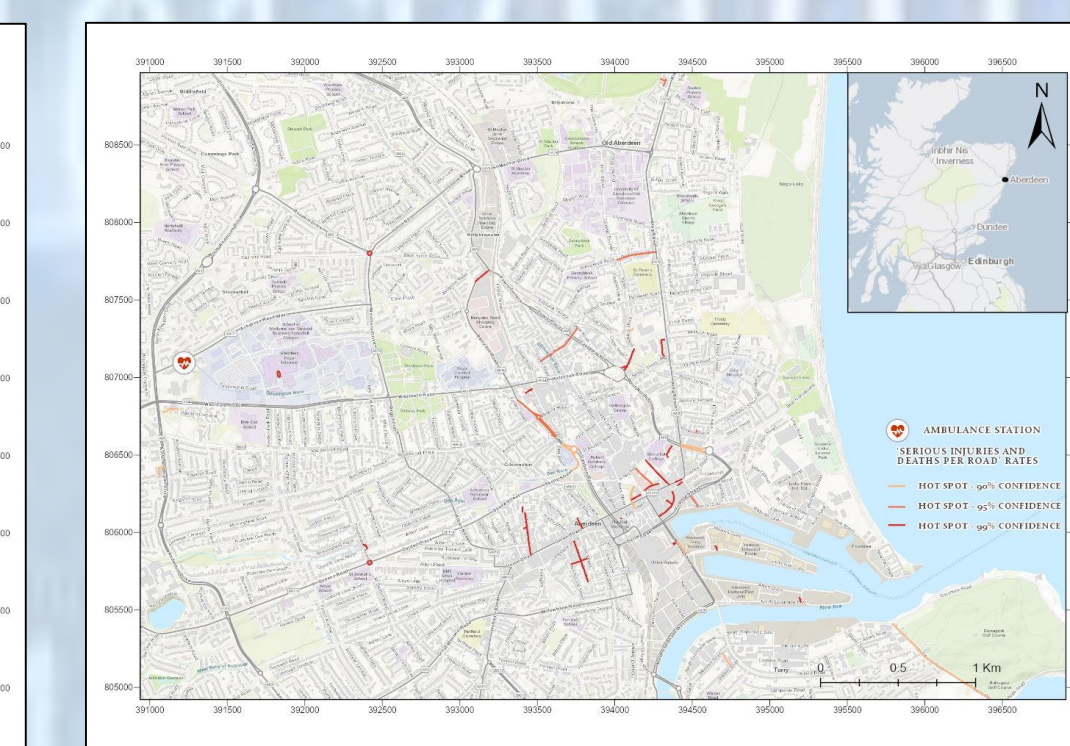


Fig. 11: 'Serious Injuries-Deaths per Road' Rate.

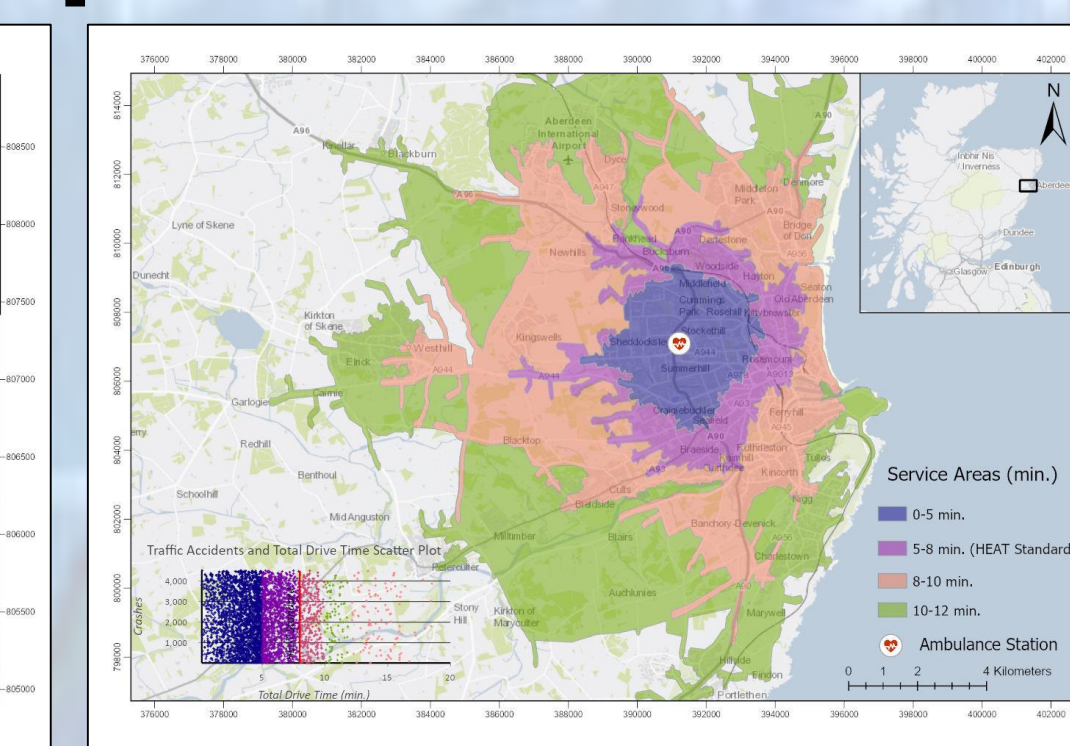


Fig. 12: Ambulance Service Areas.

### Spatial-Temporal Analysis

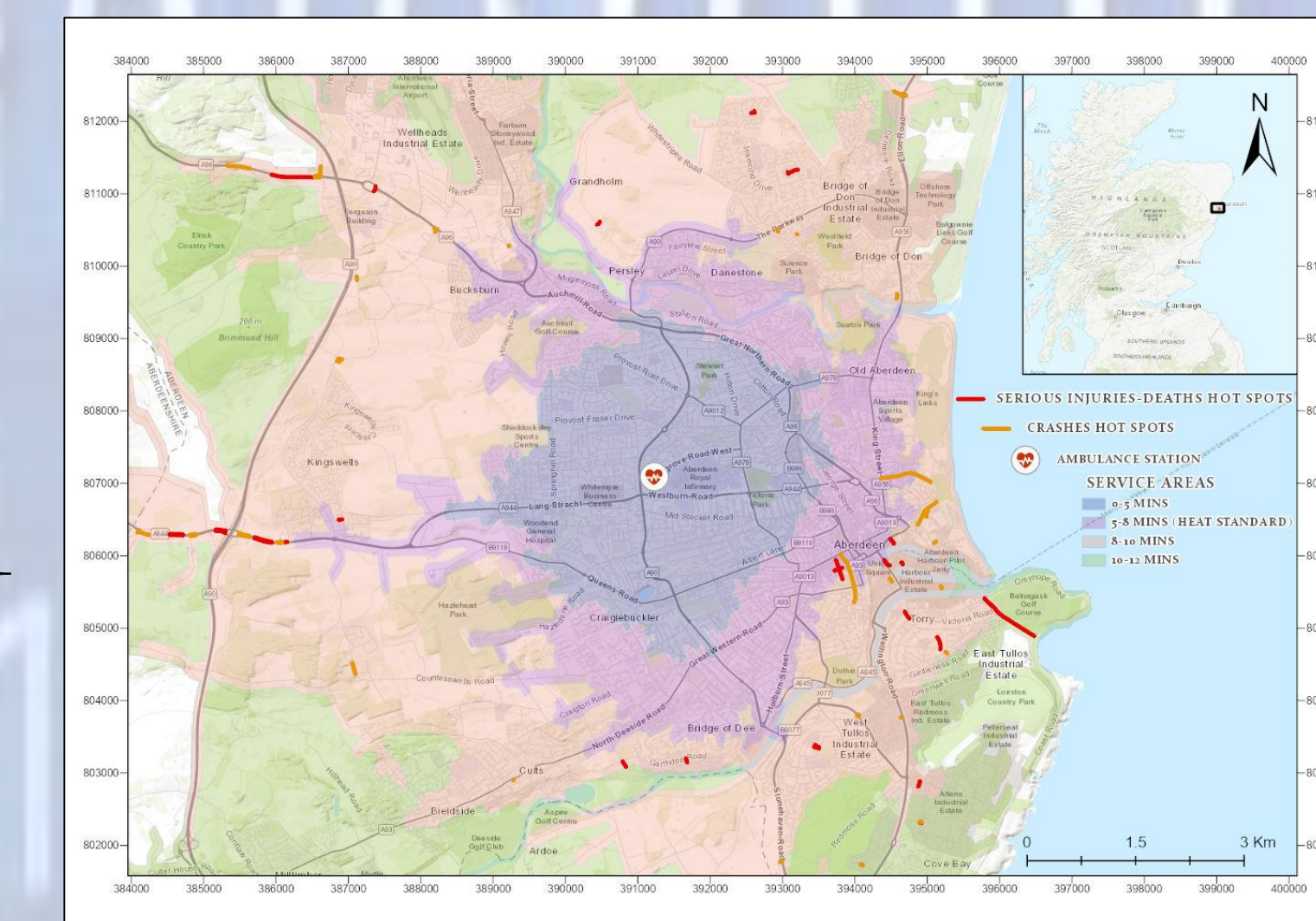


Fig. 13: Road network hot spots farther than the HEAT standard zone.

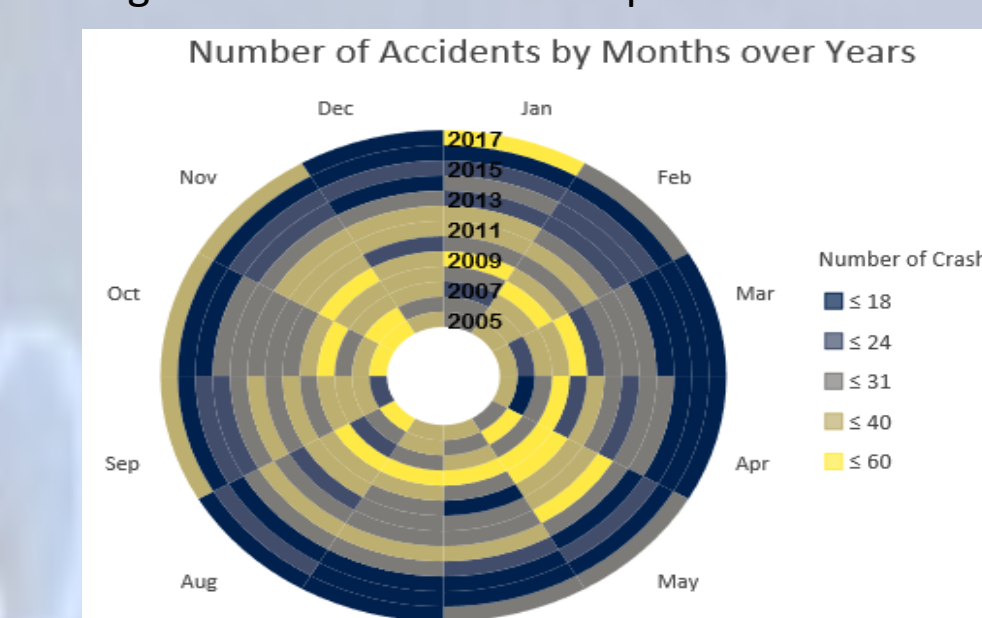


Fig. 14: Monthly and annual accident distribution.



Fig. 15: Hourly distribution of traffic accident.

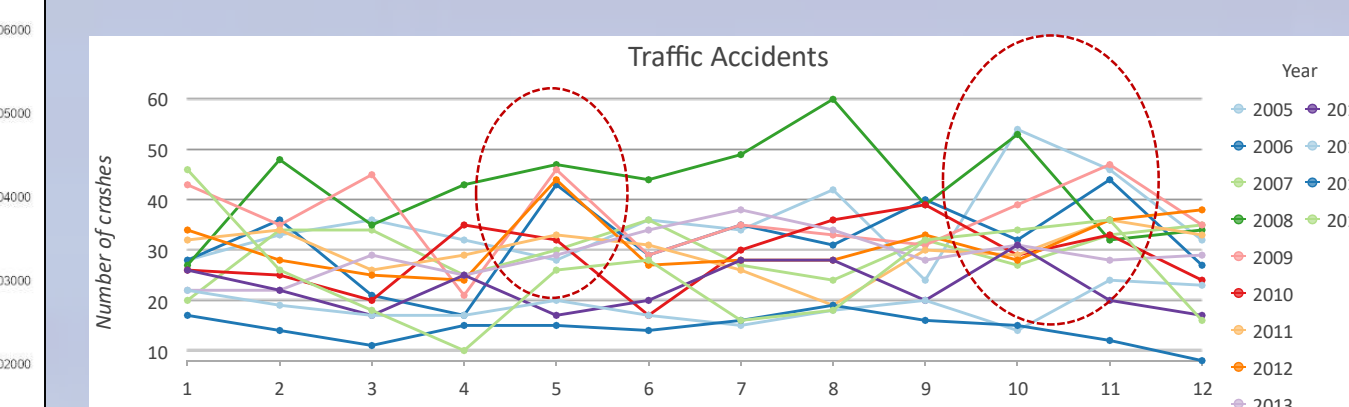


Fig. 16: Monthly distribution of accidents and the 2 high peaks.

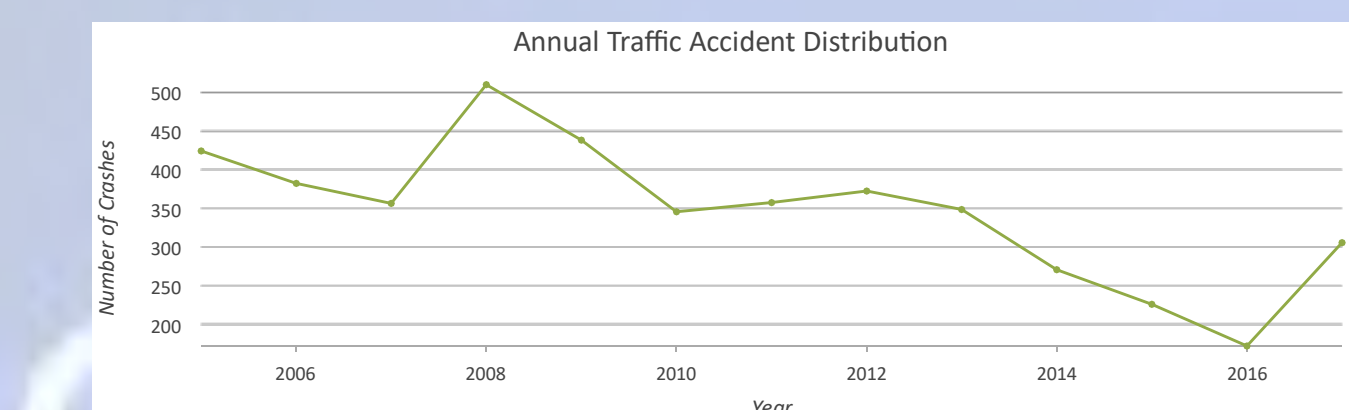


Fig. 17: Traffic accident annual distribution.