

Newcastle University Research Committee Research Impact Award: Final Report

'Software Tool for Identifying Road Traffic Accident Hotspots'

Award holders: Dr. Neil Thorpe, School of Civil Engineering and Geosciences; Dr. Lee Fawcett, School of Mathematics and Statistics

This project's main output was a software tool for road safety practitioners to identify traffic collision hotspots more reliably to prevent people from being killed and injured. The main impact envisaged therefore was an improved process for identifying locations for treatment by removing the effects of regression-to-mean and trend from collision data using algorithms based on Bayesian statistics previously developed by the research team. These algorithms have been developed using the R statistical programming language and this project has embedded them in a Shiny user interface – Shiny is a web application framework for R-based analyses. An initial phase of software development resulted in a first version of the programme that used standard before/after treatment collision data available for sites on the road network, and produced graphical and tabular output in terms of estimates of total casualties saved by a particular road safety intervention at both site-by-site and aggregate level, and also more importantly the individual effects of regression-to-mean and trend. A first meeting was then held with road safety practitioners from Gateshead Council, the Northumbria Safer Roads Initiative (NSRI) and North Yorkshire County Council as representatives of potential end-users. This meeting aimed to identify future functional requirements and also preferred data input and output formats. A second phase of development focussed on implementing algorithms for collision hotspot identification and improving the output formats. The current version of the Shiny application therefore has two distinct functionalities:

- Scheme Evaluation, providing a breakdown of changes in casualties before/after treatment disaggregated by RTM effect, trend and genuine treatment effect. This enables sites to be ranked by RTM effect, treatment effect, or treatment effect above a given threshold; and
- Collision Hotspot Identification, producing estimates of future collision/casualty numbers plus 95% confidence intervals at individual sites. Sites can be ranked by either absolute or the percentage change in collisions over previous year(s) and the probability of exceeding a given frequency of accidents in the following year can be provided. This allows road safety engineers the opportunity to identify and prioritise sites for treatment.

Legal experts at Newcastle University are currently drawing up a user agreement in order that the representatives of our potential end-users can experiment with the software on a non-exclusive basis following a forthcoming training exercise. The research-team's long-term aim is to embed the software within a commercially-available accident analysis software package such as PTV's VISUM Safety. We have worked closely with this industrial collaborator for several years with this long-term aim in mind. Our activities as part of the Impact Award have given rise to a number of other relevant developments:

- written paper, presentation and demonstration of our Shiny software at the Annual Transport Practitioners Meeting in London in July (Fawcett *et al.*, 2015);
- paper under review for the 95th Annual Meeting of the Transportation Research Board (TRB) in Washington DC (Fawcett *et al.* under review);
- invited presentation and software demonstration at the ITS and Road Safety Forum in Doha, Qatar funded by our industrial collaborators (Thorpe *et al.*, 2015);

- presentation and software demonstration to the Abu Dhabi Police, Tatweer Consultancy Abu Dhabi, and the Qatari Ministry of the Interior and Department of Transport;
- presentation at the European Conference of Transport Research Institute's Thematic Group Meeting on Safety, 23rd September 2015;
- additional funding (£5000) from the Northumbria Safer Roads Initiative to support the continued development of the software to include a new function to provide better analysis of collision contributory factors; and
- links established with Transport for London (TfL) following our presentation at the TPM conference. TfL have expressed an interest in our work and possibly using our approach for analysing collision data in London.

These activities have helped to generate global awareness and interest in the software program we have developed using the Impact Generating award. The intention is now to capitalise on this interest and our industrial collaboration to ensure that impact is maximised in future years through widespread use of our collision data analysis program by road safety practitioners to help reduce death and injury on the world's roads. Our research has been identified by both CEGS and MAS as potential impact case studies for REF2020.

References:

Fawcett, L.; Matthews, J.; Kremer, K.; Thorpe, N.; Galatioto, F.; Hoffman, T.; Muench, A. (2015) 'Identifying Collision Hotspots using Time Series Analysis and Accounting for Regression to Mean' Paper presented at the 13th Annual Transport Practitioners' Meeting, Session: Road Safety: Design Applications, London, 2015 (July)

Fawcett, L.; Matthews, J.; Kremer, K.; Thorpe, N.; Galatioto, F.; Muench, A. 'Road Safety Hotspot Prediction: A Study of the City of Halle, Germany.' Paper submitted to 95th Annual Meeting of the Transportation Research Board, January 2016, Washington DC.

Thorpe, N.; Fawcett, L.; Matthews, J.; Newman, K.; Galatioto, F.; Kremer, K.; Muench, A.; Ahuja, S. (2015) 'A novel approach to collision hotspot identification' Invited presentation at the ITS and Road Safety Forum, Doha, Qatar, 8th-9th September 2015

Other related papers:

Thorpe N, Fawcett L. (2012) 'Linking road casualty and clinical data to assess the effectiveness of mobile safety enforcement cameras: a before and after study.' *BMJ Open*, 2(6), e001304.
<http://bmjopen.bmj.com/content/2/6/e001304?ct>

Fawcett, L.; Thorpe, N. (2013) Mobile safety cameras: estimating casualty reductions and the demand for secondary healthcare. *Journal of Applied Statistics* 40(11), 2385-2406
<http://www.tandfonline.com/doi/full/10.1080/02664763.2013.817547>

Slater, P.; Thorpe, N.; Fawcett, L. (2014) Getting Value for Money from Investment in Road Safety: Are we Evaluating our Schemes Correctly? Paper presented at the 12th Annual Transport Practitioners' Meeting, Session: Road Safety – the Future, London, 2014 (July)