GEOSTATISTICAL ANALYSIS OF ROAD DESIGN and ENVIRONMENTAL CHARACTERISTICS THAT AFFECT CAR CRASHES IN VERMONT

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Abstract

Although the annual number of fatalities due to motor vehicle crashes has remained stable or been decreasing over the past decade in Vermont[i], the cause of these tragedies is still a major safety and public health issue.

This research is based on motor vehicle crash data as well as detailed road characteristics information provided by the Vermont Agency of Transportation (VAOT). Three main categories of variables have been identified in the literature as being related to the severity of crashes; they include demographic variables (e.g., driver's age and gender), environmental characteristics (e.g., weather conditions or lighting at the time of the crash), and infrastructure attributes (e.g., the presence or lack of guardrails, the road curvature and design, or road surface conditions). Using geospatial analysis, this study is mainly focused on determining whether there is a range of critical radii of curvature that may be associated with an increased probability of crashes.

Based on existing literature findings, it has been concluded that crash trends and patterns may have a strong spatial correlation[ii, iii, iv, v,vi]. Therefore, this research is currently analyzing the semivariograms of the main contributing crash variables, looking for spatial auto- and cross-correlations that may lead to future geospatial crash patterns. Applying geostatistical principles[vii], it has been found that the spatial correlation for demographic characteristics follow a very different trend than for infrastructure characteristics.

Finally, this study aims to continue with the geospatial analysis, focusing on road geometry information, in order to find specific road characteristics, such as curve radii, that increase the probability of a crash to occur. Road design and construction recommendations based on the outcomes of this study will be provided to the VAOT.

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[i] Department of Public Safety, state of Vermont.

[ii] (Aguero-Valverde, Jovanis, 2006) Spatial Analysis of fatal injury crashes in Pennsylvania. Accident analysis and prevention. Vol. 38 pp.618-625.

[iii] (Quddus, 2008) Modelling area-wide count outcomes with spatial correlation and heterogeneity: An analysis of London crash data. Accident analysis and prevention. Vol. 40 pp.1486-1497.

[iv] (Levine et al., 1995) Spatial analysis of Honolulu motor vehicle crashes. Accident analysis and prevention. Vol. 27 pp.663-674.

[v] (Aguero-Valverde, Jovanis, 2008) Analysis of road crash frequency with Spatial Models. Transportation Research Record: Journal of the Transportation Research Board, No. 2061, Transportation Research Board of the National Academies, Washington, D.C., 2008, pp. 55–63.

[vi] (Aguero-Valverde, Jovanis, 2010) Spatial Correlation in Multilevel Crash Frequency Models. Transportation Research Record: Journal of the Transportation Research Board, No. 2165, Transportation Research Board of the National Academies, Washington, D.C., 2008, pp. 21–32.

[vii] (Isaaks, Srivastava, 1989) Applied Geostatistics. Oxford University Press, 1989. Print.