JDiBrief - Analysis

Street Networks and Risk: SUMMARY (1 of 5)

Authors: Shane D Johnson and Toby Davies
UCL Department of Security and Crime Science

PURPOSE: Research shows that crime is more likely to occur at some places than others. One common aim of crim hotspots This may be achieved by identifying which areas (*e.g.* police beats) have the highest crime, or by using Kernel Density Estimation (KDE). A problem with these approaches, however, is that they ignore one of the main factors that influences where many types of crime can occur: the street network. In doing so, they do not allow the analyst to see if particular features of the street network affect crime risk, or to deploy resources to the precise locations at greatest risk. This Brief discusses one reason why risk may vary between street segments, how such effects can be tested, and describes further analyses that may inform crime prevention and operational policing.

THEORY: The street network determines the routes that people can take between locations, and hence the places with which they will become aware. In the case of offenders, it also influences the opportunities for crime they are likely to encounter. Some routes (*e.g.* the shortest ones) will be more popular than others and hence are more likely to be familiar to people, including offenders. Theory suggests that more popular streets will thus experience more crime and existing research supports this. Segment characteristics hence appear to provide a useful indication of the potential for crime, and since neighbouring streets can be of significantly different character, patterns at this scale identified using traditional hotspot analysis approaches (*e.g.* KDE) may be misleading.

METHOD: In addition to crime data regarding crime locations, data are required that define the configuration of the street network (e.g. Ordnance Survey data) and, where the analyst is interested in crime risk, the number of targets on each street segement (e.g. households in the case of residential burglary). Having assembled the necessary data, it is necessary to code street segments according to their usage. A simple categorical coding scheme that may be used is road type (e.g. Major Road, Minor Road, Local Road, Cul-de-Sac, and so on). A more sophisticated approach, which provides more precise estimates of street segment usage, uses techniques from a branch of mathematics known as graph theory. Such analysis can be conducted using tools such as the Urban Network Analysis package for ArcGIS. After the street segments have been classified in this way, a Geographica
segements and analyses conducted to see if crime risk is associated with estimated street usage.

APPLICATION: Analyses conducted for Merseyside (UK) clearly indicated that roads that would be expected to be used the most (e.g. Major Roads) had higher rates of burglary than those expected to be used the least (e.g. residential roads). Burglary risk was particularly low for Cul-de-Sacs and Private roads. These patterns were most prominent during the daytime. Analyses conducted for the West Midlands, using techniques from graph theory, also showed that streets that are estimated to be used more frequently experience higher burglary risk, but that graph theory estimates are more precise than the street segment classification method based on road type.

ACKNOWLEDGEMENTS: The authors acknowledge the support of the ESRC (grant number: ES/K000721/1) and the West Midlands Police who funded the work on which these briefs are based.