

Bo6.2

The contribution of GIS to Medway's 2001 crime audit

Drs. Jamie Tratalos, GI analyst, and Gesche Schmid, ICT and Information Manager, Medway Council

Bullet points

- Developing a method for crime and disorder audit
- Mapping of hotspot areas based on crime density per postcode
- Use of a secure internet site to update data and monitor changes

Abstract

As part of the 2001 Crime audit, Medway worked in partnership with Kent County Constabulary to develop a robust method for analysing crime and disorder, for determining crime hotspot areas and for monitoring changes of crime and disorder on a regular basis using GIS. The criteria for developing the method was to provide an output that can be regularly updated, and easily understood and queried by officers and members via a secure internet link.

The occurrence and density of crime was mapped by postcode area over a period of three years. With the aim of maximising the number of crimes captured whilst minimising the area covered, seven areas of highest crime and disorder were identified based on the mapped crime occurrence per postcode. For each of these hotspot areas, monthly time series, from April 1998 to March 2001, were plotted for each crime category. Twelve-monthly prior moving average transformations were also applied to these data so that the overall trend in crime could be identified without interference from seasonal influences and short term fluctuations. The results will be mapped on a secure GIS internet link between the council and the police so that officers from both authorities can query individual crime hotspot areas. The same link will be used to regularly update the results so that the most current information is available and changes can be monitored. The results of the crime audit are incorporated into the authority's neighbourhood renewal strategy, which will adopt a similar method for determining the most deprived neighbourhoods.

Introduction

Under the terms of The Crime and Disorder Act (1998), local authorities are required to undertake crime audits to act as a basis for crime reduction. Ideally, this process should be the result of a community safety partnership between local authority departments (e.g. community services and neighbourhood renewal), police, fire brigade, social services, health authorities and associated bodies. The main emphasis is to provide a forum for data exchange to reduce crime and improve neighbourhoods (Radburn, 2001).

Geographical and statistical analyses have now been used in a number of crime audits, primarily to identify crime hotspots, which is a requirement of the crime and disorder legislation.

Many of these analyses have been based at the ward level, which is at too large a scale to show localised crime hotspots. Other crime audit analyses have been based on geocoding crime and disorder incidences and using surface generation techniques (e.g. clustering) to determine hotspots (Denness, 1999, Doyle *et*

al., 1999, McKeon, 1999, Chainey, 2000). This has often involved an automated approach to deriving hotspots which allows little interaction with police officers. It is worth noting that Ratcliffe & McCullagh (2001) showed that in some cases the opinion of officers may concur with the results of hotspot analyses, whilst in others they are unaware of their true location.

In Medway's first audit, conducted in 1998, little use was made of GIS, although three hotspot areas were identified on the basis of data for wards and enumeration districts. However, as part of the 2001 audit, GIS officers worked in partnership with the neighbourhood renewal team and officers at Kent County Constabulary to develop a method for mapping and analysing crime and disorder data at sub-ward levels. Analyses of the occurrence of crime and disorder within hotspot areas were conducted by offence type, including examination of daily, seasonal and annual fluctuations.

Out of the community safety partnership arose the need to provide a secure internet link by which to publish and access the results of the audit and to exchange information required for further monitoring and analysis. The aim of this information-sharing project will be to give decision makers in the police and council access to up-to-date, spatially referenced crime information at sub-ward level.

Methods for the GI analysis

To carry out the audit, geo-referenced crime and disorder information were supplied by Kent County Constabulary. Crime data consisted of all offences reported between April 1998 and March 2001. Equivalent data for disorder offences were obtained for the period April 2000 to March 2001. The date and time of the offence was listed for all the data. Offences were classified into 12 types of crime offence and 12 types of disorder offence (Table 1).

Table 1. Categories of crime and disorder used in the analyses

Crime Categories	Disorder Categories
Assault	Civil Dispute
Burglary (in dwelling)	Disturbance in Licensed Premises
Burglary Other Than Dwelling	Disturbance in Public Place
Damage (including Arson)	Disturbance on Private Property
Deception	Domestic Incident, Drunkenness
Drug Offences	Homophobic Behaviour
Shoplifting	March/ Demonstration
Theft From Motor Vehicle	Neighbour Disputes
Theft Of Motor Vehicle	Disorder at Public/ Sports Events
Theft	Racial/ Ethnic Disorder
Vehicle Interference	Violent Disorder
Other Crime	Other Unlisted Disorder/ Nuisance

An important part of the analysis process was the opportunity to call on the expertise of police officers in interpreting the data. It was therefore important to come up with ways of mapping crime data which police officers felt comfortable in interpreting and which allowed monitoring and comparison over various time scales. The technique arrived at, in consultation with the officers themselves, was to map the density of crime by postcode area, per ha² and per month:

$$D = \frac{N}{A * M}$$

D = crime density

N = number of crimes

A = area of postcode, in hectares

M = number of months of data

This allowed the comparison of crime data from different periods of time and in areas of varying population density. When data from different crime categories were shown, e.g. burglary and assault, the legend in which the data were displayed was normalised so as to map the same relative intensity of crime in a given category with the same colour (Figure 1).

Separate maps were produced for:

- each crime and disorder category
- the sum of all crime categories
- the sum of all disorder categories
- the sum of all crime and disorder categories

Candidate hotspots were delineated from the mapped postcode data in consultation with police officers (see Figure 1). These hotspot areas were then further refined in GIS so as to capture the maximum amount of crime within the smallest possible area, in order that crime prevention resources could be used most efficiently.

Monthly time series, from April 1998 to March 2001, were produced of the number of crime incidents for each offence category and for each hotspot area. To eliminate the effect of seasonal fluctuations and short-term variation, these series were used to calculate 12 monthly prior moving averages for each month, March 1999 to April 2001. For example, in these latter series, the figure for March 1999 consisted of the average monthly value for the period April 1998 to March 1999, the figure for April 1999 consisted of the average monthly value for the period May 1998 to April 1999. From these figures the overall trend could be observed more clearly. Equivalent series were also produced for all reported crime in the Medway area.

This spatio-temporal analysis complemented purely temporal analysis conducted by Kent Police such as plotting crime categories according to the month or hour band in which they were committed.

Maps were also produced of the 20 postcodes with the highest density of offences and the 20 addresses with the highest number of offences. Reports of discarded needles, fly tipping (Medway Council data) and rubbish fires (Kent Fire Service) were mapped, as well as the locations of schools, leisure facilities, shopping areas and parks.

Results of the analysis

Medway is a unitary authority whose urban area forms the largest conurbation in North Kent, with a population of approximately 250 000. As a result, Medway in some respects resembles a London borough in its crime and social deprivation levels.

Seven hotspot areas were identified from the crime density maps (Figure 2). These contained 49 % of Medway's crime and disorder offences in an area representing 27 % of Medway's land surface area and 4.2 % of its properties.

Time series of total crime in each of the 7 hotspot areas are shown in Figure 3a. The town centre areas of Chatham, Gillingham, Strood, Rainham and Rochester areas showed an overall reduction in crime over the three-year period, whereas the post-war residential areas of Parkwood and Walderslade/ Lordswood showed an overall increase. This confirmed the belief amongst police officers that the latter areas, although containing lower crime levels than the other hotspots, were experiencing increasing crime levels

and should therefore be designated as crime hotspots. This may be due to a degree of displacement of criminal behaviour after the three hotspot areas identified in the 1998 audit, in Chatham, Gillingham and Strood/Frindsbury, were targeted by crime reduction strategies.

These results for the hotspot areas can be compared to equivalent data for crime throughout the whole of the Medway, which showed an overall decrease over the period, with crime at its highest between May 1998 and April 1999, generally decreasing up to December 1999 and then rising again for the period March 2000 to March 2001. Time series for individual crime categories showed a number of trends. For example, domestic burglaries were found to have dropped sharply in the Chatham area, but to have risen in Parkwood and Lordwood/ Walderslade (Figure 3b).

The majority of the top 20 postcodes and top 20 locations for all crime categories fell within one of the hotspot areas, as did locations of rubbish fires and discarded needles. However, fly tipping was found to take place mostly outside the hotspots in remote areas.

The spatial and spatio-temporal analyses described above complemented statistical analyses calculated by month and hour band by Kent Police. For example, analysis by hour band showed that shoplifting offences were concentrated in the late afternoon, coincident with the end of the school day. A number of the top twenty locations for criminal damage and burglary other than dwelling were found to be schools, and crime densities in general were often high in the vicinity of schools. This suggested the need for more targeting of schools in crime prevention strategies. Actions have already been taken to improve security around schools and to liaise with the schools to target crime.

The results of the analyses were well received both within Medway council and the police force. In addition to its contribution to the crime audit, the analysis has already brought about concrete change in community safety initiatives. For example, CCTV cameras are now being placed in the crime hotspot areas. However, for the results of the analysis to be used most effectively, there is a need to be able to share the information with all interested parties, most notably the police, whilst denying access to those who might inappropriately exploit the data, such as criminals and insurance companies. Using the success of the audit as a basis to apply for further funding, Medway are now developing a secure internet link between the council and the police as a means of sharing the data.

Plans for information sharing

The principle of information sharing forms one of the key elements of Medway's community partnership. In the 1998 audit, partners were reluctant to provide any of their raw data and would only share summarised report information. In the 2001 audit, the community safety partnership had progressed considerably and detailed datasets were exchanged between the partners to allow for better integration and more detailed analysis of the data. However, during the process it was recognised that information sharing needed to be made more efficient, by moving from exchanging data on disk to accessing information directly via a secure internet link.

The community partnership has since received GOSE (Government office for the South East) funding to develop a common database on a secure website accessed by all partners via the internet. The purpose of the system is to gather information from a range of information management systems.

Data will be exchanged as part of the Kent Police - Medway Council data sharing protocol which follows strict data protection guidelines. To protect identification of individuals, the information will be summarised in tables and graphs for specific hotspot areas and mapped as postcode density maps. Any partner within the community safety partnership will be able to access the summary and mapped information for decision making and to monitor changes in community safety patterns.

The information gathered will include not only crime and disorder data from the police but also information relating to community safety such as incidences of rubbish fires, fly tipping, abandoned vehicles, graffiti, discarded needles and vandalism, which are currently recorded by civic wardens. With the addition of crime and disorder data, this can be used to help to identify areas where community safety is threatened.

Hotspot areas of crime and other offences will be mapped via a GIS intranet front end, using the existing GIS intranet site GISMO to host the data (Schmid & Hodge, 2001).

It will also be possible to map community safety offences against

- Public places which tend to attract these offences, such as schools, playgrounds, town centres and leisure centres.
- Crime prevention measures, such as the locations of streetlights, gated alleyways and CCTV cameras.

In addition, the site will allow the analysis and mapping of other factors linked to deprivation, such as school truancy levels, numbers of benefit claimants and children in social care (see The Bradford Community Statistics Projects: <http://www.bcsp-web.org>). In the future, information could also be linked to neighbourhood statistics and census 2001 information which might also be downloaded to the site from the neighbourhood statistics website (<http://www.statistics.gov.uk/>).

Further recommendations and summary.

Medway has derived an easy to calculate methodology to determine crime hotspots which can be used by any desktop GIS without special analysis tools. This method is meaningful to all parties with responsibilities for community safety whilst providing suitable output for an in-depth analysis. Establishing a common methodology based on normalised postcode density maps will help to form base line information for future audits and comparison of various factors.

The use of a common community information database, with the information made available via a common secure GIS internet site, will give decision makers the opportunity to easily access, monitor and view the information to review their policies.

It is envisaged that the methodology used to identify crime hotspot areas will be adapted to determine deprived areas within Medway as part of the neighbourhood renewal programme. In this analysis, crime and disorder and other community safety offences will be among the many factors which contribute to indices of neighbourhood deprivation and social exclusion.

References

Chainey S 2000 The importance of geography: better information for tackling social exclusion. *Proceedings of the AGI conference at GIS 2000 (CD)*.

Crime and Disorder Act 1998. The Stationary Office Limited. ISBN 0 10 543798 0.

Denness, I., 1999, Using geographic information systems for crime auditing and analysis. *Proceedings of the AGI conference at GIS 99*. 5.7.

Doyle S, Morris C, MacLean A & Allison G 1999. Using geographic information systems for crime auditing and analysis. *Proceedings of the AGI conference at GIS 99*. 5.8.

McKeon A 1999. Joined up Government and BS7666. *Mapping Awareness*. Spring edition.

Radburn S 2001. Data exchange and & crime mapping. Home office report.

Ratcliffe JH & McCullagh MJ 2001. Chasing ghosts: police perception of high crime areas. *British Journal of Criminology* 41, 330-341.

Schmid G & Hodge A 2001. Gismo: a gremlin or? How Medway intranet serves officers, members, citizens and pupils. *Proceedings of the AGI conference at GIS 2001 (CD)*.

Additional web sites

Bromley Crime and Disorder Audit:

<http://www.bromley.gov.uk/CRIME/strategy/contents.htm>

Hertfordshire Crime and Disorder Audit:

<http://www.hart.gov.uk/comsafe/communitysafety.htm>

Redbridge Crime and Disorder Audit:

<http://194.205.125.109/partnerships/rscp/crimeb.pdf>

Infotech Enterprises Europe:

<http://www.infotech-europe.com>

The crime and disorder act:

<http://www.homeoffice.gov.uk/cdact/cdaint1.htm>

Authors

Drs. Jamie Tratalos, GI analyst, and Gesche Schmid, ICT and Information Manager, Medway Council, Compass Centre, Chatham Maritime, Kent, ME4 4YH,

e-mail: jamie.tratalos@medway.gov.uk, Tel (01634) 331465

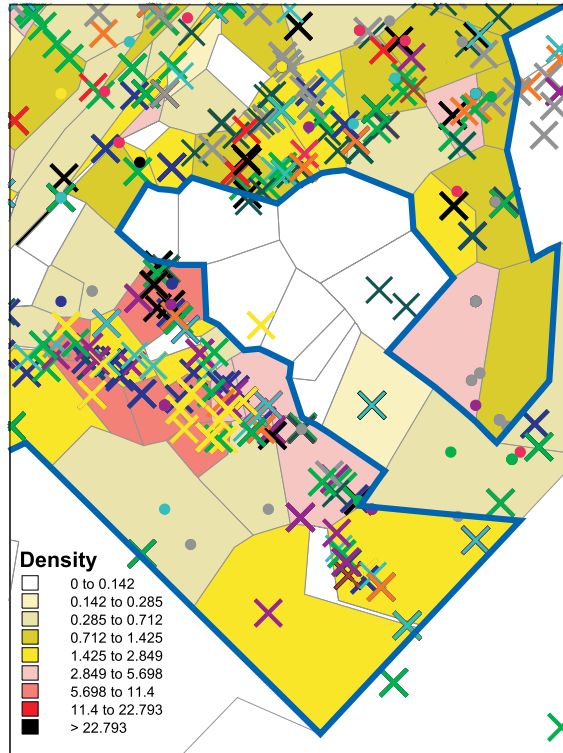


Figure 1. An example of the use of the density of crimes (per ha and per month) to delineate a hotspot area (shown with blue border). Individual categories of crime (crosses) and disorder (circles) are colour coded at the location of each offence.

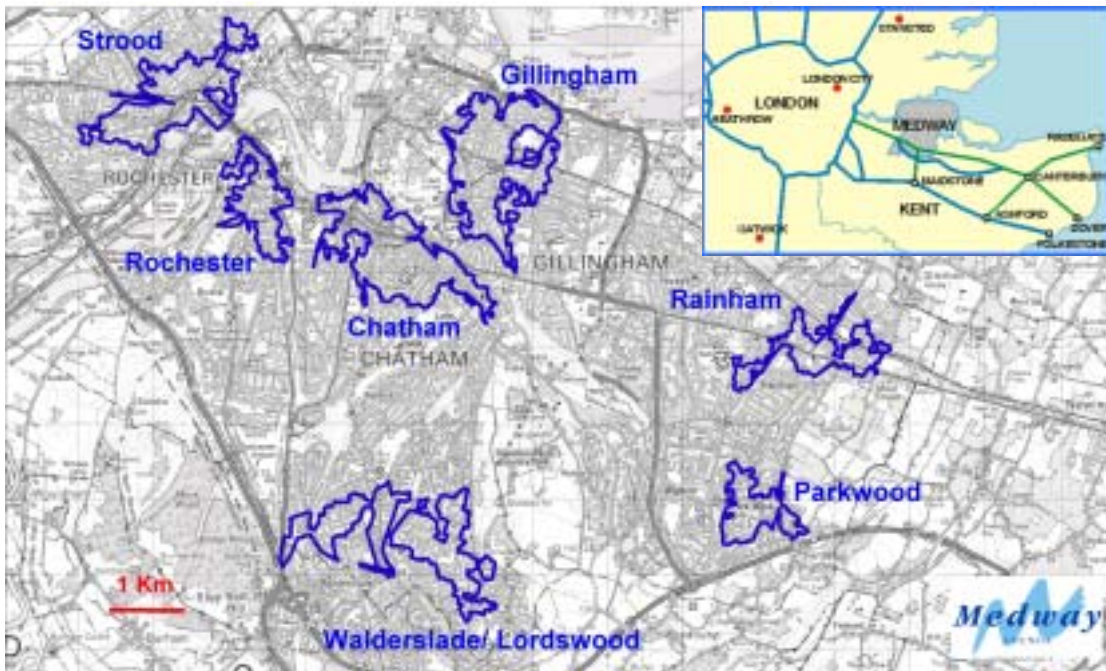


Figure 2. The seven hotspot areas identified in the analysis, with the location of Medway (inset).

Reproduced from/based upon the Ordnance Survey Mapping with the permission of the Controller of Her Majesty's Stationery Office. ©Crown Copyright. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Medway Council Licence No. 09070L 2000

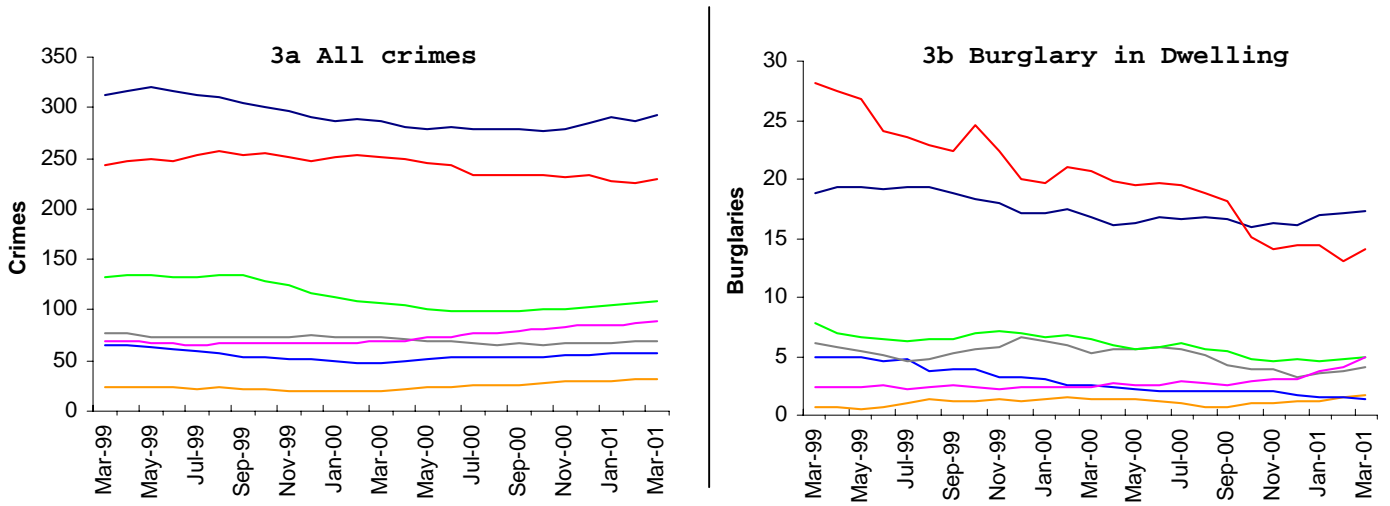


Figure 3 Twelve-monthly prior moving average time series of All Crimes (left) and Burglary in Dwelling (right) in the seven hotspot areas, for three financial years, 1998-2001.

— Chatham — Gillingham — Parkwood — Rainham — Rochester — Strood — Lordswood/Walderslade