What is the effect of reduced street lighting on crime in Leicestershire?

Aim

To determine whether the implementation of a part-night lighting scheme within Leicestershire has had an impact upon crime levels in the county.

Objectives

- To assess whether the change in crime levels in areas where the part-night lighting scheme has been introduced were significantly different (statistically) to the change in crime levels in areas where street lights remained on. The following differences were examined:
    - Crime levels overall
    - Crime levels by days of the week, times of the year and types of communities effected
    - Types of crime committed

Background

Leicestershire County Council is responsible for maintaining approximately 67,000 street lights throughout Leicestershire. In April 2010, the county council started a four year programme to reduce street lighting with the aim of reducing carbon emissions, reducing light pollution and saving money. As part of this programme Leicestershire County Council began implementing part-night lighting of streets in some residential areas. In these areas, street lights are turned off at midnight until 5am. Part-night lighting has been introduced in stages to villages and towns at parish level across Leicestershire. The first area to have part-night lighting was Smeeton Westerby in Harborough district on 1st July 2010. The final area to be part-night lit was Markfield which commenced in August 2014. In total, 157 areas have been part-night lit. These are listed in Appendix A along with the date of implementation for each area. The final six areas to be part-night lit (Groby, Birstall, Wanlip, Loughborough, Glenfield and Markfield) were not included in the analysis as there was less than six months crime data available for comparison.

Methodology

Crime Data

Where possible, four years' worth of crime data was used to assess the impact of the implementation of the part-night lighting scheme; two years prior to the implementation and two years after

Only data for certain types of crime have been included in the analysis. These are crimes where research suggests that levels of light could have an impact on crime rates. These are: burglary dwelling, burglary other than dwelling, criminal damage, robbery, theft of cycle, theft from motor vehicles and theft of motor vehicles, violence against the person, theft and some sexual crimes. Crimes which have been excluded from the analysis include, for example, fraud, hate crimes and theft from shops.

Whilst the precise time of certain crimes is known, many crimes occur at a time which is unknown, for example, burglaries that happen when homeowners are away. Therefore, the period over which the event could have taken place could span several days or weeks. To analyse crimes that occurred *only* between midnight and 5am would exclude many crimes that *could* have occurred during this time frame. Therefore, crimes were only excluded where it was certain that they happened outside of the hours of midnight to 5am. Crimes with an offence start date and offence end date that spanned more than 30 days were also removed from the data set.

The county was divided into a grid of 100 meter squares and each individual crime was mapped to this level. For each grid square, the parish name, output area code and the implementation date of part-night lighting was identified. Each crime was examined to assess whether it had happened in the relevant period before or after the implementation date of the part-night lighting scheme in that area. Crimes that occurred outside of the date ranges of interest were excluded from the analysis.

Street Lamp Data

A record of each of the 67,598 streetlamps in Leicestershire was provided by Leicestershire County Council's Environment and Transport Department. The exact location of each street lamp was provided, as well as whether the lamp was in a part-night lighting scheme. The street lamp data was mapped and assigned to the same 100m grid map as the crime data.

Combining data sets

The crime data and street lamp data were combined at the 100m grid level. Crimes which occurred in grids with no street lamps were excluded from the analysis leaving 33,783 crimes for analysis.

Each of the crime incidents in the dataset were then labelled to indicate whether they occurred in an area affected by part-night lighting or not.

Other information included about each crime:

- Season (Summer: April – September) / (Winter: October – March)
- Day of the week
- Midnight-5am indicator (crimes where there was certainty that they occurred during this time frame)

In addition, further information was also joined to the data set, specifically:

- Urban Rural Classification for England – a classification or areas based on rurality
- 2011 Census Output Area Classification (OAC) – a classification of areas based on similar characteristics using Census data (see Appendix B for further information)
- English Indices of Multiple Deprivation – a measure of deprivation (deciles for Leicestershire where 1 = most deprived)

Analysis and results

After consulting with Lex Comber, professor of Spatial Data Analytics at the University of Leeds, on appropriate methodology, the chi-square statistical test was used to look for significant differences between crime levels over time for areas that were part-lit and those that were not.

The analysis only considered changes in crime figures in areas that were part-lit verses those that were not. It does not attempt to identify nor explain other possible reasons for any changes in crime levels.

Findings

Headline results

The headline results are shown Table 1. It shows that overall, crime levels decreased over time across all areas (i.e. in both areas that were part-lit and those areas where there was no change to street lighting). It shows that, across all areas, 53.1% of the crimes examined in this study occurred in the periods before implementation and 46.9% after – i.e. a reduction in the number of crimes over time (a difference of 6.2 percentage points).

In areas where the part-night lighting programme had been implemented, 53.5% of the crimes occurred in the periods before implementation and 46.5% after (a difference of 7 percentage points). However, in comparison, in areas where there was no change in the level of street lighting, 51.3% of the crimes occurred in the periods before implementation and 48.7% after (a difference of just 2.6 percentage points).

Table 1: Number and percentage of crimes before and after part-night lighting of an area shows that crime decrease in all areas but more in areas that were part-lit

	Crimes before	Crimes after	Total
No change	3,233	3,073	6,306
	51.3%	48.7%	100%
Part-lit	14,707	12,770	27,477
	53.5%	46.5%	100%
All areas (total)	17,940	15,843	33,783
	53.1%	46.9%	100%

Therefore, although crime levels in general reduced over time, crime decreased significantly[1] more in areas where the part-night lighting programme had been implemented.

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[1] Chi-square at the 5% level

Detailed results

Additional analysis was undertaken to consider the levels of crime by more detailed criteria. The results show the type of impact that part-lighting had for each of the criteria. There were five types of impact observed. These are described below and summarised in Table 2.

- "Positive" - where there was a greater reduction in the level of crime in part-lit areas, as compared to areas that were not part-lit
- "Very positive" - where there was a reduction in the level of crime in part-lit areas but an increase in areas that were not part lit
- "Negative" - where there was a lower reduction in crime in part-lit areas, as compared to areas that were not part-lit
- "Very negative" – where there was an increase in crime in part-lit areas, compared to a decrease in areas that were not part lit
- "None" - no significant impact on crime levels

Table 2: Types of impact observed

Impact of part-lighting	Area	Change in crime	
Positive	Part-lit	Crime decreased more	↘
	No change to lighting	Crime decreased less	→
Very Positive	Part-lit	Crime decreased	↘
	No change to lighting	Crime increased	↗
Negative	Part-lit	Crime decreased less	→
	No change to lighting	Crime decreased more	↘
Very Negative	Part-lit	Crime increased	↗
	No change to lighting	Crime decreased	↘
None	Part-lit	None	→
	No change to lighting	None	→

Note: The use of the labels '*very* positive' and '*very* negative' refer to the direction of change in crime levels and indicates where the change was against the trend in the comparator area. It does not necessarily relate to the scale or magnitude of the change.

The results are shown in Table 3 below.

Table 3: Detailed analysis – impact of part-lighting - results summary.

Criteria	Subcategory	All valid crimes (33,783)	Filtered by Midnight-5am (2,931)
All crimes	All cases	Positive	None
Urban Rural	Urban areas	Positive	None
	Rural areas	None	None
Crime Types (main groups)	Burglary in a dwelling	None	None
	Burglary other than a dwelling	None	None
	Robbery	Very positive	Very positive
	Vehicle Crime	None	None
	Theft	None	None
	Criminal damage	Positive	None
	Violence against the person	Positive	None
Census Output Area Classification - supergroups	Rural Residents	None	None
	Cosmopolitans	None	None
	Multicultural Metropolitans	None	None
	Urbanites	Positive	None
	Suburbanites	None	None
	Constrained City Dwellers	Negative	Very negative
	Hard-pressed Living	Very positive	Very positive
Season	Summer (April- September)	None	Very positive
	Winter (October - March)	Positive	None
English Indices of Multiple Deprivation (deciles for Leicestershire where 1 = most deprived)	1	None	None
	2	None	None
	3	None	None
	4	Very positive	None
	5	Very positive	Very positive
	6	None	None
	7	None	None
	8	None	None
	9	None	None
	10	None	None
Days of the week (for crimes with a period of less than 24 hours)	Monday	None	None
	Tuesday	None	None
	Wednesday	None	None
	Thursday	None	None
	Friday	None	None
	Saturday	None	None
	Sunday	None	Very positive

For most criteria, there was either no impact or a positive, or very positive, impact on crime levels in areas that were part-lit compared to areas of no change.

Positive Impact

Results showed that for some criteria, part-night lighting had a positive or very positive impact on crime levels. This pattern was found for the following criteria:

- Census Output Area Classification
    - Hard pressed living – Very positive
    - Hard pressed living (Midnight-5am) – Very positive
    - Urbanites - Positive
- Indices of Multiple Deprivation
    - Decile 4 – Very positive
    - Decile 5 – Very positive
    - Decile 5 (Midnight-5am) – Very positive
- Crime type
    - Violence against the person – Positive
    - Criminal damage – Positive
    - Robbery – Very positive
    - Robbery (midnight-5am) – Very positive
- Urban and Rural Classification
    - Urban areas – Positive
- Season
    - Winter – Positive
    - Summer (Midnight-5am) – Very positive
- Day of the week
    - Sunday (Midnight-5am) – Very positive

As defined by the Census Output Area Classification mentioned in Table 3, 634,591 people or 97.6% of the population in Leicestershire live in areas where there was either no impact or a positive or very positive impact on the levels of crime after the implementation of part-night lighting.

In addition, further breakdown the 'Hard pressed living' OAC supergroup showed that two groups 'Industrious communities' and 'Hard pressed ageing workers' saw a decrease in crime in part-lit areas, whereas the crime increased in areas of no change in lighting.

Furthermore, part-lighting in areas categorised as 'Hard pressed living' had a positive impact on levels of certain types of crime, namely, violence against the person crimes and criminal damage, which decreased in part-lit areas but increased in areas of no change in lighting.

- Census Output Area Classification
    - Hard pressed living
        - Industrious communities – Very positive
        - Hard pressed ageing workers – Very positive
    - Hard pressed living
        - Violence against the person – Very positive
    - Hard pressed living
        - Criminal damage – Very positive

Negative Impact

In areas categorised as 'Constrained City Dwellers', overall the levels of crime went down post the implementation of part-night lighting. However, the difference was not as great as that experienced in areas where lights remained on. Furthermore, for crimes in these areas, where it is certain they happened between midnight and 5am on the same day, crimes went down in areas of no change in lighting but actually increased where part-lighting was introduced.

There are 69 areas in Leicestershire which are categorised as being part of the 'Constrained City Dwellers' OAC supergroup - accounting for a population of 15,898 people or 2.4% of the total Leicestershire population.

Further analysis of the data for areas categorised as 'Constrained City Dwellers' is provided in Table 4.

Table 4: Detailed analysis – impact of part-lighting – Constrained City Dwellers OAC Supergroup

Criteria	Subcategory	All valid crimes
All crimes	All Cases	**Negative**
Rural Urban	Urban areas	None
	Rural areas	None
Crime Types (Main Groups)	Burglary in a dwelling	None
	Burglary other than a dwelling	None
	Robbery	None
	Vehicle Crime	None
	Theft	**Very negative**
	Violence against the person	**Very negative**
Census Output Area Classification - groups	7a - Challenged Diversity	**Negative**
	7b - Constrained Flat Dwellers	None
	7c - White Communities	None
	7d - Ageing City Dwellers	None
Seasonal Divide	Summer (April- September)	None
	Winter (October - March)	None
English Indices of Multiple deprivation (deciles for Leicestershire where 1 = most deprived)	1	None
	2	None
	3	None
	4	None
	5	None
	6	None
	7	None
	8	None
	9	None
	10	None
Days of the week (for crimes with a period of less than 24 hours)	Monday	None
	Tuesday	None
	Wednesday	None
	Thursday	None
	Friday	None
	Saturday	None
	Sunday	None

Table 4 shows that for areas classified as Constrained City Dwellers, the levels of certain types of crime increased post implementation of part-night lighting, whereas they decreased in areas where lights remained switched on. This pattern of increased crime levels in part-lit 'Constrained City Dweller' areas was found for theft crimes and violence against the person crimes.

It has also been possible to further break down the 'Constrained City Dwellers' supergroup into four groups. Investigation highlighted that it was only one of these sub groups, 'Challenged Diversity', where there was a lesser reduction in crime overall in part-lit areas compared to areas where lights

remained on. There are 29 areas in Leicestershire classed as 'Challenged diversity' with a population of 7,154 (1.1% of the Leicestershire population).

Conclusions

The aim of this project was to determine whether the implementation of the part-night lighting scheme within Leicestershire has had an impact upon crime levels in the county.

The analysis looked at the impact of the implementation of the part-night lighting scheme on crime levels overall and also by crime type, seasonality, days of the week and type of community (using the Urban Rural Classification, the 2011 Census Output Area Classifications and the Indices of Multiple Deprivation).

In most cases, results showed that there was either no impact, or a positive or very positive impact, on crime levels in areas that were part-lit. The only exception was in areas categorised as 'Constrained City Dwellers'. In these areas, overall, there was a greater reduction in crime where lights remained on, than in areas where they were part-lit. However, for some crime types (theft and violence against the person) and times of the day (midnight-5am), crimes actually increased in areas categorised as 'Constrained City Dwellers' after part-night lighting was introduced. There are 69 areas in Leicestershire categorised as 'Constrained City Dwellers', accounting for a population of 15,898 people or 2.4% of the total Leicestershire population.

Further analysis showed that only one of the sub groups of 'Constrained City Dwellers' ('Challenged Diversity') experienced a negative impact on crime levels overall from the implementation of part-lighting – accounting for an area of 7,154 people or 1.1% of the Leicestershire population. It is recommended that further work is undertaken to examine whether part-night lighting should be reviewed in areas where there has been a negative impact.

The findings of this study have been found to be similar to those in the recently published work by the National Institute for Health Research (NIHR) Public Health Research Programme. They conducted a nationwide project in collaboration with all local authorities in England and Wales. The LANTERNS (Local Authority Collaborators' National Evaluation of Reduced Night-time Streetlight) study, led by Dr Phil Edwards, found that reduced street lighting in England and Wales is not associated with crime. They also concluded that there was no association with road traffic collisions.

The study, led by researchers from the London School of Hygiene and Tropical Medicine, in partnership with UCL, suggested that local authorities can safely reduce street lighting at night, saving energy costs and reducing carbon emissions.

However, it should be noted that this national study did not go into the same level of geographical segmentation and analysis by crime type, as covered in the Leicestershire study, which, as has been demonstrated, found negative impacts for some small geographical areas.