THE COST-EFFECTIVENESS OF IMPROVED STREET LIGHTING AS A CRIME PREVENTION MEASURE

Jason Ditton BA PhD, Gwyneth Nair BA PhD and Jonathan Bannister BSc

INTRODUCTION

Readers of The Lighting Journal may recall two earlier articles reporting the Strathclyde Twin Site Study, which itself was designed to test the effectiveness of improved street lighting in reducing crime and the fear of crime. Most recently, we showed that white street lights are no better than orange ones at reducing crime or the fear of crime,'" and earlier that there was an initially highly positive relationship between improved street lighting and reduced crime, but this eventually 'tapered off'. Indeed, we had to conclude that first article with the words:[2,p.27]

> "...only in some cases was the marked short-term improvement noted in the original study maintained over the longer period. In general there has been a drift back towards the pre-lighting situation, sometimes, as with most actual victimisations, to figures in excess of original levels..."

Such a finding is in line with international experience. Tien's 1979 American evaluation concentrating on the 103 studies of the relationship between improved street lighting and crime rates known at that time offers:[3,pp.66, 93]

> "...three general conclusions. First, there are strong indications that, following increases in street lighting, the fear of crime is reduced. Second, there is some indication that, all other things being equal, feelings of safety are higher in those night street environments that have more uniform lighting levels. Third, reported impacts on crime are inconclusive... [in sum] ...although there is no statistically significant evidence that street lighting impacts the level of crime, especially if crime displacement is taken into account, there is a strong indication that increased lighting - perhaps lighting uniformity - decreases the fear of crime..."

In general, then, apart from impacting positively the fear of crime, improved street lighting does not have a consistently positive effect on crime rates themselves.

In this article we would like to introduce and begin to develop a different approach to the relationship between enhanced street lighting and crime, and perhaps, by extension, to crime prevention measures and crime more generally. Instead of concentrating on the 'effectiveness'of, in the specific case, enhanced street lighting in reducing crime (wherein schemes followed by an increase in crime are felt to have 'failed'; and those that are followed by a decrease in crime are said to have 'succeeded'); we turn instead to the 'cost-effectiveness'of such schemes.

Within the old framework; low-budget schemes, whose implementation has been followed by, perhaps, a small decline in crime, might well be adjudged less 'effective'than high-budget schemes that secure larger falls in crime. However, and conversely, when the cost of apparently prevented crimes is added into the calculation and set against the cost of the crime prevention measure, the low-budget scheme might well be highly 'cost-effective', and the high-budget scheme, which secured a bigger fall in crime, might not be cost-effective at all.

To enable such comparisons, calculations need to be made both of the implementation cost of enhanced street lighting schemes and of the cost of crimes that the improved lighting apparently prevented. The former is, at least comparatively, simple. The latter is considerably more challenging.

Given the infancy of value-for-money assessments within the crime prevention field generally, we can hope to do no more than sketch a tentative methodology pegged to some rough and ready

Jason is Director of the Scottish Centre for Criminology, University of Sheffield, Gwyneth works at the Applied Social Studies Department, Paisley University and Jonathan at the Centre for Housing Research, University of Glasgow.

calculations. We acknowledge, in advance, the empirical weakness of the calculations we shall advance, but trust that these tentative beginnings might start a debate and foster the later development of a more refined and reliable model.

THE COST OF IMPROVED STREET LIGHTING

The two areas that we studied each comprised about 200 dwellings. Neither had a particularly high crime rate, and neither was particularly badly lit. Indeed, they were selected as being typical, rather than as atypically high crime or low light areas.

The improved lighting, which was installed in the two areas, is, at one level, simple to cost. In one site (Bellgrove - part of Glasgow's east end) three additional columns were added to the 42 already there and new lanterns were installed on all 45 columns. The total (capital plus labour) cost was £3,844. At the other site (part of a small town called Blantyre, which is 14 miles to the south of Glasgow) two additional columns were added to the 77 already there and again new lanterns were installed, in all 79. The total cost of this was £7,384.

Thus, if the value of crimes prevented exceeds the total of £11,228, improved street lighting may be deemed cost-effective; if the total value of crimes prevented falls short of that figure, then instead the improved street lighting must be deemed cost-ineffective. Yet, before we move to consider the tricky issue of calculating the value of crimes prevented (an issue that is really two questions: How many were prevented? and What is the economic value of each?), the time period over which this cost needs - for the purpose of this calculus - to be defrayed itself warrants discussion.

Our follow-up study compared two time periods: September to November 1990 (the areas were relit in December 1990) and September to November 1991."' Since we shall be looking at recorded crime totals during these two time periods, it seems sensible to defray an appropriate part of the total costs of relighting over the second three month period, taking due note of the lifetime expectancies of columns, lanterns and lamps (30 years for columns, 15 years for lanterns, and 3 years for lamps in Bellgrove and 2 years for lamps in Blantyre). Tables 1 and 2 do precisely this.

It can be seen that the three-month 'cost' of relighting in both of these two cases is, because of the

Table 1
Bellgrove

	Before	After
Energy cost per 3 months	353.75	226.91
Maintenance cost per 3 months	141.23	168.64
New column cost per 3 months		12.75
New lantern cost per 3 months		48.38
New lamp cost per 3 months		36.00
TOTAL COST PER 3 MONTHS	494.98	492.68

Table 2
Blantyre

	Before	After
Energy cost per 3 months	648.53	318.57
Maintenance cost per 3 months	258.91	317.98
New column cost per 3 months		8.00
New lantern cost per 3 months		98.25
New lamp cost per 3 months		126.20
TOTAL COST PER 3 MONTHS	907.44	869.00

considerable energy savings associated with newer lanterns, actually less than it had been for any comparable three-month period before relighting occurred. The cost of lighting Bellgrove for three months fell fractionally from £494.98 to £492.68 and the cost of lighting Blantyre fell rather more, from £907.44 for three months to £869.00.

It is unlikely that these are typical cases, but nevertheless they do allow the independent point that enhanced street lighting does not necessarily incur a local authority in additional cost. Against this background, we shall now turn to the awkward issue of the value of crimes thus prevented.

CRIMES PREVENTED

Calculating the number of events, which any introduced control measure actually prevents, must always remain more of an art than a science and doing so in the field of crime prevention is no exception. Table 3 contains the raw material for these calculations (no data on 'offences', which include minor breaches of the peace, petty assaults, road traffic offences, and so on, are available for the 'before' period at divisional or sub-divisional levels in one of our sites, so we have excluded offences altogether from the analysis presented here). It can be seen that 35 crimes were recorded in the two areas together before relighting, and 20 afterwards.

We use here police recorded crimes rather than the respondent recalled victimisations referred to in our

Table 3
Police Recorded Crimes

	Before	After
Non-sexual assault	2	2
Theft (opening lockfast place)	8	3
Theft of motor vehicle	3	2
Theft	2	1
Theft (housebreaking)	2	7
Vandalism	15	4
Drug offences	3	1
TOTAL	35	20

first article. There is no particular reason for the choice: either would do, as our intention is only to illustrate a possible methodology, rather than suggest conclusive costings. Neither victimisation data set is especially reliable and we freely acknowledge the weaknesses of the data underlying the analyses suggested here.

It is too simplistic to claim that the enhanced lighting 'prevented' 15 crimes from being committed (which we treat for the purposes of this analysis as

synonymous with recorded) as this assumes that without the intervention of enhanced lighting, the number of crimes would have remained constant. Thus a next step is to discover how crime rates in general were behaving over the same time periods. Maybe if they were level, then the constancy assumption might be valid. But they might have fallen, or, as is more likely, risen.

The critical difficulty at this juncture is knowing what level of crime rate aggregation to consult. If too low a level is chosen - the sub-division, for example - then two forms of contamination are possible.

First, the experimental controlling measure (here, the enhanced lighting) might have had the effect of displacing an unknown amount of criminal activity, which would otherwise have taken place in the relit area, to surrounding areas within the same sub-division, thus artificially inflating their crime rate and thus exaggerating the apparently beneficial effect of the experiment.

Second, and conversely, the decline in recorded crimes in the experimental area might have a depressing effect on the crime rate for the sub-division as a whole and would, thus, in turn depress the apparent effect of the experiment. Either or both (or none) of these effects could be present, and to an unknown degree.

If too high a level is chosen - perhaps the police force area, or country as a whole - then other forms of contamination could affect the outcome of the comparison. Any one or more of a myriad of other crime prevention measures could be depressing crime rates, and/or any one or more of a myriad of crime encouragement measures (changes in the age structure of the population, rises in unemployment and so on) could be inflating it.

A cautious rule of thumb might be to suggest that, assuming that a crime prevention measure is believed to be affecting less than half of a policing sub-division, to compare rates of change in an experimental area with rates of change in a policing division (in the Strathclyde Police force area, each is composed of three sub-divisions). In other words, contaminations of various sorts will have their effects hypothetically minimised if the experimental area is less than one-sixth of the larger area of which it is a part and with which it is being compared.

If we consult data from the two separate police divisions of which Blantyre and Bellgrove are a small

part, we find that for both, at this higher level of recorded crime aggregation, little change in rates for the two time periods: September to November 1990 and September to November 1991.

The division which includes Blantyre recorded 5898 crimes in the 'before'period, and 5935 crimes in the 'after'period: an additional 37 recorded crimes amounting to a rise of 0.6%. The experimental area which was relit recorded 22 crimes in the 'before' period and 11 in the 'after'period. We may reasonably assume that another 22 would have been committed in the area if it had not been relit and that the improved lighting prevented, thus, some 11 crimes.

Coincidentally rather similarly, the division which includes Bellgrove recorded 2849 crimes in the 'before'period and 2830 crimes in the 'after'period: 19 fewer recorded crimes, or a fall of 0.7%. The experimental area which was relit recorded 13 crimes in the 'before'period, and 9 in the 'after'period. We may reasonably assume that here the improved lighting prevented 4 crimes.

Can a monetary value be put on the total of 15 crimes apparently prevented?

THE COST OF CRIME

At a general level, although the 'cost of crime' is hardly a new phrase, actual monetary values are hardly ever allocated to it, other than vague enormities. The most recent professional contribution to this being from an independent Working Group on the Costs of Crime, which reported to the Standing Conference on Crime Prevention at the Home Office that it could come no closer than *"...many billions of pounds a year... .*" [4, preface]

However, at the micro level - perhaps a more appropriate place to start - Pease and colleagues have been building cautiously upon, and applying, calculations first attempted by Bailey and Lynch.[51] After conducting a rigorous financial audit, Bailey and Lynch suggest that a minimum cost (i.e. that which excludes any values stolen or damaged) of an undetected burglary is £160.67 and a detected one as £3,213.89. They offer similarly generated, and startlingly precise, costs for other fairly typical criminal events.

Pease and colleagues have adapted this approach and applied it to a burglary prevention programme

developed in Kirkholt. They concluded that the cost of the burglary prevention programme was £208,398 and that it prevented 730 burglaries. They further calculated that this in turn saved £1,504,664, thus making the burglary prevention programme highly cost-effective.[6]

We can begin to apply the same sort of reasoning to our data from Blantyre and Bellgrove, although a number of assumptions are initially necessary.

First, what types of crimes (given that costs vary for different types) are represented by the 11 saved in Blantyre and the 4 saved in Bellgrove? We suggest that since, in the 'before'period, about 36% of Blantyre's recorded crimes were for theft and 64% for vandalism, it seems reasonable to propose broadly the same division for the 11 prevented crimes: thus, 3 of them would have been prevented thefts and 8 of them prevented acts of vandalism.

Similarly, in Bellgrove, since in the 'before'period 54% of the area's reported crimes were for theft, 15% for assault and 23% for drugs, then (again using the same division for the 4 prevented crimes) one would have been a prevented assault, 2 prevented thefts and one a prevented drugs offence.

How can these be costed? We have adapted Bailey and Lynch's costs by first calculating an average cost for an array of undetected crimes as being roughly 24%> of their detected cost. It is perhaps ironic that introducing the concept of cost and cost-effectiveness into crime prevention evaluation effectively turns conventional criminological thinking on its head, as a crime for which an offender is apprehended, prosecuted, found guilty and punished is considerably more 'expensive' than one where no successful policing action ensues. Yet it is true nevertheless.

Accordingly, we have assumed a 20% detection rate, and an average cost as being the cost of 4 undetected events plus one detected event, all divided by 5. Table 4 gives the thus calculated costs of the 4 types of prevented crime in Bellgrove and Blantyre. Bailey and Lynch calculate £3,214 (we have rounded their costs) for a detected burglary where, after a successful prosecution, the offender served 3 months in an open prison. We have used this as our theft model and applied it unaltered to our prevented drugs offence (if a drugs offender is arrested, it is likely to be for dealing, and a three-month sentence is not implausible).

Bailey and Lynch do not suggest a cost for vandalism either, so we have borrowed their cost for a theft from

Table 4
Crime Costs

	Detected Cost	Average Cost
Theft	3214	768
Assault	9569	2287
Vandalism	206	49
Drugs	3214	768

CONCLUSION

an unattended motor vehicle (the offender was cautioned): again a scenario not altogether implausible for an offence of vandalism.

Thus, laboriously, Blantyre's 11 prevented crimes (3 for theft and 8 of vandalism) would have an averaged cost of 3 times the average cost for theft (£2,304) and 8 times the average cost for vandalism (£392). Some £2,696 was saved by improving the street lighting in Blantyre. In Bellgrove, the 4 prevented crimes (one each for drugs and assault and 2 for theft) would have cost a total of £4,591.

What can be made of this? The total lifetime cost of the enhanced street lighting in both sites taken together was £11,228: the total value of crimes thus prevented in just one three-month period was £7,287. This is a rate of saving of £2,429 per month, and would theoretically 'repay' the original investment in less than 5 months.

If, alternatively, we consult the three-month costs of the street lighting improvements and the real costs of new installations over their lifetimes, then, in Bellgrove, prevented crimes give a saving of £1,530.30 per month, which can be added to the saving of 76p per month on lighting energy costs: a total of £1,531.06. In Blantyre, prevented crimes give a saving of £898.67 per month, to which can be added the saving of £12.81 from reduced lighting energy costs: a total here of £911.48.

Looked at this way both street lighting improvement experiments were effective and cost-effective at the recorded crime level. We should add that had we taken the even more dramatic reductions in victimisation revealed by the original victim survey in the two areas relit, then the cost-effectiveness would have been shown to be even greater.

Inevitably, endless objections could be raised to the way we have presented this analysis. These could be evidential, as in, for example, the claim that apparently prevented crimes have merely been displaced to nearby areas (yes, possible: but displacement or deflection, while conceptually essential in any study of crime prevention, is notoriously difficult to enumerate quantitatively);[7] or they could be practical, as in, for example, the claim that Roads and Lighting Departments pay for street lighting improvements, yet Police, Prosecution and Prisons reap the financial rewards of crimes which are thus prevented (yes, admitted: probably the major problem in financing crime prevention initiatives).

Alternatively (or additionally) objections could be financial, such as the claim that these costings are non-marginalised, that is, they ignore the reality that if a policeman has been saved from recording crimes and arresting criminals he is still being fully paid and only marginal costs are being saved (y'es, true); or that, there are other ways of costing that would have produced different outcomes (true again); or they could be a mixture of the practical and the moral, as in, for example, the claim that 'real' savings are in the fear of victimisation rather than victimisation, but that it would be, in the delightful phrase of the equally delightfully named Elphinstone M Dalglish *"...both arrogant and impertinent to try to do it [measure the saving in fear of crime consequent upon improving street lighting] in terms of £.p..."*[8,p.252] and so on and so on.

We do not think we have a good model, so much as feel we have a good case for seeking to develop one. Undoubtedly, this article has presented more questions than answers and future models will have to include consideration of factors such as additionality and displacement. The late 1990s will surely see the development of more refined and sophisticated (and convincing) cost-effectiveness models unless - which we feel very unlikely - the crime prevention field discovers some magical immunity from the apparently unstoppable societal demand that every activity, quite apart from every initiative, must demonstrate that it is offering value for money.

We feel that, as a mania for installation of city centre closed circuit television camera monitoring systems seems to be sweeping the land as the latest 'magic bullet' solution to all our problems and fears, cost-

effectiveness will become an even more important factor in choosing crime prevention measures and that consequently, improved street lighting, which seems so demonstrably cost-effective, may re-emerge as a powerful and cheap component of an overall coordinated approach.

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