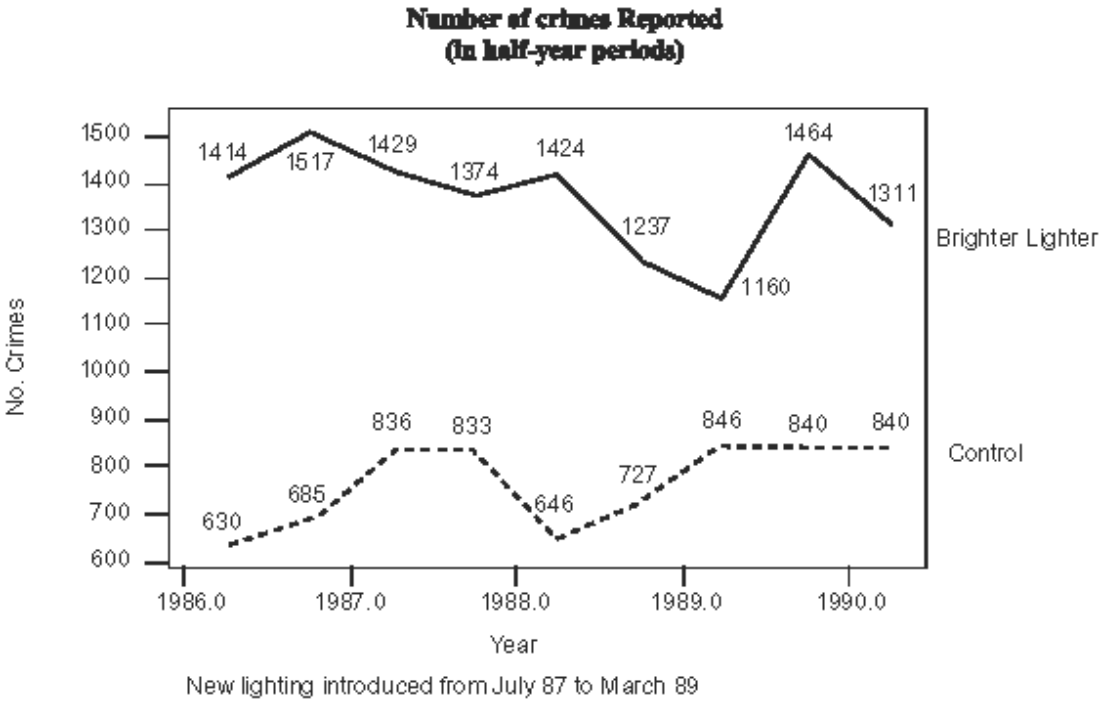
Annex

A SIMPLE DEMONSTRATION THAT "THE CLAIM THAT BRIGHTER LIGHTING REDUCES CRIME IS UNFOUNDED"

By P R Marchant

The major systematic review on street lighting and crime by Farrington and Welsh (2002) Home Office Research Study 251, see www.homeoffice.gov.uk/rds/pdfs2/hors251.pdf, suggests that claims for the effectiveness of lighting against crime are justified. The review at first sight appears to be an appropriate statistical synthesis of studies on street lighting and crime, but on close examination the statistical claims and methods are unfounded. In three cases examined there is a clear conflict between the evidence and the reviewers' interpretation of this. One of the principal problems is easily seen. The graph of the Bristol lighting and crime study data, given below, shows no evidence for the crime reduction benefit of lighting. However the review gives the result for the same data as being extremely statistically significant. It is suggested that such a difference between the newly lit and the control areas occurring purely by chance is less than one in a billion, but this is manifestly wrong. Two other component studies, Bristol and Dudley are examined.

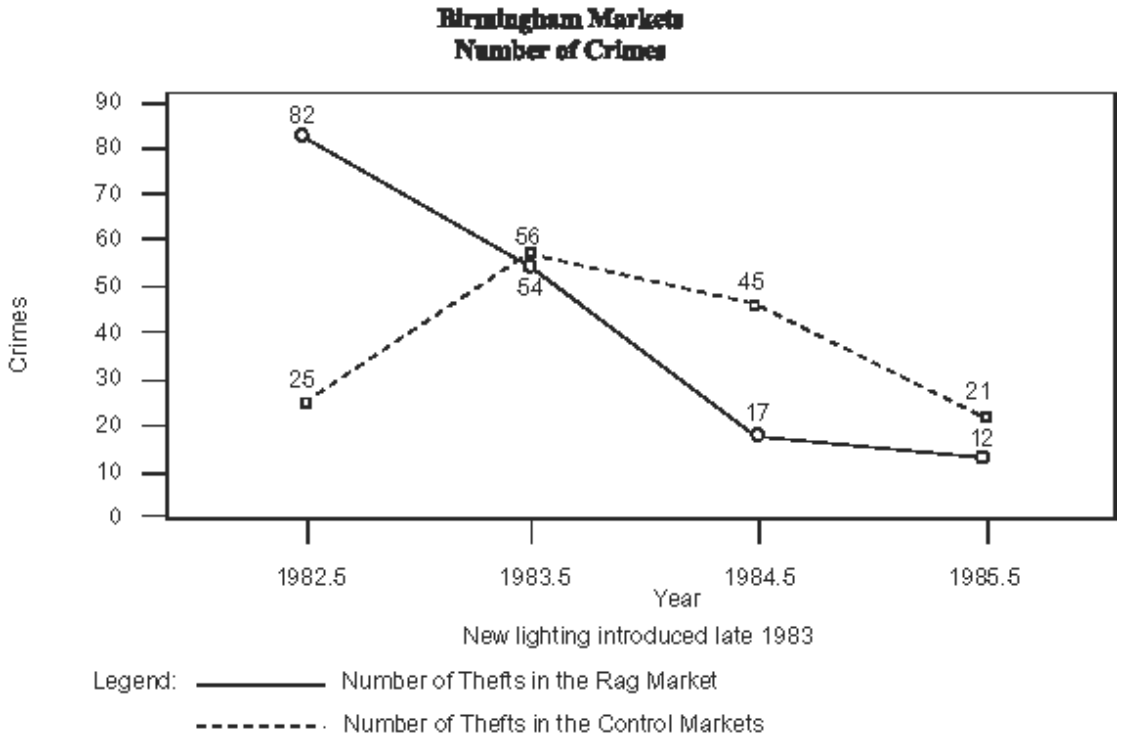
A major flaw with the review is to use methods which ignore the large variation (overdispersion) in the data and implicitly assume that crimes are independent events, which is implausible in the extreme. As but one example of the problem, one can examine the contribution from the Bristol study that used data on crime from the beginning of 1986 to mid 1990. The treatment area had brighter lighting introduced between July 1987 and March 1989 and the control area had its lighting left unchanged. The reviewers compared the ratio of crimes committed in the first year and the final year in both areas. It is claimed, by the reviewers, that the benefit of lighting shown by this contributing study is clear (z-statistic 6.6, consistent with its confidence interval in the "forest plot" of Figure 3.1 HORS 251, being very well displaced from the null line). The original paper (Shaftoe, H (1994)) from which the data was taken makes no such claim for the crime reduction benefit of lighting. Indeed anyone is free to check for themselves with the data from Shaftoe.



Just inspection of the plot of the two time series, noting when the new lighting went in, shows nothing to support a claim of the benefit of lighting. (Remember, the reviewers' claim that this data shows a very highly statistically significant result for the benefit of lighting with probability of occurring by chance of less than one in a billion, corresponding to z=6.6. Their claim is literally incredible).

A requirement of the statistical method used by the reviewers is that a typical range for fluctuation is equivalent to approximately the square root of the mean, in this case say around 20 something for the control and 30 something for the treatment area. But the fluctuations are on average around 100 or so, this shows that in this case the wrong method has been used and the results are invalid, showing the reviewers' method is incorrect in underestimating the true variability. This is consistent with the conclusions of Shaftoe, the original investigator in the Bristol study who could find no evidence that the new lighting reduced crime, in stark contradiction to the reviewers' claim.

It is not just the Bristol study. The fundamental problem is the review's method. The Birmingham Market Study, Poyner and Webb (1997), another of those included in the review, also clearly shows the excess variation via the two time points in each of the four settings, (treatment and control and before and after the intervention of brighter lighting). There is a much larger drop than square root mean in the treatment area and also an excessively large rise in the control area, before the new lighting went in, for example:



One might ask why the variability in both the Bristol and Birmingham studies is so much larger than that expected. The answer is that crime events are not "statistically independent" as the method used by the reviewers assumes, but are instead correlated. Crime is perpetrated by people. There is repeat victimisation. One criminal may be responsible for many crimes and this one person changing behaviour can cause a large change in the number of crimes committed and recorded.

Different statistical methods are needed to deal with such variability. Where it has been possible to reanalyse the data the appropriate methods have not provided evidence for brighter lighting reducing crime.

There are also other problems with the review. One is of not comparing like with like for the individual studies in general. This is because brighter street lighting is applied to more crime-ridden areas and the comparison areas are less crime-ridden. This is rather like performing a trial of treatment for the common cold on a group of people suffering quite lot but the people in the control group are not very poorly at all. Then after following-up the patients some time later, and finding them all virtual cold-free a great success is claimed for the new treatment, as though this had been responsible for bringing down the cold symptoms in the ill group more than the standard treatment did in the not so ill group. There are further statistical issues for example the reviewers make the "unit of analysis error", as whole areas are assigned to treatment rather than individuals.

There are a number of other shortcomings with the review, however the Bristol study is sufficient to show how and why the reviewers have got it very wrong. Crime reduction is frequently presented as a potent argument for increased lighting—here I have shown that there is no scientific basis for this claim.

A fuller examination of the review has been written Marchant (2003), which gives much more detail.

References:

Farrington D.P. and Welsh B.C. (2002a) *The Effects of Improved Street Lighting on Crime: A systematic review,* Home Office Research Study 251, http://www.homeoffice.gov.uk/rds/pdfs2/hors251.pdf

Marchant P.R. (2003) *The Claim that Brighter Lighting Reduces Crime is Unfounded* submitted for peer review and publication with the Royal Statistical Society

Poyner, B. and Webb B. (1997) Reducing Theft from Shopping Bags in City Center Markets, in *Situational Crime Prevention: successful case studies* ed. R.V. Clarke. P83-89, pub. Harrow and Heston.

Shaftoe, H (1994) Easton/Ashley, Bristol: Lighting Improvements, in S. Osborn (ed.) *Housing Safe Communities: An Evaluation of Recent Initiatives* pp 72-77, Safe Neighbourhoods Unit, London.

30 April 2003

Prepared 6 October 2003