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ABSTRACT

Recent years have shown a rise in crimes committed in English schools necessitating the need to formulate security policies. This document examines the use of security lighting and provides guidance and technical advice on policy to assist those responsible for design, specification, purchase, installation, maintenance, operation, and management of security lighting systems for educational buildings. Concluding sections list and categorize the types of lamps and luminaries that are available, highlight case studies showing types of lighting needs of educational facilities and their associated costs, and provide a glossary of lighting terms. (GR)

Security Lighting

CRIME PREVENTION IN SCHOOLS

Crime prevention in schools

1

Architects and Building Branch

DFE
DEPARTMENT FOR EDUCATION

BUILDING BULLETIN 78

SECURITY LIGHTING

Crime Prevention in Schools

Architects and Building Branch

LONDON: HMSO

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Contents

Introduction

Recent years have seen an increase in crimes committed in schools which has resulted in schools needing to formulate security policies. Security lighting as a part of a package of measures can improve security. This publication is one of a series *Crime Prevention in Schools* produced by the Department for Education. The other titles in the series are listed under Further Reading. The object of this publication is to provide guidance and technical advice on policy to assist those responsible for design, specification, purchase, installation, maintenance, operation and management of security lighting systems for educational buildings. Case studies and a glossary are included at the end.

Security Lighting at Hayes Park Primary School (Case study 2).

1. Most acts of arson, theft and vandalism occur when premises are unoccupied and when intruders have the time to penetrate school defence systems; given time any defence system can be penetrated. In darkness an intruder may find it easy to work undetected for many hours to achieve his objective.

2. Intruders often feel that they are exposed to a greatly increased risk of detection when they are saturated by light. This feeling is more intense when the intruders cannot tell if they are under observation. Even when the lighting itself is an insufficient deterrent, it's mere presence is likely to increase apprehension, restricting the time of break-in to a minimum and reducing the extent of actual loss.

3. Without the presence of effective security lighting, the police or others responding to an intruder alert are hampered. Intruders may hide in the shadows observing the investigators and take the opportunity to escape or to attack those responding to the alert. In dark areas, investigators need to carry torches and their presence and movements may be made obvious to criminals hiding in the shadows.

4. Security lighting is normally directed upon buildings and the surrounding grounds so that intruders may be observed by police patrols or others outside the premises. Conversely where there are people inside the premises there is advantage in casting some light from the building towards its boundary. The intruders are then faced with the daunting prospect of walking towards the glare produced by powerful lights without being able to see what lies beyond the lights and whether or not they are being observed from within the building. In all cases great care must be taken to avoid a nuisance to neighbours or a glare hazard to the drivers of passing vehicles.

5. Modern lighting technology has made available to the specifier an efficient source of illumination to suit every application. For example, a small low energy luminaire (18 watt SOX) can be operated for 3,900 hours of darkness per annum for an approximate energy cost of less than £8, whilst an extremely powerful (400 watt SON) floodlight with good colour rendering would incur energy costs of approximately £125 per annum. Costs may be significantly reduced where the electricity tariffs include an off-peak element.

6. Security lighting which deters intruders can be a most cost effective form of defence, the capital cost of which can often be partially offset against the cost of necessary outside amenity lighting. For maximum effectiveness security lighting should be used in conjunction with other security measures including intruder alarms.

7. However, there are instances where security lighting is not useful. In schools which are not overlooked by houses or passers-by, generally out of town schools, security lighting may make it easier for an intruder to gain entry by illuminating the building for him and other forms of security would be more appropriate. Security lighting should only be used if there is a probability of intruders being observed.

Design

1. Designing a security lighting system has in recent years become a more specialised subject. This is because of technical developments in lighting and a greater crime prevention awareness. Both of these developments have been driven by the rising costs of energy and crime. In concept, a security lighting installation should be based upon the technical and psychological factors that serve to both deter and detect intruders. This bulletin gives an introduction to design, covering the basic concepts. Publications giving further technical information are listed under Further Reading.

2. To be effective a security lighting installation must be designed by a suitably qualified person. This is even more important where Closed Circuit Television is to be used in conjunction with the lighting system. The reputable manufacturers of security lighting systems provide a design support service and issue product information. Easy to use guidance charts are available showing how to achieve a given light level using different lamp types at various spacings and mounting heights. A rough guide to suitable levels of illumination is 5 Lux on the building facades and also for car parks and 3 Lux on the surrounding areas.

3. However, whilst these aids assist in the location of luminaires in regular arrays for illuminating regular areas; the designer will need to use his experience and expertise to supplement these to provide for the irregular parts of the site. Manufacturers of luminaires provide design photometric data including polar curves to assist the designer in determining the layout of the lighting installation.

4. The designer must visit sites with site layout drawings in order to determine the special areas where supplementary lighting will be required. The external building form affects the ease of lighting. Care is needed to avoid providing intruders with light to work in and shadows in which to hide. Uniformity of light should be maintained and the lighting should be continuous around the buildings to be protected.

Car Park at Cassio College, (Case study 1).

5. With particularly difficult building sites it may be advantageous to experiment with temporary luminaires. This is particularly true where floodlighting is to be incorporated as part of the security lighting scheme. Once the installation is in operation it should be viewed after dark to identify areas which need additional illumination; it is not possible to foresee all practical problems and limitations at the design stage.

6. The protection of the property is achieved by providing a continuous zone of light through which the would be intruder must pass in order to get to the buildings. Thus the continuity and uniformity of the lighting are important. Luminaires with lighting distributions to suit the particular requirement should be chosen to avoid the wasteful illumination of unnecessary areas.

7. Where installation on roofs is possible, it may be sensible to light from the top down.

8. Ideally the area illuminated will be a clear area or strip around the perimeter of the building devoid of all foliage, cars, outbuildings etc. Anything in this clear area can offer means of concealment for the would be intruder. Thus it may be sensible to discuss with building management the creation and maintenance of the clear area, in order that the full benefit of the lighting is obtained.

9. Also if passers-by and patrolling police or security services are to be relied upon to detect intruders their viewpoints from outside the site must be unobstructed. Again any obstruction should be discussed with building management and if possible removed.

10. Consideration should be given to areas surrounding the site. Badly lit roads and footpaths offer no deterrent and therefore can promote undesirable behaviour. It may be possible to negotiate with Local Authority Public Lighting departments for existing lighting to be improved, or for lighting to be installed where none exists. Again poor uniformity can result in the shadowy conditions which promote anti-social behaviour.

11. The local crime prevention officer will often be able to assist in determining the security lighting requirement.

12. The domain of security lighting is principally outside buildings. However, low energy, low pressure sodium (SOX) lamps used inside buildings can have significant benefits. They are extremely economical to operate and their distinct yellowish amber light signifies that they are serving a security function and are not installed for normal occupancy lighting. Accordingly persons seen inside buildings by passers-by can be more certainly regarded as intruders.

13. Ideally, vulnerable areas such as locations with expensive equipment will be located in rooms on the first floor or in internal spaces which cannot be seen from outside the building.

14. Lighting may be needed for more than a single function such as amenity and security lighting. Where the lighting requirements of each differ, it may be economic to design for the lesser requirement and provide a supplementary circuit to meet the higher requirement. Separate switching will then facilitate energy conservation.

Installation

1. Luminaires and controls should be mounted in positions where they are normally inaccessible in order to limit possible damage from physical attack (such as with stones, hammers, spray paint), or attempts to incapacitate them by lamp removal. Access for maintenance is however important.
2. Electricity supplies to the lighting installation should be protected from attack; the installation is worthless if the cutting of a cable extinguishes the lighting. For building mounted luminaires, cabling should either be run through the building with through the wall back entry into luminaires or be run inaccessibly at high level, externally. Cables run in steel conduit provide a more secure supply. Cables run underground are also more secure, although care must be taken to protect or conceal them where they emerge and run up to luminaires.

100 Watt SON-T area floodlight and photocell mounted at high level on hall wall, (Case study 1).

Maintenance

1. The security lighting installation, as an electrical installation, will require to be inspected and tested at regular intervals.
2. Luminaires (and photocells) will need to be cleaned and lamps replaced. As the hours of use can be reasonably accurately predicted (the hours of darkness defined as lighting up times in the United Kingdom being approximately 3,900 hours per annum) a planned maintenance programme can be drawn up. This will be necessary in any event if a specialist contractor is to carry out these duties due to luminaire location, lamp type etc.
3. The installation should be regularly checked for signs of damage or lamp failure. In the case of the former, careful investigation should be carried out to establish whether a more suitable method of lighting or location of equipment may be necessary. In either case remedial action should be effected immediately to reinstate complete cover.
4. It may be useful to keep a small stock of spares of particular lamps, front covers etc., which are likely to be required on a regular basis.

Lamp Selection

1. Modern technology has made available a wide range of lamp types from which to select the most suitable for any given situation. Figure 1 shows a range of lamps whilst Figure 2 charts the salient features of the various lamp types to enable easy comparison. The terminology used is explained in the glossary at the end of the bulletin.

2. The ideal lamp will have good colour rendering, high efficacy, long life and instantaneous start-up/restrike time and have an extensive range to cater for all requirements. In practice lamp selection is based on the best compromise to suit the particular situation.

3. General Lighting Service (GLS) lamps are generally not the most suitable for security lighting due to their low efficacy and short life. Their life is further reduced when they are enclosed in a luminaire as they operate at increased temperature and when they are mounted in other than recommended orientation—horizontal mounting results in lamp life of approximately 25% of that when mounted vertically. Their main virtue is that they produce full illumination at the instant of switch on.

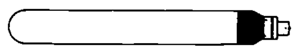
4. Gas Discharge Lamps overcome the two main problems of GLS lamps, having efficacies of up to 11 times greater and lives of up to 12 times longer. However, many require a finite time from switch on to full illumination. Also in some cases their operation is affected by low ambient temperatures although there are ranges of luminaires available with suitable control gear to overcome this problem.

5. A new and expanding range of low energy, high efficacy lamps have evolved over recent years and in most instances are of the compact fluorescent tube type. Where the dimensions of the fittings are large enough to accommodate the larger lamps, plug- in adapters can be used to convert existing general service lamp fittings to operate with the new compact fluorescent lamps.

6. If colour rendering is not an important consideration the Low Pressure Sodium (SOX) lamp should be used, due to the benefit of its very high efficacy and long lamp life. Also the low pressure sodium (SOX) and recently the high pressure sodium (SON) lamps are available in very low power ratings.

The SON lamp is currently favoured for some applications as it has a reasonable colour and efficacy. It restrikes quickly in the event of a short power cut and its small size lends itself to good optical control. In security applications it is often used in small floodlights.

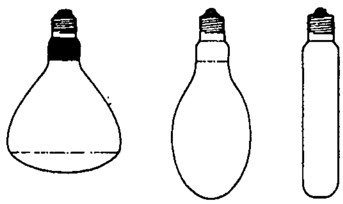
Figure 1: Lamp types



SOX Low pressure sodium lamps

Wattage range:	18 to 131
Efficacy:	67 to 165 lm/W
Life:	Circa 8000 h
Restrike:	Igniter circuits instantaneous while lamp is hot.

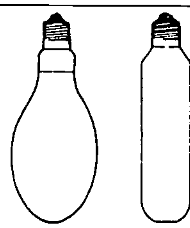
These lamps produce the most light for a given input and are very economical in use. They are not recommended where the best visibility is required at extreme range.



SON High pressure sodium lamps

Wattage range:	50 to 1000
Efficacy:	55 to 110 lm/W
Life:	Most ratings in excess of 8000 h
Restrike:	Igniter circuits usually within one minute. Others 5 minutes or longer.

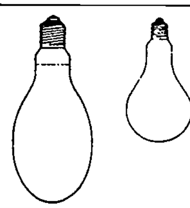
A general-purpose lamp with economic running costs. Other versions with higher output (SONP) and better colour rendering (SONDL) are available.



MBI Metal halide lamps

Wattage range:	75 to 2,000
Efficacy:	50 to 85 lm/W
Life:	Circa 7500 h depending on operating conditions
Restrike:	Igniter circuits usually within one minute. Others 4-5 minutes.

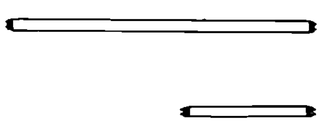
For use where colour rendering is of prime importance.



MBF Colour-corrected mercury discharge lamps

Wattage range:	50 to 2000
Efficacy:	30 to 55 lm/W
Life:	7500 h
Restrike:	5 minutes or longer.

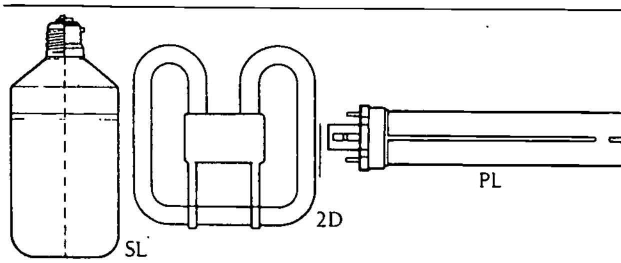
A cheaper circuit than MBI but now largely superseded for security purposes.



MCF Tubular fluorescent lamps

Wattage range:	8 to 125
Efficacy:	20 to 75 lm/W (High efficacy colours)
Life:	1.2 m and longer 7500h; others 5000 h
Restrike:	Immediate.

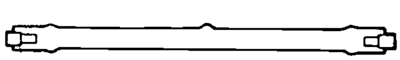
A general-purpose lamp for short range use. Very cold weather can significantly reduce light output.



CFL Compact fluorescent lamps

Wattage range:	7 to 35
Efficacy:	Circa 50 lm/W
Life:	5000 h
Restrike:	Immediate.

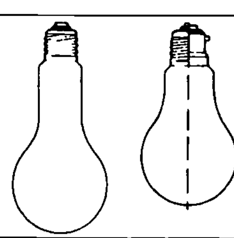
Available as original equipment but may also be used as a filament lamp replacement in small bulkheads etc.



TH Tungsten-halogen lamps

Wattage range:	200 to 2000
Efficacy:	16 to 22 lm/W
Life:	2000 h
Restrike:	Instantaneous.

A floodlighting lamp for short to medium range distances. Its high energy consumption makes it uneconomic for use on a large scale.



GLS lamps

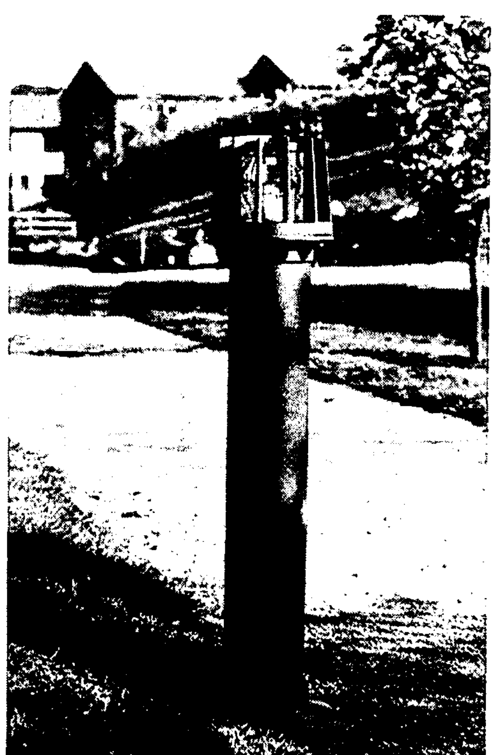
Wattage range:	40 to 2000
Efficacy:	10 to 18 lm/W
Life:	1000 h (some ratings are available in 2000 h or longer versions)
Restrike:	Instantaneous.

Smaller wattages useful for infill purposes but short life and low efficacy, makes them uneconomic for large scale use.

Figure 2: Lamp data

Lamp type	Colour rendering	Efficacy (Approximate) Lumens per Watt	Typical lamp life hours	Typical range of lamp power rating (Wattage)	Control gear required	Lamp start up time (approx)	Lamp restrike time
GLS Tungsten Filament Lamp	Excellent	15	1,000	7–1,000	No	Instant	Instant
TH Tungsten Halogen Filament Lamp	Excellent	20	2,000	100–2,000	No	Instant	Instant
MBI Metal Halide	Good/Excellent depending upon exact specification of lamp	75	7,500	250–1,500	Yes	1–2 min	1–5 min
MCF Tubular Fluorescent	Good/Excellent depending upon exact specification of lamp	20–75 Dependent upon lamp specification	5,000–7,500	4–125	Yes	1–3 sec	1–3 sec
CFL compact Fluorescent Lamps	Good/Excellent depending upon exact specification of lamp	50	5,000–8,000	7–35	Yes	1–3 sec	1–3 sec
MBF High Pressure Mercury Discharge Lamp	Poor/Good depending upon exact specification of lamp	35–54	5,000–10,000	50–2,000	Yes	4 min	10 min
SON High Pressure Sodium Discharge Lamp	Fair/Good depending upon exact specification of lamp	55–110	6,000–12,000	55–1,000	Yes	5 min	1–5 min dependent upon type of control gear
SOX, SOXE Low Pressure Sodium Discharge Lamp	Yellowish Amber light. Colours other than yellow appear brown/black. Most widely used security light source	67–165	6,000–12,000	18–131	Yes	6–12 min	Instant–3 min dependent upon control gear and lamp temperature

Wall-mounted vandal resistant 70 Watt SON-T polycarbonate luminaire, (Case study 1).



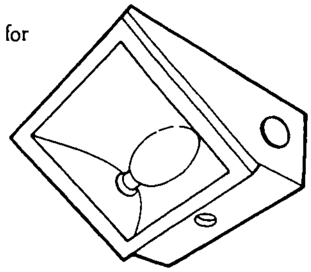
Vandal resistant bollard light.

Luminaires

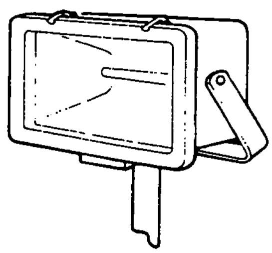
1. Luminaires house the lamps and integral control gear, although in some instances remote control gear will be accommodated in separate enclosures. Often luminaires and integral control gear are designed for a specific lamp type and do not permit interchangeability of lamps.
2. Luminaires for internal use will generally be of similar construction to those used for normal lighting. Luminaires for external use will obviously need to be weatherproof (usually IP54) but will also need to be vandal resistant. Ideally glass will not be used or if essential will be toughened and curved to resist attempts to break it. Polycarbonate presents a much tougher enclosure. Wire guards can be used with luminaires, either as a purpose made accessory or custom built, to provide added protection.
3. The body of the luminaire should be substantial in order to resist attack. Cast metal bodies are generally more resilient than thin gauge sheet metal versions. Many manufacturers make luminaires with substantial plastic bodies.
4. Access to the luminaire interior for relamping and maintenance purposes should be quick and easy, bearing in mind access by unauthorised persons should be prevented.
5. Experience has proved that any luminaire which is accessible to a vandal or intruder may be disabled. If not physically damaged it may be covered with paint or other material. Accordingly, for security purposes luminaires and passive infrared detectors are preferably sited in normally inaccessible positions provided that maintenance access can be reasonably achieved. Bollards and lighting columns should be set back from kerb edges to prevent accidental damage where cars are parked towards the kerbing.
6. Figure 3 shows a selection of luminaires suitable for security lighting. Each has its own particular light distribution and hence application.

Figure 3: Luminaire types

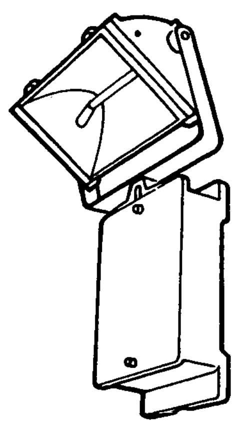
General-purpose floodlight
A modern enclosed luminaire for HID lamps.



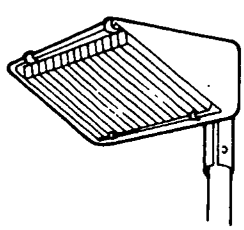
Tungsten-halogen flood
Made for TH lamps of 500W and larger.
Pole or building mounting. Vertical distributions from narrow beam to wide angle are available but all horizontal distributions are a wide fan.



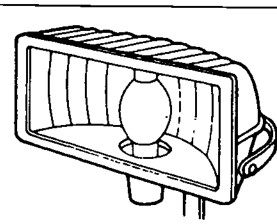
High pressure sodium floodlight
Made for double ended linear lamps but generally similar to above.



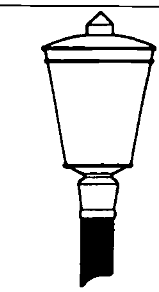
Small tungsten-halogen flood
Asymmetrical distribution for area lighting. Also suitable for checkpoints and under canopies. Made for TH lamps, 200, 300 and 500W sizes.



Wide-angle flood
Can be used for floodlighting walls and buildings, and for large area lighting. Made for HID and larger GLS lamps.

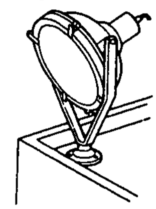


Post-top lantern
Lantern with all-round light distribution – may be used as a road lighting unit, or for lighting between buildings etc. Usually mounted at 3m or 6m above ground, either on pole or on bracket attached to building.
Made for low wattage HID lamps.

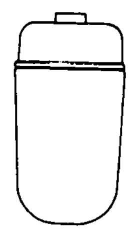


Medium-angle floodlight
for long-throw floodlighting and area lighting. Suitable for use on high masts and towers. Made for HID lamps and larger GLS lamps.

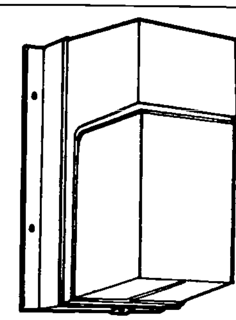
Narrow-angle floodlight
For long-throw topping up. Take great care not to cause hazard from the intense beam. Made for larger GLS lamps, Class B projector lamps and some HID lamps.



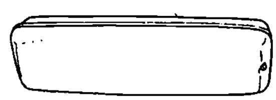
Well-glass luminaires
For topping up, and for mounting over doorways, under canopies, on faces of buildings etc. Come in many varieties, including prismatic diffusing and clear enclosure. A vandal-resistant version should be used. Made for GLS (small), low wattage HID lamps, and compact fluorescent lamps.



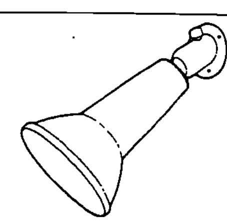
Wallmounted luminaires
Some versions have wide distribution with side lighting; others give forward lighting with no side lighting. Made for small HID lamps and compact fluorescent lamps. A vandal-resistant version should be used.



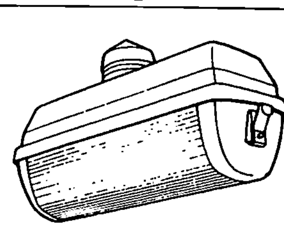
Fluorescent bulkhead luminaires
Made for smaller MCFU lamps. Multi-tube versions may have one tube supplied from emergency power supply. Vandal-resistant version should be used.



PAR-lamp luminaires
Weatherproof lampholder units to take internally silvered PAR lamp. Commonly used in clusters at checkpoints etc.

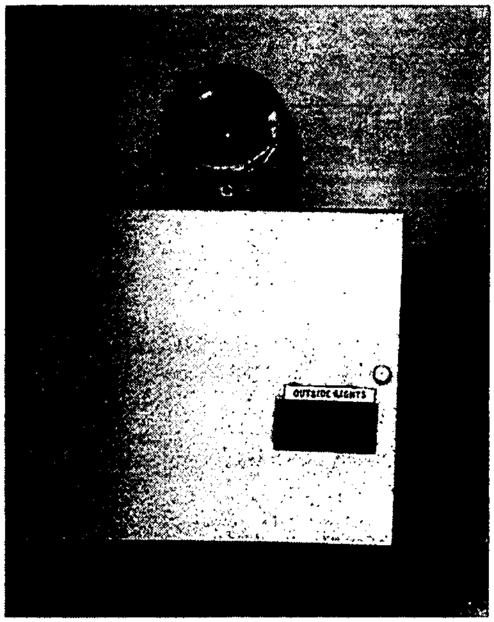


Street lighting lantern
Lantern with two-way distribution for lighting access roads or strips parallel to buildings or fences. Usually mounted at up to 10m from the ground, either on pole or on bracket attached to building. Photo-cell control incorporated.



Illuminated bollards
For traffic control etc. Made for fluorescent tube or small HID lamps Several patterns available.

Controls



External lighting distribution board with timeswitch control (Case study 2).

1. Controls will be required to activate the security lighting. Manual switching relies on someone remembering to switch it on which, whilst obvious in winter when it is dark before they leave site, may not be thought of in summer when it is still light when they leave. This is not energy efficient as lighting will be on at times when it is not needed.

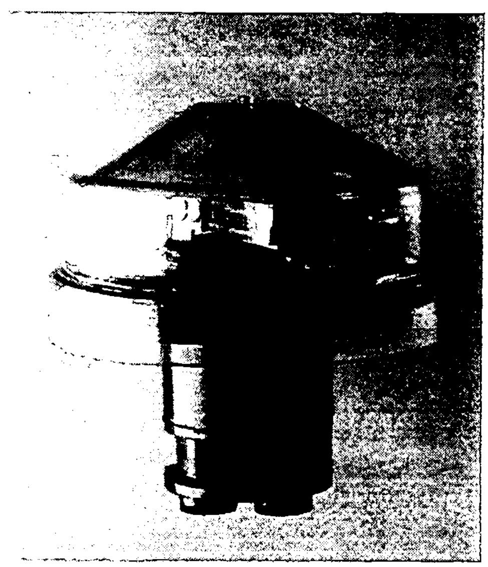
2. Standard timeswitches can be used to improve the situation, but will require continual resetting in order that switch on and off times correspond to the ever changing daylight hours; also in event of power failure their time setting will require correction.

3. Solar dial timeswitches are a further improvement as their on and off times are adjusted automatically throughout the year to accord with daylight hours.

4. Time switches are available with spring reserve or battery back-up to ensure their retention of time setting during supply interruptions.

5. There are considerable advantages in using photo-electric cells for control purposes. They respond to the amount of ambient light rather than the time of day and therefore automatically respond to actual lighting conditions. They are relatively cheap and fail in the 'on' state which is quickly noticed. There is no time sequence to lose if there is an interruption in the electricity supply which is preferable to timeclock control.

There are two types of photoelectric control, one using a central photoelectric cell and one with a cell in each fitting. There may be advantage in using the latter where ambient conditions vary around the site such as in a dark area between tall buildings.



External Photocell fitted to street lighting columns and other luminaires or alternatively separately mounted.

6. Where lighting is required for security purposes only after the premises have been vacated, it may be useful to combine the benefits of both timeswitch and photocell. The timeswitch allows lighting during the period required, and the photocell only switches it on when ambient conditions are such that it is needed.

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7. When continuous lighting is not required, luminaires can be controlled by Passive Infrared (PIR) sensors which detect the heat given off by bodies, objects etc. However, they are prone to nuisance switching, being initiated by animals, swaying trees etc. Also criminals have been known to deliberately trigger the lighting and retire to observe any reaction; if there is none they know that they can proceed to intrude with impunity. Where PIR sensing is used, lamps must have instantaneous start-up and restrike. The PIR sensors should be inaccessible to prevent them being covered up.

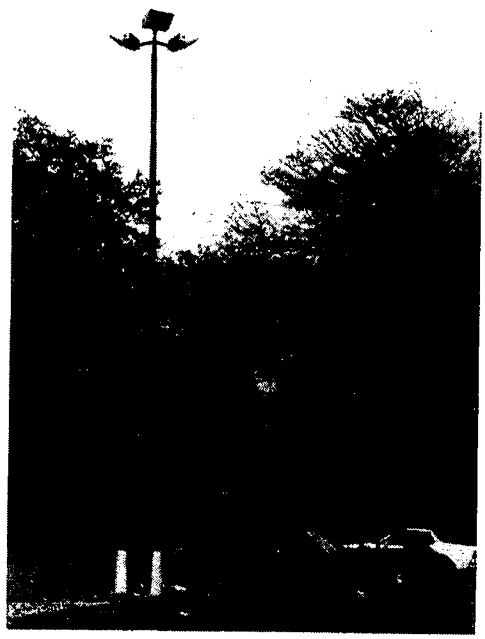
8. With all automatic controls it is essential to have provision for isolation to prevent the lighting being automatically switched on whilst maintenance work is being done.

Case Studies

Case Study 1

West Herts College, Cassio Campus

Cassio campus is a catering college which runs a large number of evening courses. Many students come to the college by car and there is a large car park set amongst mature trees. Security lighting was provided when the school was constructed. Following recent criminal incidents it has been improved and modernised.



10 metre Mini High Bay columns fitted with 3 No. 400 Watt SON-T area floodlights, (Case study 1).

5 metre 70 Watt SON-T street ting column, (Case study

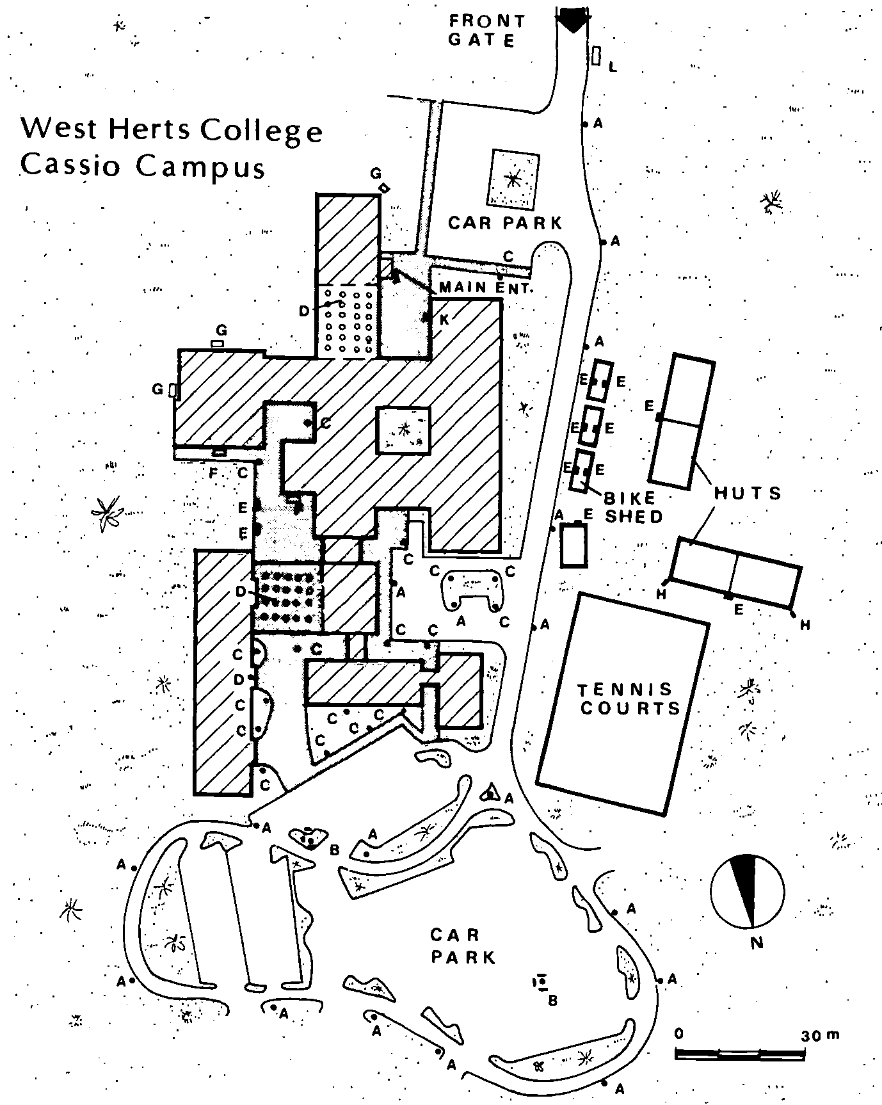
The original system of lighting employed fittings incorporating 6 No. 2'6" fluorescent tubes vertically mounted on each 5 metre high column together with fluorescent bollard type fittings. The columns light both the access roads and the car park. The fluorescent column fittings posed a serious maintenance problem as the lamp life was only about 1,000 hours due to their vertical orientation. Also the lamp control gear was installed in the fittings and due to the outside exposure frequently required maintenance.

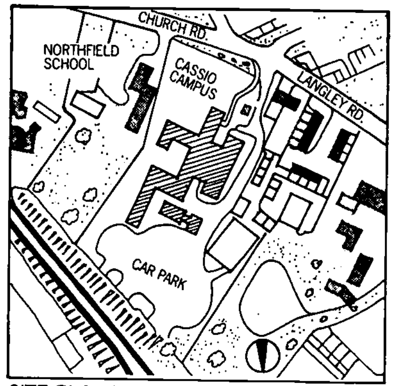
The 5 metre columns have been upgraded by replacing the fluorescent fittings with 70 Watt SON-T fittings mounted on the same columns with a 28% energy saving. This upgrading had a payback period of 3.5 years. The lighting was recently further improved following a series of thefts from cars and two more serious incidents in which two female students were accosted. To prevent these incidents two higher 10 metre columns have been used to light the car park in addition to the 5 metre columns. The 10 metre columns are each fitted with 3 No 400 Watt Son-T area floodlights.

Taking into account the 10 metre high columns the total energy consumption has increased, however the standard of lighting has improved greatly and since installation the criminal incidents have stopped.

The security lighting is controlled by three time-switches. The one controlling the car park lights operates through a photocell operated contactor.

The lights are on from dark to 12 pm and again for the two hours before dawn.





SITE PLAN West Herts College

Legend

- **A** 70 Watt SON-T on 5 metre lighting column
- **B** 10 metre column with three 400 Watt SON-T area floodlights
- **C** Miniature Fluorescent Bollard lights 2 × 7 Watt
- **D** Tungsten Bulkhead soffit mounted
- **E** Tungsten Bulkhead wall mounted
- **F** 70 Watt SON-T wall mounted
- **G** 100 Watt SON-T wall mounted area floodlight
- **H** 55 Watt SOX
- **K** 55 Watt SON-T
- **L** Fluorescent back-lit school sign

Capital and running costs of the lighting installations at 1992 prices:

- replacement of fluorescent street lights by 70-Watt Son-T fittings reusing existing columns and wiring = £2,789

Savings in annual running costs of street lights only:

- annual saving on electricity = £199
- annual saving on maintenance = £600

Using a Treasury Test Discount Rate of 6% and assuming a 20 year life for the new lighting installation produces a Net Present Value of £6,374, an Internal Rate of Return of 28.5% and a Simple Payback Period of 3.5 years, therefore the replacement is a good financial investment.

- Cost of recent addition of two 10 metre columns each mounted with three 400 Watt area floodlights = £6,413 at 1992 prices

annual running costs of lights on 10 metre columns:

- Electricity = £272
- Maintenance cost = £75

The total cost of all the Cassio College security lighting if it were to be installed now including wiring and builders work would be £32,000

Total site annual running costs:

- Maintenance cost = £467
- Electricity cost = £1,162

Case Study 2

Hayes Park Primary School

The school had a complete re-wire in 1990. At this time security lighting was added. This consists of 70 Watt wall mounted luminaries, 2D-soffit mounted fittings and 70 Watt SON-E street lamps on 5 metre high columns.

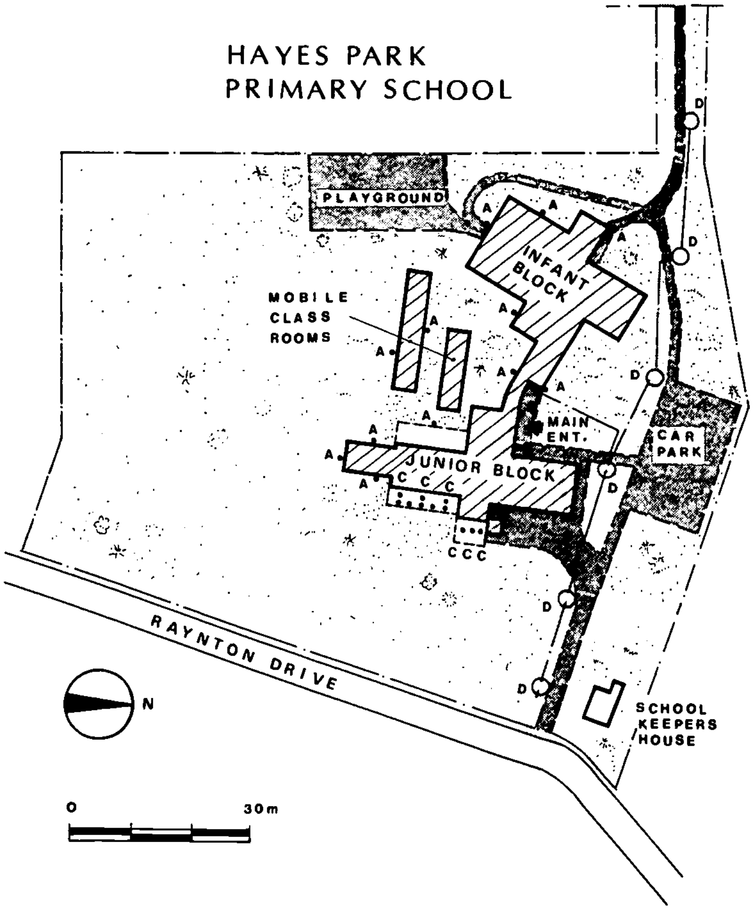
The total cost of the installation was £6,154.

The annual running costs are:

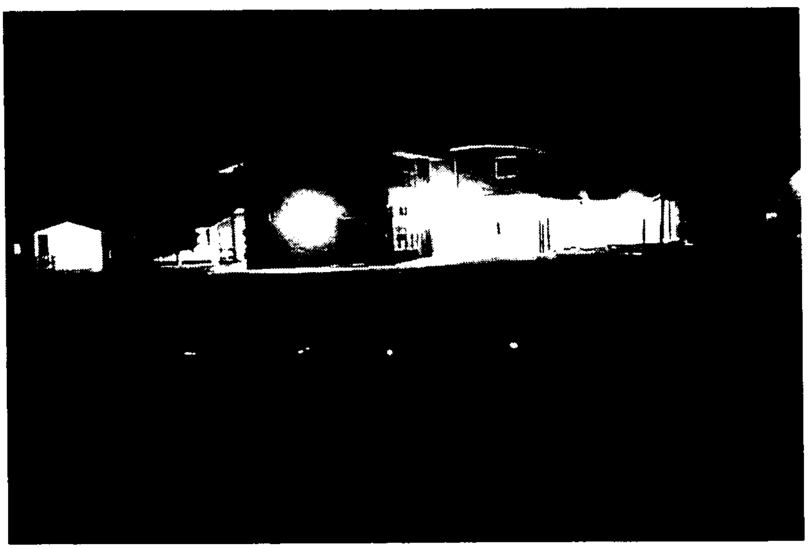
- maintenance cost £138
- electricity cost £262

Legend

- **A** 70 Watt SON-T wall mounted with integral photocell
- **B** Tungsten bulkhead fitting
- **C** Soffit mounted 2D bulkhead fitting with integral photocell
- **D** 70 Watt SON-E on 5 metre column



Hayes Park Primary School.



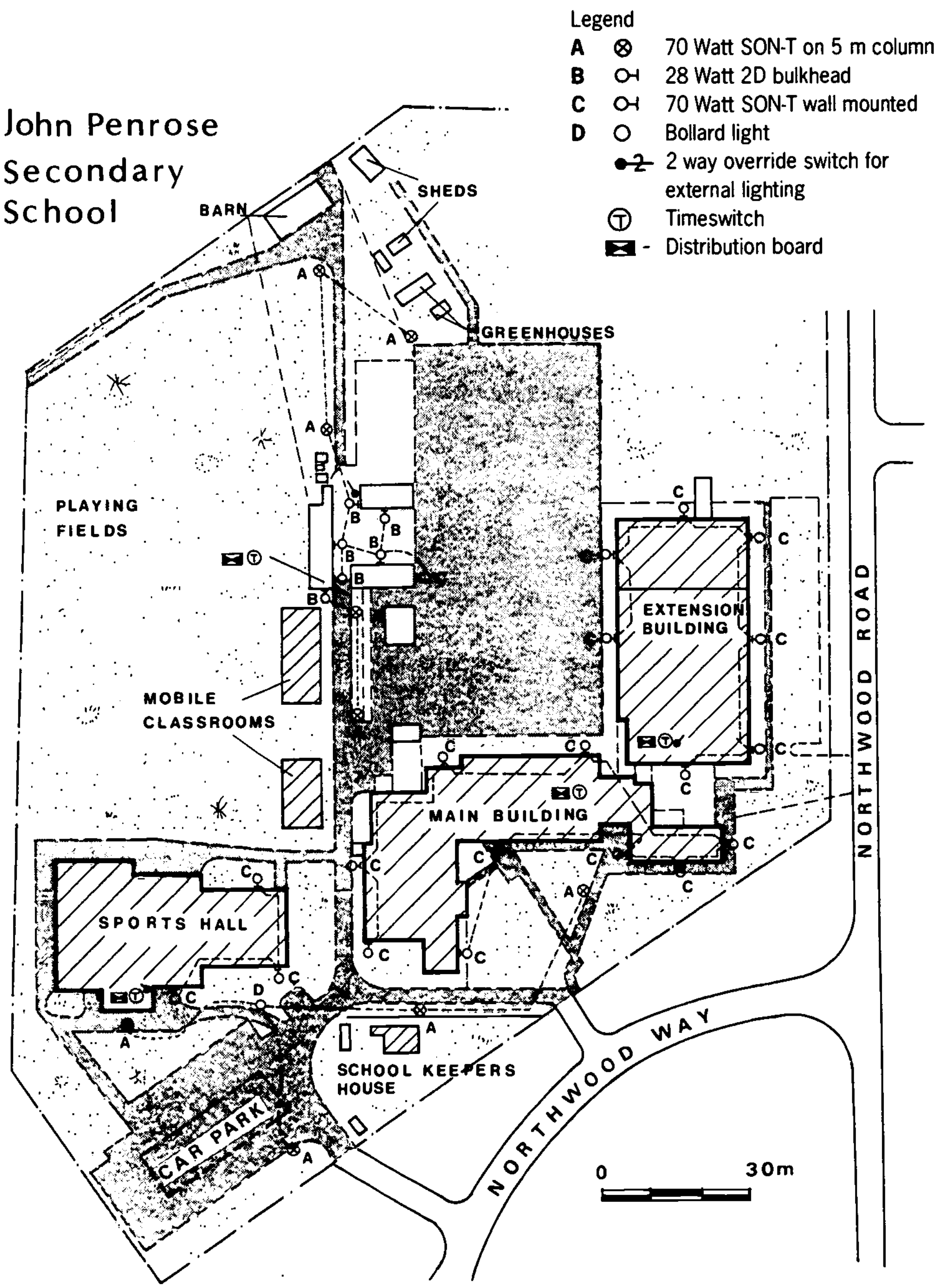
Case Study 3

John Penrose Secondary School
The school was completely rewired in 1990 when security lighting was added. It consists of 19 wall mounted luminaries, six bulkhead and soffit mounted 2D-fittings and eight 70 Watt SON-T street lamps as fitted at Cassio College. There is also one bollard light in the car park. All the lights have integral photocell control and are controlled by timeswitches and 2 way override switches on each of the circuits.

Total cost of the installation was approximately £14,000 at 1992 prices.

The annual running costs are:

- Maintenance cost £314
- electricity cost £291



COLOUR RENDERING A measure of how accurately the colour of surfaces appear when illuminated by the lamp type when compared, with their appearance under a standard light source e.g. daylight. Thus good colour rendering would mean that colour appearance which approximates daylight conditions. Colour rendering is not important for purely security applications but may aid identification of suspects or vehicles. Where black and white closed circuit television (CCTV) is employed colour rendering is unlikely to be an important consideration; for colour CCTV systems it is likely to be critical.

CONTROL GEAR Some lamps such as filament lamps generate light by their simple connection to the supply voltage. Other lamps, discharge lamps, require control gear to initiate/ maintain the light producing process. Usually such control gear comprises of chokes, capacitors and sometimes igniters or starters. The control gear is matched to particular lamp types and power ratings and controls the starting of the lamp and limits the power consumed by the lamp.

EFFICACY A measure of the efficiency of the lamp and is the ratio of the light output of the lamp to the electrical power consumed by the lamp in lumens per watt. When selecting on the basis of efficacy it is essential to use the values for luminaires, i.e. the ratio of luminaire light output to luminaire electrical power consumption in order to include for all effects of the lamp and any control gear.

GAS DISCHARGE LAMPS These lamps contain sodium or mercury to which metal halide or other chemical compounds are added. The sodium or mercury is vaporised and produces light when electricity is discharged through the gas produced as a result of vaporisation. This type of lamp requires control gear to initiate (and maintain) the discharge/light producing process.
They are sometimes called high intensity discharge(HID) lamps.

GENERAL LIGHTING SERVICE (GLS) LAMPS These are the normal everyday tungsten filament lamps (light bulbs) which contain a filament of tungsten in an inert gas that glows white hot, thereby producing light.

HIGH INTENSITY DISCHARGE LAMPS Generic term covering Mercury Discharge(MBF & MBI) and High Pressure Sodium(SON) Lamps (see GAS DISCHARGE LAMPS).

LAMP LIFE The typical hours of usage of the lamp before it fails or the output reduces below a certain level, when used in normal conditions, orientation, etc., as defined by the manufacturer.

LAMP RANGE The typical range of electrical power input ratings over which the lamp type is manufactured, e.g., for GLS lamps the range could be 25–1,000 watts and include 25, 40, 60, 100, 150, 200, 300, 500, 750, and 1,000 watt lamps.

LAMP RESTRIKE TIME Except for the normal fluorescent tube many other types of gas discharge lamps require a restriking time of a few minutes following an interruption to the power supply during which illumination is lost.

LAMP START-UP TIME Where lamps need control gear to initiate their light emitting cycle, the process takes a finite time until full light output is achieved. This period is known as the lamp start-up time.

LUMINAIRE An apparatus which controls the distribution of light given by a lamp or lamps and which includes all the components necessary for fixing and protecting the lamps and for connecting them to the supply circuit.

Luminaire has superseded the term light fitting.

LUX The SI unit of illuminance or luminous flux density at a surface, i.e. the luminous flux incident per unit area
1 Lux = 1 Lumen per square metre

PASSIVE INFRARED (PIR) DETECTORS These work by sensing an intruder's body heat.

POLAR CURVES Graphical, transverse and longitudinal light output distribution diagrams produced for luminaires by manufacturers to enable the choice of the most appropriate luminaire for a particular application.

SON High pressure sodium discharge lamp with an arc tube in an elliptical outer envelope with white internal diffusive coating.

SON-T High pressure sodium discharge lamp with an arc tube in tubular outer envelope of clear glass.

SOX/SOX-E A low pressure sodium discharge lamp with linear arc tube in which arc tube and outer envelope are combined to form one unit (linear construction). SOX-E is an economy version in which new SOX-E control gear has produced a rise in efficacy while retaining interchangeability which can achieve a 30% lower electricity cost than ordinary SOX lighting.

TUNGSTEN HALOGEN (TH) LAMPS These are similar to GLS lamps except that a halogen chemical is added to the gas filling to increase light output and life. Low voltage tungsten lamps have a higher efficacy due mainly to the fact that for a given power rating they have a thicker filament than mains voltage lamps. Therefore, there is a greater surface area of white hot filament.

Further Reading

PUBLICATIONS RELATING TO SECURITY IN SCHOOLS

Building Bulletin 76 Maintenance and Renewal in Educational Buildings: Maintenance of Electrical Services, outlines a strategy for electrical maintenance, which also applies to security lighting. ISBN 0 11 270799 8 HMSO 1992 £13.50

Crime Prevention in Schools Series:

Building Bulletin No 67 Crime Prevention in Schools: Practical guidelines following nine months' research into vandalism, theft and fire in English schools. Details various preventative measures against vandalism, theft and arson in schools. ISBN 0 11 270637 1 HMSO 1987 £4.95

Building Bulletin No 69 Crime Prevention in Schools: Specification, Installation and Maintenance of Intruder Alarm Systems, deals with the management and technical aspects of intruder alarm systems. ISBN 0 11 270677 0 HMSO 1989 £7.50

Building Bulletin No 75 Crime Prevention in Schools: Closed Circuit TV Systems in Educational Buildings, deals with the design, specification installation and maintenance of CCTV systems. ISBN 0 11 270778 5 HMSO 1991 £5.00

DFE Broadsheet 28, School glazing and vandalism, deals with cost effective replacement options for vandalised glazing, 1992. Available from DFE Publications Centre, PO Box 2193, London, E15 2EU. Tel: 081 533 2000 (answerphone out-of-hours).

The Essentials of Security Lighting: Commercial and industrial premises, The Electricity Council, 1988, EC5075/8.88 [Source of Figures 1, 2 and 3]

Security in Schools—a Management Guide, published by the North East Region School Security Group. Contact: Mr T. B. Coulson, NERSSG, c/o West Denton High School, West Denton, Newcastle-upon-Tyne NE5 2SZ.

CIBSE Lighting Guide LG6:1992 The Outdoor Environment, £44.00 from the Chartered Institution of Building Services Engineers.

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This bulletin will be helpful to headteachers, governors, consultants and others responsible for the security of schools. It covers strategy, design, installation and maintenance of security lighting and describes the types of lamp and luminaire available. Three case studies of a primary school, a secondary school and a college of further education are included as examples.

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