Lighting in the Countryside: Towards Good Practice - Main document

On 5th May 2006 the responsibilities of the Office of the Deputy Prime Minister (ODPM) transferred to the Department for Communities and Local Government.

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Summary

This guidance was published jointly with the (then) Countryside Commission. It gives advice, which is also relevant in towns, on good lighting types and installations for street, sports and security lighting. It describes how to avoid light pollution of the night sky, glare hazards to drivers and nuisance to neighbours. It also offers design guidance and a bibliography.

Order

This publication is out of print and only available online - see below.

The findings and recommendations in this report are those of the consultant authors and do not necessarily represent the views or proposed policies of the Department for Communities and Local Government.

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Preface

Excessive lighting on rural roads, village streets and in other areas of the countryside is a concern to many rural residents. The light can shut out the splendour of the night sky, and lighting apparatus can spoil daytime views. There is also a subtle, cumulative effect on countryside character that tends to blur the distinction between urban and rural areas.

In recognition of these issues, in the 1995 White Paper: *Rural England - A Nation Committed To A Living Countryside*, the Government made clear its belief that the intrusiveness of lighting in the countryside should be kept to a minimum. The White Paper suggested that this could be achieved by improving design standards for lighting, varying light levels where these are inappropriate for rural settings, and taking advantage of opportunities to remove unnecessary lighting. The Countryside Commission - which for some years had been expressing concern over the impacts of rural lighting - was asked to commission research that would lead to a good practice guide for lighting in the countryside.

In March 1996 we were appointed by the Countryside Commission and the Department of the Environment jointly, to undertake the research and to prepare this guide, *Lighting in the Countryside: Towards Good Practice*. The guide covers all forms of lighting, including lighting for security, sports facilities, commerce, retail, agriculture and mineral extraction; lighting of buildings, villages and residential development; and lighting of rural roads, junctions, services and parking areas. Its key objectives are to identify good practice in the planning and design of lighting in rural areas, and to advise on how it can be achieved, using case study examples.

The guide is based on comprehensive research undertaken by a team comprising a planner, a landscape architect, a lighting engineer and a transportation engineer. The research included a desk study of existing policies, controls, procedures, standards and advice; consultations and structured interviews with planning and highway authorities and with a wide range of other interested parties; and case studies of both good and bad practice for a variety of forms of lighting. Findings were presented in an interim *Research Report*, and were discussed with a Steering Group comprising representatives of the Department of the Environment, Countryside Commission, Highways Agency, Department for Transport, Royal Town Planning Institute and Royal Institution of Chartered Surveyors.

We hope that the guide will prove to be a valuable reference source and tool for preventing and alleviating the adverse effects of poorly designed and installed lighting schemes on the English countryside.

Environmental Resources Management, the NEP Lighting Consultancy and the Carl Bro Group

The content of the Guide should not be taken to be a definitive statement of Government policy.

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Acknowledgements

The study team would like to thank all members of the Steering Group for their help and support during the preparation of this good practice guide. In particular, we acknowledge the assistance of Peter Matthew of the Department of the Environment - Chairman of the Steering Group, and Ray Woolmore of the Countryside Commission - Project Officer for the study. Other members of the Steering Group comprised Caroline Rigg and Sue Toland (Department of the Environment - Countryside Division); David Williams (Department for Transport); Sally Dyke (Highways Agency); David Cowell (Highways Agency); Bernard Bowen (Chief Planning Officer, Harborough District Council - representing the Royal Town Planning Institute); and Alan Oakley (Surrey County Council - representing Royal Institution of Chartered Surveyors).

Thanks are also due to the many organisations and individuals who have provided invaluable information and comment. In particular we acknowledge the help of Chris Baddiley and Bob Mizon (British Astronomical Association), Sin Phipps and Caroline Cotterell (Council for the Protection of Rural England), Nigel Gibbs (Dacorum Borough Council), Francis Golding (Royal Fine Art Commission), Brough Skingley and David Stewart (English Heritage), Brian Hatfield (Sports Council), Mike Simpson (Past President of the Institution of Lighting Engineers), Andrew Knight, and all others who participate in the seminar held to review the research findings.

The study team comprised Julie Martin, Kate Collins and Rebecca Knight of Environmental Resources Management; Nigel Pollard of the NEP Lighting Consultancy; and Steve Wallace and Malcolm Turner of the Carl Bro Group.

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Executive Summary

Background

The UK has long been proud of having well-lit roads, cities and public open spaces. The availability of low-cost lighting has helped to promote security, reduce road accidents, advertise commercial enterprises, permit outdoor working and sports activities at night, and enhance the environment. There is no doubt that exterior lighting brings many benefits and considerable personal convenience to those living and working in the countryside today.

However, in recent years there has been growing recognition that excessive, poorly designed and badly aimed lighting may have adverse effects. Excessive lighting on rural roads, village streets and in other areas of the countryside can lead to skyglow which shuts out the splendour of the night sky, and lighting apparatus can spoil daytime views. Glare from excessively bright or poorly aimed lights causes dazzle, with safety implications for motorists and pedestrians, particularly the elderly. Light spill or trespass may impinge directly on the home, destroying its sense of privacy and interfering with people's ability to sleep. There is also a subtle, cumulative effect on the character of rural landscapes that tends to blur the distinction between urban and rural areas.

Research Objectives

In recognition of these issues, in the 1995 White Paper: *Rural England - A Nation Committed To A Living Countryside*, the Government made clear its belief that the intrusiveness of lighting in the countryside should be kept to a minimum, and that it would ask the Countryside Commission - which for some years had been expressing concern over the impacts of rural lighting - to commission research that would lead to a best practice guide on lighting for rural roads. At the request of the Department of the Environment, the objectives of the study were subsequently expanded to examine lighting associated with development in the countryside. The specific objectives of the study were to:

- inform and advise the Countryside Commission and Department of the Environment on the applicability of existing advice and guidelines;
- investigate existing practice for lighting on rural roads and village streets, and lighting associated with development in the countryside;
- consider the role that the planning system can play in influencing good practice for lighting associated with development in the countryside;
- identify good practice in mitigation of the excessive or intrusive effects of lighting and lighting structures on the countryside; and
- prepare a good practice guide to mitigating the excessive effects of lighting associated with developments in the countryside, rural roads and village streets.

The Good Practice Guide

Aims and Objectives
The purpose of the Good Practice Guide, therefore, is to provide practical advice on the prevention and control of lighting impacts through appropriate action by all those involved with lighting in the countryside. Specific objectives are to:

- identify good practice in the planning and design of lighting in rural areas; and
- advise on how it can be achieved, using case study examples.

The guide is intended to present an overview and common understanding of all aspects of good lighting practice for a wide audience, including planning authorities, highway authorities, developers, lighting and landscape professionals, lighting manufacturers and members of the public. All these parties have important roles to play in reducing the intrusiveness of lighting in the countryside, and hence the guide is written as far as possible in simple, non-technical language.

Controls over lighting appear to be poorly understood by professionals, developers and the public, and there is a lack of information on technical lighting issues and options. The guide, therefore, is intended to explain the basic principles, and point to where additional information can be found. For the lighting profession and manufacturers, we hope the guide will bring greater awareness and understanding of the environmental issues with which the public is increasingly concerned.

Structure Of The Guide
The guide is structured to broadly reflect the process of planning, designing and implementing a lighting scheme in the countryside. It reviews the background to light and lighting; the steps taken in preparing a new lighting scheme; and sets out good practice principles. The content of the individual chapters is as follows:

- Chapter 2 looks at lighting in an historical perspective, and explains lighting terminology and basic equipment types.
- Chapter 3 examines the scale of exterior lighting in Britain today and the effects of excessive lighting on people, wildlife, and landscape in the countryside.
- Chapter 4 outlines the key stages in preparing a lighting scheme, including consideration of lighting need; initial scheme appraisal; planning, environmental and cost issues; lighting and landscape design; and installation and aftercare.
- Chapter 5 reviews land use planning and lighting, and explains the way in which good development planning and development control procedures can promote good lighting practice.
- Chapter 6 describes how the impacts of a lighting scheme can be assessed, at night and in daytime, and how assessments should feed into the design process.
- Chapter 7 explains the links between lighting need, site planning and landscape design, and describes specific landscape measures to help mitigate lighting impacts.

- Chapter 8 examines lighting equipment, standards and design procedures that apply to lighting installed for different purposes.
- Chapter 9 looks at lighting issues in practice for individual lighting types. Good practice principles for both landscape and lighting design are identified, and are illustrated by a series of case studies.
- Finally, Chapter 10 summarises the roles of all those involved in lighting in the countryside, and suggests action the future to help to achieve good practice.

Some Issues To Consider When Preparing A Lighting Scheme

Assess The Need For Lighting

The process of preparing a lighting scheme should begin with an assessment of the need for lighting. The reasons for preparing the scheme should be clear at the outset. Instead of automatically assuming that lighting is necessary, promoters of lighting schemes should carefully consider whether:

- the development could proceed without lighting;
- the benefits of lighting outweigh any disbenefits; and
- there are any alternatives to lighting.

Having established that lighting is needed, an initial appraisal of the specific lighting requirements of the task in hand should be made and an outline scheme design prepared. The main purpose of the appraisal is to identify a viable outline scheme that has the potential to be successfully integrated with its surroundings. It is also helpful to consider environmental and cost issues at this stage and to involve third parties such as planners and local resident groups.

Planning And Environmental Considerations

There are a number of ways in which the planning system can influence lighting proposals. Development plans and, in particular, supplementary planning guidance can help inform people about lighting issues and indicate ways in which they should be addressed within development proposals. The development control process offers scope to control and influence many forms of lighting. By participating in the planning process, developers, professional advisers and members of the public play an important part in encouraging and initiating good lighting design proposals.

Planning issues should be addressed in parallel with the initial scheme appraisal, as they are likely to have a fundamental influence on the location and design of any outline scheme. It is important to establish at the outset what planning requirements will apply, in particular:

- relevant structure and local plan policies on lighting, as well as policies on development in

the countryside generally;

- supplementary planning guidance on lighting; and
- planning application procedures and information requirements.

Developers are encouraged to apply the principles of formal environmental assessments to their own lighting impacts as an integral part of the preparation of a lighting scheme. Among the issues that should be examined will be the effects of night lighting on dark landscapes, the appearance of lighting structures in daytime, potential impacts on the amenity of local residents and effects on the safety of transport users.

Costs

Lighting equipment, like all manufactured goods, varies widely in quality and price. A number of factors will contribute to the selection of cost-effective, quality equipment. These include the suitability of the product to the task; its performance; and the security of the fixing system. In addition, there are a number of trade-offs that are also likely to affect the costs of lighting schemes. For example, a higher column will result in a higher cost (including the foundations costs) but, for a given area, fewer will be required which, in turn, may reduce costs.

The effectiveness of lighting equipment relates directly to its energy and maintenance costs; hence these costs should always be considered together with the initial supply and installation costs. Unfortunately, at present, energy use does not necessarily equate to energy cost in relation to lighting. Electricity costs vary with demand and as there is normally little demand through the night, energy costs during the night can be very low. Hence lamps that are lit throughout the night may be a waste of energy, but may not necessarily be a waste of money. A lighting installation will always require maintenance, if only to change the lamp periodically. The maintenance of outdoor lighting installations is normally labour intensive and therefore expensive.

Scheme Design and Installation

Lighting design should always proceed in parallel with careful site appraisal, planning and landscape design. The design of lighting schemes is governed by the use of technical lighting guides and standards. Other important influences are the requirement to comply with current Health and Safety Regulations and, increasingly, an awareness of the need to reduce light pollution. A 'free' lighting design service is offered by most lighting equipment manufacturers for, or on behalf of, an installation contractor. On the other hand, independent professional lighting designers will be more customer-orientated and it is possible that the additional cost involved in using professional advice will be partially offset by the resulting lighting design.

Good installation is critical to the success of a lighting scheme, and to the control of potentially intrusive light. The installation contractor should be aware of the optical design of the luminaire being installed and the arrangement for fixing the luminaire to its support. This must be secure and ideally not require altering when the lamp is replaced.

Most security lighting systems are purchased and installed by property owners and individuals who may not be fully aware of the environmental implications of poorly fitted equipment. Manufacturers and retailers should provide more information on lighting choice and installation

at the point of sale, so that the minimum lighting for the task in hand is purchased, and so that light spill and glare can be prevented. The aftercare of lighting schemes is crucial to the control of lighting impacts. A post-installation check should always be carried out to ensure that the scheme has been installed correctly.

Action On Lighting In The Countryside

Toward Good Practice: Some Conclusions

Lighting in itself is not a problem; it only becomes a problem where it is excessive, poorly designed or badly installed. Better use of planning controls; greater awareness of the potential adverse impacts of light amongst developers, manufacturers and the general public; and improved lighting design and landscape design are among the most important ways of tackling issues of over-lighting.

The planning system offers much greater scope than is currently realised to control, guide and influence lighting associated with new development. The research shows that with the exception of domestic security lighting (which cannot readily be brought within planning control), most of the lighting that gives rise to problems is associated with new development that does require planning permission. More effective development plan policy and development control practice, therefore should be able to achieve a great deal.

Developers of a lighting scheme also have a vital role to play in addressing lighting issues, and needs to have a clear understanding of planning controls and procedures. Although lighting has many benefits, the research suggests that the questions of lighting need and alternatives should be considered much more critically than they have been in the past, and that environmental considerations should be given greater weight. Environmental assessment, although not a formal requirement for lighting schemes, can help to highlight potential problems at an early stage. In most instances, problems that may arise can then be successfully resolved during the design process, thus permitting the development to proceed smoothly and swiftly.

For significant lighting schemes, professional advice, whether from the lighting manufacturer or from a qualified lighting engineer, is recommended. The range of lighting standards and lighting products on the market today is very broad - the guide summarises the main standards and types of lighting equipment that will be appropriate for different lighting purposes. This information should be particularly useful to planners, developers and members of the public who are unfamiliar with lighting equipment and options, and wish to take an informed view. Heightened public awareness and expectations should encourage manufacturers of lighting equipment to produce and sell high quality lighting products with good control abilities.

Achieving Good Practice

If action on lighting in the countryside is to be effective, it will require the close cooperation and participation of all those involved in planning, designing and installing lighting schemes. The responsibility for tackling lighting issues is very much a shared one, which will need ongoing care and attention in years to come. As well as producing new lighting schemes of higher quality than in the past, there will also be opportunities to remove or redesign existing lighting that is inappropriate to a rural setting.

The following principal actions are needed to achieve good practice:

- *Local planning authorities* should recognise the cumulative impacts of lighting on countryside character. They should consider the need for policies on lighting in the development plan, and for supplementary planning guidance to elucidate those policies. Through better awareness and understanding of technical lighting issues, they should be able to deal more effectively with planning applications that involve lighting, for instance by using planning conditions to prevent and control adverse impacts.

- *Developers* should look differently upon lighting than they did in the past, and should not automatically assume that it is a good thing. This implies a more critical assessment of lighting need and alternatives, and a greater willingness to consider the removal or upgrading of intrusive lighting. In judging the costs of lighting, they should take a long term view and give due weight to energy and maintenance costs as well as capital costs. Developers should also be aware of the benefits of specialist lighting expertise, and should seek professional lighting design advice for significant schemes.

- *Lighting engineers and designers* should adopt a more structured approach to assessing the environmental impacts of lighting installations. The approach outlined in this guide is suggested as a model. In advising developers, lighting engineers and designers should be flexible in interpreting design standards, and should draw developers' attention to the environmental benefits and frequent long term cost savings of high quality equipment that gives good light control.

- *Manufacturers and suppliers* of lighting equipment should provide a design service that is as impartial and responsible as possible, and should focus increasingly on high quality lighting products, as these will be expected by planning authorities and the public. In relation to security lighting that is intended for DIY installation, retailers have a special responsibility to ensure that good information is available on how to choose appropriate equipment, minimise light levels, and control light pollution through good installation.

- Lastly, *members of the public* have a vital role in the control of light pollution. They are responsible not only for most domestic security lighting, but also for much of the small scale lighting on commercial and business premises that does not need planning permission. They should take great care in the selection and installation of lighting equipment, and if in doubt should always seek professional advice. In addition, they can contribute in other ways, for instance by participating in 'local lights' schemes and in the preparation of Village Design Statements that will influence lighting proposals in the locality.

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1. Introduction

1.1 Lighting in the Countryside

The UK has long been proud of having well-lit roads, cities and public open spaces. The availability of low-costlighting has helped to promote security, reduce road accidents, advertise commercial enterprises, permit outdoor working and sports activities at night, and enhance the environment. There is no doubt that exterior lighting brings many benefits a considerable personal convenience to those living and working in the countryside today.

However, in recent years there has been growing recognition that excessive, poorly designed and badly aimed lighting may have adverse effects. Excessive lighting on rural roads, village streets and in other areas of the countryside can lead to skyglow which shuts out the splendour of the night sky, and lighting apparatus can spoil daytime views. Glare from excessively bright or poorly aimed lights causes dazzle, with safety implications for motorists and pedestrians, particularly the elderly. Light spill or trespass may impinge directly on the home, destroying its sense of privacy and interfering with people's ability to sleep. There is also a subtle, cumulative effect on the character of rural landscapes that tends to blur the distinction between urban and rural areas.

1.2 The Good Practice Guide

As a result of all these factors there are growing calls for action to prevent and control lighting impacts, by influencing the decision-making process about where and how lighting is installed, and by improving lighting design. However, there is no existing guidance that is comprehensive, relevant and accessible, and the topic is a complex one both procedurally and technically.

The purpose of this good practice guide, therefore, is to provide practical advice on the prevention and mitigation of lighting impacts through appropriate action by all those involved with lighting in the countryside. Specific objectives are to:

- identify good practice in the planning and design of lighting in rural areas; and
- advise on how it can be achieved, using case study examples.

The guide is aimed at a wide audience, including planning authorities and statutory consultees, highway authorities, developers, the lighting and landscape professions, lighting manufacturers and retailers, and members of the public. All these parties have important roles to play in reducing the intrusiveness of lighting in the countryside, and will find guidance that is specific to them within this publication. However, the guide is also intended to present an overview and common understanding of all aspects of good lighting practice for everyone, and hence it is written as far as possible in simple, non-technical language.

Controls over lighting appear to be poorly understood by professionals, developers and the public, and there is a lack of information on technical lighting issues and options. The guide,

therefore, is intended to explain the basic principles, and point to where additional information can be found. For the lighting profession, manufacturers and retailers, we hope that the guide will bring greater awareness and understanding of the environmental issues with which the public is increasingly concerned.

1.3 Existing Advice on Lighting and the Environment

There is remarkably little existing comprehensive advice on lighting and the environment. However, there are a number of useful publications on specific aspects of the problem of which the reader should be aware.

First, the Department for Transport (DoT) has produced guidance on road lighting and the environment, which has recently been incorporated into Volume 10 of the Design Manual for Roads and Bridges. This reviews the reasons why the environment may be sensitive to lighting, and considers issues of appearance by day and by night. It describes how lighting considerations should be fed into highways appraisal procedures, and gives a checklist of environmental issues to be addressed. Ideas are presented on how to reduce environmental intrusion by road lighting, both by day and by night. Although the guidance was developed specifically for trunk roads, the foreword indicates that the principles are also intended to be useful to other highway authorities when determining policy on local roads.

Second, the Chartered Institution of Building Services Engineers (CIBSE) and the Institution of Lighting Engineers (ILE) in 1995 published Lighting and the Environment: A Guide to Good Urban Lighting. This excellent guide, with a foreword by the Royal Town Planning Institute, aims to encourage high quality lighting design in an urban environment. As well as looking at the lighting design process for cities, towns and individual buildings, it reviews the planning and heritage issues associated with urban lighting.

A more specialist approach is taken in Lighten Our Darkness, a report by the Royal Fine Art Commission on successes, failures and opportunities in lighting our cities, which covers issues of lighting strategy city-wide, and the design of lighting for buildings, monuments, parks, gardens, roads and footways.

In addition to these three key publications, there is a host of technical publications on lighting design and on controlling the effects of obtrusive lighting, and these are referred to later in the Good Practice Guide.

1.4 The Structure of the Guide

The structure of the guide broadly reflects the process of planning, designing and implementing a lighting scheme in the countryside. The first part of the guide reviews the background to light and lighting; the second part looks at the steps in preparing a new lighting scheme; and the third part sets out good practice principles and recommendations for action. The content of individual chapters is as follows:

- Chapter 2 looks at lighting in a historical perspective, explains lighting terminology and basic equipment types, and reviews how lighting design and installation are normally handled at present.

- Chapter 3 examines the scale of exterior lighting in Britain today and the effects of excessive lighting on people, wildlife, the landscape and other countryside resources.
- Chapter 4 outlines the key stages in preparing a lighting scheme, including consideration of lighting need; initial scheme appraisal; consideration of planning, environmental and cost issues; detailed lighting and landscape design; and installation and aftercare.
- Chapter 5 reviews land use planning and lighting, and explains the way in which good development planning and development control procedures can promote and influence good lighting practice. As well as giving guidance to local authority planners, this section is intended to clarify controls and procedures for the benefit of developers and others, including the general public.
- Chapter 6 describes how the impacts of a lighting scheme on residents, road users and special interest groups can be assessed. It also discusses how to assess impacts on the landscape at night and in daytime, and how to feed the findings of the assessment into the subsequent design process.
- Chapter 7 explains the close links between lighting need, site planning, and landscape design, as well as describing specific landscape measures to help mitigate lighting impacts.
- Chapter 8 reviews lighting equipment, standards and design procedures in general terms. It then examines the specific standards, procedures and products that apply to lighting installed for different purposes.
- Chapter 9 looks at lighting issues in practice for each of the principal lighting types. Generic issues and good practice principles for both lighting and landscape design are identified, and are illustrated by a series of case studies.
- Finally, Chapter 10 summaries the roles of all those involved in lighting in the countryside, from planners and developers, through to lighting manufacturers and members of the public, and presents action points for the future.

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2. Principles of Light and Lighting

2.1 The Historical Context

Until around a hundred years ago all artificial light was produced by burning candles, oil and gas lamps. Such lamps are heat-based or incandescent sources of light, which have the ability to radiate light throughout the colour spectrum in a similar way to the sun. They represent a simple but very inefficient source of light. The introduction of electric filament lamps, in about 1850, created a revolution in lighting and it was suddenly possible to achieve much higher levels of light because of improved energy efficiencies. However, until the 1930s, most artificial light sources continued to be of an incandescent type. Since then many new light sources have been developed. All produce brighter light, use less energy and last longer. The most efficient lights, of a gas discharge type, are sometimes orange in appearance, with little or no ability to render colours.

The town of Godalming illuminated by the electric light, September 26 1881

As a result of these dramatic improvements in lighting technology, exterior lighting has become widespread in Britain, especially in the post-war period, bringing huge changes in the night-time environment. The quality of light is also relevant. The majority of exterior lighting installations (over 80% of road and street lighting) use yellow/orange gas discharge lamps, because they are most energy efficient. These lamps produce the uniform orange glow that is characteristic of Britain's cities and main roads.

2.2 Lighting Terminology

In common with other technologies, lighting has its own language. In any discussion of lighting issues, it is important to understand the differences between the various terms and to use them with precision, as they are often misconstrued.

2.2.1 Quantity

Light is a type of radiation and forms part of the electromagnetic spectrum visible to the eye. It is measured in *lumens (lm)*. A modern electric light takes in energy in watts, and its efficiency can be measured in *lumens per watt (lm/w)*.

The amount of light falling on a surface is known as the *illuminance* and is measured in *lumens per square metre or lux*. This is easy to calculate and measure and is therefore widely used. The illuminance of direct sunlight is approximately 100,000 lux, but normal daylight, which is filtered through a cloudy sky, is between 5,000 and 10,000 lux, while moonlight is as little as 0.25 lux.

Human vision is a complex process. The eye does not see the light arriving at an object, but rather the light radiating or reflecting from its surface. This is known as *luminance*, or brightness. It is directional and is measured in *candelas per square metre (cd/m2)*.

The other term commonly used by lighting engineers is *luminous intensity*. This refers to the strength of light in a given direction and is measured in *candelas* (cd). However, in reality, a source's luminous intensity is seen by the eye relative to the brightness of its surroundings, and this is not easy to measure.

The relationship between the main terms for the quantity of light is shown in Figure 2(1).

Figure 2.1: Lighting Terminology - the relationship between the main terms expressing quantites of light - available to download below.

2.2.2 Colour

The *colour appearance* of light is identified by its *chromaticity coordinates*. Even light which appears `white' will actually be made up from a range of colours from the visible spectrum. The location of a specific colour within the range is identified by quoting its *correlated colour temperature* (CCT) in degrees kelvin (K). Light with a low CCT, such as 2700K, will have a warm appearance while that with a CCT of 6500K will appear cold.

The *colour rendering* capability of different types of light indicates the degree of accuracy with which the light enables different colours to be seen. It can be assessed by comparing the output of the light within each of the eight bands of the spectrum with a theoretically perfect source. This process results in a *colour rendering index* (CRI), where 100 represents a perfect match and 80 is considered very good. The index is often identified as Ra8 to indicate the system of assessment used.

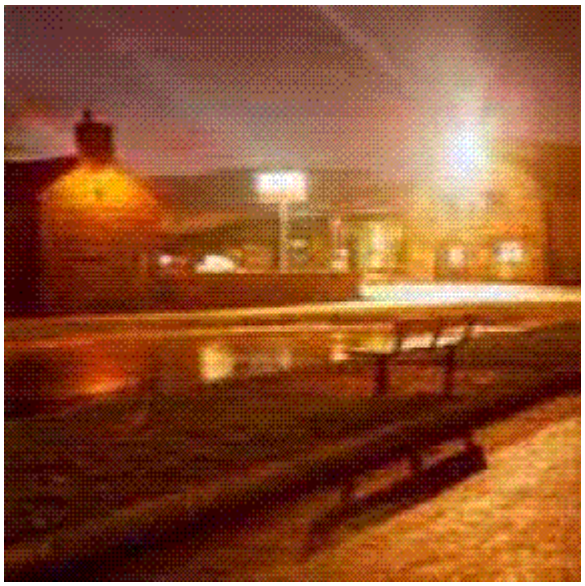
2.2.3 Effects

Light pollution is a very general term which refers to the effect of over-lighting resulting from poorly designed lighting schemes and excessive levels of light. It is commonly subdivided into sky glow, glare and light trespass, each of which has a different meaning technically, and is measured in different ways.

Sky glow is the glow (often a coloured glow, depending on the light source) caused by a scattering of artificial light by dust particles and water droplets in the sky. It is closely related to the *upward light waste ratio* (ULWR) of lighting installations in the vicinity.

The orange sky glow from an urban illuminates the night sky for miles around.

Glare is the uncomfortable brightness of a light source when viewed against a darker background. A light source's *luminous intensity in candelas* (cd) gives an indication of levels of glare. However, because this is difficult to measure, the *threshold increment*, that is the *percentage increase in luminance* is sometimes used as a surrogate measure.



Excessive glare from a floodlight illuminating a village garage in the Peak District.

Light trespass is the spill of light beyond the boundary of the property on which a light is located. Again, it can be estimated from the luminous intensity in candelas (cd) of the light

source, but a more accurate guide is illuminance in the vertical plane in lux, measured at the boundaries or windows of properties.

Light-spill from a security light at a commercial premises illuminates nearby trees.

2.3 Lighting Equipment Types

2.3.1 Lamps

Incandescent filament lamps are those that produce their light by heating up a filament, usually tungsten, until it glows white hot. They produce a continuous colour spectrum and are the most popular domestic lamp. More advanced types, containing halogen gas, are used in vehicle headlamps and domestic security lights. All can be plugged directly into an electrical supply of the correct voltage, but have low efficiencies and relatively short lives.

Gas discharge lamps can be split into two types. The first type produces ultra-violet radiation from the gas discharge which is converted into visible light through a reaction with a phosphor coating on the glass bulb. This type includes the tubular fluorescent lamp used in most commercial offices and the growing number of small 'energy saving' compact fluorescent lamps available for the home. The second type, which produces visible light directly, includes metal halide, high pressure sodium and low pressure sodium lamps. All gas discharge lamps require extra electrical components, both to switch on the light and throughout the period they are working. They have relatively high efficiencies and long lives, but varying colour appearance and rendering capabilities.

2.3.2 Luminaires

While it is possible to run most lamps in free air, it is normal practice to fit them into some type of *luminaire*. The luminaire can provide protection for the lamp against damage and/or the weather and may protect people in the vicinity against burning or electric shock. In the case of gas discharge lamps, the luminaire may act as a container for the lamp control gear, and most

importantly, it may act as an optical device for controlling and directing light, helping to reduce the risk of light trespass.

The two types of luminaire commonly used in exterior lighting are the *fixed angle* and *variable angle* luminaires. The former is designed for use in a fixed orientation, such as on the top of a lamp post or built into the wall of a building, while the latter is fitted with a movable bracket, allowing the installer to direct the light beam to the direction required. In many cases it is the choice of luminaire which will determine the impact of the light. Luminaires which provide *full horizontal cut-off* (HCO) can minimise sky glow, and many have reflectors which control and direct the light beam with varying degrees of accuracy and effectiveness.

2.4 Lighting Design

Today, there are many reasons for introducing artificial lighting in rural areas. The most important include:

- safety of movement;
- security of property;
- extension of working practices;
- extension of sporting and leisure activities;
- advertising of commercial enterprises;
- "bringing on" horticultural and farming produce; and
- enhancing the amenity value of important buildings and settlements.

Lighting in itself is not a problem; it only becomes a problem where it is excessive, poorly designed or badly installed. Hence the process of lighting design is critical.

The principal considerations when introducing a new lighting scheme should be lighting need, the specific lighting requirements of the task in hand, the comparative costs of installation and operation between different types of lighting product, and (where appropriate) environmental factors. However, as lighting is convenient and often evokes positive feelings of warmth, security and personal safety, there is an implicit assumption in its favour, and a tendency to maximise rather than minimise the light levels sought.

This is perhaps accentuated by a system whereby most major lighting schemes are designed and installed as a package, by manufacturers. As a result, there is limited awareness amongst lighting users of the process of lighting design and the capabilities of the vast range of products available.

By contrast, smaller lighting schemes, including domestic security lighting, often receive no professional lighting input at all. Typically the lighting products are selected from the local DIY store and installed at the property owner's discretion. This often leads to excessive light levels

and poorly aimed lights that spill onto others' property.

These are issues that are addressed in later sections of the guide, notably in Chapter 8 on good practice in lighting design, which presents a more detailed discussion of lighting equipment, standards and design procedures.

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3. The Effects of Lighting on People and the Environment

3.1 Night Lighting in Britain Today

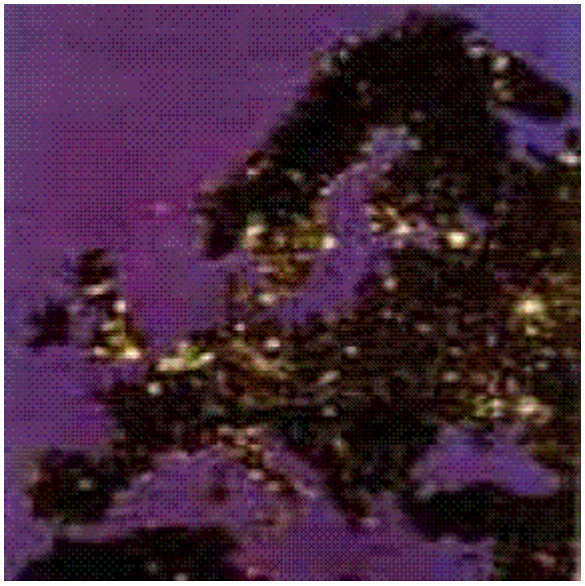
The satellite image of British Isles at midnight reveals the scale and distribution of night lighting today. Looking wider, the satellite image of Europe shows that England's conglomeration of brightly-lit areas is more extensive than anywhere other than the Netherlands. Although light levels are partly a function of population density, the implication is that there is a relative scarcity of places in England where it is possible to experience a truly dark sky.

Lighting has developed incrementally, over the course of the past fifty years, with very little monitoring or even recognition of its effects. There is consequently very little hard data to confirm its impact. However, it is clear that there are a number of different types of effect.

Satellite image of the British Isles at night. (NSRC Ltd/Science Photo Library)

3.2 Effects on People

People need and respond positively to light and take it for granted as an essential aspect of daily life. Lighting is associated both with activity and security. Most exterior lighting is intended to prolong the working day or allow access to leisure facilities during the darker winter months, and to create an environment which feels safe and secure.



Europe at night. (W Sullivan/Hansen Planetarium/Science Photo Library)

However, the cumulative glow of artificial lighting, combined with mist or a polluted atmosphere, may be far stronger than moonlight and may obliterate views to the star-studded night skies. Over the years, people have drawn inspiration from the magical qualities of such views and the transformation of their environment at night. There is concern from a growing number of organisations that these qualities will not be available for future generations to enjoy. In addition, there is a sense that the glow from different sources of light has an urbanising effect on rural areas, disturbing their tranquillity.

Loss of remoteness - light glare and skyglow affecting part of the Peak District.

The loss of colour rendition caused by some types of lamp, particularly sodium lamps, is a related factor. Unfortunately, low pressure sodium lamps, which have very poor colour rendition, are particularly common on rural roads and in village streets. Their orange light blurs

the pale dimness of moonlight, which has a subtle white tinge, and adds to the loss of people's appreciation and understanding of the countryside at night.

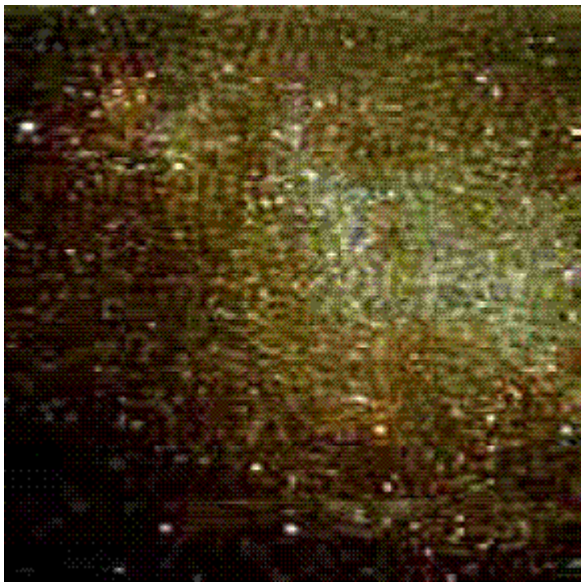
While the human eye has an extraordinary ability to adjust to different levels of light, over-bright lighting can be dazzling and even painful as the muscles controlling the iris are forced to contract suddenly to control the entry of light to the eye. The effect can cause momentary blindness and bring safety risks for drivers moving rapidly from dark areas to relatively bright ones. The elderly are particularly susceptible to glare as the muscles controlling the iris in the human eye tend to deteriorate with age and therefore become less efficient in reducing the amount of light entering the eye. The effect is compounded by the deterioration of the surface of the eye's retina, with the result that the elderly are dazzled by lighting which will not generally be perceived to be too bright.

Light spill from a misdirected source can be distracting and annoying, particularly when the light source is also too bright. It upsets the balance of exterior lighting within an area and may cause particular anxiety when it impinges directly on the home and destroys its associated sense of privacy. In some cases, there is a perception that the combined effects of light trespass and glare may trigger a reduction in property values. Increasingly, environmental health officers are receiving complaints from the public about light trespass and glare. A 1993 survey by the Chartered Institute of Environmental Health indicated that 80% of local authorities had received complaints about light pollution, with most complaints being concentrated in non-metropolitan counties, suggesting that light is perceived to be a particular nuisance in rural areas. When a similar survey was conducted in 1996 (see endnote 1), the level of complaints was found to have risen by 44%. The main sources of complaints were domestic security lighting (55%), sports facilities (21%), and industrial and commercial premises (19%).

The intense orange glow of low pressure sodium street lamps on a misty evening. (Reproduced with the kind permission of Dr Chris Baddley)

Britain's astronomers have been particularly affected by the impact of light pollution on the night sky and the British Astronomical Association (BAA) has been instrumental in promoting

public awareness of the issue. The BAA initiated the Campaign for Dark Skies (CfDS), a campaign for action to alleviate light pollution which is also actively supported by the CPRE. A 1991 survey by the CfDS of astronomical societies throughout the UK showed that over 90% of observers are affected by light pollution, some to the extent that they are no longer able to observe the night sky. There are no longer professional observatories in many parts of the country, and there is specific concern at the impacts on education and science. The activities of astronomers are affected most by sky glow, but light trespass and glare may also cause severe problems if they are close by. These effects can often be traced to a specific light source, and could be resolved by the use of lighting apparatus designed to prevent light pollution.



The impact of light pollution on the night sky: the Cygrus Constellation seen with no light pollution and then nearby, with light pollution. (Reproduced with the kind permission of Dr Chris Bradley)

3.3 Effects on Wildlife

Wildlife suffer many of the same effects as human beings when affected by light pollution, although their reactions may differ. The ecological effects of artificial lighting are still poorly understood (see endnote 2), and cannot be addressed in detail in this guide, but an appreciation of the main impacts is nonetheless important. In general terms, ecologists would like to adopt a precautionary approach and to see mitigation of lighting impacts, especially close to sites of high conservation value or to known populations of rare species.

Development of lighting in rural areas has implications for wildlife since day length, which influences the activities of plants and animals, may become altered or extended. Impacts are most prevalent among insect populations and nocturnal mammal species, although nesting or roosting birds may also be affected, and natural diurnal rhythms may be disrupted in a wide range of animals and plants.

Moths and other night-flying insects are attracted to lights, and it is believed that street lighting may adversely affect their populations. A high general level of illumination may cause night-

flying insects to cease flying and settle; while individual lights may mislead the insects' flight, causing them to fly in spirals. Outdoor lighting may also act selectively on particular individuals within a population, perhaps selecting against those most strongly attracted to light. Some entomologists in Britain believe that urban locations today support much less diverse moth populations than they did 30-40 years ago, and that increased street lighting since that time is a significant factor in this decline. The same urban changes that increase outdoor lighting also lead to a fragmentation of habitats, and the result may be the creation of small isolated insect colonies exposed to illumination. Urbanisation may thus increase both exposure and vulnerability of such insect populations to artificial lighting.

Nocturnal animals are likely to be disturbed by the presence of bright illumination and could be deterred from using established foraging areas.

Since many mammals are already under threat, this represents a further pressure on remaining populations. In particular, security lighting or sports floodlighting on premises alongside river corridors, in foraging areas or near other areas of open countryside may be seriously detrimental. However, lighting of motorways may have a positive effect in deterring deer, badgers and other mammals from crossing the carriageways. Beneficial effects also have been reported for fast-flying bat species feeding on insects attracted to street lamps, although such locations are apparently not exploited by the slower-flying species, which include most of those considered particularly vulnerable in Europe. Some observers have suggested that continuous lighting along roads creates barriers which bats will not cross.

The attraction of birds to lights has been known for a long time. A close correlation has been demonstrated between commencement of dawn singing in thrushes and critical light intensity at sunrise, suggesting that artificial lighting may modify the timing of natural behaviour patterns. Reproduction in birds is photoperiodically controlled, and artificial increase of day length can induce hormonal, physiological and behavioural changes, initiating breeding. Around 60 species of wild birds have been brought into breeding condition prematurely by exposure to artificially long days in winter. In addition, bright lights such as those on telecommunication towers, lighthouses and other tall structures may attract and disorientate birds, especially on moonless nights, resulting in mortalities. Nocturnal species, many of which are already under threat, are particularly likely to be disturbed by the presence of bright illumination.

For plants, the main effects are that some short-day plants will not flower if the night is shorter than the critical length, while others will flower prematurely as a result of exposure to the photoperiod required for flowering. In addition, low pressure sodium lamps have been shown to disrupt the photoperiodic regulation of plant growth and development.

3.4 Effects on Countryside Character

At night, in unlit surroundings, the eye quickly adjusts to the cool, whiter dimness of moonlight, and the countryside is transformed into an abstract landscape with a special magical quality. Hedgerows stand out as dark lines, the branching silhouettes of isolated trees become striking features and even subtle variations in landform are heightened by shadows. The hard edges of buildings, driveways and fences are softened and seem integrated with their surroundings.

Artificial light may distort our impressions of the countryside, undermining some of the less

tangible, perceptual dimensions of the landscape. For instance, the bright glare from individual lights is often overwhelming; it may blot out the delicate tracery of the stars and the subtleties of moonlight and shadow in views across the moonlit countryside. The scattering of lights deep in the countryside may blur the distinction between urban and rural areas and decreases the sense of remoteness which is a much valued quality in our increasingly urban society.

In addition, the proliferation of columns, brackets and lanterns may themselves be visually intrusive in daytime, particularly where they are prominent in relatively open, expansive landscapes characterised by long views, and where they interrupt the local skyline. Even in farmland landscapes with a smaller scale and relatively enclosed character the lighting apparatus often seems tall and out of scale with the surrounding countryside. Lighting structures are particularly intrusive in historic settlements and areas renowned for their scenic qualities or special cultural associations. In areas with a more degraded character, such as those already affected by extensive suburban development, mineral workings or major infrastructure, lighting apparatus may reinforce the negative characteristics of the landscape.

These effects are important because the diversity and tranquillity of the English landscape are increasingly recognised as a valuable national resource (see endnote 3). With its rich pattern of distinctive local landscapes, the English countryside is the product of a complex underlying physiography, shaped by centuries of human activity. The visual landscape is just one aspect of the whole, which also contains a wealth of wildlife habitats, geological and geomorphological features, archaeology, historic features, buildings and settlements. Together they create a strong sense of place and shared local identity. However, these qualities are very vulnerable to the cumulative impact not just of major developments, but of smaller, piecemeal changes which individually may seem of little importance. The installation of lighting on rural roads, villages and in the countryside generally is today a key source of incremental change that poses a long term threat to countryside character.

In addition, there are specific concerns from organisations such as English Heritage and the Royal Fine Art Commission about the impacts of lighting on the settings of historic buildings and monuments and on the rural villages which are so often the focus for people's enjoyment of the countryside. Poor lighting of historic buildings and settlements may adversely affect their heritage value, for instance by obliterating striking architectural details or the colour of building materials; whereas good lighting should enhance the built heritage and facilitate public enjoyment of the cultural and historic features of the English countryside.

Endnotes

1. Jukes, GM, *Light Pollution*, unpublished paper parepared on behalf of the Chartered Institute of Environmental Health, 1996
2. Outen, AR, *The Possible Ecological Implications of Artifical Lighting*, Hertfordshire Environmental Records Centre, 1994
3. Council for the Protection of Rural England and Countryside Commission, *Tranquil Areas* series, various dates

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4. Issues to consider in Scheme Preparation

This chapter, and Chapters 5 to 8 aim to outline good practice in the preparation of a new lighting scheme. They are intended to provide a framework for guiding planners, developers and promoters of lighting schemes (including local authorities), lighting and landscape professions, lighting manufacturers, and members of the public. In most instances the scheme preparation process will be led by the developer, but, all these parties have important roles to play.

The flow chart presented in Figure 4(1) shows the process as a whole and illustrates the links between each of the stages. The key stages - planning, environmental assessment, landscape design and lighting design - are then explained in more detail in subsequent chapters.

4.1 The Need for Lighting

The process begins with an assessment of the need for lighting. As we saw in Chapter 2, the reasons for introducing artificial lighting in rural areas include:

- safety of movement;
- security of property;
- extension of working practices;
- extension of sporting and leisure activities;
- advertising of commercial enterprises;
- "bringing on" horticultural and farming produce; and
- enhancing the amenity value of important buildings and settlements.

The reasons for preparing a lighting scheme should be clear at the outset, and automatic assumptions should not be made that lighting is necessary. The following questions should be carefully considered:

- *Could the development proceed without lighting?* Lighting may not in fact be essential to the safety, security or viability of the development, and there should always be flexibility in the application of lighting standards.
- *Will the benefits of lighting outweigh any disbenefits?* Lighting has environmental, capital and maintenance costs. These costs need to be weighed against the benefits of lighting.
- *Are there alternatives to lighting?* Alternatives may include improved site layout or use of other security measures such as fencing or closed circuit television (CCTV). Such measures may obviate the need for lighting.

At present there is no formal procedure for assessing the need for most forms of lighting. The exception is for roads, where the DoT and also many highway authorities conduct a cost-benefit analysis comparing the costs of installing and operating a lighting scheme over a 30 year evaluation period against the potential for accident reductions, which are quantified by using average road accident costs.

Figure 4.1: Preparing a Lighting Scheme - available to download below.

4.2 Initial Scheme Appraisal

Having established that lighting is needed, an initial assessment of the specific lighting requirements of the task in hand should be made, and an outline scheme design prepared. This may include a number of options such as different locations and types of lighting provision, but detailed consideration of lamp and luminaire type is not necessary at this stage.

The main purpose of the initial appraisal is to identify a viable outline scheme that has the potential to be successfully integrated with its surroundings and that can be taken forward for more detailed assessment. At this stage it is helpful to consider environmental and cost issues in a broad-brush way, and also to involve third parties such as planners and local resident groups who will be consulted further and more formally later in the process. The process should be an iterative one, with constant feedback, review and refinement of the emerging proposals.

For rural roads, a more formal procedure is often followed at this stage, based on the DoT framework appraisal . In this approach, the findings of cost-benefit analysis and other information on non-quantifiable benefits and disbenefits of the various scheme options are brought together in a table that summarises and compares the implications of different development scenarios. The framework appraisal allows key issues to emerge and overall decisions to be made on whether and how to progress the scheme.

One further issue that should be considered during the initial scheme appraisal stage is the potential to remove or redesign any existing lighting installations that may be inappropriate, intrusive, or redundant, for instance due to the downgrading of a rural road.

4.3 Planning Considerations

Planning issues should be addressed in parallel with the initial scheme appraisal, as they are likely to have a fundamental influence on the location and design of any outline scheme. In addition, it is important to establish at the outset what planning requirements will apply. Usually this is best achieved through informal contact and pre-application discussions with the local planning authority. Questions that need to be asked at this early stage relate to:

- any relevant structure and local plan policies on lighting, as well as policies on development in the countryside generally;
- supplementary planning guidance on lighting (such guidance, where it exists, sets out the

detailed planning and technical requirements that apply to new lighting schemes); and

- planning application procedures and information requirements.

Although many forms of public sector development, such as new local authority sports facilities and school playing fields, are subject to normal planning application procedures, these procedures do not apply to new road or street lighting by highway authorities. Nonetheless, highway authority staff should take account of relevant planning policy and supplementary planning guidance in developing their proposals. Further details of planning issues in relation to lighting are presented in Chapter 5.

4.4 Environmental Considerations

Chapter 6 describes the process of environmental assessment of a lighting installation. Although a formal environmental assessment under the *Town and Country Planning (Assessment of Environmental Effects) Regulations 1988* will be required for only a very few major development projects, it is good practice for developers to apply the principles of such assessments to their own lighting impacts as an integral part of the preparation of a lighting scheme.

Among the issues to be examined will be the effects of night lighting on dark landscapes, the appearance of lighting structures in daytime, potential impacts on the visual amenity of residents and special interest groups such as astronomers, and effects on the safety of transport users. The results of the assessment will feed into the lighting and landscape design of the scheme as a whole, and may also influence the choice of development option.

4.5 Cost Considerations

Cost considerations naturally come into play quite early in scheme development, and often have a strong influence on decision-making and design. There is a tendency to focus attention on the capital costs of equipment and installation, and to ignore the cost implications of operating the scheme. However, in the longer term, energy and maintenance costs may outweigh the scheme's capital costs in importance. Therefore it is strongly recommended that any decisions are based on a long term evaluation of the total capital and operating costs of the scheme over say a 30 year period. This is already considered good practice in relation to lighting on highways. In addition, cost considerations always need to be weighed carefully against environmental issues.

4.5.1 Capital Costs

Lighting equipment, like all manufactured goods, varies widely in quality and price. However, the following factors will contribute to the selection of cost-effective, quality equipment:

- suitability of the product to the task;
- reliability;

- and security of the fixing system.

There are a number of trade-offs to consider in deciding on the height of lighting columns. Normally the rule is that a higher column will result in a higher cost. If high columns or masts are involved, the cost of the foundations may be more expensive than that of the mast itself. However, for a given area, the higher the columns, the fewer will be required. The use of a higher column has additional benefits in relation to light pollution as it allows the lights to be directed downwards. Conversely, if a lower mounting height is selected, the lamps will not need to be so powerful, possibly resulting in a cost-saving.

Many luminaires have optical arrangements designed specifically for individual tasks while others have more general optics that can function for a multitude of tasks. Often, the latter will be less costly, but their light control for the specified task may not be so good.

4.5.2 Energy and Maintenance Costs

The performance of lighting equipment relates directly to its energy and maintenance costs; hence these costs should always be considered together with the initial supply and installation costs. For instance, a luminaire which uses a simple incandescent filament lamp will always be cheaper than one that uses a gas discharge lamp, but it will have a shorter life and its energy and maintenance costs will be higher.

Unfortunately, at present, energy use does not necessarily equate to energy cost in relation to lighting. Electricity costs vary with demand and as there is normally little demand through the night, energy costs during the night can be very low. Hence lamps that are lit throughout the night may be a waste of energy, and environmentally unsustainable, but may not necessarily be a waste of money to the operator under current electricity pricing. In the longer term, though, the pricing position may change, so use of timed cut-off switches in new installations is recommended.

A lighting installation will always require maintenance, if only to periodically change the lamp. *The Health & Safety at Work Act* requires that all `electrical installations' are subject to a routine maintenance programme. The maintenance of outdoor lighting installations is normally labour intensive and therefore expensive.

Lamps designed for a long life are not the only answer as the optical system can itself become dirty and inefficient. A well-sealed luminaire is normally advantageous and there is an international system of *Ingress Protection* (IP) ratings to assist in selecting the correct design. All luminaires used in permanent, outdoor installations should be of IP54 minimum, and ideally IP65 or IP66. Dirt on the optical surfaces, both inside and out, will reduce the overall efficiency of the lighting system and will also add to the potential for light pollution since light will be diffused and dispersed. The use of high IP rated luminaires will help to improve the efficiency of the system while also keeping maintenance costs to a minimum.

4.6 Design

Lighting design should always proceed in parallel with careful site appraisal, planning and

landscape design, and this process is described in Chapter 7. The design of lighting schemes is governed by the use of technical lighting guides and standards, which are discussed in full in Chapter 8. There are international standards for the lighting of exterior working areas and floodlighting, and national guidance notes for designing the lighting associated with sporting activities. Other important influences are the requirement to comply with current Health and Safety Regulations and, increasingly, an awareness of the need to reduce light pollution.

A 'free' lighting design service is offered by most lighting equipment manufacturers for, or on behalf of, an installation contractor. Such a service will be limited in the sense that the design will be based on that one manufacturer's equipment. In addition, one of the aims of the design will be the supply and installation of lighting equipment, and this may not necessarily mean a cost-effective lighting design.

On the other hand, independent professional lighting designers will be more customer-orientated and it is possible that the additional cost involved in using professional advice will be partially offset by the resulting lighting design which should be both economical and environmentally sustainable.

Computer software is used cost-effectively for some of the more theoretical aspects of road lighting design, although there are currently no programmes available which can fully simulate the complex effects of lighting on the exterior environment. However, the technology is accelerating fast and in five years' time the situation may be very different.

4.7 Installation and Aftercare

Good installation is critical to the success of a lighting scheme, and to the control of potentially intrusive light. The installation contractor should be aware of the optical design of the luminaire being installed. There are many examples of equipment being incorrectly aimed, and even installed upside down, by contractors unaware of the intended direction of the main beam from the luminaire.

A further important factor is the arrangement for fixing the luminaire to its support. This must be secure and ideally not require altering whenever the lamp is replaced. The final directional position of a luminaire should be always permanently marked when it is first installed so that its correct alignment is clear.

Most private and many commercial security lighting systems are purchased and installed by property owners and individuals who may not be fully aware of the environmental implications of poorly fitted equipment. There is a need for manufacturers and retailers to provide more information on lighting choice and installation at the point of sale, so that the minimum lighting for the task in hand is purchased, and so that light spill and glare can be prevented.

Last, but by no means least, the aftercare of lighting schemes is crucial to the control of lighting impacts. A post-installation check should always be carried out to ensure that the scheme has been installed correctly, and all subsequent maintenance checks should include a check on alignment.

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5. Planning and Lighting

5.1 Background

There are a number of ways in which the planning system can influence lighting proposals. Development plans and, in particular supplementary planning guidance, can help inform people about lighting issues and indicate ways in which they should be addressed within development proposals. The development control process, which is guided by development plan policy, offers scope to control and influence many forms of lighting. By participating in the plan making process, developers, professional advisers and members of the public play an important part in encouraging and initiating good lighting design proposals. This chapter is intended to outline the way in which development plans and the development control process can influence the design and installation of lighting schemes associated with development. The main elements of these processes are summarised in Figure 5(1). While aimed primarily at planning officers, the chapter is also intended to advise developers on how the planning system works in relation to lighting.

Figure 5.1: Planning and Lighting - available to download below.

5.2 Planning Policy

5.2.1 The National Policy Framework The Government has indicated that the principal means of tackling lighting issues are: by increasing public awareness of the possible problems that badly designed and installed lighting can lead to; better advice on ways of minimising impacts; and the more effective use of existing planning powers.

National planning policy is contained in *Planning Policy Guidance Notes (PPGs)* issued by the Department of the Environment (DoE). These statements are used to guide the preparation of development plan policies and, in turn, the determination of planning applications. The guidance provide a framework and a useful reference in relation to the overall principles and requirements of the planning system. The main advice they provide on lighting are summarised in Box 1.

Reference to lighting issues is also made in the *DoE Circular 5/94 Planning Out Crime*. This describes how the planning system can encourage siting and design of proposals that are sensitive to security issues. In an annex to the circular, security lighting is mentioned as one possible measure to help reduce crime. However, the need to strike a balance between the desire for security and the possible effect of unnecessarily obtrusive and glaring light due to badly installed or designed lighting fixtures is also highlighted.

BOX 1 : Main Advice On Lighting In Planning Policy Guidance Notes.
PPG 1 (1997): General Policy and Principles gives guidance on the role of design considerations in planning (paras 13-20) and states that development plans should set out design policies against which development proposals are to be considered. It also advises that supplementary design guidance may usefully include advice about

matters such as lighting , where these are likely to have a significant impact on the character or quality of the existing environment (Annex A).

PPG 23: Planning and Pollution Control permits planning authorities to take account of the possible polluting impact of lighting in preparing local plan policies (para 2.18). In addition, (para 3.25) it permits the use of conditions or planning obligations to meet planning goals to protect the environment, where these are relevant to the development proposed.

PPG 7 (1997): The Countryside - Environmental Quality and Economic Development advises planning authorities (para 4.1) to take account of the special features or qualities of designated areas such as Areas of Outstanding Natural Beauty (AONBs) in their planning policies and development control decisions. It also states that development in the countryside should maintain and enhance the environment, and should be sensitively designed (paras 2.3 and 2.12).

PPG 17: Sport and Recreation recognises the importance of sport and recreational land uses, and gives guidance on their location. It advises that sport and recreation activities in the countryside should be appropriate and in harmony with it (para 39). It indicates (paras 32 and 34) that recreational facilities may be an appropriate use for urban fringe land, and, in terms of outdoor activities, Green Belt land, subject to environmental considerations. It encourages shared provision with schools in rural areas.

PPG 15: Planning and the Historic Environment indicates (para C.68) that there are some standard external fixtures that require listed building consent when they affect the character of a listed building. These fixtures include security and other floodlighting. Only undamaging and visually unobtrusive positions for such fixtures should be agreed.

PPG 19: Outdoor Advertisement Control summarises government policy on outdoor advertisements. It advises (paras 11 and 12) that local planning authorities should have regard to the effect of an advertisement on the appearance of the building or on visual amenity in the immediate neighbourhood. The cumulative impact on the distinctive character of the locality is relevant. In National Parks, the Broads, all AONBs and conservation areas, stricter controls usually apply to advertisements that elsewhere may be displayed without the local planning authority's express consent (para 25).

5.2.2 Development Plan Policy

Sound development plan policy is a prerequisite to effective development control. There are two key considerations that should guide development plan policy on lighting in the countryside:

- the importance of countryside character;

- and the need to minimise the use of lighting and its impacts.

It is the Government's policy that the countryside should be safeguarded for its own sake and that non-renewable and natural resources should be afforded protection, not only within designated areas, but within the countryside as a whole.

To this end, the Countryside Commission and English Nature have conducted an analysis of the distinctive features of all the English countryside in both landscape and nature conservation terms (see endnote 1), and English Heritage has contributed its knowledge of the historic features of the landscape. This approach identifies broad areas of cohesive character which can be described in terms of their sense of place, local distinctiveness, characteristic wildlife and landscape features, and nature of change.

To complement the broad scale findings of the national countryside character assessment, planning authorities are advised to maintain, or to consider preparing, a local assessment of countryside character. This should assist in accommodating necessary change without sacrificing local character, and should be taken into account in formulating development plan policies and proposals. The aim is to help ensure that development respects or enhances the distinctive character of the land and the built environment.

Countryside character assessments can and should encompass the sensitivity of a given area to the introduction of exterior lighting. The countryside may be sensitive to lighting impacts for two principal reasons:

- *The presence of dark skies*. Areas of countryside which retain a dark sky (sometimes known as 'dark landscapes') should be recognised. Such areas often correspond closely with designated landscapes such as National Parks and AONBs. However, they may also include other remote, isolated or undeveloped areas of countryside, such as coastal marshes; and areas of wildlife importance that are vulnerable to light intrusion.
- *The visual character of the landscape or built environment*. The appearance of the countryside in a given locality by day and by night is a relevant consideration. The introduction of lighting may have a significant effect on visual character, for instance because prominent new structures would alter the area's scenic or architectural character by day, or because the lights would blur the distinction between urban and rural areas by night.

It should not be complicated or time-consuming for planning authorities to include these two aspects of countryside character in their ongoing survey and assessment work. In relation to dark skies, a strategic overview of patterns of settlement and communication can give a general indication of where such skies occur and of their relationship to the principal landscapes and habitats of importance within the plan area. Documentary sources such as satellite imagery and the Tranquil Areas reports may also be helpful in identifying dark skies; there are likely to be strong variations in brightness levels and a general increase in the prevalence of dark landscapes with distance from principal urban areas. In relation to visual character, sensitivity to lighting impacts can be covered within landscape assessments,

conservation area character appraisals and other similar assessments, by highlighting areas where lighting installations or structures might give rise to problems. In addition, these assessments may identify existing intrusion caused by lighting installations, so that opportunities can be taken to remedy any problems in future.

Countryside Character assessments should identify areas of the countryside which are sensitive to lighting, and feed into the formulation of policy on development in the countryside. In this way, development plan policy and supplementary planning guidance will recognise the contribution of dark skies to the visual character to the countryside environment.

Lighting Need and Acceptability

The research included a review of recent planning applications and appeals that involved exterior lighting. This showed that in a number of cases, the lighting proposed was:

- not essential to the operation of the development concerned - better use could have been made of careful site planning and layout to achieve, for example, solutions to security issues;
- excessive or inappropriate to the task in hand; and
- the impacts of lighting on adjoining properties, roads and countryside often received scant attention.

If the problems of excessive lighting are to be tackled successfully, it is essential that current attitudes towards lighting in the countryside should change. Planning policy - especially at local plan level - offers a key opportunity to influence developers' attitudes. Supplementary planning guidance may usefully advise on ways in which developers may address issues of need and acceptability, and identify key information requirements and appropriate technical lighting standards (see Chapter 8).

The Form and Content of Policy

Planning policies on lighting are relatively new, and so far a small proportion of planning authorities have specific policies in place. Nonetheless, examination of existing policies provides some useful pointers as to the form and content of policy.

Structure plans can address lighting issues in a strategic way, for example by recognising the contribution of dark skies to countryside character, setting objectives to reduce light pollution, and where appropriate, raising it as one of the issues which should be considered in relation to development proposals. There is evidence that some authorities are already doing this. An example of structure plan policy on lighting is presented in Box 2.

BOX 2 : Structure Plan Policy On Lighting
Policy G2(b) of the West Sussex Structure Plan Deposit Draft 1996 states that:

"Development will not be permitted if it will:-

(1) cause unacceptable visual damage;
(2) cause unacceptable pollution of air, water or land or nuisance by way of smell, noise or light;
(3) cause or increase danger, from flooding, erosion (of soil or coastline) or road traffic;
(4) destroy, sterilise or prejudice the use or enjoyment of an important resources, such as the best and most versatile agricultural land, water, minerals, landscape, townscape, wildlife, cultural or historic interest, recreational assets or potential, or tranquillity..."

Local plan policies offer the greatest scope to influence and control development proposals with lighting implications at the planning application stage. An appropriate policy in relation to lighting can be a key tool for development control and can help ensure that lighting impacts are prevented or minimised. Some examples of good lighting policies, that would largely meet the key principles outlined earlier, are presented in Box 3.

BOX 3 : Local Plan Policy On Lighting

Policy EN16 of the Bracknell Forest Borough Local Plan Deposit Draft 1996 states that:

"Outside the defined settlement boundaries, lighting schemes will only be acceptable where proposals would not have:
(i) an adverse effect on the character of the surrounding land; and
(ii) an adverse impact on local amenity."
The explanatory text accompanying this policy states that schemes will be expected to comply with the Council's guidelines relating to the reduction of light pollution. These form Appendix 8 of the plan and constitute supplementary planning guidance.

A proposed modification to the Doncaster Metropolitan Borough Deposit Unitary Development Plan 1994 states that:
"The Borough Council will seek to minimise light pollution. Details of any external lighting scheme required as part of any new development will be expected to demonstrate to the Local Planning Authority that the scheme proposed is the minimum needed for security and working purposes and that it minimises the potential pollution from glare and spillage, particularly to residential and commercial areas, areas of nature conservation importance, and areas whose open and remote landscape qualities would be affected."

Environment Policy 6 of the Malvern Hills District Local Plan Deposit Draft 1994 states that:
"Applications for development requiring or likely to require external lighting shall normally include details of lighting schemes which will be expected to demonstrate that:

- the lighting scheme proposed is the minimum required to undertake

the lighting task,

- light spillage is minimised,
- in edge of town or village locations, or in rural areas, landscaping measures will be provided to screen the lighting installation from view from neighbouring countryside areas, and
- there will be no dazzling or distraction of drivers using nearby highways."

Supplementary Planning Guidance

Full and sound policies benefit the planning authority and offer better, more specific guidance to applicants.

However, for a technical topic such as lighting, supplementary planning guidance provide a useful tool for elaborating and providing details. The Government advises that supplementary design guidance may usefully include advice about lighting where this is likely to have a significant impact on the character or quality of the environment, and a number of planning authorities have already begun to prepare such guidance on lighting issues.

Supplementary planning guidance elucidate and amplify plan policies, thereby giving greater certainty to all those involved in the design and development process. As mentioned earlier, it should also make clear any specific information requirements that the planning authority may have, and should refer to the technical lighting guides and standards that should be applied. It should be noted that the weight accorded to supplementary planning guidance in planning decisions will be increased where there has been public consultation on the guidance, and where it has been formally adopted by the planning authority.

The format of the guidance produced to date varies considerably. In some cases it is a short, freestanding statement for the guidance of developers, explaining in lay person's language the planning authority's powers, the need for permission, the factors that will be taken into account when considering lighting proposals and the types of planning conditions that may be applied. In other cases, the guidance is much more comprehensive and technical in nature, and may apply only to certain forms of development, such as recreational floodlighting. Some examples of supplementary planning guidance on lighting issues are described in Box 4.

BOX 4 : Supplementary Planning Guidance on Lighting

- *Suffolk County Council* has prepared guidance on *Lighting on County Council Premises 1995*, which has been formally adopted. The guidance was produced in recognition of the fact that every year the County Council applies to its own planning committee for permission for sports floodlighting and for security lighting at depots, car parks and other County Council premises, and that these applications have often given rise to concern for reason of their visual impact by day and by night. The guidance, which is very full, outlines the factors which will be taken into account in determining applications for lighting, giving clear advice on control of upward waste light, light levels that will be considered

acceptable at site boundaries and adjoining properties, and control of the effects of glare and spillage on adjoining highways. It also outlines the types of measures that will be used to mitigate unavoidable impact, and lists the lighting information that must be submitted with planning applications.

- *Suffolk Coastal District Council* has produced *Supplementary Planning Guidance on Recreational Floodlighting 1995*, and hopes to produce guidance covering other forms of lighting also. The guidance has been subject to consultation and has been adopted as part of the local plan. It describes the factors which will be taken into account in determining lighting applications, including location, size of area to be lit, nature of the illumination, relationship of the site to other uses (limits of obtrusive light are given), type of use proposed, location and height of columns, time and frequency of use, type of light source, and participation in sport. It also lists the information required, presents lighting standards for different sports, and includes a comprehensive bibliography and a glossary of lighting terms.
- *Bracknell Forest Borough Council* has produced supplementary planning guidance on lighting associated with new development, which forms Annex 8 to the *Bracknell Forest Borough Local Plan Deposit Draft 1995*. The guidance draws mainly upon the *ILE Guidance Notes for the Reduction of Light Pollution* and covers such issues as the control of hours of illumination, use of infra-red sensors and the direction of lighting. It lists sources of additional advice on lighting.

5.3 Planning Controls

Control of lighting in the countryside is currently exercised primarily through the planning system. Unlike noise pollution, excessive light is not recognised as a statutory nuisance, although individuals who are affected by light may have recourse through private nuisance actions, which are primarily a matter for civil law.

The principal consent procedures applicable to lighting are development controls, supplemented by listed building and advertisement controls. A brief summary of the scope and nature of these controls is given below. For further information, reference should be made to the relevant Acts, Orders and Regulations.

5.3.1 Development Control

Artificial light as such is not classed as 'development' and therefore does not require planning permission. However, the structures and installations involved may require planning permission, especially if they are substantial and affect the external appearance of a building. Therefore controls may exist over many new lighting installations. Control may also be exercised by attaching conditions to planning permissions (see Section 5.3.5 below).

In considering whether a lighting installation is subject to planning controls, it is useful to

consider:

- whether it constitutes 'development' under Section 55 of the *Town and Country Planning Act 1990*;
- whether it is 'permitted development' under the *Town and Country Planning (General Permitted Development) Order 1995*; or
- if it does not constitute development, whether it is associated with a development proposal which requires planning permission.

In general, planning permission will be required for a lighting installation if it constitutes development. Even when planning permission is not required for the lighting installation as such, it is likely that most of the developments with which lighting is associated will require planning permission, in which case the lighting elements can be influenced by use of planning conditions. However, within these general guidelines, there is considerable scope for interpretation and flexibility. The research phase of this study also indicated that unauthorised development is quite often a problem - this is mainly due to a genuine lack of awareness of planning requirements for lighting. In common with most other forms of development, retrospective controls can be applied over lighting installations in circumstances where development is in breach of planning control. In addition, the lighting of highways cannot be controlled under the Planning Acts. However, highways lighting is subject to separate appraisal procedures by highways authorities.

5.3.2 Listed Building Controls

Under the *Planning (Listed Buildings and Conservation Areas) Act 1990*, there are some standard external fixtures that require listed building consent when they affect the character of a listed building. These fixtures include security and other floodlighting. PPG15 advises that only undamaging and visually unobtrusive positions for such fixtures should be agreed. Listed building consent may be required for any alteration within the curtilage of a listed building, so a lighting installation may still require listed building consent even where it does not touch the fabric of the building. For instance the intensity or colour the light may be deemed to alter the specific character of the building or that of its setting. In relation to conservation areas, it should be noted that no special lighting controls apply.

5.3.3 Advertisement Controls

The provisions for the control of outdoor advertisement are contained in the *Town and Country Planning (Control of Advertisements) Regulations 1992 (SI 1992/666)* as amended by the *Town and Country Planning (Control of Advertisements) (Amendment) Regulations 1994 (SI 1994/2351)*. PPG19 explains Government policy on the operation of the Regulations.

The Regulations prohibit the display of advertisements without local planning authority consent, although a wide range of advertisements (including some illuminated advertisements) are either excepted from control or may be displayed with deemed consent. In exercising their powers under the Regulations, local planning authorities are required to have regard to

amenity and public safety.

Schedules 2 and 3 of the Regulations lists the classes of advertisement which are either excepted from control or may be displayed with deemed consent (subject to the local planning authority's power to serve a discontinuance notice if they consider the advertisement is causing a substantial injury to amenity or a danger to the public). These classes permit some forms of illuminated advertisements, such as those indicating the availability of medical services or supplies on the premises, and commercial advertisements on the frontage of business premises (but not in conservation areas, National Parks and Area of Outstanding Natural Beauty). The Regulations specify in each case the permitted type and maximum luminance of illumination (eg individual character or "halo" illumination) as well as the maximum permitted size, height above ground and position of the advertisement.

Further advice on illuminated advertisements is given in the Institute of Lighting Engineers *Technical Report No 5: Brightness of Illuminated Advertisements*.

5.3.4 Development Control Procedures

Section 54A of the *Town and Country Planning Act 1990* requires that planning applications are determined in accordance with the development plan unless material considerations indicate otherwise. Hence, in any informal, preliminary discussions with developers, development control officers should refer intending applicants to both the development plan policies and any supplementary planning guidance.

On receiving a planning application for development which includes major outdoor lighting, planning officers should begin by reviewing the application to confirm exactly which controls will apply, and should make an initial appraisal of the issues that may need to be addressed. The very first question to ask is whether adequate information has been provided. It may be useful at this point to review the information against a standard checklist such as that shown in Box 5.

BOX 5 : Information That May Be Requested In Support Of Planning Applications Involving Lighting Schemes

- a statement of why the lighting is required, the proposed frequency of use, and the hours of illumination;
- a site plan showing the area to be lit relative to the surrounding area, indicating parking or access arrangements where appropriate, and highlighting any significant existing or proposed landscape or boundary features;
- details of the number, location and height of the proposed lighting columns or other fixtures;
- the type, number, mounting height and alignment of the luminaires;
- the beam angles and upward waste light ratio for each light;
- an isolux diagram showing the predicted illuminance levels at critical

locations on the boundary of the site and where the site abuts residential properties or the public highway; and

- where necessary, the percentage increase in luminance and the predicted illuminance in the vertical plane (in lux) at key points.

In addition to the requirements of development plan policy and supplementary planning guidance, the following factors may also be considered:

- whether the lighting is necessary - have alternatives been considered?;
- the intended light levels for the intended purpose in relation to relevant published lighting standards;
- possible effects on areas or sites of special countryside character or interest;
- effects on local amenity; and
- any opportunities to remove or redesign existing lighting that is inappropriate or intrusive.

Ideally any guides or standards that are applicable should have been referred to in development plan policy or supplementary planning guidance.

Where potential problems are identified, early discussion with the applicant is advisable. One of the subjects that may need to be addressed is the need for professional advice. The appointment of a professional lighting engineer or designer should be strongly encouraged for any major sporting or other scheme; failing that, applicants may take advantage of the design service offered by the larger lighting manufacturers, if they have not already done so.

Others who may be able to help in the design process in an informal capacity are:

- county engineers or surveyors, who will wish to be consulted on highways implications in any event;
- district council technical services and environmental health officers, who may have specialist expertise in lighting issues; and
- police architectural liaison officers, who have a remit to assist in planning and design for the purposes of security.

In some instances and as a last resort, where there are serious, unresolved lighting issues, the planning authority itself may need to seek advice from a lighting consultant.

5.3.5 Use of Planning Conditions

Conditions are an important way in which planning authorities can influence the design of lighting installations and mitigate their impacts. The use of conditions in planning permissions

is explained in the *DoE Circular 11/95 The Use of Conditions in Planning Permissions*. Briefly, this states that conditions must be necessary, reasonable, enforceable and relevant, the test being that planning permission would be refused if the condition were not imposed.

In relation to lighting, conditions may cover such matters as:

- hours of illumination;
- light levels;
- column heights;
- specification and colour treatment for lamps and luminaires;
- the need for full horizontal cut-off;
- no distraction to the highway;
- levels of impact on nearby dwellings;
- use of demountable columns;
- retention of screening vegetation;
- use of planting and bunding to contain lighting effects;
- erection of demonstration luminaires; and
- review of lighting impacts after installation.

While standard conditions for lighting are unlikely to be adequate or appropriate in every case, they can provide a useful starting point. Box 6 shows an example of the standard conditions for sports floodlighting that are applied by Suffolk County Council.

BOX 6 : Standard Conditions for Floodlighting of Tennis Courts
1. *Hours of use limitations* The games area shall not be used after 2200 hours on Mondays to Fridays or after 2100 hours on Saturdays, Sundays and Bank Holidays. The games area shall not be used before 0900 hours on Sundays. The floodlights shall be turned off within fifteen minutes of the end of the last match played and in no circumstances shall they be left on for more than fifteen minutes from the latest time referred to above. Reason: In the interests of the amenity of adjacent residents. 2. *Avoidance of glare from light source* The light source shall not be exposed to view or cause glare from the highway. Reason: In the interests of road safety. 3. *Angle of main beam* Each light must be aligned to ensure that the upper limit of the main beam does not exceed 70 degrees from its downward vertical.

Reason: In the interests of residential amenity and road safety.

4. *Light spill limits near highways* Any spill level of illumination must not exceed one lux at the boundary with the highway.
Reason: In the interests of road safety.

5. *Post-installation check* Within one month of the installation of the lights, they shall be inspected by a qualified lighting engineer in liaison with the County Planning Authority and any defects identified shall be rectified within one month of the inspection.
Reason: To ensure that the development complies with the submitted technical information and to ensure that any problems are rectified.

6. *Illuminance levels* The average illuminance value on the court shall not exceed 300 lux measured in the horizontal plane. Reason: In the interests of the amenity of adjacent residents.

Endnotes

1. English Nature and Countryside Commission, The Character of England: Landscape, Wildlife and Natural Features, 1996

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6. Environmental Assessment

Environmental assessment is an important technique for ensuring that the likely effects of new development are fully understood and taken into account before the development is allowed to go ahead. For some major development projects the *Town and Country Planning (Assessment of Environmental Effects) Regulations 1988* require formal environmental assessment of the environmental impacts. The DoE publication *Environmental Assessment: A Guide to the Procedures* explains which projects are likely to need formal environmental assessment and describes the special procedures that will apply. The impact of lighting is one of the issues to be considered in formal environmental assessment.

As mentioned in Section 4.4, formal environmental assessment is seldom likely to be necessary. Nonetheless, the principles of environmental assessment are useful and relevant to the preparation of lighting schemes. A structured approach to assessing and mitigating the impacts of lighting is the best way of taking the full range of environmental factors into account in scheme planning and design, and is illustrated in the flow chart presented in Figure 6(1). The aim is to heighten awareness of the sensitivity of an area and its capacity to accommodate lighting.

The predicted impacts of the scheme should include both the effects of the lighting at night and the appearance of the lighting apparatus in daytime; they should take full account of any local communities and important landscape, historic or wildlife features which are likely to be affected. Environmental assessment is inextricably linked to the process of designing the lighting scheme to mitigate its impacts on the landscape.

6.1 Relevant Guidance

The DoE has recently issued a good practice guide on environmental assessment (see endnote 1) to assist developers and planning authorities in the preparation and review of Environmental Statements (ESs) prepared under the *Town and Country Planning (Assessment of Environmental Effects) Regulations 1988*. The guide - and the Regulations themselves - make passing reference to light emissions (Schedule 3, para 3 of the Regulations) among the list of information that may be included in an ES; and it is clear that a planning authority may request a developer to provide information on lighting impacts within the ES. In practice, though, only very major development projects will require formal environmental assessment, and therefore the assessment of lighting impacts will normally be undertaken on a voluntary basis.

There is no existing guidance on environmental assessment of lighting as such, but two general guides on the assessment of impacts on countryside resources are relevant:

- the Countryside Commission publication *Environmental Assessment: The Treatment of Landscape and Countryside and Recreation Issues (1991)*; and
- the Institute of Environmental Assessment and the Landscape Institute *Guidelines for Landscape and Visual Impact Assessment* (1995).

In relation to roads specifically, Volume 11 of the DoT *Design Manual for Roads and Bridges* contains advice on environmental assessment of lighting within a section on landscape effects. This describes how environmental assessment should be applied to lighting provided as part of a new road or as an addition to an existing road.

One other key technical document to which everyone should refer, is the *ILE Guidance Notes for the Reduction of Light Pollution (1994)*. As well as presenting some simple suggestions on ways to reduce the problems of unnecessary, obtrusive light, the guidance notes recommend specific limitations on obtrusive light for exterior lighting installations within four environmental zones. These limits are widely accepted in the UK as being the best criteria against which to assess the acceptability of the impacts of a new lighting installation. They cover sky glow, light into windows, source intensity and building luminance.

Figure 6.1: Assessment of Lighting - available to download below.

6.2 Approach

The flow chart in Figure 6(1) outlines a structured approach to the assessment and mitigation of lighting impacts that is intended to guide the thinking of developers and lighting engineers when considering major lighting schemes. Drawing on the terminology and procedures commonly used in environmental assessment, the approach involves four key stages.

The first step is a baseline assessment of existing levels of lighting in the area, coupled with work to identify the primary receptors of lighting impacts. This is followed by an analysis of the predicted impacts of the proposed lighting scheme, an assessment of the significance of these impacts, and proposals for mitigation.

The level of detail should be appropriate to the scale of the lighting scheme and the sensitivity of its surroundings. For a simple scheme, the assessment need only be a page or two long; but for a large and complex scheme, in an urban fringe setting for example, something more substantial will be required.

6.3 Baseline Assessment

The baseline assessment involves gathering, mapping and analysing information about the locality. The concept of countryside character, and any countryside character assessment prepared by the planning authority, will be relevant here - see the earlier discussion of countryside character in Section 5.2.

The content of the assessment inevitably will vary, but ideally should include:

- a review of *areas and features of landscape, historical and wildlife importance* in proximity to the site, including any relevant designations;
- an overview of *dark landscapes and existing lighting* in the locality;

- an assessment of *landscape character and sensitivity*;
- identification of the main potential *receptors of light*, particularly nearby dwellings and roads; and
- *informal consultation* with those who may be affected.

The first step in the baseline assessment, which will be primarily a desk exercise, is to identify any planning policy areas or other designations that may need to be taken into account. This will require a review of structure and local plans, and discussions with planning officers and others to establish if the scheme might affect designated landscapes, conservation areas, listed buildings or important nature conservation sites.

As a second step, it will be useful to consider how dark the area surrounding the development site is at present. This will include a site visit at night to help understand the site context and the interrelationships between lighting from different sources, such as road junctions, commercial and retail developments. Sources of light, together with an indication of their visibility, brightness and prominence should be plotted on an Ordnance Survey map, and any areas with dark skies, which may be particularly sensitive, should be noted.

To establish landscape sensitivity to the introduction of lighting and associated apparatus, a rapid landscape character assessment should be carried out; the level of detail required will depend on the scale of the development, and its proximity to designated landscapes and other important countryside resources. The *Countryside Commission's Landscape Assessment Guidance (1993)* is a useful guide to planning a landscape character assessment and tailoring it to meet specified objectives, and the process need not be complex or long-winded. Table 6(1) gives a broad indication of the relative sensitivity to lighting of the different types of landscape commonly found in England. Sensitivity depends on a range of factors including visibility, remoteness and scenic quality. The degree of enclosure afforded by landform and vegetation are key factors, along with patterns of fields and settlements.

To complement the assessment of landscape character and sensitivity, potential receptors of visual impact should be identified, and their distribution plotted on a map. They may include local residents, users of public footpaths and other recreational areas, and motorists on nearby roads. It should be borne in mind that astronomers and the elderly are particularly sensitive to the effects of light glare and trespass. Informal consultation with those who may be affected is strongly recommended, and in the case of potential impact on adjoining roads, this should include early discussions with the highway authority.

The completed baseline assessment will provide a framework for determining the overall sensitivity of the area and its capacity to accommodate lighting.

Table 6(1) Landscape Types and their Sensitivity to the Impacts of Lighting	
Landscape Type	**Sensitivity to Impacts of Lighting**
Lowland Basin Broad vales, often overlooked from surrounding ridges	• Dense hedgerows, with numerous

eg the Weald.	hedgerow trees and small woodlands screen daytime views to lighting apparatus; • areas of good quality farmland, where dense land cover is reduced, may be more sensitive; • relatively flat landform and well-developed hedgerows contain views but cannot screen sky glow from the many settlements and rural developments; • and areas overlooked from adjacent uplands are particularly sensitive - night-time views across lowland basins often reveal the full extent of light pollution across a broad region.
Rolling Farmland Quintessential English lowland landscape, with a patchwork of fields and hedgerows eg much of Northamptonshire.	• Rolling landform may divide the landscape into relatively small visual units and so reduce impacts of lighting, but the landscape will become more sensitive in flatter, upland areas; • strong field patterns generally help to define and enclose the landscape and provide some potential for mitigation; • areas with a relatively degraded field pattern will be more sensitive; and • relatively remote areas, with a distinctive local character, will be more sensitive.
Plateau Farmland Intensively farmed, open countryside; shallow, rolling landform dissected by steep valleys and fringed by a steep escarpment eg Cotswolds, South Downs.	• Large, arable fields and relatively open character means the landscape is fairly sensitive; • predominance of skyline views adds to sensitivity, particularly in daytime views; • windswept, expansive feel and long views mean impacts of lighting are likely to extend over long distances; and • typically few, small settlements so dark skies predominate, increasing sensitivity.

Lowland Heath Diverse, patchy mosaic of open heathland and woodland eg the New Forest, Brecklands.	• Fairly flat landform and dense land cover will screen lighting structures in daytime; • irregular landscape pattern provides plenty of scope for integrating lighting apparatus; • heathland of historic or ecological value is more sensitive; and • often strong sense of wilderness, which increases sensitivity, particularly to impacts on dark skies.
Upland Moor Open, wild upland landscape with a remote character eg North Yorks Moors.	• Large-scale, open, windswept character allows long views and makes the landscape extremely sensitive; • strong sense of wilderness means both day and night-time impacts will be intrusive; • skyline views are particularly sensitive; and • lack of settlements and development means these are some of the most extensive remaining areas of dark skies in the country and merit conservation.
Upland Ridges Steep, mountainous landscape, often with extensive conifer plantations eg Cumbria.	• Remoteness and sense of wilderness of upland areas ensure that they are extremely sensitive to lighting, but are unlikely to be under pressure for such development; • lower slopes and valleys are also sensitive as they are overlooked from recreational paths on steep surrounding ridges - even small-scale lighting will be prominent at night; and • daytime impacts may be reduced in areas with conifer plantations or woodlands on the lower slopes.

6.4 Impact Prediction

This is a critical stage of the assessment process. It is important to consider (and where possible prepare quantitative predictions of) the impacts of lighting on different potential

receptors of landscape, visual and other forms of impact. These receptors will include:

- *specific areas or features of historical or wildlife interest*, such as conservation areas, listed buildings, nature reserves or known populations of rare species;
- *dark landscapes*, especially those of AONBs, National Parks and any other relevant countryside designations that may be included in structure or local plans;
- the appearance of the landscape by day, including the effects of lighting apparatus on skylines, key views, and landscape character generally;
- *local residents*, especially where bedrooms may be affected by increased light levels at night;
- *astronomers*, including local observers and astronomical societies, as well as any scientific observatories; and
- *motorists, cyclists and pedestrians*, together with any traffic lights, junctions or transport signalling systems in the locality.

Different prediction techniques and measures will be required for each of these receptors, and these are summarised in Table 6(2).

The daytime visual impact of lighting structures at a roundabout in open countryside in Lincolnshire.

The daytime visual impact of floodlights at a football pitch in the South Yorkshire urban fringe.

The aim should be to identify and predict, in an appropriate level of detail, the impacts of the proposed lighting on built heritage, local wildlife resources, the landscape and local communities. The analysis should take special account of any important sites or features and any communities or interest groups who are likely to be particularly sensitive to lighting. Special attention should also be given to the predicted impacts of the lighting on remote parts of the countryside, where there are existing dark night skies.

Table 6(2) Measures of Lighting Impact on Different Receptors	
Receptor	**Possible Measures**
Historical or Wildlife Features	*Importance or rarity of affected resource and nature of change that it will suffer*. Impacts upon these resources will be difficult to predict quantitatively, and there will be a need to rely on professional judgement of the likely effects of change, which may be beneficial in some instances.
Dark Landscapes	*Surface luminance in cd/m2 of the building facade or sign*. Suggested limits for building luminance are presented in the ILE Guidance Notes. *Prominence and visibility of the light source*. These may be predicted using computer modelling, or by preparing isolux contours (lines of equal illuminance), and examining the screening effects of topography, vegetation and other features.
Appearance of the Landscape by	*Effects on skylines, key views and on*

Day	*landscape character generally*. The best way to predict and measure these effects is by using traditional techniques for visual impact assessment, including visibility analysis, sketch overlays and photomontages. Further information can be found in the *Guidelines for Landscape and Visual Impact Assessment*.
Local Residents	*Luminous intensity of the light source (ie source intensity) in cd. The ILE Guidance Notes* present suggested source intensity limits for control of glare. *Illuminance in the vertical plane in lux. The ILE Guidance Notes* present suggested limits for illuminance in the vertical plane, for control of light trespass.
Astronomers	*UWLR of the lighting installation*. This gives an indication of the skyglow produced. Skyglow limits are presented in the *ILE Guidance Notes*.
Motorists, Cyclists and Pedestrians	Threshold increment in %. This measure of the percentage increase in luminance is often used to assess the effects of glare on road users. The CIE (see endnote 1) has produced draft guidance.

6.5 Impact Significance

The assessment should be based on common sense and balanced, well-reasoned judgement. The impact predictions outlined above should permit the implications of the scheme to be clearly understood, and conclusions should take account of the views of local residents and representative bodies, balancing the need for lighting against its potential impacts.

Key factors that may assist in the evaluation of impact significance are:

- *The importance of the affected countryside resources*. Designated landscapes such as AONBs and National Parks together with our most important heritage and nature conservation designations, represent countryside resources that are acknowledged to be of national importance. Increasingly they are described as part of Britain's 'critical natural capital'. Lighting impacts upon such areas, which often coincide with dark landscapes, should be regarded as significant.

- *The existing character of the surrounding countryside*. Government and the statutory countryside agencies (the Countryside Commission and English Nature) all place a strong emphasis on countryside character, as we saw in Section 5.2.2. Proposals that are out of keeping with the existing character of unspoilt countryside, regardless of location, are likely to be viewed unfavourably; and in areas of more degraded character, new development is encouraged to make a positive contribution to character.

- *Recommended light limits, as set out in the ILE Guidance Notes and elsewhere*. Where predicted light levels exceed the recommended limits described in Table 6(2), impacts should be regarded as significant. Other factors influencing the significance of these impacts on visual receptors are the number of viewers affected, the distance from the light source, and the timing and duration of the impacts.

6.6 Mitigation

The environmental assessment as a whole should assist in determining whether and how a lighting scheme should be installed; it should also indicate how its impacts need to be mitigated through improved scheme design or specific control measures. Chapters 7 and 8 on landscape design and lighting design respectively address general design issues; while the ways of preventing or mitigating the impacts of lighting schemes for different activities are set out in Chapter 9, on lighting issues in practice.

There is always scope to design and site lighting equipment to minimise its impacts on the landscape and people, both at night and in the daytime. However, it is important to bear in mind that it will not always be appropriate to use landscape design as a means for mitigating the impacts of lighting. For instance, new planting near a roundabout on open moorland is likely to be out of keeping with local landscape character and more intrusive than the lighting columns themselves.

In seeking to mitigate the impacts of lighting on historical or wildlife features, it is usually advisable to seek specialist advice from English Heritage or English Nature. In relation to the built heritage, the main issue is likely to be the effect of the lighting scheme on the fabric and appearance of historic buildings and settlements, and the solution will lie in design that respects the built character, highlights but does not overwhelm architectural detail, and gives good colour rendering. In relation to nature conservation impacts, mitigation measures may include keeping light levels low; fitting shades and filters; switching off lights close to sensitive sites when lighting is not essential; and where insect populations are vulnerable, using low pressure sodium lamps, which affect insects less because they emit little ultra - violet light.

Endnotes

1. International Commission on Illumination (CIE), Guide on the Limitation of the Effects of Obtrusive Light for Outdoor Lighting Installations (TC5.12), Draft, 1995

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7. Landscape Design

Some types of landscape are more vulnerable to the impact of lighting than others. Factors such as the overall visual scale of a landscape and the degree of enclosure provided by vegetation cover and topography have a strong influence, and lighting columns are far less likely to seem visually intrusive in an undulating, small-scale farmland landscape than on open fenland. In some of the more remote parts of the countryside, such as Dartmoor and the Pennines, even a single security light can be prominent over wide areas. Here there may be a strong case for avoiding lighting altogether or for enforcing strict controls.

Most of the published guides relevant to lighting in rural areas concentrate on the technical aspects of lighting design and make only passing reference to the related processes of site appraisal, site planning and the design of new planting and landform. Yet there is often considerable scope to integrate lighting structures within the landscape and mitigate their impact. Figure 7(1) summarises the key stages and indicates the close links between the processes of landscape and lighting design.

Figure 7.1: The Landscape Design Process - available to download below.

While this section is aimed primarily at the developers and promoters of lighting schemes, it should be noted that local people also have an important part to play. One useful way in which local planning authorities and communities can become involved in and influence the design process for new lighting schemes in the countryside, is through the preparation of Countryside Design Summaries (see endnote 1) and Village Design Statements (see endnote 2), and their adoption as supplementary planning guidance. These two mechanisms, which are being promoted by the Countryside Commission as part of its *Design in the Countryside Initiative*, are intended to enable links to be made between countryside character and the design of built form. Ideally they should encompass the design issues associated with rural lighting.

7.1 Site Appraisal

Building on information from the landscape character assessment that should have been prepared during earlier work on environmental assessment, detailed appraisal of the site itself should begin with an analysis of the character and context of the immediate environs. The relative prominence of the site is particularly important and it is useful to plot a rough visual envelope indicating the broad area over which the site is visible. This can be usually be drafted from a map and then tested in the field. Ideally the site appraisal should cover the full area over which the lighting will have an impact, ignoring any immediate landownership boundaries. Particular account should be taken of views from public rights of way and local settlements.

It will also be necessary to consider the existing levels of lighting, both within the site and in the surrounding area, so that the potential impacts of the proposed lighting can be understood. An overview of dark skies in the area will be a useful point of reference. The desk study should also take careful note of any areas designated for their scenic quality, ecological value or historic importance.

At a more detailed scale, a site visit will be necessary to analyse local views to and from the

site. The nature and extent of the views - whether glimpsed, short or long - and the character of the local landscape should be recorded in some detail to determine the relative sensitivity of different parts of the site and to act as a future reference in designing mitigation measures. The appraisal should also record characteristic elements, patterns and features of the landscape and built heritage, together with areas of existing vegetation and semi-natural habitat. Skylines, distinctive landforms and local landmarks such as avenues or historic buildings are especially relevant. The appraisal should consider the potential impacts on the local community and must identify any local communities or interest groups who are likely to be affected by the lighting.

7.2 Siting and Layout

The design and siting of lighting equipment should be considered during the preliminary master planning stages of a new development rather than as an afterthought once the layout of the site is resolved. Setting aside any requirements for promotional lighting, the fundamental need for light is determined by demands for site safety and security, and there is usually scope to design roads and pathways to minimise lighting requirements; for instance by segregating pedestrians and vehicular traffic and introducing traffic calming measures such as speed limits and road surface treatments.

Ideally, the different types of lighting - for security, safety, working areas and amenity - should be designed in conjunction with the buildings and landscape to achieve an attractive, integrated scheme with minimal environmental impact. This is particularly important in the countryside, where there is generally a need for a more unified approach than in an urban environment and where local landscape character should influence the scale, style and form of the development.

It is important to bear in mind that the use of new planting or earthworks may not always be an appropriate measure for mitigating the impacts of lighting, particularly in landscapes with an open, natural character where extensive trees and hedgerows would seem out of place. In some instances it may be worth considering off-site planting over a wide area designed to strengthen local landscape character and provide adequate screening without drawing attention to the new infrastructure.

In general, lights should be positioned to minimise their impact on sensitive parts of the site and those living nearby. This may involve concentrating lights in one part of the site, screening key views and giving careful consideration to the treatment of the boundaries of the development. Options for the siting, hierarchy and layout of lights should be developed, tested and refined as an integral part of the design of the site as a whole, taking account of the views of planning authorities, the local community and any special interest groups such as ornithologists, archaeologists and astronomers. It is important to analyse the design in relation to the view of the average person, both standing on the ground and driving a car; all too often schemes are designed from the bird's eye perspective of a plan view.

7.3 Detailed Design

New planting and landforms should be designed to reinforce and build upon local landscape character rather than to screen the lighting structures throughout the site. For instance, there may be opportunities for small copses or hedgerow trees in areas where these are

characteristic, but elsewhere the most appropriate solution may be open hedgerows or shelterbelt planting. The character of existing trees, buildings and landform, both in the immediate vicinity and in the surrounding landscape, will be the predominant influence.

However, there is often scope to design any new planting and earthworks to take account of key views, particularly from public rights of way and local communities. Lighting structures may also be sited so that they are screened by buildings or existing vegetation. New planting can be used to soften the visual impact of the lighting equipment during the daytime, but it may only be effective during the summer months, when the vegetation is in full leaf, and will rarely provide a complete screen. In general, only native species which are appropriate to the locality should be used although there may be some scope for using a more varied mix, including evergreen or ornamental species, in the vicinity of parkland, gardens or settlements. Wherever possible, new planting should be linked to existing vegetation to maximise opportunities for habitat creation.

Design details such as the colour of lighting columns or the precise form of earthworks can have a significant influence on the quality and overall impact of the scheme. For instance, it may be appropriate to use lighting columns with a dark colour and matt finish in areas where they are seen against background vegetation, whereas a light grey might help to minimise the impact of lights which are generally seen against the sky. In general the number of lights should be kept to a minimum and a unified scheme, in which there is a strong visual link between the different types of lighting, is likely to produce the most attractive and least intrusive result.

Photographs may be used as a basis for sketch overlays and photomontages to illustrate the visual impact of different lighting apparatus in the landscape and to test alternatives. A basic three dimensional computer modelling package, such as Autocad, may be useful to generate perspective views of different angles quickly and effectively. More complex computer programmes for modelling the effects of lighting in exterior conditions are still being developed, although at present the procedures for data input are generally considered to be too cumbersome and expensive for widespread use.

Endnotes

1. Countryside Commission, *Countryside Design Summaries: Achieving Quality in Countryside Design*, CCP 502, 1996
2. Countryside Commission, *Village Design: Making Local Character Count in New Development*, CCP 501, 1996

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8. Lighting Design

Having carried out an appraisal of the need for lighting and an assessment of its potential impacts, the design of the lighting scheme itself involves gathering and sorting all the relevant data; identifying the detailed lighting requirements and specifying lighting equipment to meet them; and selecting and installing the apparatus to meet a range of technical and aesthetic objectives. The basic process is summarised in Figure 8(1). It is common to all types of lighting installation, although some aspects of the sequence may require more emphasis according to the type or scale of the lighting scheme and the sensitivity of the landscape.

A range of legal standards and publications is available to provide guidance on the design of lighting schemes. This chapter summarises the current position, both generally and in relation to different types of lighting installation. It also provides an overview of the range of lighting equipment available and the technical issues and design procedures related to the use of lighting equipment in different circumstances.

8.1 Current Lighting Guides and Standards

Lighting guides and standards are many and varied. Most concentrate on defining specific lighting requirements for a particular task, but there are also some which provide general guidance. The principal non-specific guides and standards relevant to lighting in the countryside are summarised in Table 8(1). They help to unravel some of the more technical aspects of lighting design, provide guidance on how to judge acceptable levels of light for different purposes and advise on how to limit its wider impacts. Specific lighting standards (for roads, area lighting, sports facilities etc) are covered in Section 8.3.

8.2 Different Types of Lighting Equipment

Tables 8(2) and 8(3) summarise the range of lamps and luminaires which are commonly available, comparing the character and performance of different types of lighting equipment.

8.2.1 Lamps

Lamps are available to suit every budget and situation. Apart from cost, the principal differences are in colour, efficiency, life-expectancy and colour rendering capacity. In summary, the tungsten lamps have excellent colour rendering, but are relatively inefficient and short-lived. Both fluorescent and high pressure mercury lamps are used as a replacement to tungsten in situations where energy savings and a longer lamp life are required. They produce a white light and have good colour rendering properties. Metal halide lamps are relatively white in appearance and have a carefully developed colour spectrum which gives very good colour recognition. They are used extensively for sports floodlighting and have a relatively good performance in terms of rated life expectancy and efficiency.

Figure 8.1: The Lighting Design Process (Based on BS5489) - available to download below.

By contrast, the deep orange low pressure sodium lamp which is commonly used for street lighting throughout the country has no colour rendering properties. The high pressure sodium

lamp is considered to be an improvement in aesthetic terms, although it is less energy efficient. It has a broader colour spectrum but still a rather yellow appearance. Both types of sodium lamp are used extensively for lighting roadways and industrial areas.

Table 8(2) presents a comparison of the different lamp types in terms of price, colour appearance and rendering, efficiency and rated life.

Table 8.1 Principal General Lighting Guides and Standards

Principal Standards and Guides	Synopsis
International Commission on Illumination (CIE) Publications No 1: Guidelines for minimising urban sky glow near astronomical observatories 1980 No.92: Guide to the lighting of urban areas 1992 In Draft: Guidelines for minimising sky glow (TC 4.21) In Draft: Guide on the limitation of the effects of obtrusive light from outdoor lighting installations (TC 5.12)	• Describes sky glow; • provides a methodology for estimating sky glow in relation to its impacts on bservatories; • suggests mitigation measures to minimise the problem with specific reference to needs of astronomers. • Recommends lighting standards for roads and public areas, such as paths, community areas, industrial roads, access points; • discusses effect of light on crime; • considers the suitability of light sources for different sites; • explores the effects of lighting on the environment; • discusses general aesthetics of lighting equipment. • gives general guidance on how to reduce or avoid impacts of sky glow on astronomical observatories; • provides methods for surveying and measuring sky glow as a basis for classification of zones; • recommends sky glow limits for these zones and covers restrictions for lighting equipment and installations. • Sets out guidelines for assessing the environmental impacts of exterior lighting

	and gives recommended limits for tolerable levels of light; • gives guidance for limiting: o llumination falling on surrounding roads and properties; o bright luminaires in the field of view; o the effects on transport systems; o sky glow; o the effects ofoverlit building facades and signs.
Chartered Institution of Building Services Engineers (CIBSE) Publications No. LG6: The Outdoor Environment Lighting the Environment - A Guide to Good Urban Lighting 1995 (with ILE)	• Provides advice on lighting a wide range of situations in the outdoor environment, but contains little information on reduction of light pollution. • Recommends a strategic, integrated approach to lighting design, integrating the recommendations from the range of existing guides and codes of practice; • advises on energy conservation, appropriate lighting for different situations and activities and suggests measures for mitigating and avoiding light pollution; • provides design guidance and recommends good practice; • suggests lighting may increase the vibrancy and use of the urban environment, particularly for pedestrians; many of the general principles are applicable to rural as well as urban situations.
Institution of Lighting Engineers (ILE) Publications Guidance Notes for the Reduction of Light Pollution 1994 Lighting and Crime	• Provides simple advice on minimising intrusive light; • details some useful technical parameters for measuring and monitoring levels of light, including the upward waste light ratio, vertical illuminance, intensity and luminance and applies them to the

	problems of sky glow, light spill onto windows, over-bright light sources and building luminance. • Describes problem of crime and the role of lighting in its prevention; • provides relevant references and case studies; • provides details on financing and specifying lighting to minimise crime.
Royal Fine Art Commission Lighten Our Darkness: Lighting Our Cities - Successes, Failures and Opportunities 1994	• Provides technical and design guidance on improving design of urban lighting - many of the principles are applicable to lighting in the countryside; • describes the scale and extent of light pollution; • promotes an approach to lighting which combines functional security with opportunities for aesthetic enhancement and provides case studies of good practice in urban situations; • advises on design of floodlighting to enhance rather than overwhelm architectural detail.

8.2.2 Luminaires

The range of different types of luminaire on the market is even greater than the range of lamps; over the years they have been designed to accommodate every conceivable style and function. The selection and correct installation of an appropriate luminaire is a crucial part of the lighting design process, since the luminaire controls the direction and intensity of the light beam, and thus its environmental impact.

Table 8(3) compares the *peak intensity* (the maximum light emitted in the principal beam) and light distribution parameters for the principal different types of luminaire. In general, floodlights emit more light than road lights and bulkhead units. As the angle of most floodlight luminaires is variable it is particularly important to install and direct the light correctly in order to minimise the risks of light pollution. By contrast, most road lighting applications, both decorative and functional, together with wall mounted bulkhead fittings and illuminated bollards, have fixed-angle luminaires.

The UWLR of luminaires can be assessed by measuring the ratio of light emitted at and above

the horizontal to the total light emitted. The UWLR for variable-angle luminaires can only be calculated accurately once the equipment has been installed and the elevation angles of the luminaires recorded, but Table 8(3) gives an indication of the potential risks of light pollution. However, the UWLR for fixed angle luminaires is available from all reputable manufacturers and should be reliable provided the apparatus is suitably installed.

Table 8.2: General Lamp Types and Characteristics - available to download below.

Table 8.3: General Luminaire Types and Characteristics - available to download below.

8.3 Lighting Design for Specific Tasks

Lighting should always be designed to fulfil a specific purpose; efficient, effective lighting installations provide sufficient light for the task in hand without impinging on surrounding areas. Over the years, lighting products have been developed to secure property, to allow people and vehicles to move safely at junctions and in residential areas and to extend the period during which people can work or enjoy leisure activities out-of-doors during the winter months. Lighting equipment has also been developed for advertising commercial premises such as pubs and petrol filling stations and, in a more subtle vein, for enhancing the amenity value of important buildings and historic settlements.

The following sections describe the standards, lighting apparatus and specific procedures for designing the principal types of lighting found in rural areas.

8.3.1 Security Lighting

Security lighting may be designed to illuminate a site area or building for all to see, creating a direct visual deterrent to criminals, or it may consist of a passive infra red or other `presence detection system' which only switches on when someone invades a selected space. Both systems have their place and neither should cause light pollution provided they are carefully designed, correctly installed and well maintained. However, many security lighting schemes are of a poor standard and are incorrectly installed with excessive levels of light and inadequate luminaires.

There is currently little published guidance available to advise specifically on the design and installation of security lighting, although the ILE publications provide some useful advice on levels of light and on how to reduce the risk of crime. In addition, the Home Office Crime Prevention Agency has published the *Police Architectural Liaison Manual of Guidance (1994)*. The manual describes the principles of crime prevention through environmental design.

Security lighting is commonly selected and installed by electrical contractors who work closely with lighting equipment salesmen. However, it is also increasingly installed by members of the public who must rely on the instructions which accompany the product. These are typically minimal and make no reference to the risk of light pollution.

But security lighting may not always act as a real deterrent to crime; the glare from lighting may cast some areas into permanent dark shadow, creating dark spots which may potentially assist intruders. The growing use of sophisticated CCTV security systems may also reduce the need

for visible lighting, through the use of infra red lighting and infra red cameras.

A wide spectrum of lamps and luminaires can be used for security lighting schemes. They range from fixed angle wall-mounted bulkhead units using one 500 lumen lamp to a 20m tower fitted with several 100,000 lumen lamps installed in multi-angle projectors. Maximum lighting levels, usually defined on the ground, would be around 20-30 lux. Ideally, security lights should be controlled by photo-electric switches. For domestic and small scale security lighting, the *ILE Guidance Notes* recommend passive infra red detectors with a maximum 150W (2000 lumen) tungsten halogen lamp, or low level lighting such as a compact fluorescent porch tube of just 9W (600 lumen).

8.3.2 Lighting of Roads and Pathways

The principal objective in designing lighting systems for roads and pathways is to promote safe and efficient movement of vehicular and pedestrian traffic. The motorist must be able to discern the presence and movements of objects on or adjacent to the road which may be a potential hazard. Road lighting is therefore designed to create an even luminance on the road surface as it is seen by the motorist; other details of forms and textures are unimportant. However the pedestrian is more concerned with identifying local landmarks and negotiating the correct route. Lighting is necessary to assist in locating the entrance to shops and public buildings, the layout of junctions and the position of the kerb. This normally requires carefully positioned lamps with a relatively low level of light.

The primary responsibility for lighting rural roads and village streets lies at county council level. In general, highway authorities do not have documented policy or procedures for road lighting, but most adopt the following broad standards of provision for rural roads:

- no lighting on new rural roads;
- lighting on existing roads if accident rate is poor; and
- lighting on all roundabouts and some 'T' junctions.

Some authorities are replacing or altering lighting in line with changes in traffic flows on roads which have been detrunked or bypassed as a result of changes in the wider road network.

All new residential estates will usually have road lighting, regardless of their rural location, unless there is strong resistance from local people. However, practice varies considerably and local consultation, with parish councils, and special interest groups is a growing influence. Road lighting schemes are generally designed using British Standard BS 5489. The standard is split into ten codes of practice which cover the principal different categories of lighting (Ref Table 8(4) and offers a considerable degree of flexibility and interpretation for the designer. It contains flow charts to guide the design of road lighting schemes, but in practice lighting suppliers often provide a design service to engineers, using computer software to calculate the optimum location, height and spacing for alternative lighting solutions.

Lighting of public areas in the countryside and village street lighting may fall into several of the categories within BS 5489, leading to differences in interpretation of the appropriate light level

to be used. It is therefore important to maintain a clear, logical approach and to avoid the cumulative intrusive impact of lights designed for different purposes. For example, lighting on subsidiary rural roads should be designed so that pedestrians can orientate themselves and detect vehicular and other hazards. It should provide guidance to motorists, but may be insufficient to reveal objects on the road without the use of headlights.

The design process involves careful consideration of the specific locations for lighting columns to give the best distribution of light. For example, on straight roads a staggered arrangement will produce an optimal effect, but on curves the luminaires are placed on the outside of the curve to ensure reflection off the road surface and at T-junctions a column is always positioned opposite the minor road approach.

Lighting is normally required at at-grade roundabouts for reasons of safety. However, a recent review (see endnote 1) suggests that there may be scope to reduce lighting along the approaches to rural roundabouts since lighting here may detract from that at the roundabout itself. It concludes that a reduction in lighting at isolated junctions is unlikely to affect road safety but would result in less overall environmental intrusion.

In general local highways authorities use high pressure sodium lamps with flat glass horizontal cut-off (HCO) luminaires for new rural road and junction lighting schemes. Columns are usually 10-12m high, with 8m high columns sometimes being preferred at isolated locations. Individual lamp light outputs normally vary between 12,000 and 50,000 lumens. Non HCO low pressure sodium luminaires may require fewer columns and be more energy efficient, but high pressure sodium luminaires normally have a lower whole life cost if the columns are over 8m high and may therefore be preferred. Most road lamps are installed in fixed angle luminaires, whose main beams of light radiate out, up and down the road at between 60 and 75 degrees to the downward vertical. There is normally no need for any light to radiate above the horizontal and it is becoming more common to stipulate that luminaires have a full HCO.

Lighting installations for pedestrian pathways are normally scaled down versions of the above, although many use more decorative luminaires. Mounting heights are usually between 4-6m and light outputs vary between 3,000-6,000 lumens. In rural towns and villages, with the permission of the building owner, units can be mounted on buildings. This reduces street clutter and can considerably enhance the day-time visual scene, although it does create more work for the designer and installer in gaining permissions.

Table 8(4) Guidance For Lighting Roads and Pathways	
British Standards Institution (BSI) British Standard 5489, 1992 • general principles (part 1); • traffic routes (part 2); • subsidiary roads and associated pedestrian areas	Provides guidance on the design of road lighting schemes. Based on practical experience, but also takes account of: • the reflection properties of the surface (dry, wet, light, dark, polished, rough-textured etc); • the distribution of the light from the luminaire (medium threshold increment, low threshold increment, horizontal cut-

(part 3); • single-level road junctions including roundabouts (part 4); • grade-separated junctions (part 5); • bridges and elevated roads (part 6); • tunnels and underpasses (part 7); • roads near aerodromes, railways, docks and navigable waterways (part 8); • urban centres and public amenity areas (part 9); • motorways (part 10).	off); and • the relative height and distance between luminaire, carriageway and observer.
International Commission on Illumination (CIE) No. 115. Recommendations for the Lighting of Motorised and Pedestrian Traffic, 1995	Advises on the design of lighting for pedestrian and motorised traffic. Includes recommendations for lighting 'conflict areas' (where there is an increased potential for accidents to occur)
European Committee for Standardisation Road Lighting: Part 1: Selection of Lighting Classes, ECS, 1995 (Draft) Road Lighting: Part 2: Performance Requirements, ECS, 1996 (Draft)	Describes method for evaluating and defining lighting requirements for outdoor areas. Also considers environmental aspects of road lighting, including daytime/night time aesthetics and methods for minimising the environmental impact of lighting generally.
Department for Transport (DoT) Design Manual for Roads and Bridges Volume 10, Section 1, Part 4, Chapter 15, Lighting	Presents guidance on road lighting design principles and key issues, mainly from an environmental standpoint. Suggests how to reduce the environmental impacts of road lighting by day and night with reference to the size, spacing and form of lighting equipment, appropriate levels of light and the sensitivity of the surrounding landscape and receptors of the lighting.

Working and security lights at an urban fringe car stockyard in the Midlands

8.3.3 Working Lights

The use of artificial lighting to extend the working day is usually justified on economic grounds. Ten years ago a few lamps in the cowshed to extend the evening milking would have seemed adequate, but lighting is now required not only for the whole farmyard, but also the milk distribution depot, abattoir and the loading bays at the out-of-town supermarket. Lighting may also be used in glass houses for bringing on commercial horticultural produce such as vegetables, fruits and flowers but can be controlled simply by drawing blinds to mask the light from the outside.

The working lights from a local cement works and the combination of security and street lighting in a small village all detract from the quality of the rural landscape of part of the Peak

District.

Working lights, whether related to agricultural, commercial or industrial developments, are a modern economic necessity but they should be designed to minimise their environmental impacts and to avoid light pollution.

The guidance documents relevant to the control of lighting in the workplace are listed in Table 8(5).

The CIBSE lighting guides together recommend a wide range of light levels for specific tasks. Maximum lighting levels depend on potential safety concerns but would not normally be higher that 50 lux. A wide range of lamps and luminaires can be employed for lighting the work place and there are many examples of equipment that can fulfil a specific lighting task with minimum spilled light elsewhere. However, it is important to ensure that the correct lighting equipment is selected for the task in hand and that it is competently installed and maintained thereafter. There are economic and environmental benefits to be gained by switching off the lights when they are no longer required.

The Health and Safety Executive guides are also important, and it should be noted that a fundamental principle of the Executive's approach is that safety standards (on roads, pathways and external work areas) should be met through the maximum use of (non- lighting) physical measures such as separation of vehicles and pedestrians, so that the minimum use of light is needed.

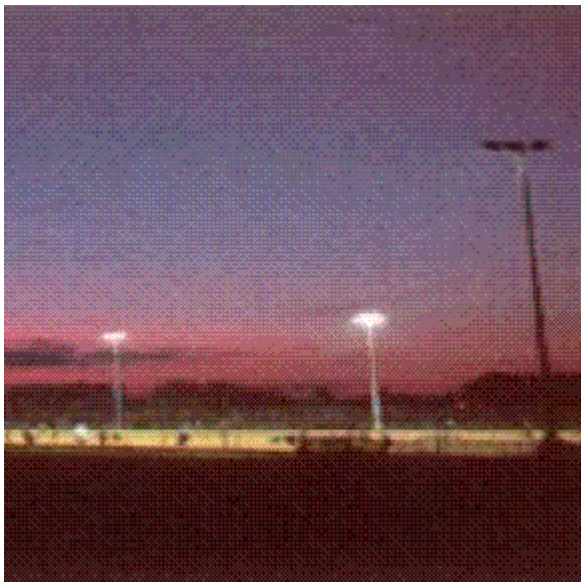
Table 8(5) Guidance for Lighting the Workplace
International Commission on Illumination (CIE) No 68 *Guide to the Lighting of Exterior Working Areas*, 1986 *Chartered Institution of Building Services Engineers (CIBSE)* LG1 *The Industrial Environment*, 1989 LG6, *The Outdoor Environment*, 1992 *Healthy workplaces: Guidance on complying with 1992 health and safety regulations*, 1993 *Health and Safety Executive* *Lighting at Work*, 1987 *Workplace Health, Safety and Welfare*, 1992 *Workplace Transport Safety: Guidance for Employers*, 1993
Table 8(6) Guidance for Sports Floodlighting
Chartered Institution of Building Services Engineers (CIBSE) *Lighting Guide No 4: Sports Lighting*, 1990 *Sports Council* *Guidance Notes: Floodlighting*, 1994 *Factfile 2: Floodlight for Sport*, 1993 *International Commission on Illumination (CIE)* *Guide for Floodlighting (No 94)*, 1993 *Glare Evaluation System for use within outdoor sports and area lighting* (No 112), 1994

8.3.4 Lighting for Sports and Leisure Activities

As the demand for leisure increases and the health and social benefits of sports become more widely accepted, there is a growing requirement for sports facilities to be available throughout dark winter evenings. Night lighting also permits the same facilities to be used more intensively, and in that sense gives value for money. Even small villages often have floodlit football pitches and tennis courts and golf driving ranges are commonplace.

CIBSE, the Sports Council and other specific sporting bodies have agreed comprehensive lighting standards for the floodlighting of sporting activities. The principal publications are listed below.

The guidance recommends a hierarchical approach, with up to three levels of lighting, for recreational, county and national play. To date the publications have concentrated on the lighting requirements of players and spectators, rather than on environmental and non-sporting issues. However, the emphasis is changing and high powered multi-angle `asymmetric' luminaires, which can illuminate a playing field while minimising light spill, are widely available. Timing is also relevant and floodlights should be switched off after a locally agreed curfew of say 21.00-22.00 hrs, which would equate with that of natural twilight in midsummer.



Modern floodlights with cut-off around rural hockey club pitch (Reproduced with the kind permission of Mike Simpson & Phillips Lighting)

The majority of exterior sports lighting installations have requirements for horizontal illuminance at ground level only (generally between 100-500 lux). However, all need some degree of vertical illuminance in order to see the ball. Generally, the lighting scheme will consist of lights mounted on columns at a height which exceeds that expected of the ball during play. Sports floodlights tend to be tall and may often seem intrusive in visual terms. However, there are advantages in mounting the lamp as high as possible so that its light can be directed downwards, minimising glare and sky glow. It may be possible to use hinged columns which can be lowered to the ground and de-mounted during the summer months.

Excessive glare from the lights of a golf-driving range on the edge of a town in the Midlands.

An exception is golf driving ranges, which require levels of illumination on a vertical plane of around 50 lux. However the light is required over a fairly limited horizontal plane so, with careful screening, these lighting installations can also be controlled to minimise the environmental impacts. Ground-mounted luminaires are sometimes used. They have the advantage of being virtually invisible during daylight hours and may also reduce the risk of night-time glare but they will always cause some additional skyglow. The long term solution lies in careful site design, involving some form of substantial screening at the far end of the range.

A wide range of lamps and luminaires has been developed for lighting sports facilities. They vary from fixed angle 15,000 lumen units to multi-angle projectors utilising 180,000 lumens or more. For sports such as football and hockey, 16m masts are usually used, whereas for tennis lower heights of between 8-12m will normally suffice. Luminaires should ideally be designed, installed and maintained to ensure that there is full horizontal cut-off, with glare, light spill and energy use kept to a minimum.

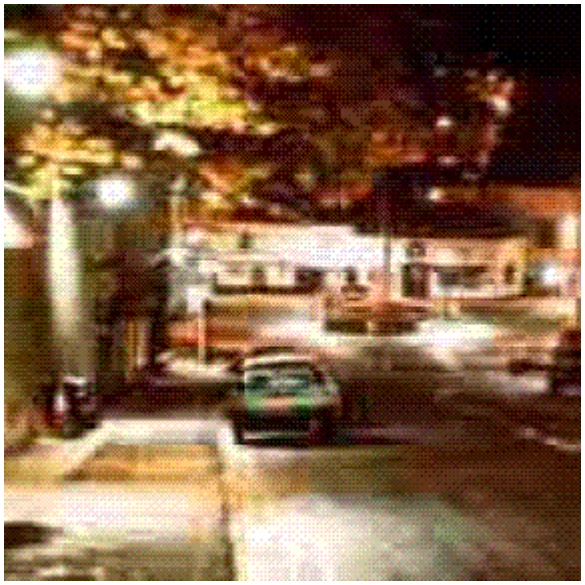
8.3.5 Lighting to Advertise Commercial Enterprises

Within remote rural areas, the lighting associated with hotels, public houses and petrol filling stations may have a significant impact. Many modern petrol filling stations have carefully designed promotional lighting schemes with full horizontal cut-off and white light sources, but elsewhere lighting associated with commercial advertising is often of a poor standard.

The *ILE Guidance Notes* recommend appropriate levels of light for lighting both buildings and signs. A wide range of lamps and luminaires is available for promotional lighting and most are sold in DIY centres, although many are out of keeping with their immediate surroundings. One common example is the use of tubular fluorescent lamps which tend to be dominant and intrusive within the overall scale of the typical village street.

8.3.6 Amenity Lighting for Important Buildings and Settlements

Amenity lighting is increasingly considered a worthwhile investment for villages seeking to enhance their potential for tourism. It may also be valued as a means for generating a sense of local identity and pride and for bringing vitality to the village centre during the evening.



Arundel Town Centre - showing a good example of good, sensitive, public amenity lightening, which had been designed to bring harmony to the visual scene by both night and day. 'White' (metal halide) lighting split between traditional laterns with modern optical controls, both lamp post and wall-mounted, and small architectural floodlights mounted inconspicuously on the buildings. (Reproduced with the kind permission of the CDP/NEP Lighting Consultancy, West Sussex County Council and the photographer, David Nicholls)

A combination of different types of lighting is usually involved, with street lights, wall- mounted floodlights, decorative porch lights, signs and lighting within shop windows all contributing to the overall effect. There is a wide choice of lighting products on the market, but care with siting, installation and maintenance is essential to anticipate the effect of the light and avoid light spill. It is becoming common practice to use high pressure sodium of metal halide lamps for amenity lighting as these have better colour rendering properties.

The practice of mounting lights on existing buildings will minimise the number of lighting columns along the street, although the process of obtaining permission from individual property owners may be time-consuming. The design of a co-ordinated scheme inevitably needs to be a flexible process, taking advantage of local opportunities and working around the inevitable constraints. It is common practice for the local authority (or organisation responsible for the scheme) to enter into a signed agreement with individual property owners, taking responsibility for any damage contractors might cause during installation.

Of the general guides listed in Table 8(1), the Royal Fine Art Commission's *Lighten our Darkness* and the *Guide to Good Urban Lighting* published by CIBSE and the ILE contain much useful and relevant advice. They emphasise the need to balance light and shadow and to design lighting so that it enhances the architectural detail of the building rather than overwhelming it. It is important to adopt an integrated approach in which all the various

sources of light within a settlement complement each other.

Endnotes

1. Jacoby and Pollard, *The Lighting of Rural Roundabouts*, 1994, LE

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9. Lighting issues in Practice

Lighting in the countryside stems from a wide variety of sources which together have a cumulative impact. Most lighting schemes have evolved gradually, often in an ad hoc fashion, as different types of lights have been installed for different purposes. The following sections review the broad categories of lighting typically found in the countryside and recommend principles for good practice in both lighting and landscape design. Many of the principles are illustrated by case study examples.

9.1 Security Lighting

In recent years there has been a proliferation of security lighting in the countryside, both in relation to commercial and industrial developments and domestic properties. Most security lighting is installed by members of the public rather than professional lighting designers and there is generally a lack of information and a need to educate the public about the installation and intensity of security lights.

Issues and Good Practice for Security Lighting	
Component Lighting Elements Most domestic security lights are rated at 300-500W and are sold on the premise of `more is better', with little concern for the potential for light pollution. Security lights are not usually very directional and tend to spill light onto adjacent property. They may also cause dazzle and potentially, dark spots, which could even assist intruders. Many are tripped by animals, pedestrians and motorists from well outside the property and are often left on, or knocked out of alignment.	**Principles for Good Practice** • Lighting should be controlled by photo-electric switches and should be on the minimum time-setting - avoid sensors which can be tripped by road or footway users. • Lighting should be directed down and mounted below the property boundary height. • Develop an integrated approach to security lighting, balancing levels of light with other lighting in and around the site to avoid glare and light spill as well as dark spots. • Consider the use of alternative security measures, such as an inside light that is on a time-switch, or CCTV.
Bobsleigh Inn, Bovingdon, Hertfordshire Comments from the local community, planning officers, police and the architectural liaison officer resulted in the imposition of planning conditions and the alteration of a scheme for security lighting along the boundary of a new car	

park at this Hertfordshire inn.

The initially submitted scheme showed a 17m brick frontage wall incorporating 15 brick piers separated by spiked black railings. Each of the brick piers was to be topped by a metal lantern.

Local people were concerned about light spill onto the adjacent roadside and the general impacts of lighting on residents and visitors to this part of the Metropolitan Green Belt; the local planning authority commented that the proposed style of the lights and the scale of the scheme were inappropriate in the rural setting the local architectural liaison officer played a key role in convincing the hotel that the scheme was excessive and would not enhance the security of the car park.

Consultation, negotiation and a frank analysis of the need for lighting resulted in a vastly altered scheme, with minimal environmental impact. Lighting in the inn car park is now reduced to the bare minimum, with a single small, flat-glass floodlight directed into the car park area which gives adequate light for security while avoiding the risk of light spill.

9.2 Sports Facilities

Extensive floodlighting is now an accepted part of larger sports complexes, many of which are on the fringes of urban areas and have an influence on the surrounding countryside. However, even relatively minor village sports pitches may be floodlit and there is often particular concern about the lighting associated with golf driving ranges in rural areas.

Issues and Good Practice for Lighting Sports Facilities	
Component Lighting Elements	**Principles for Good Practice**
Floodlights for Sporting Activities - floodlights are typically mounted on tall columns and may be intrusive in daytime. They may be visible over long distances, particularly if the sports area is on relatively high ground. Lights designed to minimise light pollution are available, but often not installed. *Car Park Lighting* - at the larger sports complexes, car park lighting may be extensive but is normally minimal in comparison to sports floodlighting. The impact of lighting structures (in daytime) and at nightmay be reduced by planting.	• Consider potential for temporary floodlighting and for lowering lighting columns in summer, when they are not in use; • design lighting to be as directional as possible, using the minimum number of lights required, and to minimise light pollution; • the colour of lighting poles may have significant influence - light colours should be used if lights are generally seen against the sky, or dark if there is a backdrop of vegetation; and

Security Lighting - lights are often mounted on buildings or boundary fences.	• floodlights should only be on when the facility is in use.

Backwell United Football Club, Backwell, Avon.

Backwell United football ground lies close to residential areas adjacent to the A370 on the western edge of the village. It is close to, but not in, a Green Belt and conservation area.

When the club was promoted into the league it applied for planning permission for floodlights at the football ground, but Woodspring District Council turned down the application on the grounds that there would be negative environmental impacts on the village of Backwell. A subsequent appeal was allowed subject to the following conditions:

- the floodlights shall not be switched on for more than 15 minutes before kick-off and shall be switched off within 15 minutes of the end of the game, and no later than 2200 hours;
- light levels at the boundary fence shall not exceed 50 lux;
- the light shall not be used for more than fifteen midweek matches per football season;
- the columns shall be lowered to ground level between 1 May and 30 September; and
- the columns shall be painted a matt colour.

The council responded to the concerns of local residents by calling in a lighting consultant to assess light levels in the vicinity of the ground and to provide advice on mitigation measures. The scheme has benefited from expert advice on the design and installation of floodlights and luminaires which contain light spill and prevent light pollution. The resulting light levels do not exceed the recommended limits of 50 lux (by Woodspring District Council) at the boundary of the ground.

In winter, 16m lighting columns stand at the four corners of the pitch. This arrangement tends to produce more light spill than the `side-lighting' arrangement but allows clear views for spectators from the side. The use of carefully designed luminaires, with side baffles to contain and direct the light beam, is therefore essential to avoid light spill onto the adjacent residential properties. The columns and luminaires are painted with a matt paint which reduces reflection from the sun.

Careful liaison between the planning authority, the football club and local residents and cooperation in observing a set of conditions has resulted in an exemplary floodlighting scheme.

Blue Mountain Golf Driving Range, Binfield, Berkshire

The Blue Mountain Golf Driving Range lies within a narrow 'green wedge' between Bracknell and Binfield. This is an undulating landscape and the driving range is prominently sited on a ridge so it is visible in views from the local town of Binfield.

An application for planning permission to install floodlights on the club building and along the perimeter fence of the driving range was received in 1992 but the local parish council objected on the grounds that the lighting would cause light pollution and disturb the rural, undeveloped character of the landscape. Planning officers eventually approved the application but responded to the concerns of the local community by enforcing a series of conditions designed to prevent light pollution and limit the environmental impacts of the lighting.

Under the conditions, the floodlights are switched off at 9.30pm during the winter months and the levels of illumination close to ground level are restricted to comply with the levels recommended in the ILE Guidance Notes. The range is in a prominent location, but is particularly visible from properties on rising land to the west. The planning officers recognised the need for careful siting and screening and the conditions also required the erection of a screen fence along the western side of the driving range.

The design of the driving range has subsequently been modified to take on board the comments of both the planning officers and the local community. Earth bunds have been constructed around the perimeter of the range and trees planted to reduce overall visibility and the impact of the floodlighting, which is mounted on the driving range building and on 8m columns or fencing posts along both sides of the range.

Hastoe Hill Riding School, Tring

Situated on a hill-top in the heart of the Chiltern AONB, this riding school is in a prominent and sensitive rural landscape. The area is also recognised for its nature conservation value and the riding school is adjacent to several Sites of Special Scientific Interest including semi-natural ancient woodland and semi-improved grassland sites. A planning application was submitted in March 1996 to construct an all-weather manege on the area of land to the west of the main group of buildings. The proposal included floodlights at each corner of the manege which would be fixed to 7m high telegraph posts.

The application led to a series of objections from the local community, English Nature, the Hertfordshire Environmental Records Centre (HERC) and a local conservation society. All were concerned about the impacts of the floodlighting element of the proposal. The local Town Council and local residents pointed out that the riding school is sited at the highest point in Hertfordshire and that floodlighting would be visible for miles

around. It also suggested that a floodlit manege would have a suburbanising effect on the nearby hamlet of Hastoe.

HERC raised serious concerns that the floodlighting proposals could be detrimental to the ecology of some of the important local wildlife habitats in the area. It suggested that lighting in such a prominent location could affect the behaviour of moths and other nocturnal insects within a 1km radius from the source and was also concerned about the possible effect on the local bat population. HERC was fully backed by a representation from English Nature which suggested that stringent conditions be applied to control light pollution from the proposed floodlights if planning permission were granted. The conditions suggested by English Nature included the following restrictions on the timing, direction and character of the lights:

- the lighting is not operated more than four times a week, preferably on alternate nights;
- the lighting is focused on the area of the manege and the luminaires designed to block the spill of light in all other directions; and
- sodium lamps are used, preferably low pressure, as these are known to have least impact on invertebrates.

The conditions were never implemented as the floodlighting element was subsequently deleted from the proposal. Planning permission was granted for construction of an unlit riding school manege.

9.3 Commercial Developments

Many commercial developments in rural areas are large complexes, generally located close to principal road junctions. They include business parks, factories, retail developments, garden centres and roadside services. Most have extensive lighting along access roads, at the entrance to the complex, within car parks and at the public entrances to the buildings, as well as security lighting throughout.

Issues and Good Practice for Lighting Commercial Developments	
Component Lighting Elements	**Principles for Good Practice**
Promotional Lighting - lights may be associated with signage and a corporate image. They are usually placed at the entrance to the complex, which may bein a rural setting, and are often part of a road lighting scheme to guide people into car parks etc. They are also placed	• All lighting should have a clear purpose - avoid use of lights simply to create a 'presence' at night; • concentrate lights where they are needed and establish a clear hierarchy, with minimum lighting around the outer, more rural,

at the entrance to the public buildings; *Road Lighting* - this is found particularly in business parks or retail parks, where there is an internal road system. Usually there is a unified lighting scheme throughout the area. Road lighting is often supplemented by lighted bollards along pavements and the scheme tends to be designed to create a relatively `urban' environment. *Car Park Lighting* - this is rarely designed to minimise light pollution. Its impact may be reduced a little by planting. Loading bays, or areas where work often continues after normal hours, are usually lit by taller, directional floodlights. *Security Lighting* - this is typically extensive and often carefully located and directed to light areas most at risk. Security floodlights may be mounted on columns and on buildings and are often designed as part of a sophisticated security system, which includes cameras. *Working Lights* - these are generally concentrated in the loading bays or storage areas of commercial developments and are particularly significant in those which include warehouses. They may be mounted on the buildings, or on tall columns within the working/loading areas of the development.	perimeter of the complex; • reduce the scale of street/road lighting (from usual standards for roads) and consider height and spacing of lights in relation to buildings; • direct all floodlights carefully to where they are most needed and design equipment to minimise light pollution; • encourage a `rural' image, with low key lighting in small developments and on the edges of larger sites and design lighting to be in harmony with the building styles; • use a unified lighting scheme, so that the different types of lighting are not intrusive in daytime; • position promotional lighting/signs so that they are not visible from open countryside ie. concentrate at public entrance to buildings; • consider timing of lights - avoid any lights being left on during daytime and turn off all lights after working hours; and • consider design of overall site to minimise use of lighting eg segregate pedestrian and vehicular traffic and introduce traffic calming measures.

Magna Park, Lutterworth, Leicestershire

Magna Park is Europe's largest distribution development, constructed on an old airfield in open countryside to the west of Lutterworth. The first phase of the development incorporated low pressure sodium lighting on 10-12m columns but the orange glow from these lights was subsequently recognised as being out of keeping in this relatively prominent rural setting. Recent applications for development in the second phase of Magna Park have provided opportunities

to address the problem and to ensure that lighting is coordinated and controlled more rigorously in future phases of the development.

Attention has also been given to the design of perimeter bunding and new planting which will help to reduce the overall visibility of the site and mitigate the impact of the lighting. The current landscape design philosophy includes earth mounding to screen and shelter the site with woodland framework planting and a new 50 acre broadleaf woodland which, when mature, will help to integrate the development into the landscape.

The latest development at Magna Park demonstrates the sensitive approach to lighting which is now being adopted by developers. The lighting on the Merck site (part of Magna Park) consists of high pressure sodium lamps mounted on relatively low (6m) columns, giving good colour rendition. The luminaires provide full horizontal cut-off and minimise light spill into the surrounding landscape.

As well as being environmentally sensitive, the lighting on the Merck site is an attractive feature, designed as an integral part of the development. The lighting columns are painted blue-grey, to blend with the colour scheme of the Merck buildings, and there is continuity in style across the site. However, the new woodland planting and earth mounds will soon ensure that views of the lighting from the surrounding landscape are screened.

Magna Park: the new lighting scheme at the Merck site has high pressure sodium lamps with full horizontal cut-off.

J Sainsbury, Ferndown, Dorset

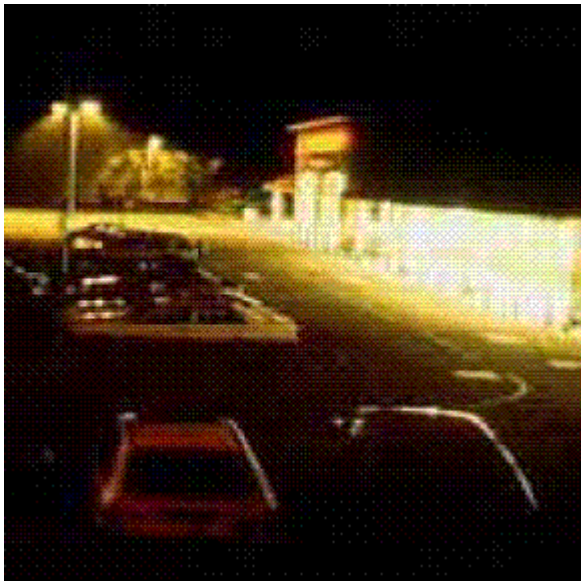
J Sainsbury received an award from the BAA Campaign for Dark Skies, for the car park lighting scheme at their superstore between the towns of Ferndown and West Moors. This is a fairly urbanised area, close to the Bournemouth-Poole conurbation, and it is therefore particularly important that the remaining pockets of countryside should retain their rural heathland character.

The superstore is next to the A348 in an area of undulating heathland characterised by extensive birch- pine woodland. The site has the advantage of being relatively enclosed by existing vegetation.

The lights are positioned within planting beds and are designed to provide light for both pedestrian and vehicular traffic. They consist of luminaires with full horizontal cut-off mounted on 10m high steel columns which are spaced at approximately 30m intervals. The height of the columns reduces the need for a high density and the apparatus is painted black to avoid reflection in the sun.

The lamps are high pressure sodium and the luminaires designed to prevent light spill during the hours of darkness. When the supermarket is closed, a selected minimum of lights remains lit, maintaining a balance between safety requirements and the need to prevent over-lighting. The existing trees on the edge of the site provide a backdrop which helps to limit light spill while also containing and integrating the lighting columns visually within the wider landscape.

This simple, sophisticated car park lighting scheme at J Sainsbury's superstore at Ferndown has minimal environmental impact.



Night time at J Sainsburys Ferndown superstore showing the minimal environmental impact of the lighting scheme. (Reproduced with the kind permission of Bob Mizon)

9.4 Farms and Market Gardening

Many large farms have lighting to assist with evening working, particularly during winter months. Increasingly, they also have security lighting. Lighting may be used to bring on horticultural produce in some of the larger market gardening complexes.

Issues and Good Practice for Lighting Farms and Market Garden Centres	
Component Lighting Elements	**Principles for Good Practice**
Security Lighting - most lights are attached to buildings wherever convenient. They are installed by the property owner and all the problems of domestic security lighting are relevant, although often on a larger scale, and the lights may be particularly intrusive as farms may be in remote and largely undeveloped countryside;	• Mount lights below the roof height of buildings and direct light downwards, to where it is needed;
Working Lights - these are associated with routine activities, such as milking, which must continue year round;	• avoid use of sensors which can be tripped by animals; • as far as possible, position lights so that they are shielded by buildings and are not visible
Glasshouse Lighting - this is for artificial control of photoperiodism in	

commercial crops.	from the surrounding countryside; • use internal blinds to screen glasshouse lighting; and • the potential impact of light from glasshouses should be considered at planning application stage.

9.5 Mineral Extraction

Lighting is installed for security, and to some extent for increasing the length of the working day, although most working operations are timed to fall within daylight hours.

Issues and Good Practice for Lighting Mineral Workings	
Component Lighting Elements	**Principles for Good Practice**
Security Lighting - this tends to be mounted on buildings in a rather sporadic fashion. Some lights are mounted on buildings and on parts of the plant. There is often an accumulation of different types of light and rarely any coordinated scheme; *Working Lights* - safety is of paramount importance so mineral extraction is confined to daylight hours, but working lights are used in delivery areas, or where routine operations, such as washing down, are carried out.	• Mount lights below the roof height of buildings and perimeter fencing and direct light downwards, to where it is required; • position lights so that they are shielded by buildings or permanent plant and are not visible from the surrounding countryside; • avoid lights mounted on the side of buildings which shine directly out, dazzling users of the facility.

9.6 Decorative Building Lighting

Historic buildings, or those of architectural importance, may be floodlit. Floodlighting is generally concentrated in urban areas, but insensitively designed floodlighting schemes on buildings in the countryside may sometimes seem intrusive.

Issues and Good Practice for Decorative Building Lighting	
Component Lighting Elements	**Principles for Good Practice**

Decorative Lights - historic buildings, or those of architectural merit, may be lit by decorative lights. However, many are positioned to create a wash of light across the whole building, obliterating architectural detail and colour, rather than enhancing the character of the building. Decorative building lighting may cause light pollution if the equipment used is not designed and positioned with care.	• Keep lighting understated and aim to enhance rather than swamp architectural character. • Consider timing of lighting - only on special occasions? • Direct light carefully, minimising uplighting where it distorts architectural detailing and design lighting scheme to prevent light pollution.

Waddesdon Manor, Aylesbury, Buckinghamshire

Waddesdon Manor, a nineteenth century chateau originally built for Ferdinand de Rothschild, has received top awards in the Lighting Design Awards '96 for its stunning exterior architectural lighting schemes. The newly installed lighting is designed by M Pierre Bideau, who has been responsible for lighting many of the Loire Chateaux, as well as the Eiffel Tower.

The exterior lighting scheme lends drama to this important historic building, highlighting its architectural detail and interpreting its inherent character. In concept, the lighting scheme is closely linked to the landscape setting of the Manor, and in particular to the sequential approach to the front entrance. Visitors arriving from the south catch a glimpse of the Manor on the hill above, before entering a long, curving drive which is enclosed by trees. The new lighting emphasises this sequence, adding accents and elements of surprise along the way. The Manor itself is transformed from its daytime appearance as the lighting enhances attractive minor details and gives a new depth and vitality to the architecture. In the gardens, the fountains and sculptures take on a magical, mythical quality.

The new lighting is intended for occasional use, to add a festive sense of drama to the building and its grounds when it is used for functions and events. Different zones of the lighting system can be isolated as required and the effect of the whole scheme is designed to change as the sky darkens from dusk onwards.

The lighting equipment is remarkably unobtrusive; the luminaires are discreet in size, character and colour and are recessed or hidden by existing structures. The scheme therefore complements and enhances the Manor without compromising its historic importance or conservation value.

9.7 Village Centres

Lighting within rural villages has generally been installed in response to a demand for a safer,

more secure streetscape. However, it may also be part of a holistic approach to village refurbishment, perhaps as part of a wider amenity enhancement scheme to promote tourism in conservation areas. A variety of lighting equipment is used, including standard street lighting and security lights mounted on buildings.

9.8 Residential Development

Small housing estates and linear developments are common as infill housing within rural villages. Many are lit, even though the rest of the village may be relatively dark.

Issues and Good Practice in Lighting Residential Developments	
Component Lighting Elements	**Principles for Good Practice**
Road Lighting - standard road lights may be used, even if the size and scale of the development doesn't warrant full lighting. These residential developments tend to be on the edges of villages and may have a significant impact on the surrounding landscape.	• Consider whether lighting is required at all, and where it will be most effective; • keep lighting in new residential areas in balance with that of the village as a whole and lighting on adjacent road junctions; • consider views from surrounding countryside and avoid a line of lights, defining the edge of a village.
North End Land, Great Malvern, Hereford and Worcester This residential road on the eastern edge of Great Malvern has recently been widened and extended to provide access to a new business park and housing estate. The new developments were expected to increase traffic flows and an upgrade of the road lighting was therefore carried out as part of the road widening scheme. Low pressure sodium lamps were installed on 10m high lighting columns. However, the new lighting was unpopular with local residents, who felt that it was intrusive and out of character with the area. Some also complained of light spill into their back gardens. The residents formed a campaign group and eventually persuaded the county council to remove the 10m columns over a 500m length of the road. The replacement lighting comprises 8m columns with high pressure sodium lamps and horizontal cut-off luminaires which minimise the upward spill of light into the night sky and provide better control and direction of the light beam at lower levels. The new lighting installation at North End Lane demonstrates that	

pressure from members of the public can be an effective catalyst for improving the environmental impacts of a lighting scheme in a residential area.

9.9 Road Junctions and Accesses

Rural road junctions and accesses are lit for reasons of safety. Lighting is usually designed to achieve at least the minimum light levels stipulated in the British Standard, and high pressure sodium lamps with horizontal cut-off luminaires are the most common specification. However, some authorities are experimenting with lighting that does not meet British Standards. For instance, Gloucestershire County Council has used single point light sources at junctions with accident problems, intending to warn drivers of a hazard rather than to fully light the junction. Similarly, Cambridgeshire County Council has installed low-level lighting on chevron signs on a mini-roundabout which is only 1.5m above the surface of the road.

Issues and Good Practice for Lighting Road Junctions and Accesses

Component Lighting Elements	**Principles for Good Practice**
Road Lighting - standard road lights are used for most junctions, with both high and low pressure sodium lamps; lights are controlled automatically by photo-electric switches. The density of columns is often excessive and many junctions are overlit in relation to their `dark' rural setting. The transition from the lit junction to the surrounding countryside may be dangerous. The character of the wider landscape is an important influence and trees and hedgerows may be important in helping to contain the light.	• Keep number of columns to a minimum - a single column may be sufficient on many small roundabouts; • consider colour of lighting columns in relation to surrounding landscape, ie use a dark colour if the columns are set against backdrop of vegetation; • give priority to the use of high pressure sodium lights which give some degree of colour rendition, and to the use of luminaires with full horizontal cut-off, wherever a lit junction is necessary; and • carry out a visual appraisal and design lighting scheme to minimise visual intrusion of light at night and of structures by day.

Stanton Harcourt Roundabout, Oxfordshire

This small roundabout is in a farmland landscape on the outskirts of a picturesque Oxfordshire village. It was constructed in 1983 for safety

reasons as the road is regularly used by lorries carrying sand and gravel from gravel pits nearby. The village residents and local parish council oppose lighting in the village itself and objected strongly to lighting on the new roundabout. The local authority therefore adopted a flexible approach and initially only the chevrons on the roundabout were lit. However, these lights were regularly vandalised and the county council resorted to the original plan for full scale lighting columns, to ensure safety at the junction. Again the local residents objected and the resulting lighting installation is a negotiated compromise.

The roundabout is lit in a simple, relatively unobtrusive way. Four high-pressure sodium lamps are mounted on a single 8m grey lighting column which is positioned in the centre of the roundabout. The surrounding farmland has a relatively open character and the lighting column is visible at close quarters but seems unobtrusive in views from the village as it appears to blend with other elements in the landscape, such as telegraph poles.

The single light source at Stanton Harcourt roundabout does not provide sufficient illumination to meet the full requirements of BS 5489, but the level of illumination is a compromise, agreed by the local planning authority and local residents. It is a minimal lighting scheme which demonstrates the potential for local residents to influence the design of road lighting.

9.10 Petrol Filling Stations

These are always lit, with a proportion of the lights remaining on throughout the day. Much lighting is associated with promoting the station, and giving a driver sufficient warning to pull in. Security is also important, for the public using the forecourt at night, and to protect equipment and cars in adjacent parking and workshop areas.

Issues and Good Practice for Lighting Petrol Filling Stations	
Component Lighting Elements	**Principles for Good Practice**
Canopy Lighting - overhead canopies generally provide cut-off to lights, preventing any light pollution. The best examples have unobtrusive, minimal lighting, fully recessed into the canopy. It can be very effective at night, without causing any light pollution. However, older stations often also have fluorescent tube lighting and in many instances this is left on throughout the day;	• Canopy lights should be positioned to avoid light spill from the sides of the canopy; • the use of dish diffusers causes some additional glare and should be avoided in rural areas; • reduce lighting or avoid it during daylight hours; • integrate design for promotional signage with that of the canopy,

Signage and Promotion - signs are generally positioned at the entrance to the garage alongside the carriageway. In the past they were often quite garish, but increasingly signs are not lit and many are designed to minimise their visual intrusion. Additional signage may be included on the canopy and at the public entrance to the building itself. Sometimes this is placed on the canopy, away from the road, and may be visible from surrounding countryside; *Security Lighting* - security lighting tends to be rather disparate, with a collection of different types of light mounted on walls and often the roof of buildings and sheds adjacent to the principal buildings. Car parks in these areas are often lit by floodlights.	but ensure signs on canopies do not cause additional light spill; • avoid lighting internal fascia around canopy; • design and position signs so that they are visible only from the carriageway and not from the surrounding landscape; • co-ordinate security lighting to minimise accumulation of daytime structures; and • direct lighting to where it is needed and design apparatus to control levels of light spill and glare.

9.11 Railway Stations and Road/Rail Interchanges

Rural railway stations are often outside the village or town that they serve and the lighting on the platforms, at the entrance to the station building and in the adjacent car parks may therefore have a significant impact on the surrounding countryside. New road/rail interchanges are likely to be proposed as a result of rail privatisation and are likely to be extensive and in rural locations.

Issues and Good Practice for Lighting Railway Stations and Road/Rail Interchanges	
Component Lighting Elements	**Principles for Good Practice**
Entrance Lighting - most rural stations have some additional lights at the entrance to the station. In some instances these are over-bright and set a precedent for intense lighting throughout the wider station area; *Car Park/Security Lighting* - floodlights are typically mounted on tall columns and there may be several lights on one column,	• Design the lights for the station as a whole, balancing the need for lighting in different areas and considering the impact of light in views from the surrounding countryside; • concentrate on lighting to enhance the architectural character of the station building (which is often attractive) rather than on creating an `urban' level of light on the platform and in the station forecourt;

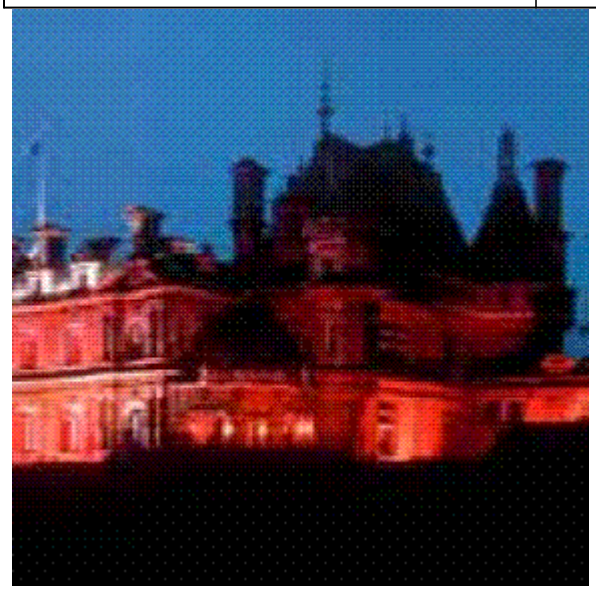
angled to cover as wide an area as possible. The equipment available gives scope to direct light efficiently, but the areas of tarmac may be extensive and the height of the columns and daily need for lighting mean that there is considerable potential for pollution; *Platform Lighting* - most is intense and tends to be prominent as platforms are often relatively elevated; *Marshalling Yard Lighting* - only found in the larger stations, but where lighting does occur it is extremely bright. Floodlights are generally mounted on high columns and the light is directed downwards, towards the tracks and railway equipment.	• direct car park and security floodlights downwards and to where the light is required; • design floodlights to minimise light pollution; and • consider use of a larger number of lights mounted on lower columns if the station is in a relatively prominent site.

9.12 Rural Car Parks

Car parks are becoming increasingly common in the countryside. Many are very small and remain unlit but larger rural car parks, at country parks, visitor centres and park-and-rides, are considered to be a high risk for vandalism and may have lighting schemes to enhance the safety and security of both pedestrians and parked cars.

Generic Issues and Good Practice for Lighting Rural Car Parks	
Component Lighting Elements	**Principles for Good Practice**
Car Park Security Lighting - the scale of the scheme and the height of the lighting columns will depend on the size of the car park; large park-and-ride car parks may have floodlights mounted on tall masts, while a small visitor centre may have only a few low-key lights. Both floodlights and street-lamp style lights are commonly used.	• Direct lighting downwards and design equipment to control levels of light spill and glare; • car park lighting should fall within the levels recommended in the ILE Guidance for rural zones E1 and E2; • site lighting equipment carefully, making use of the backdrop provided by any existing vegetation and introducing new planting within the car park to help integrate the lighting

	structures and minimise the visual impact of both equipment and lighting; and • consider views from the surrounding countryside and give special attention to the car park boundaries, using new hedgerow or tree planting to help minimise the impact of car park lights on the wider landscape.



Waddesdon Manor at Night, South Front (Reproduced with the kind permission of the Country Life Picture Library, the photographer June Buck and the National Trust, Waddesdon Manor)

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10. Action on Lighting in the Countryside

This guide is intended to assist a wide range of players in preventing and alleviating the growing problems caused by excessive lighting in the countryside, and to complement existing advice on lighting and the environment. It has examined the historical context and development of the patterns of lighting that we see today, and explained the basic principles of light and lighting for those to whom they may be unfamiliar. It has highlighted the reasons why lighting may give rise to problems, and examined its effects on people, wildlife and countryside character. As well as the direct effects of light pollution, one of the most serious issues is the incremental and cumulative impact on the dark skies and tranquillity of the English countryside, qualities that are increasingly rare, but highly valued.

10.1 The Role of the Good Practice Guide

Lighting in itself is not a problem; it only becomes a problem where it is excessive, poorly designed or badly installed. Better use of the planning system to influence lighting proposals; greater awareness of the potential adverse impacts of light amongst developers, manufacturers, retailers and the general public; and improved lighting design and landscape design are among the most important ways of tackling issues of overlighting.

The planning system offers much greater scope than is currently realised to control, guide and influence lighting associated with new development. The research shows that with the exception of domestic security lighting (which cannot readily be brought within planning control), most of the lighting that gives rise to problems is associated with new development that does require planning permission. More effective development plan policy and development control practice, therefore should be able to achieve a great deal. We hope that this guide will assist in that process by giving planning officers advice on good practice drawn from the experience of other authorities; and countering the complex and technical nature of light and lighting design.

Developers of a lighting scheme also have a vital role to play in addressing lighting issues, and need to have a clear understanding of planning controls and procedures. Although lighting has many benefits, the guide suggests that the questions of lighting need and alternatives should be considered much more critically than they have been in the past, and that environmental considerations should be given greater weight. Environmental assessment, although not a formal requirement for lighting schemes, can help to highlight potential problems at an early stage. In most instances, problems that may arise can then be successfully resolved during the design process, thus permitting the development to proceed smoothly and swiftly. The guide outlines how a basic environmental assessment can be carried out.

For all but the simplest lighting scheme, professional advice, whether from the lighting manufacturer or from a qualified lighting engineer/designer, is recommended. The range of lighting standards and lighting products on the market today is very broad. The good practice guide summarises the main standards and describes in broad terms the types of lighting equipment that will be appropriate for different lighting purposes. This information should be particularly useful to planners, developers and members of the public who are unfamiliar with lighting equipment and options, and wish to take an informed view. Heightened public

awareness and expectations should encourage manufacturers of lighting equipment to produce and sell high quality lighting products with good light control abilities.

The material that we have presented on lighting issues in practice contains many practical pointers about the planning, siting, layout and design of lighting installations, and is accompanied by case studies that illustrate specific ideas and lessons. It should form a useful point of reference for all those involved with rural lighting schemes.

10.2 Action to Achieve Good Practice

If action on lighting in the countryside is to be effective, it will require the close cooperation and participation of all those involved in planning, designing and installing lighting schemes. The responsibility for tackling lighting issues is very much a shared one, which will need ongoing care and attention in years to come. As well as producing new lighting schemes of higher quality than in the past, there will also be opportunities to remove or redesign existing lighting that is inappropriate to a rural setting; these opportunities should be recognised and exploited wherever possible.

The principal actions that are needed to achieve good practice are summarised below:

- Local authority planners should recognise the cumulative impacts of lighting on countryside character and be more pro-active. They should consider the need for policies on lighting in the development plan, and for supplementary planning guidance to elucidate those policies. Through better awareness and understanding of technical lighting issues, they should be able to deal more effectively with planning applications that involve lighting, for instance by using planning conditions to prevent and control adverse impacts.

- Developers should look differently upon lighting than they did in the past, and should not automatically assume that it is a good thing. This implies a more critical assessment of lighting need and alternatives, and a greater willingness to consider the removal or upgrading of intrusive lighting. In judging the costs of lighting, they should take a long term view and give due weight to energy and maintenance costs as well as capital costs. Developers should also be aware of the benefits of specialist lighting expertise, and should seek professional lighting design advice for schemes of any complexity.

- Lighting engineers and designers should adopt a more structured approach to assessing the environmental impacts of lighting installations. The approach outlined in this guide is suggested as a model. In advising developers, lighting engineers and designers should be flexible in interpreting design standards, and should draw developers' attention to the environmental benefits and frequent long term cost savings of high quality equipment that gives good light control.

- Manufacturers and suppliers of lighting equipment should provide a design service that is as impartial and responsible as possible, and should focus increasingly on high quality lighting products, as these will be expected by planning authorities and the public. In relation to security lighting that is intended for DIY installation, retailers have a special responsibility to ensure that good information is available on how to choose appropriate equipment, minimise light levels, and control light pollution through good installation.

- Lastly, members of the public have a vital role in the control of light pollution. They are

responsible not only for most domestic security lighting, but also for much of the small scale lighting on commercial and business premises that does not need planning permission. They should take great care in the selection and installation of lighting equipment, and if in doubt, should always seek professional advice. In addition, they can contribute in other ways, for instance by participating in 'local lights' schemes and in the preparation of Village Design Statements that will influence lighting proposals in the locality.

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Bibliography

Appleton, J. *The Aesthetics of Landscape*, 1975

British Astronomical Association, *Domestic and Security Lights and the Night-time Environment*, 1993

British Standards Institution, *BS5489: Parts 1-12*, 1992:
- *Part 1: General Principles*
- *Part 2: Traffic Routes*
- *Part 3: Subsidiary Roads and Associated Pedestrian Areas*
- *Part 4: Single Level Road Junctions including Roundabouts*
- *Part 5: Grade-Separated Junctions*
- *Part 6: Bridges and Elevated Roads*
- *Part 7: Tunnels and Underpasses*
- *Part 8: Roads near Aerodromes, Railways, Docks and Navigable Waterways*
- *Part 9: Urban Centres and Public Amenity Areas*
- *Part 10: Motorways*

Chartered Institution of Building Services Engineers (CIBSE) Lighting Guides:

- LG1 The Industrial Environment, 1989;
- LG4 Sports, 1990;
- LG6 The Outdoor Environment, 1992

Chartered Institution of Building Services Engineers, *Healthy Workplaces: Guidance on Complying with 1992 Health and Safety Regulations*, 1993

Council for the Protection of Rural England/BAA, *Starry Starry Night: How to Keep Sight of the Stars*, BAA, 1993

Council for the Protection of Rural England, *Light Pollution (briefing paper)*, CPRE, 1996

Countryside Commission, *Environmental Assessment - The Treatment of Landscape and Countryside Recreation Issues*, 1991, CCP 326

Countryside Commission, *Trends in transport and the countryside. The Countryside Commission and Transport policy in England*, 1992, CCP 382

Countryside Commission, *The Suffolk Coast and Heaths Landscape*, 1993, CCP 406

Countryside Commission, *Design in the Countryside*, 1993, CCP 418

Countryside Commission, *Golf Courses in the Countryside*, 1993, CCP 438

Countryside Commission, *Landscape Assessment Guidance*, 1993, CCP 423

Countryside Commission, *Design in the Countryside Experiments* CCP 473, 1994

Countryside Commission, *Roads in the Countryside*, 1995, CCP 459

Countryside Commission, *Public Attitudes to the Countryside*, 1997, CCP481

CPRE, *Tranquil Areas in the North East and Tranquil Areas in the South East*, CPRE, 1993

Department of the Environment, *Environmental Protection Act*, 1990

Department of the Environment, *PPG1: General Policy and Principles HMSO*, 1992

Department of the Environment, *PPG1 (Revised): General Policy and Principles* TSO, 1997

Department of the Environment, *PPG2: Green Belts*, HMSO, 1992

Department of the Environment, *PPG7: The Countryside and the Rural Economy*, HMSO, 1992

Department of the Environment, *PPG7 (Revised): The Countryside - Environmental Quality and Economic and Social Development*. TSO, 1997

Department of the Environment and the Department for Transport, *PPG13: Transport*, HMSO, 1994

Department of the Environment, *PPG15: Planning and the Historic Environment*, HMSO, 1994

Department of the Environment, *PPG17: Sport and Recreation*, HMSO, 1991

Department of the Environment, *PPG19: Outdoor Advertisement Control*, HMSO, 1992.

Department of the Environment, *PPG23: Planning and Pollution Control*, HMSO, 1994

Department of the Environment, *Temporary Uses of Land, external lighting and miscellaneous amendments to the Town and Country Planning General Development Order 1988 (Consultation Paper)*, DOE, 1992

Department of the Environment *Circular 5/94 Planning Out Crime*, HMSO, 1994

Department of the Environment, *Preparation of Environmental Statement for Planning Projects that Require Environmental Assessment: A Good Practice Guide*, HMSO, 1995

Department of the Environment, *Circular 11/95 The Use of Conditions in Planning Permissions*, HMSO, 1995

Department of the Environment/MAFF, *Government White Paper, Rural England - A Nation*

Committed to a Living Countryside, DOE/MAFF, 1995

Department for Transport, *Appraisal of New and Replacement Lighting on Trunk Roads and Trunk Road Motorways TA49/86*, 1986

Department for Transport, *Design Manual for Roads and Bridges, Vol 10, Sections 1,2 & 3: Environmental Design - The Good Roads Guide*.

Department for Transport, *Design Manual for Roads and Bridges, Vol 11: Environmental Assessment*, Sections 1, Part 4, Chapter 15

English Heritage, *Street Improvements in Historic Areas*, 1993

English Nature, *Species Conservation Note: Impact of outdoor lighting on insect populations*, EN, 1994

Environmental Resources Management, *Environmental Capital for the Countryside*, The Countryside Commission, 1995

European Committee for Standardisation, *Road Lighting: Part 1: Selection of Lighting Classes*, ECS, 1995 IN DRAFT

European Committee for Standardisation, *Road Lighting: Part 2: Performance Requirements*, ECS, 1996 IN DRAFT

European Committee for Standardisation, *Technical Guidance Note Road Lighting* (CEN/TC 169/226/JWG/TGI) IN DRAFT

European Committee for Standardisation, *Traffic Signs, Technical Guidance Note* (CEN/TC 226/WG3/NI33E) IN DRAFT

Gibbs, N, '*Planning for darker skies', Lighting Equipment News pp20-21*, April 1995

Health and Safety Executive, *Lighting at Work*, Workplace Transport Safety: Guidance for Employees 38, 1987

Health and Safety Executive, *Workplace Health, Safety and Welfare*, 1992

Health and Safety Executive, *Workplace Transport Safety: Guidance for Employers*, 1995

Hertfordshire County Council, *Residential Roads in Hertfordshire*, HCC, 1990

Hill, D, *The Impact of Noise and Artificial Light on Waterfowl behaviour*, BTO Research Report No 61, 1992

Home Office Crime Prevention Unit, Paper No 28, *The Influence of Street Lighting on Crime and the Fear of Crime*, by Atkins S, Hussein, S and Storey A, 1991

Home Office Crime Prevention Unit, Paper No. 29, *The Effect of Better Street Lighting on*

Crime and Fear: A Review, by Ramsay M, 1991

Home Office Crime Prevention Centre, *Police Architectural Liaison Manual of Guidance*, 1994

Institute of Environmental Assessment and Landscape Institute, *Guidelines for Landscape and Visual Impact Assessment*, E & FN Spon, 1995

Institution of Environmental Health Officers, *Survey to Local Authorities on the Incidence of Light Pollution*, 1994

Institution of Lighting Engineers (ILE), *Guidance Notes for the Reduction of Light Pollution*, 1994

Institution of Lighting Engineers, *Lighting and Crime*, 1994

Institution of Lighting Engineers, *Technical Report No 5: Brightness of Illuminated Advertisements*, 1995.

Institution of Lighting Engineers and Chartered Institution of Building Services Engineers, *Lighting the Environment: A Guide to Good Urban Lighting*, 1995

International Commission on Illumination (CIE) Publications on:

- Guidelines for Minimising Urban Sky Glow near Astronomical Observatories (No 1) 1980;
- Guide to the Lighting of Exterior Working Areas (No 68) 1986;
- Guide for the Lighting of Sports Events for Colour TV and Film Systems (No 83) 1989;
- Guide to the Lighting of Urban Areas (No 92) 1992;
- Guide for Floodlighting (No 94) 1993;
- Glare Evaluation System for use within Outdoor Sports and Area Lighting (No 112) 1994;
- Recommendations for the Lighting of Roads for Motor and Pedestrian Traffic (No 115) 1995;
- Urban Sky Glow, A worry for Astronomy (x8 - Proceedings of a symposium of CIE TC 4.21) 1994

CIE Technical Report, *Guidelines for minimizing sky glow*, 4th DRAFT (TC 4.21) September, 1995

CIE Technical Report, *Guide on the limitation of the effects of obtrusive light from outdoor lighting installations*, 3rd DRAFT (TC 5.12) August, 1995

Jacoby R.E. and Pollard N.E., *The Lighting of Rural Roundabouts*, LITEC '94 Conference

Paper, Institution of Lighting engineers (ILE), 1994

Lothian Regional Council, *Standards for Development Roads*, LRC, 1992

New England Light Pollution Advisory Group (NELPAG), *From Internet*, 1995

Outen, A, Hertfordshire Environmental Records Centre, *The Possible Ecological Implications of Artificial Lighting*, 1995

Planning 1157, '*Special advertisement control areas put forward for abolition*', p28, 23 February 1996

Planning 1174, '*Council and conservationists combine to save advert regime*', p32, 21 June 1996

Pollard, N.E., *Lighting for Car Parks*, BPA Parking News, Issue 152, 1996, British Parking Association (BPA)

Pollard, N.E., *Floodlighting the Outdoor Environment*, 3rd European Conference on Energy-Efficient Lighting (IAEEL)

Pollard, N.E., *Sky-glow Conscious Lighting Design*, Lighting Research & Technology, Vol. 26, No 3, 1994, Chartered Institution of Building Services Engineers (CIBSE)

Public Health (Scotland) Act, 1897 Section 36 (1)

Royal Fine Art Commission *Lighten Our Darkness: Lighting our cities - successes, failures and opportunities*, 1994

Schreuder, Dr, *Quality Lighting-The Need to Cry over Spilled Milk* 3rd European Conference on Energy-Efficient Lighting, 1995 International Association for Energy-Efficient Lighting (IAEEL)

Sports Council, *Factfile 2: Floodlight for Sport*, 1993

Sports Council, *Guidance Notes: Floodlighting*, 1994

Sports Council, *Planning and Provision for Sport Factfile 2 Facilities*, 1994

The Scottish Office, *Roads, Bridges and Traffic in the Countryside*, 1992

UK *Government Sustainable Development: The UK Strategy*, HMSO CM 2426, 1994