

From: [REDACTED]
To: [Norfolk Boreas](#)
Subject: Submission for Deadline 4
Date: 30 January 2020 19:00:42
Attachments: [CPRE Breckland District Night Lights..pdf](#)
[CPRE Document. What Is Light Pollution.docx](#)
[CPRE View.docx](#)
[guidance-notes-light-pollution-2011 \(1\) \(1\).pdf](#)

Dear Planning Inspector,

As a resident of Necton, [REDACTED] overlooking the area proposed for the extension to the existing National Grid sub-station for Norfolk Boreas, I am concerned about the almost certain effect of 'Light Pollution' having experienced this during both construction and subsequent operation of the Dudgeon sub-station. My concern includes the on-shore project sub-station proposed by the applicant for Norfolk Boreas (and the sister project Norfolk Vanguard) also to be built at Necton.

As a representative of the NSAG I attended the Accompanied Site Visit on 23-1-2020 and spoke to the Planning Inspector about some of my concerns while we were at the existing National Grid sub-station. In particular I pointed out a line of sight anomaly not mitigated for by the Dudgeon sub-station developers which gives some residents of St.Andrews Lane (including myself) a clear view of the sub-station from both within buildings and gardens. My reason for doing this was to raise the issue both with yourselves and the applicant to try and ensure the same did not happen should the Boreas project proceed to construction. From the reaction of the applicant's Landscape designer, it is apparent that such residents view points are not being considered. In any event, whether that be so or not, there is the wider issue of 'Light Pollution' over the whole area. And when considering this it should be noted that according to the Campaign For the Protection of Rural England (CPRE) map of Breckland Night Sky, the Breckland District is the 21st darkest district out of the 326 within England. See attached.

There follows an extract from the applicants Environmental Statement Chapter 30, Volume 1 defining a Dark Sky. There also follows another statement by the applicant clearly trying to say that the Necton area is not included in Norfolk's Dark Skies. This second statement is both incorrect and disingenuous.

Environmental Statement Norfolk Boreas Offshore Wind Farm 6.1.30 June 2019 Page 41

30.6.4.7 Dark Sky Areas 141. A Dark Sky Area is one with a low level of light pollution where the night sky can be observed for the purpose of star gazing or astronomy. The International Dark-Sky Association (IDA) describes the problem as: "light pollution is the result of outdoor lighting that is not properly shielded, allowing light to be directed into the eyes and the night sky. Light that shines into the eyes is called glare and light shining into the night sky above the horizon causes sky glow. Lighting can also cause light trespass when it is directed into areas that it is not wanted." (IDA, 2018)

142. The IDA officially recognises 8 Dark Sky Places and Reserves in the UK, none of which are located in Norfolk. However, the Dark Sky Discovery Partnership also lists a significant number of sites across the UK, of which three are located in Norfolk. Two are within the Norfolk Coast AONB. These are at Kelling Heath Holiday Park and Wiveton Downs (Norfolk Coast AONB, 2019) which are 28km and 36km (respectively) from the landfall area. The third is near Attleborough, which is 22km south east of the onshore project substation (Dark Sky Discovery, 2018).

I have included other documents from, and with the permission of, the CPRE regarding lighting.

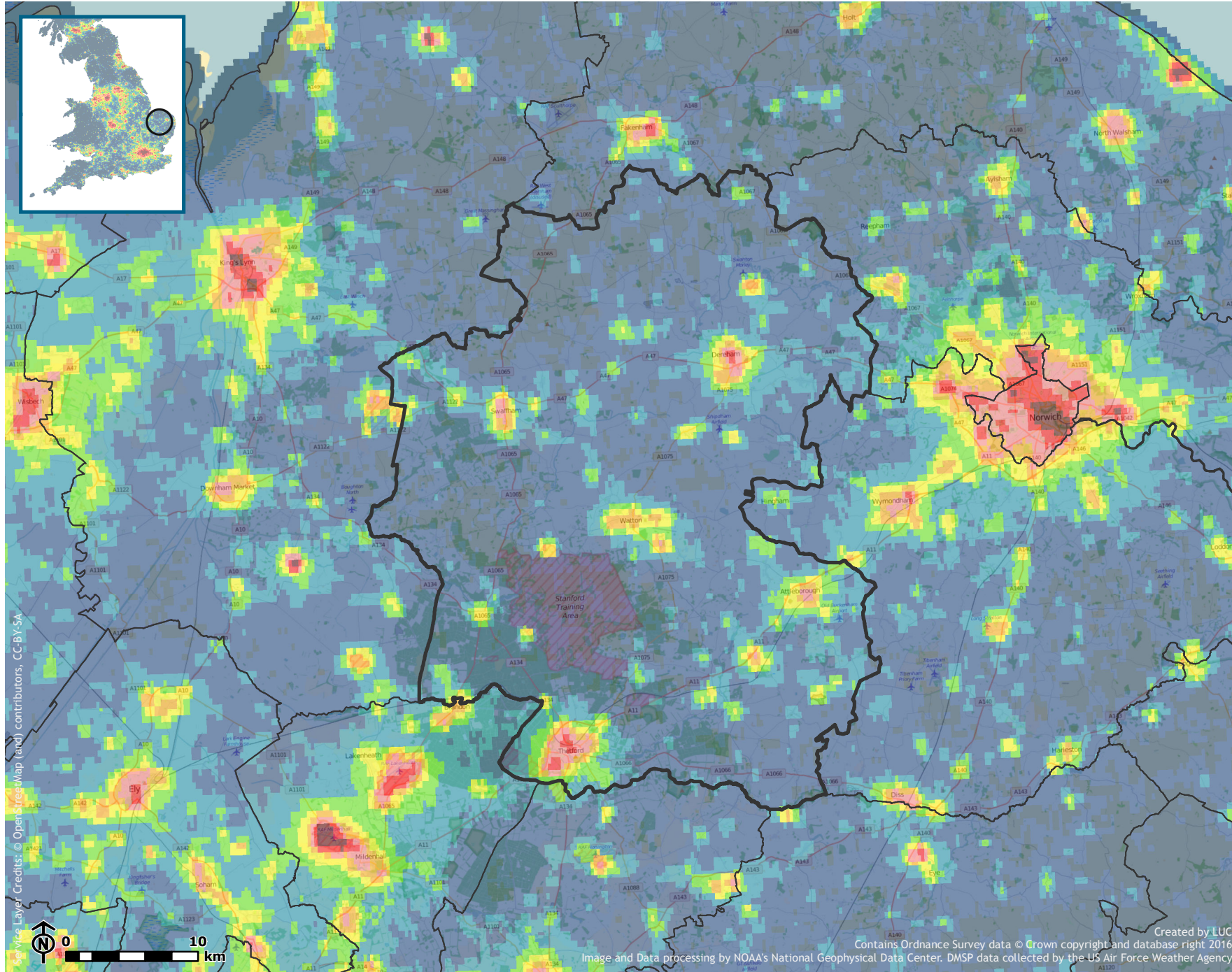
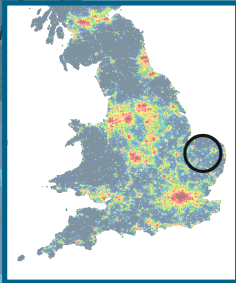
I would request these documents and the advice contained therein be considered by yourselves as a minimum requirement to avoid light pollution and as such be placed upon the applicant should the project proceed to granting of a DCO.

Regards,

Tony Smedley

For NSAG

Breckland District



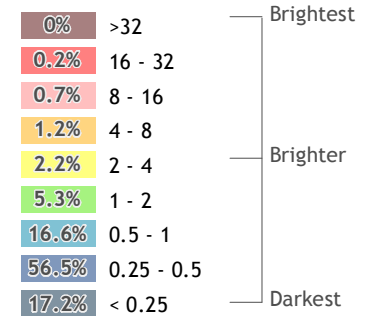
Key

Breckland

This is the 21st darkest district out of the 326 within England

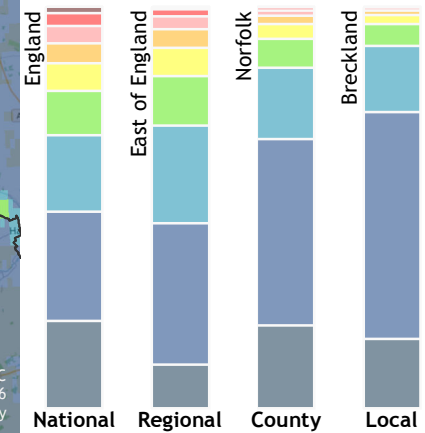
Night Lights

(NanoWatts / cm² / sr)



Each pixel shows the level of radiance (night light) shining up into the night sky. These have been categorised into colour bands to distinguish between different light levels. The percentage of pixels that fall within each band is shown as a % in the chart above.

Proportion of land covered by each Night Lights category at various extents



Service Layer Credits: © Open StreetMap (and) contributors, CC-BY-SA

CPRE View:

CPRE believes that darkness at night is one of the key characteristics of rural areas and it represents a major difference between what is rural and what is urban. Security lights, floodlights and streetlights all break into the darkness and create a veil of light across the night sky.

While CPRE agrees that some of this light is necessary, much of it is wasting energy, shining upwards where it isn't needed, spilling into homes, disrupting people's sleep and affecting the behaviour of wildlife. The quality of our lives and natural world is being diminished by light pollution, yet there are simple things that can be done to ensure light shines only where and when it is needed.

Light doesn't respect boundaries; it can spread for miles from the source and blurs the distinction between town and country. Light spilling up into the night sky is also a waste of energy and money - local councils were estimated to spend £613 million on street lighting in 2014-15 - and the lights can account for between 15-30% of a council's carbon emissions.

We're not saying there should be no artificial light at all, but it should be the right type of lighting and only used where and when it is needed. We want to see more done to ensure that our communities are lit in a responsible way, with local authorities considering how they can improve their approach to street lighting, ensuring that new developments are lit appropriately and that areas of existing dark skies are protected.

CPRE Document: What Is Light Pollution.

It's a sad fact that many children will grow up never seeing the Milky Way, our own galaxy, because of the impact of artificial light.

Light pollution is a generic term referring to artificial light which shines where it is neither wanted nor needed. In broad terms, there are three types of light pollution:

skyglow – the pink or orange glow we see for miles around towns and cities, spreading deep into the countryside, caused by a scattering of artificial light by airborne dust and water droplets

glare – the uncomfortable brightness of a light source

light intrusion – light spilling beyond the boundary of the property on which a light is located, sometimes shining through windows and curtains

There is increasing awareness of the impact that light pollution can have on wildlife, by interrupting natural rhythms including migration, reproduction and feeding patterns. Man-made light is known to cause confusion to migrating birds, often with fatal outcomes, and many of us will have heard birds singing late into the night in trees lit by a streetlight.

A survey by CPRE found that light pollution can cause a great deal of distress to humans too, including disrupted sleep, and in some cases has driven people to move house to get away from light pollution. Recent studies suggest that exposure to light at night can disrupt the body's production of melatonin, a brain hormone best known for its daily role in resetting the body's biological clock.

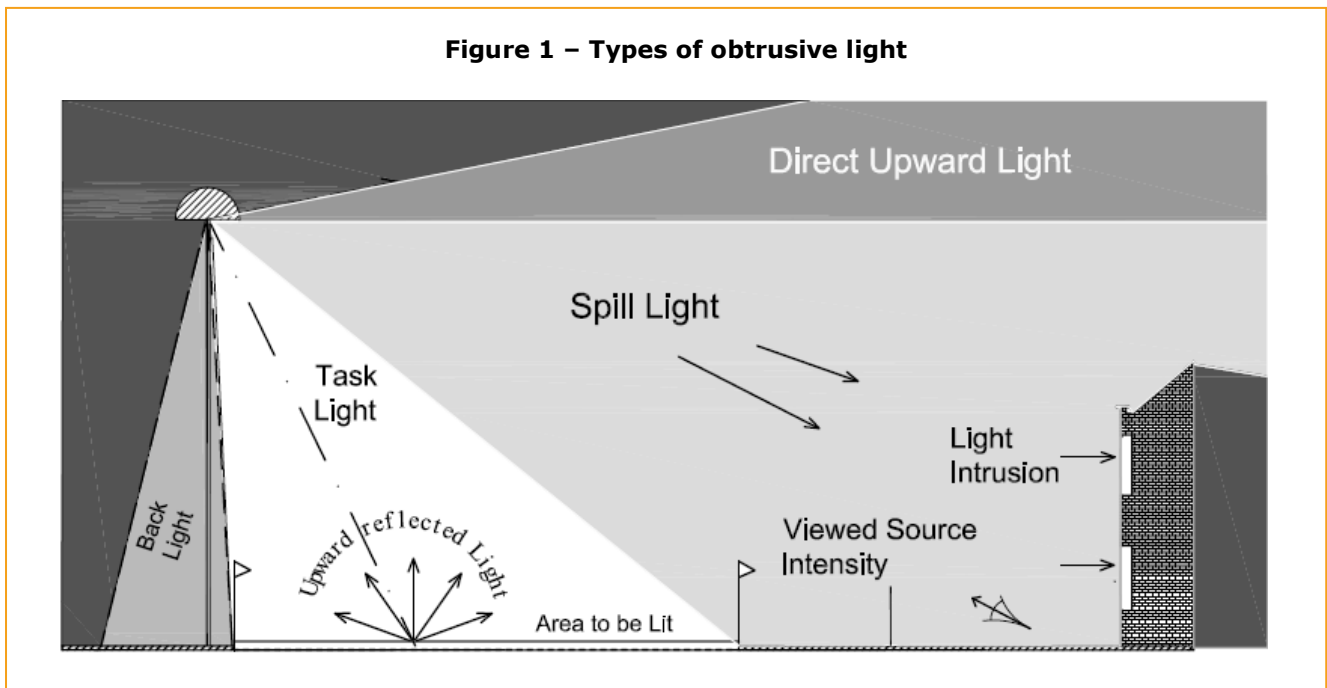
GUIDANCE NOTES FOR THE REDUCTION OF OBTRUSIVE LIGHT

“Think before you light - The right amount of light, where wanted, when wanted.”

Man's invention of artificial light has done much to safeguard and enhance our night-time environment but, if not properly controlled, **obtrusive light** (sometimes referred to as light pollution) can present serious physiological and ecological problems.

Obtrusive Light, whether it keeps you awake through a bedroom window or impedes your view of the night sky, is a form of pollution, which may also be a nuisance in law and which can be substantially reduced without detriment to the lighting task.

Sky glow, the brightening of the night sky, **Glare** the uncomfortable brightness of a light source when viewed against a darker background, and **Light Intrusion (“Trespass”)**, the spilling of light beyond the boundary of the property or area being lit, are all forms of obtrusive light which may cause nuisance to others and waste money and energy. Think before you light. Is it necessary? What effect will it have on others? Will it cause a nuisance? How can you minimise the problem?



Do not "over" light. This is a major cause of obtrusive light and is a waste of energy. There are published standards for most lighting tasks, adherence to which will help minimise upward reflected light. Organisations from which full details of these standards can be obtained are given on the last page of this leaflet.

Dim or switch off lights when the task is finished. Generally a lower level of lighting will suffice to enhance the night time scene than that required for safety and security.

“Good Design equals Good Lighting”

Any lighting scheme will consist of three basic elements: a light source, a luminaire and a method of installation.

Light sources (Lamps)

Remember that the light source output in LUMENS is not the same as the wattage and that it is the former that is important in combating the problems of obtrusive light.

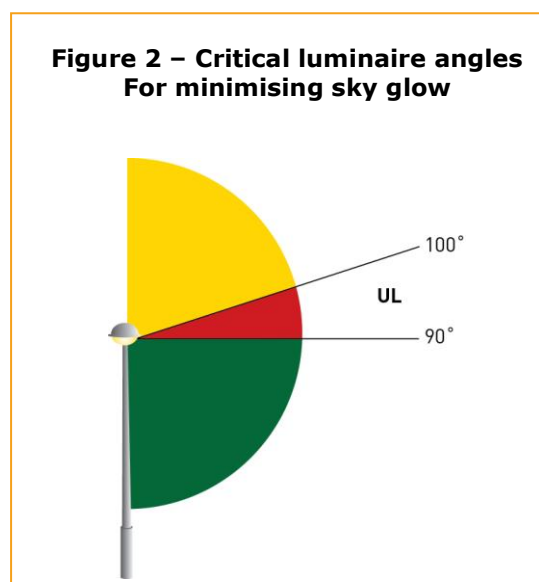
Most nighttime visual tasks are only dependant on light radiated within the visual spectrum. It is therefore NOT necessary for light sources to emit either ultra-violet or infra-red radiation unless specifically designed to do so. It is also understood that light from the shorter wavelengths of the spectrum has important effects on both flora and fauna that should be considered.

Research indicates that light from the blue end of the spectrum has important non-visual effects on the health of the human body, in particular in our sleep/wake patterns. It is therefore important to appreciate that while in obtrusive light terms the use of blue light should be minimised, there are many night-time tasks such as driving and sports where to be fully awake is an important aid to safety.

Luminaires

Care should always be taken when selecting luminaires to ensure that appropriate products are chosen and that their location will reduce spill light and glare to a minimum.

Use specifically designed lighting equipment that minimises the upward spread of light near to and above the horizontal. The most sensitive/critical zones for minimising sky glow are those between 90° and 100° as shown in Figure 2 and referred to as the lower, upward light output zone (UL).



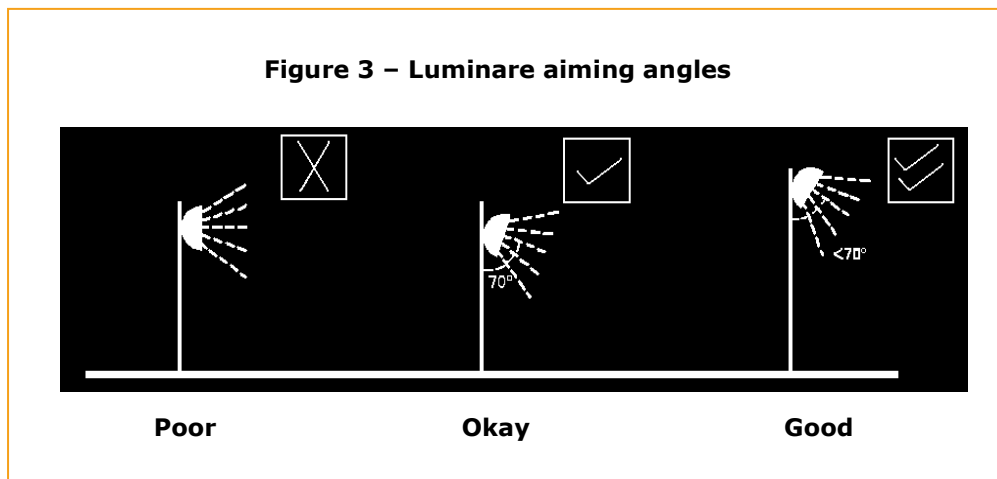
For most sports and area lighting installations the use of luminaires with double-asymmetric beams designed so that the front glazing is kept at or near parallel to the surface being lit should, if correctly aimed, ensures minimum obtrusive light.

Appendices 1 and 2 to these notes gives more details of how to choose and if necessary modify luminaires.

Installation

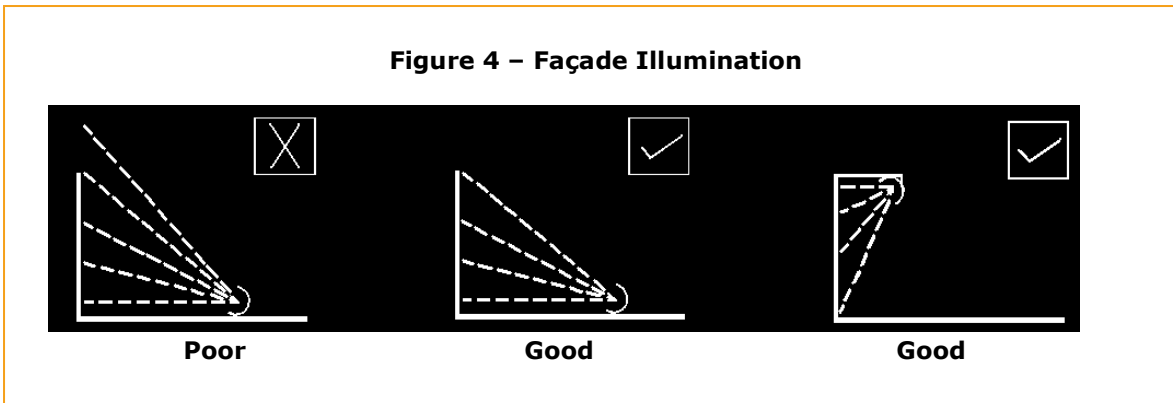
In most cases it will be beneficial to use as high a mounting height as possible, giving due regard to the daytime appearance of the installation. The requirements to control glare for the safety of road users are given in Table 3.

Keep glare to a minimum by ensuring that the main beam angle of all lights directed towards any potential observer is not more than 70°. Higher mounting heights allow lower main beam angles, which can assist in reducing glare. In areas with low ambient lighting levels, glare can be very obtrusive and extra care should be taken when positioning and aiming lighting equipment. With regard to domestic security lighting the ILP produces an information leaflet GN02:2009 that is freely available from its website.



When lighting vertical structures such as advertising signs, direct light downwards wherever possible. If there is no alternative to up-lighting, as with much decorative lighting of buildings, then the use of shields, baffles and louvres will help reduce spill light around and over the structure to a minimum.

For road and amenity lighting installations, (see also design standards listed on Page 5) light near to and above the horizontal should normally be minimised to reduce glare and sky glow (Note ULR's in Table 2). In rural areas the use of full horizontal cut off luminaires installed at 0° uplift will, in addition to reducing sky glow, also help to minimise visual intrusion within the open landscape. However in some urban locations, luminaires fitted with a more decorative bowl and good optical control of light should be acceptable and may be more appropriate.



Since 2006 “Artificial Light” has been added to the list of possible Statutory Nuisances in England, Wales and Scotland. The monitoring of such nuisances will be the responsibility of Environmental Health Officers (EHOs) for which separate guidance is being produced.

With regard to the planning aspect, many Local Planning Authorities (LPAs) have already produced, or are producing, policies that within the planning system will become part of their local development framework. For new developments there is an opportunity for LPAs to impose planning conditions related to external lighting, including curfew hours.

The Scottish Executive has published a design methodology document (March 2007) entitled [“Controlling Light Pollution and Reducing Energy Consumption”](#) to further assist in mitigating obtrusive light elements at the design stage.

ENVIRONMENTAL ZONES

It is recommended that Local Planning Authorities specify the following environmental zones for exterior lighting control within their Development Plans.

| Table 1 – Environmental Zones | | | |
|--------------------------------------|--------------------|-----------------------------|---|
| Zone | Surrounding | Lighting Environment | Examples |
| E0 | Protected | Dark | UNESCO Starlight Reserves, IDA Dark Sky Parks |
| E1 | Natural | Intrinsically dark | National Parks, Areas of Outstanding Natural Beauty etc |
| E2 | Rural | Low district brightness | Village or relatively dark outer suburban locations |
| E3 | Suburban | Medium district brightness | Small town centres or suburban locations |
| E4 | Urban | High district brightness | Town/city centres with high levels of night-time activity |

Where an area to be lit lies on the boundary of two zones the obtrusive light limitation values used should be those applicable to the most rigorous zone.

NB: Zone E0 must always be surrounded by an E1 Zone.

DESIGN GUIDANCE

The following limitations may be supplemented or replaced by a LPA's own planning guidance for exterior lighting installations. As lighting design is not as simple as it may seem, you are advised to consult and/or work with a professional lighting designer before installing any exterior lighting.

Table 2 – Obtrusive Light Limitations for Exterior Lighting Installations – General Observers

| Environmental Zone | Sky Glow ULR [Max %] ⁽¹⁾ | Light Intrusion (into Windows) E_v [lux] ⁽²⁾ | | Luminaire Intensity I [candelas] ⁽³⁾ | | Building Luminance Pre-curfew ⁽⁴⁾ |
|--------------------|-------------------------------------|---|-------------|---|-------------|--|
| | | Pre-curfew | Post-curfew | Pre-curfew | Post-curfew | Average, L [cd/m^2] |
| E0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E1 | 0 | 2 | 0 (1*) | 2,500 | 0 | 0 |
| E2 | 2.5 | 5 | 1 | 7,500 | 500 | 5 |
| E3 | 5.0 | 10 | 2 | 10,000 | 1,000 | 10 |
| E4 | 15 | 25 | 5 | 25,000 | 2,500 | 25 |

ULR = **Upward Light Ratio of the Installation** is the maximum permitted percentage of luminaire flux that goes directly into the sky.

E_v = **Vertical Illuminance in Lux** - measured flat on the glazing at the centre of the window.

I = **Light Intensity in Candelas (cd)**

L = **Luminance in Candelas per Square Metre (cd/m^2)**

Curfew = **the time after which stricter requirements (for the control of obtrusive light) will apply**; often a condition of use of lighting applied by the local planning authority. If not otherwise stated - 23.00hrs is suggested.

***** = **Permitted only from** Public road lighting installations

(1) Upward Light Ratio – Some lighting schemes will require the deliberate and careful use of upward light, e.g. ground recessed luminaires, ground mounted floodlights, festive lighting, to which these limits cannot apply. However, care should always be taken to minimise any upward waste light by the proper application of suitably directional luminaires and light controlling attachments.

(2) Light Intrusion (into Windows) – These values are suggested maxima and need to take account of existing light intrusion at the point of measurement. In the case of road lighting on public highways where building facades are adjacent to the lit highway, these levels may not be obtainable. In such cases where a specific complaint has been received, the Highway Authority should endeavour to reduce the light intrusion into the window down to the post curfew value by fitting a shield, replacing the luminaire, or by varying the lighting level.

(3) Luminaire Intensity – This applies to each luminaire in the potentially obtrusive direction, outside of the area being lit. The figures given are for general guidance only and for some sports lighting applications with limited mounting heights, may be difficult to achieve.

(4) Building Luminance – This should be limited to avoid over lighting, and related to the general district brightness. In this reference building luminance is applicable to buildings directly illuminated as a night-time feature as against the illumination of a building caused by spill light from adjacent luminaires or luminaires fixed to the building but used to light an adjacent area.

| Table 3 – Obtrusive Light Limitations for Exterior Lighting Installations – Road Users | | |
|---|---|-------------------------------|
| Road Classification ⁽¹⁾ | Threshold Increment (TI) | Veiling Luminance (Lv) |
| No road lighting | 15% based on adaptation luminance of 0.1cd/m ² | 0.04 |
| ME6/ ME5 | 15% based on adaptation luminance of 1cd/m ² | 0.25 |
| ME4/ ME3 | 15% based on adaptation luminance of 2cd/m | 0.40 |
| ME2 / ME1 | 15% based on adaptation luminance of 5cd/m ² | 0.84 |

TI = Threshold Increment is a measure of the loss of visibility caused by the disability glare from the obtrusive light installation

Lv = Veiling Luminance is a measure of the adaptation luminance caused by the disability glare from the obtrusive light installation

(1) = Road Classifications as given in BS EN 13201 - 2: 2003 Road lighting Performance requirements. Limits apply where users of transport systems are subject to a reduction in the ability to see essential information. Values given are for relevant positions and for viewing directions in path of travel. For a more detailed description and methods for determining, calculating and measuring the above parameters see CIE Publication 150:2003.

RELEVANT PUBLICATIONS AND STANDARDS:

| | |
|--|--|
| British Standards: www.bsi.org.uk | BS 5489-1: 2003 Code of practice for the design of road lighting – Part 1: Lighting of roads and public amenity areas BS EN 13201-2:2003 Road lighting – Part 2: Performance requirements BS EN 13201-3:2003 Road lighting – Part 3: Calculation of performance BS EN 13201-4:2003 Road lighting – Part 4: Methods of measuring lighting performance. BS EN 12193: 1999 Light and lighting – Sports lighting BS EN 12464-2: 2007 Lighting of work places – Outdoor work places |
| Countryside Commission/ DOE | Lighting in the Countryside: Towards good practice (1997) (<i>Out of Print but available on www.communities.gov.uk/index.asp?id=1144823</i>) |
| UK Government / Defra www.defra.gov.uk | Statutory Nuisance from Insects and Artificial Light – Guidance on Sections 101 to 103 of the Clean Neighbourhoods and Environment Act 2005 Road Lighting and the Environment (1993) (Out of Print) |
| CIBSE/SLL Publications: www.cibse.org | CoL Code for Lighting (2002) LG1 The Industrial Environment (1989) LG4 Sports (1990+Addendum 2000) LG6 The Exterior Environment (1992) FF7 Environmental Considerations for Exterior Lighting (2003) |
| CIE Publications: www.cie.co.at | 01 Guidelines for minimizing Urban Sky Glow near Astronomical Observatories (1980) 83 Guide for the lighting of sports events for colour television and film systems (1989) 92 Guide for floodlighting (1992) 115 Recommendations for the lighting of roads for motor and pedestrian traffic – Second Edition (2010) 126 Guidelines for minimizing Sky glow (1997) 129 Guide for lighting exterior work areas (1998) 136 Guide to the lighting of urban areas (2000) 150 Guide on the limitations of the effect of obtrusive light from outdoor lighting installations (2003) 154 The Maintenance of outdoor lighting systems (2003) |
| ILP Publications: www.theilp.org.uk | TR 5 Brightness of Illuminated Advertisements (2001) TR24 A Practical Guide to the Development of a Public Lighting Policy for Local Authorities (1999) GN02 Domestic Security Lighting, Friend or Foe |
| ILP/CIBSE Joint Publications | Lighting the Environment - A guide to good urban lighting (1995) |
| ILP/CSS Publications | Joint Code of Practice for the installation, maintenance and removal of seasonal decorations. (2005) |
| ILP/CfDS Joint Publication www.dark-skies.org | Towards Understanding Sky glow. 2007 |
| IESNA www.iesna.org | TM-15-07 (R) Luminaire Classification System for Outdoor Luminaires |

NB: These notes are intended as guidance only and the application of the values given in Tables 2 & 3 should be given due consideration along with all other factors in the lighting design. Lighting is a complex subject with both objective and subjective criteria to be considered. The notes are therefore no substitute for professionally assessed and designed lighting, where the various and maybe conflicting visual requirements need to be balanced.

APPENDIX 1 - PROPOSED OUTDOOR LUMINAIRE CLASSIFICATION SYSTEM

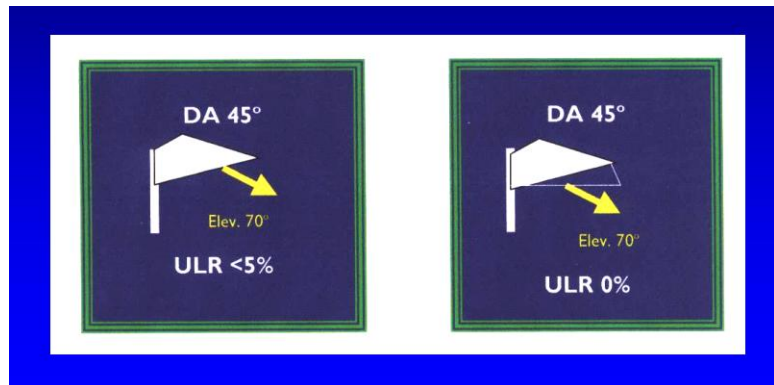
Variable Aim Luminaires – General Classifications:

| | | |
|----------|---------------------|--|
| ➤ Type A | Symmetrical | |
| ➤ Type B | Asymmetrical | |
| ➤ Type C | Double-Asymmetrical | |

Proposed labelling System:

Fixed Position luminaires

Variable Aim Luminaires
 (Shown here for a 45° Double-Asymmetric luminaire aimed at 70° – with and without a cowl).



APPENDIX 2 - ILLUSTRATIONS OF LUMINAIRE ACCESSORIES FOR LIMITING OBTRUSIVE LIGHT (images provided by Philips and Thorn)

Cowl (or Hood)



External Louvre



SHIELD



SHEILD "Barn Doors"



Double Asymmetric Luminaire



Simple Hood



Circular Louvre



Cowl & Louvre



Internal Louvre (horizontal)



Internal Louvre (vertical)

