South Derbyshire District Council

Planning & Lighting Design

A Guide to Help Developers Design out Light Pollution

Environmental Health

April 2017

1.0 Introduction

Many developments, particularly in the commercial and industrial sectors, need to include external lighting for customer convenience, operational safety and advertising. As well as being acceptable to visual amenity, planning authorities must also ensure that external lighting it not detrimental to the local amenity. This means that it mustn't be having a significantly adverse effect on protected species of wildlife or local human populations due to light pollution.

There are no legal standards for light pollution, but most local planning authorities refer to technical guidance issued by The Institution of Lighting Professionals (Guidance Notes for the Reduction of Obtrusive Light GN01:2011) as a way of setting measurable standards which developers must meet.

The ILP Guidance provides quantitative standards for sky glow, light intrusion (trespass), luminaire intensity and building luminance. Different standards apply to various classifications of environment - ranging from urban areas of high district brightness where additional light can be tolerated, to rural dark environments where even relatively small new lightly can be seriously disruptive.

It isn't easy for a developer with no understanding of lighting to know what product needs to be specified in order to meet the ILP Guidelines. As with any technical specialism, expert help should be sought where there is doubt. But we've pulled together some relatively simple advice to help small scale developers with no technical expertise.

2.0 Definitions

There can be a confusing variety of technical terms and measurements of lighting. These are the main ones for the purposes of development control.

Candela (cd)

Candela is the base measurement for describing **luminous intensity**. It tells you how bright the light source is which shows how far away from an object you can be and while still being able to see it. Any light source eventually becomes too dim to see the further away you are. This is different from lumens (a total light output) because it's the value of light intensity from any point in a single direction from the light source. Laser pointers or spot lights have the highest candela rating since the majority of their light is focused in a single direction. A simple comparison is that 1 candela is roughly equivalent to the light from a single candle. If you have a light bulb generating 1 cd and block part of the light, every direction not obscured still produces 1 cd

Lumen (lm)

Lumens are now the most common measurement for a light bulb. The lumen is a measurement of **luminous flux**, or the total amount of visible light. To put it simply, the lumen rating is how much total visible light is produced by a light source. To show the difference between lumens and candela, let's go back to the example previously used for candela with the partially obscured light bulb. For a bulb emitting 1 cd, that bulb would produce a luminous intensity of 12.57 lm. Obscuring half the bulb (making it a hemisphere instead of a full sphere), a 1 cd bulb will emit only 6.28 lm. This is because lumens measure the total amount of visible light from a light source.

Lux (lx)

Lux is a measure of **illuminance**, which is the amount of light on a surface per unit area. 1 lux is equal to one lumen per square meter. If the lamp displays its brightness as a measurement of lux, it usually lists a distance from the bulb since any change in distance or bulb type changes the lux level. As an example, if you place a

100 lumen bulb in a flood light that shines on only one square meter of surface, that surface will be lit at 100 lx. However, if you back the flood light away to shine on four square meters, the surface is now lit with 25 lx.

In summary

- Lumens are how much light is given off;
- Lux is how bright your surface will be;
- Candela measures the visible intensity from the light source.

Watts (W)

Historically, the power of a light source (expressed in Watts) has always been taken as a direct indication of the amount of light it generates. Given the different forms of available lighting products this is no longer the case. By way of example, a 6W LED can produce the same level of brightness as a 60W filament bulb and so referring to the power of a product alone gives no useful indication about its potential to cause light trespass.

3.0 Estimating Potential Light Pollution from Product Specifications

When planning authorities make an assessment of whether the impact of light is causing a nuisance we are interested in what the **illuminance** levels are at the location of the person or light sensitive protected species being effected – i.e. the measurement of lux at the location of adverse impact.

Unfortunately, for a developer buying a lighting product, it often won't give you enough information to tell you in straightforward terms what the illuminance levels at a given distance from the product will be.

So how can you tell if the product you are buying will meet our light trespass standards? Here's how:

First - work out how far away the nearest light sensitive location is to your proposed light source. This usually means the window of the nearest house.

Second - work out what ILP Environmental Zone classification your development falls within. The Zones are classified as follows.

Environmental Zone Class	Description of Surroundings	Examples
E0	Protected	UNESCO Starlight Reserves, IDA Dark Sky Parks
E1	Natural	National Parks, Areas of Outstanding Natural Beauty etc
E2	Rural	Village or relatively dark outer suburban locations
E3	Suburban	Small town centres or suburban locations
E4	Urban	Town/city centres with high levels of night-time activity

Generally, developments in South Derbyshire will be within Zones E1, E2 and E3. If you are in doubt about what Environmental Zone you are in you can have a look at the CPRE Light Pollution Map for Great Britain at http://nightblight.cpre.org.uk/maps/

Finally - Once you've identified the lighting product you want to install then you need to get the lighting specification of the product in order to estimate the illuminance at the nearest light sensitive receptor.

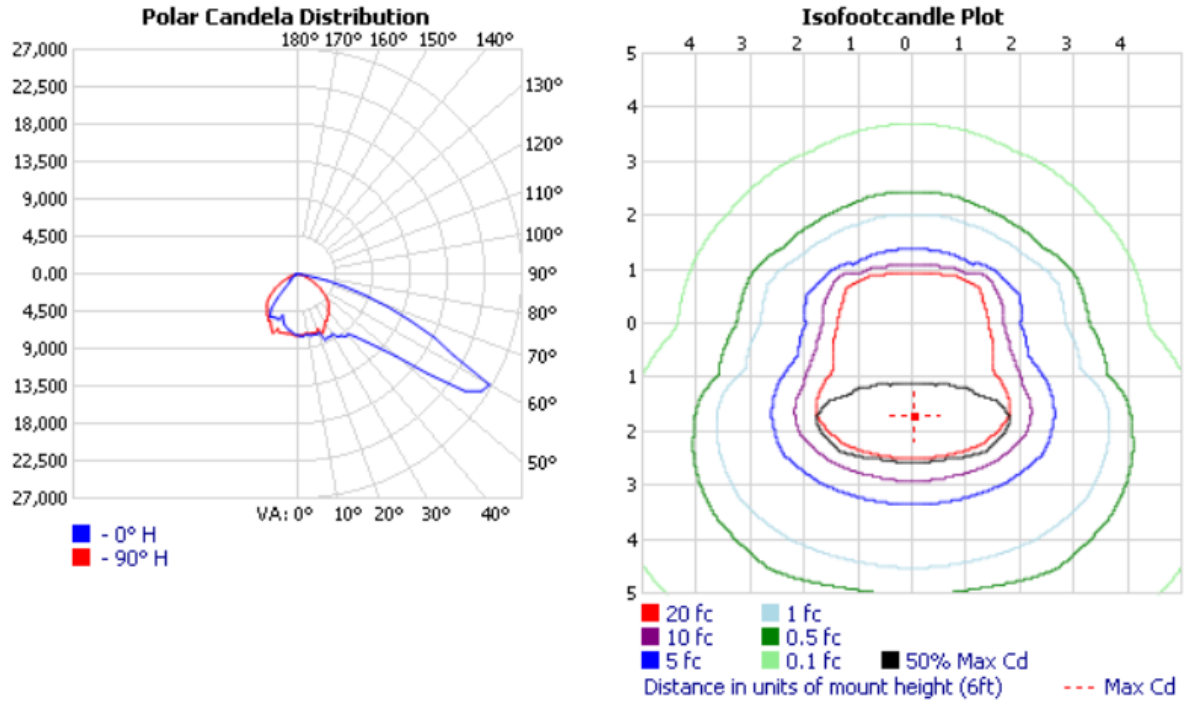
Most of the time simple retail products still only quote the wattage of the light. Not a problem. There are plenty of online calculation tools which can help you do a rough estimate of the light trespass provided you know the product type, wattage and distance from light to light sensitive location.

http://www.rapidtables.com/calc/light/watt-to-lux-calculator.htm

More specialist products will also provide detailed specifications including candela distribution plots. From these it is possible to estimate the light trespass based on the quoted luminous intensity (in cd) in the direction of the light sensitive location. Illuminance at a given distance can be calculated from the equation:

Lux (Ev) = Candela (Iv) / (distance from source to receptor)^2

https://www.compuphase.com/electronics/candela_lumen.htm



©Holophane

These relatively simple calculations should provide an indication about whether a lighting product is likely to cause a light trespass problem or not. If it is apparent from these calculations that there is a significant risk of detriment to amenity because of light trespass then we would suggest seeking technical advice. You can find local advisors through the Institute of Lighting Professionals. https://www.theilp.org.uk/home/

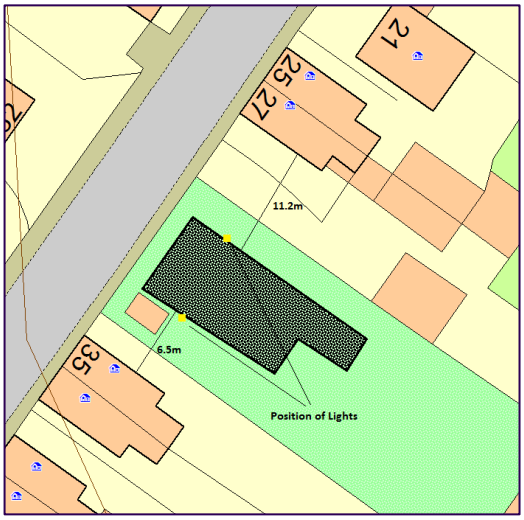
We've given an example of a quick lighting assessment below.

Example Calculation

A property developer wants to install external security lighting on a detached domestic build on the outskirts of a small rural town in South Derbyshire.

The lighting is proposed to be installed on two sides of the building with existing residential each side (see plan below).

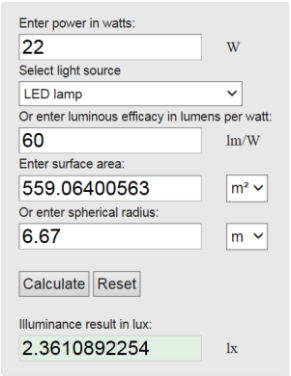
The nearest window is directly opposite the south façade of the new build at first floor level. The developer has identified a particular product from a high street retailer which he wants to install. From the retailers website, the product is a 22watt LED producing 1,800 lumens.



The distance from the proposed light location to the nearest building façade is 6.5m. As the nearest window is at 4m, the distance from light to window is **6.67m**.

The area being developed is best described as “Village or relatively dark outer suburban locations”, therefore it is classified as Environmental Zone E2. From the ILP guidance **the limits on light trespass are 5lux up until 23:00, and 1 lux in hours of darkness after 23:00**.

The light trespass calculation is shown. This estimates that the light will result in **2.26 lux** at the neighbouring window.



Based on the ILP guidance the light fitting will therefore be acceptable, but only until 23:00. Any later than this and the amount of trespass from the light is above the ILP guidance and it will need to be kept off.

In this case we would recommend that the developer find an alternative product which doesn’t exceed 1 lux.

The same online calculation tool can quickly be used to show that a 9watt LED light product will meet the standard.

Primary Source: https://blog.1000bulbs.com