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**Client**

Mr R Porritt

**Lighting Report**

3D modelling and light spill calculations at The Wood Shed, Godden Green.

**Rev B**

**Date** 25 January 2022

## Background

A small residential building, The Woodshed, has been constructed on land alongside Park Lane and close to the village of Seal, TN15 0JS.

The development has planning approval from Sevenoaks District Council (19/02020/FUL) subject to some Conditions.

Conditions 11 and 12 refer to the glazing, light spill and the SDC requirements for conformance to their Dark Sky policy shown in the ADMP policy document, section EN5.

SDC require evidence that these Conditions have been met.

Alan Tulla Lighting is an independent lighting consultancy specialising in the outdoor environment and has been asked to provide this evidence.

Rev B: Following comments (21 December) from SDC concerning additional measures to reduce light spill from the glazing, the client has changed the specification of the glass such that less light is transmitted to the outside. This report, Rev B, includes revised calculations and comment on the visual impact.

*Alan Tulla, FSSL, FILP, is a Fellow and Past President of the Society of Light and Lighting and has been awarded the CIBSE/SLL Lighting Diploma. He is also a Fellow of the Institution of Lighting Professionals, ILP and lectures for them on the topic of exterior and amenity lighting. He is author of the Society of Light and Lighting "Guide to the Exterior Environment", LG06.*

## Summary of scheme with reference to Policy EN5 and EN6

A full description of the scheme and isolux contour lines are shown later in this report.

**Para 2.35 of EN5** states that “Sevenoaks District as a predominantly rural area is sensitive to light pollution through sky glow which can affect the character of the countryside and have a negative impact on biodiversity”.

The Woodshed has no dormer windows or rooflights which could emit light directly upwards. Strictly speaking, from a technical viewpoint, some light is reflected off the floor and emitted upwards through the windows but this would be insignificant.

We are not aware of any particular ecological or wildlife considerations but our calculations show that lighting levels on the trees and foliage which border Park Lane are within ILP guidelines.

The horizontal spill light, both west and east, extends no further than 5m from the property.

Paragraph 2.35 also states that artificial lighting is essential “for reasons of safety and security”. Our report gives examples of typical outdoor fittings which could be used which do not emit any upward light. These could be used on the access path and car park.

**Policy EN6** refers to outdoor lighting. As well as minimising the impact on the night sky, this policy also recommends the use of time limited and user activated lighting. This can easily be accomplished by the use of movement sensors/PIR. The Policy also recommends the use of low energy lighting. All the luminaires recommended in our report use LEDs which are much more efficient than other sources such as fluorescent or incandescent.

### **Conclusion**

The building, as it stands, fully meets the lighting requirements of SDC policies EN5 and EN6. The minimal amount of spill light on the tree line parallel to Park Lane is also within the guidelines of the ILP and Bat Conservation Trust.

## Description of the 3D model

A 3D model of the house is used to calculate illumination on the horizontal and vertical calculation “surfaces” or planes of any ecologically sensitive areas.

We have calculated the spill up to 10m away from the house. Note that there are no windows on the north or south faces.

It is standard practice for these calculated illumination plots to be “worst case”. I.e. based on all the lighting inside the rooms facing these areas being switched on at the same time.

Similarly, the windows are treated as clear openings in the fabric of the building. I.e. without the mitigating effects of any curtains or blinds. The glass used in the calculations is as specified by the client.

You can see from the datasheet below that double glazing is used which has a bronze finish. This has a Light Transmission of 56% and thus meets the recommendations given by the UK Dark Skies Partnership document “Towards a Dark Sky Standard”. This recommends a Light Transmission of 40 – 65% for “Large continuous domestic glazing”. This compares with a typical value of 90% transmission for clear glass which was used in our earlier calculations.

We have assumed that the interior decoration of the three rooms is pale in colour, typically with reflection values of 50%, 70% and 20% for the walls, ceiling and floor respectively. A pale wall and ceiling will reflect more light through the window than darker finishes.

Note that for a given size of window, the amount of spill light outside is directly proportional to the illumination level inside. The model is based on the living room being lit to 150 lux, the bathroom 200 lux and the bedroom 50 lux. These are typical values for residential properties. We have used generic ceiling recessed downlights to provide the lighting. Suspended light fittings or spotlights opposite the windows are likely to direct more of the light outside.

We have assumed there is no spill light from the basement cinema room. Similarly, there are no windows on the north and south faces of the house and hence no spill in these directions.

## **Interpretation of the calculated results**

The Bat Conservation Trust and the ILP Guidance Note 08 “Bats and Artificial Lighting in the UK” both recommend a maximum illumination level of 0.5 lux along bat foraging routes.

As a comparison, 0.5 lux is also generally taken to be the illumination level received from a full moon on a cloudless night. Streetlighting in residential areas is generally 3 – 5 lux.

### Eastern boundary

The calculated results show that horizontal illumination levels reduce to below 0.5 lux approximately 5m from the house.

### Western boundary

Here, the 0.5 lux limit is even closer to the house because the windows facing this direction are smaller than on the east.

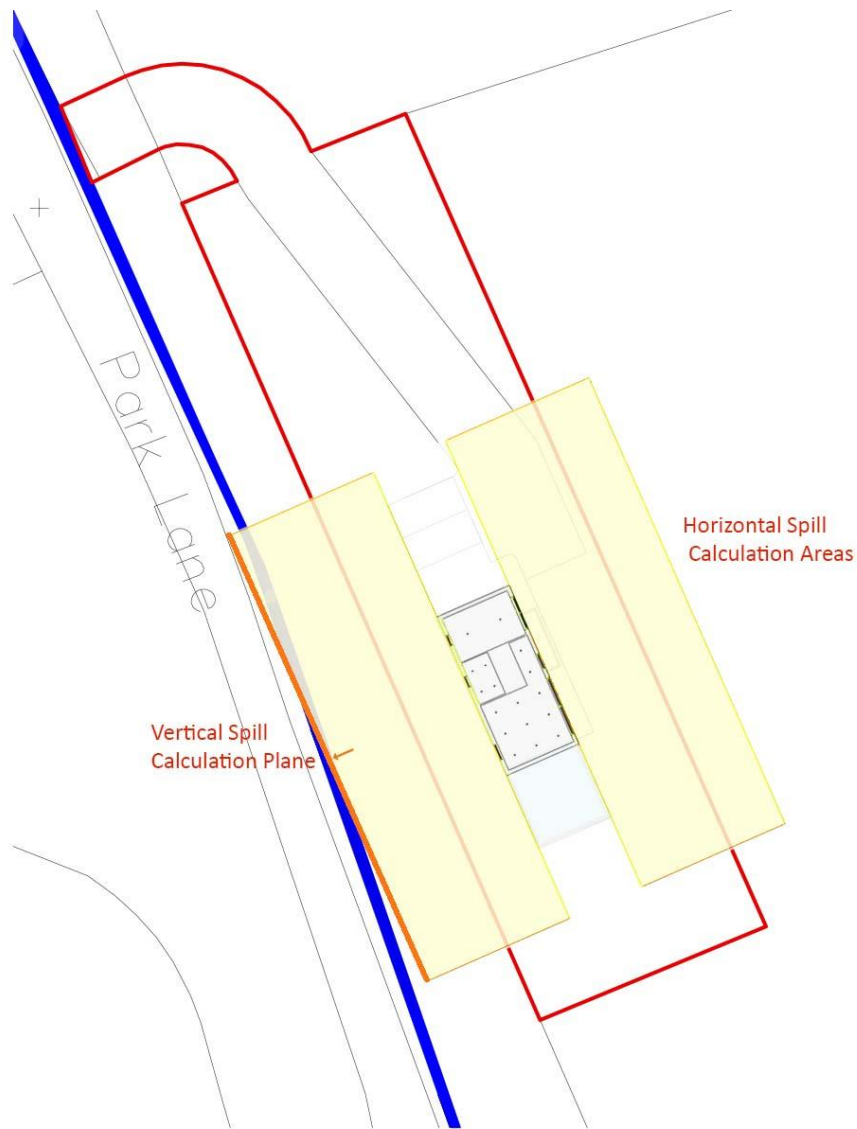
We are unaware of any foraging routes in the hedge and treeline alongside Park Lane but you can see from the vertical calculation plane that the illumination is well below the recommended upper limit of 0.5 lux.

## **Mitigation measures**

In accordance with EN5, any external lighting should not emit any upward light. For example, bollards should be used for the car parking. Similarly, recessed step lights can be used to access the basement.

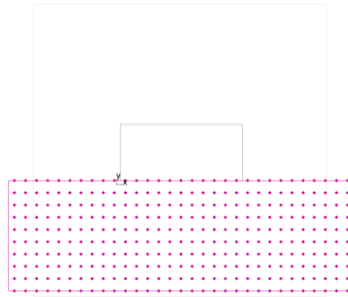
Passive infra-red, PIR, movement sensors can be used for the access path and parking area. In this case, we recommend that the ON time is kept fairly short, approximately one to two minutes.

## Calculated results

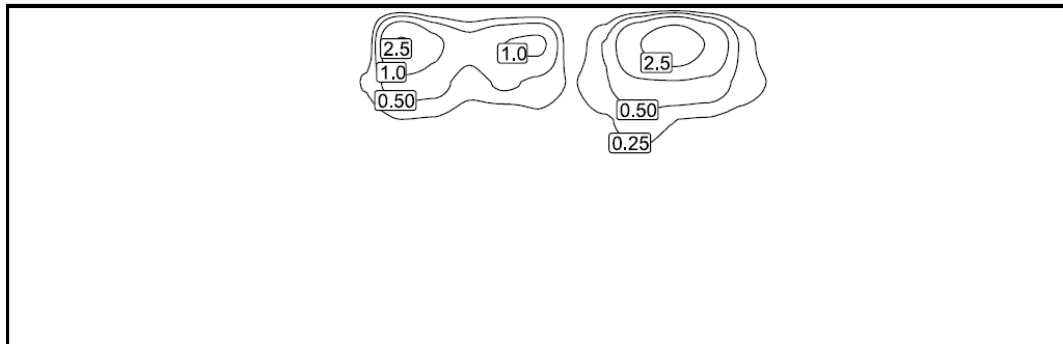


Yellow horizontal calculation areas are 10m x 31m. The vertical calculation plane is 31m x 5m high.

## Horizontal plane west

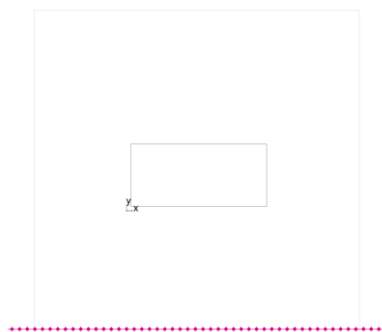


### Isolines [lx]

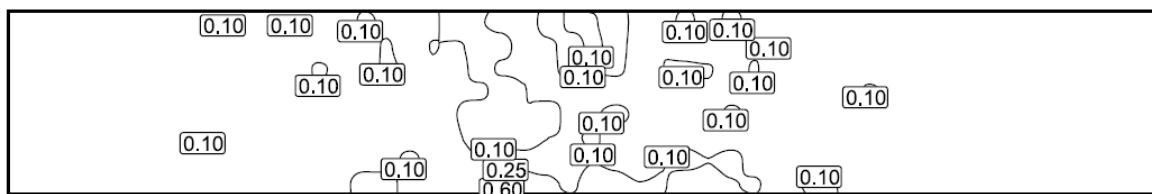


This calculation area is 31m wide by 10m deep. You can see that beyond approximately 3m from the house the illumination reduces to less than 0.5 lux.

## Vertical calculation plane west

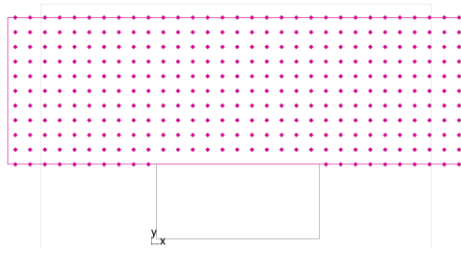


### Isolines [lx]

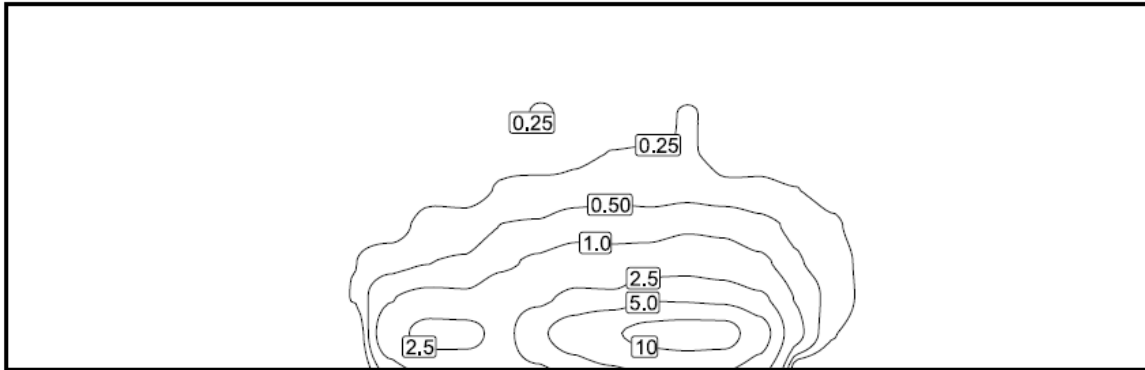


The plane is 5m high and 31m wide. I.e. it extends 10m beyond the ends of the house. All lux values are well below 0.5 lux (max value is 0.3 lux).

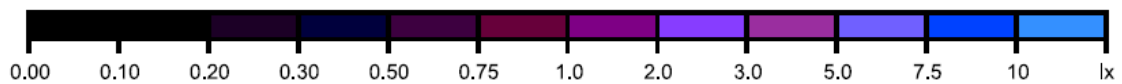
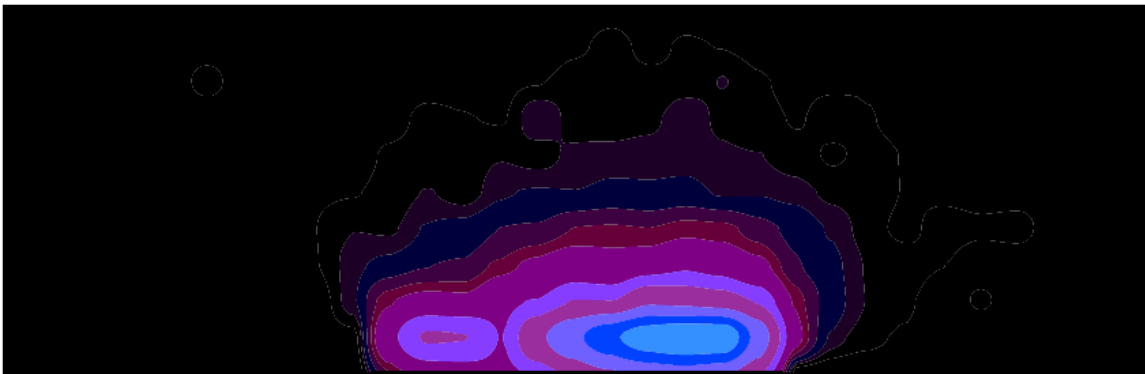
Horizontal plane east



**Isolines [lx]**



**False colours [lx]**

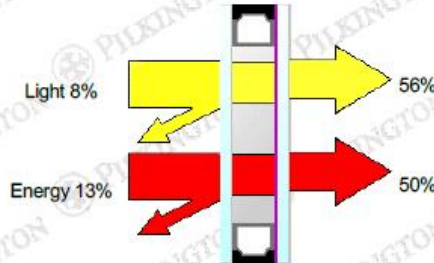


Here, the illumination extends just slightly further from the house due to the larger windows on this side.



**Glass used in calculations.**

As specified by client.



**DESCRIPTION**

Position	Product	Process	Thickness (nominal) mm	Weight kg/m <sup>2</sup>
Pilkington Insulight™ Sun				
Glass 1	Pilkington Optifloat™ Bronze	Annealed	4.0	
Cavity 1	Argon (90%)		16.0	
Glass 2	Pilkington K Glass™ S	Annealed	4.0	
Product Code	4bz-16Ar-KS4		24.0	20.00

**PERFORMANCE**

Light			Energy		
Transmittance	LT	56%	Direct Transmittance	ET	42%
	UV %	15%	Reflectance	ER	13%
Reflectance Out	LR out	8%	Absorptance	EA	45%
Reflectance In	LR in	11%	Total Transmittance	g	50%
<b>Performance Code</b>			Shading Coefficient Total		0.57
U <sub>g</sub> -value/Light/Energy		1.2 / 56 / 50	Shading Coefficient Shortwave		0.48
Ra		95	Sound Reduction	R <sub>w</sub> (C;C <sub>tr</sub> ) dB	31 (-2; -5)
The values of some of characteristics are displayed as NPD. This stands for No Performance Determined.			Thermal Transmittance	W/m <sup>2</sup> K	1.2

Pilkington Spectrum allows you to combine a wide range of products available from Pilkington and determine their key properties such as light transmittance, g value and U value. The program includes restrictions that prevent some combinations being selected that may be considered unwise or impractical. Even with these restrictions, it is still possible to create product combinations that may not be available from your supplier. Please check with your supplier that your chosen product combination is possible, available in the sizes required and in a timescale appropriate to your project. Furthermore, it is essential that you check that your product combination is appropriate for satisfying local, regional, national and other project-specific requirements.

Calculations are made according to EN standards 410 and 673/12898

Pilkington Spectrum Version UK:7.3.1

24/01/2022



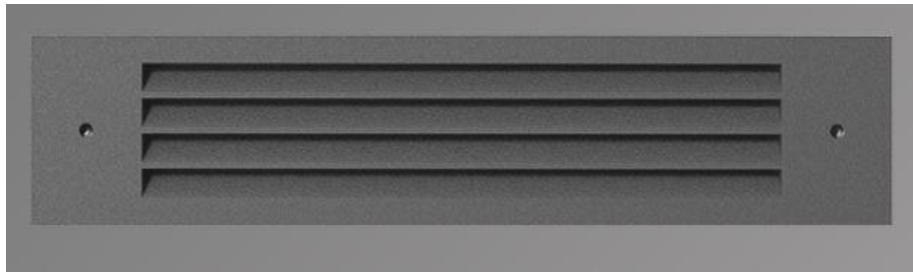
It can be seen that the glass used has a light transmittance of 56% thus reducing the light spill to the outside compared with clear glass panes.

## Illustration of dark-sky type fittings

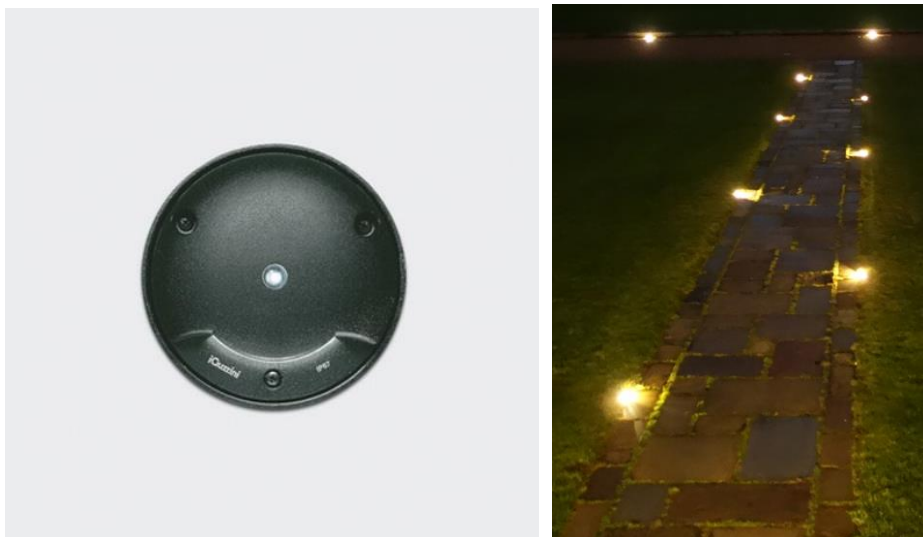
Pharola manufactured by DW Windsor



The illumination level using this DS version reduces to less than 0.5 lux at 5.5m from the bollard. It emits zero upward light.



Typical steplight, illustration from We-ef, emitting no upward light. Can be used on steps to basement.



Wayfinding type path light from iGuzzini.

## **Glossary of Lighting Terms**

Illuminance: this is the SI term for what is normally referred to as Illumination level. It is measured in lux. It refers to the light falling on a surface. Normally this is a horizontal plane such as the ground or desktop. It can also refer to vertical surfaces such as windows and building facades. Illuminance is measured in lux.

Lumen: is the SI term for luminous flux or quantity of light. A typical 60w tungsten filament lamp emits 700 lumens; a 1.5m fluorescent lamp emits around 5,500 lm.

Lux: is defined as an illuminance of 1 lumen/m<sup>2</sup>. A typical tennis court would measure 300 - 500 lux, a major traffic route 20 – 30 lux, a residential road 3 – 10 lux. Note that lux is normally taken to be the horizontal value but the vertical value is often relevant. E.g. vertical illuminance is important in recognising faces or light intrusion on windows.

Luminance: It is a measure of objective brightness and is a function of how much light is reflected off a surface. There are many factors involved but the major one is the reflectance of the surface. For a given level of illuminance, dark surfaces have lower luminance than light coloured surfaces. Its importance is that it is the metric used for classifying traffic routes, signs and advertising hoardings.

Luminaire: is the term for what is usually referred to as a light fitting. A fixture or lantern are other commonly used terms. These terms are used to distinguish them from the light source or lamp.