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Client

Simon Alexander

Lighting Report

3D modelling and light spill calculations at Mirabella, Chippenham.

Rev A

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Background

RCC Town Planning are working with their client, Simon Alexander, on converting a barn to a four-bedroom dwelling. The site is accessed from New Road in Bromham, SN15 2 JA. The surrounding land is rural and the nearby roads are unlit.

Wiltshire Council in their planning response has asked for more information regarding an assessment of the impact of the increase in lighting from the dwelling and also the impact of the glazing and rooflights.

Wiltshire Council also mentions the possible impact on the landscape and character.

Alan Tulla Lighting is an independent lighting consultancy specialising in the outdoor environment and has been asked to provide light spill calculations and a visual impact assessment.

Alan Tulla, FSLL, 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 until recently, lectured for them on the topic of exterior and amenity lighting. He is also author of the Society of Light and Lighting "Guide to the Exterior Environment", LG06.

Location and model

The surrounding land is rural, fairly flat and the nearby roads are unlit.

We have constructed a simplified 3D model of the house. This model contains the exterior facing windows and any external glass doors.

Methodology and assumptions used in the 3D model

The model is based on drawings from PKA Architects PL-001 A (April 2026) and PL-002 (July 2026).

The 3D model of the house is used to calculate illumination on the ground immediately surrounding the property.

It is standard practice for these calculated illumination plots to be “worst case”. I.e. based on all the lighting inside the rooms being switched on at the same time but with no mitigating measures such as curtains or blinds.

We have assumed that the interior decoration of the 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.

We have used generic, recessed, LED light fittings to provide the illumination. In this way, the illumination transmitted outside is received by reflection from the walls, floor and ceiling rather than individual fittings.

Suspended light fittings or directional spotlights opposite the windows are likely to direct more of the light outside.

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/dining rooms being illuminated to 100 lux, bathrooms, kitchens and utility rooms 200 lux and the bedrooms 50 lux. These are typical values for residential properties.

Windows used in the model

The amount of light transmitted to the exterior environment through the windows obviously depends on how “clear” or “dark” the glass is (including double/triple glazing, colour tinting and any thermal coatings).

We have assumed that the windows are standard, clear glass, double glazed units. This has a Visible Light Transmittance, VLT, of 76% and gives “worst case” results.

Our calculations allow for the reduced amount of light transmitted to the outside by the horizontal solar shading slats. An intrinsic feature of solar shading is that it also reduces the amount of light directed skywards from the inside.

The rooflights used in our calculations have glazing which conforms to the requirements of “Towards a Dark Sky Standard” produced by the UK Dark Skies Partnership (40% - 50% VLT) and there will therefore be minimal upward light and no spill light on to the surroundings.

Exterior lighting

We have included for some small, narrow beam, 4W downlights under the loggia. These illuminate the route from the garage and parking bays to the front entrance on the south side of the house. There is little spill beyond the edge of the loggia but it is included in our calculated results.

Elsewhere there are 2.5W wooden wayfinding bollards at the parking bays. The bollards emit no upward light and rearward spill drops to below 0.5 lux within 1m.

We suggest a small 3W light over the northern utility room door. This could be controlled by a PIR movement sensor with a short ON time, say 1 minute. In our view, therefore, any spill would not materially affect the nearby hedge.

Note that there is a small amount of light falling on the hedge reflected off the ground around the bollard.

The bollards and loggia lights are 2700K. The door light is 3000K as standard and 2700K as an option.

None emit any upward light.

Controls and mitigation

It is recommended that the bollards and loggia are controlled with movement sensors. The ON time should be adjusted to suit the application but 1 – 2 minutes should be acceptable.

Interpretation of the calculated results

Isolux lines from the calculations of the light spill from the new house are shown below. We show the contour lines down to a value of 0.2 lux which the Bat Conservation Trust, document GN08, recommends it as acceptable for areas where there are, or likely to be, bats.

As a comparison, 0.5 lux is 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.

Our calculations include both the internal and external lighting.

Summary of results

Internal lighting: The calculations are based on the illumination levels and reflection factors of the internal decoration as mentioned above. The calculations assume all the lights are on and there is no reduction made for blinds or curtains.

It can be seen that there is very little spill light outside and it does not extend anywhere near the site boundary.

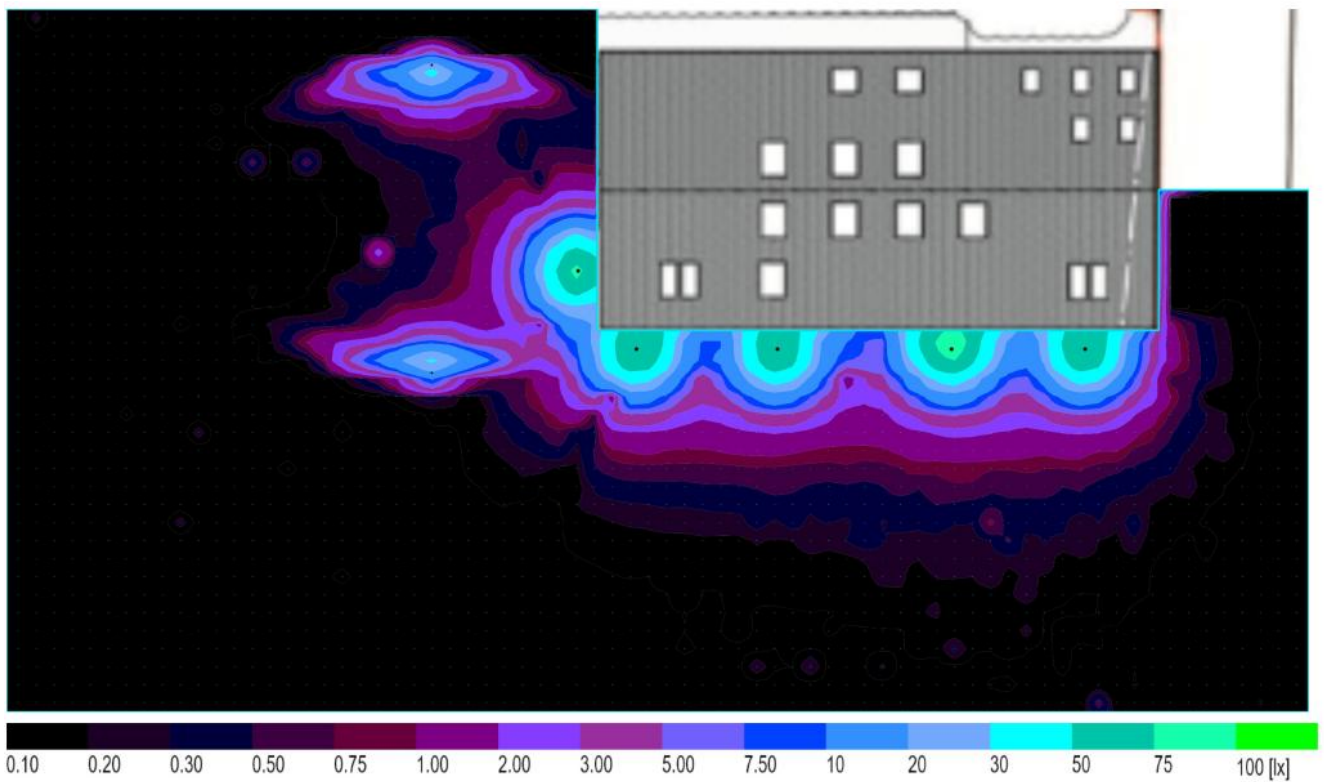
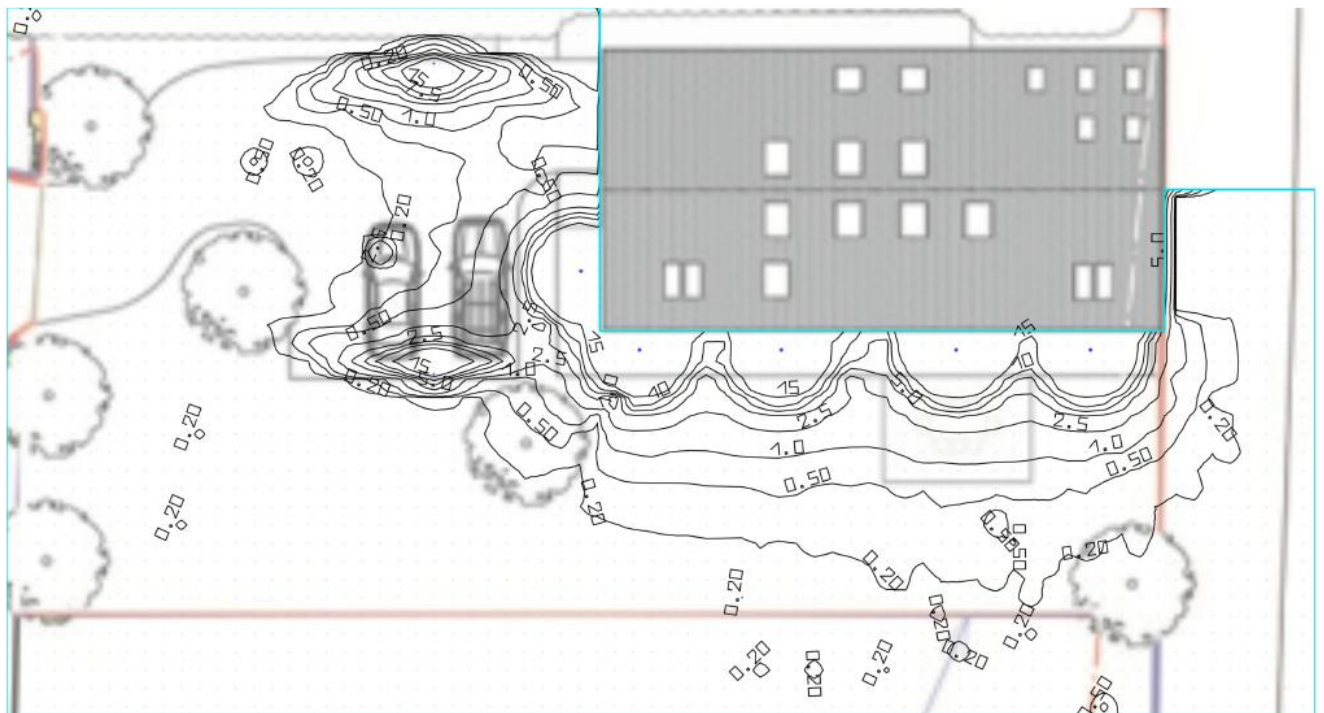
External lighting:

None of the external lighting equipment emits any light upwards. It can be seen that both horizontal and vertical illumination fall to below 0.2 lux within a few metres of the house or the bollards.

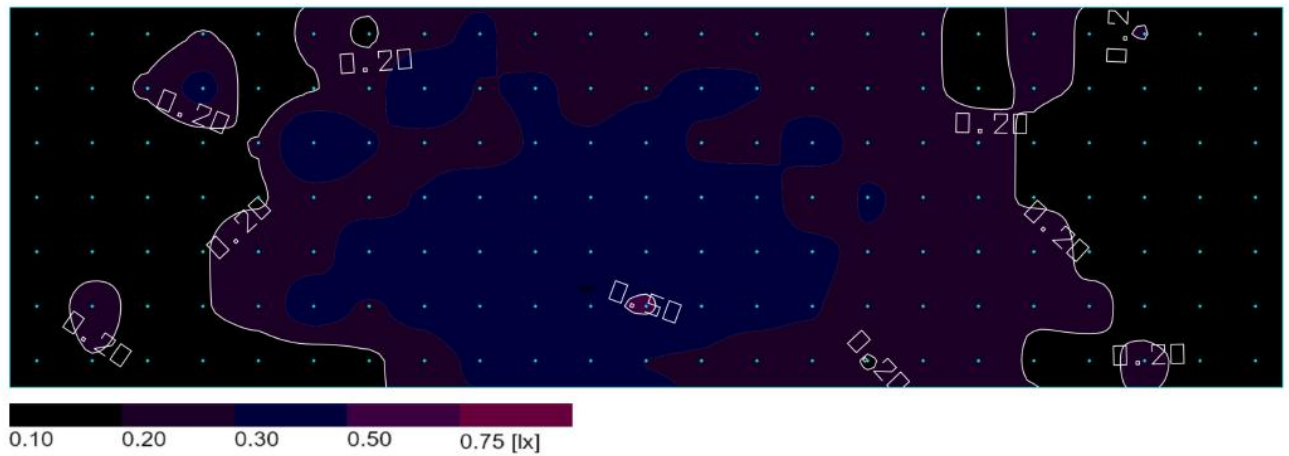
No light falls on the western hedgerow/tree line.

Calculated results

Overall view, all lights ON.



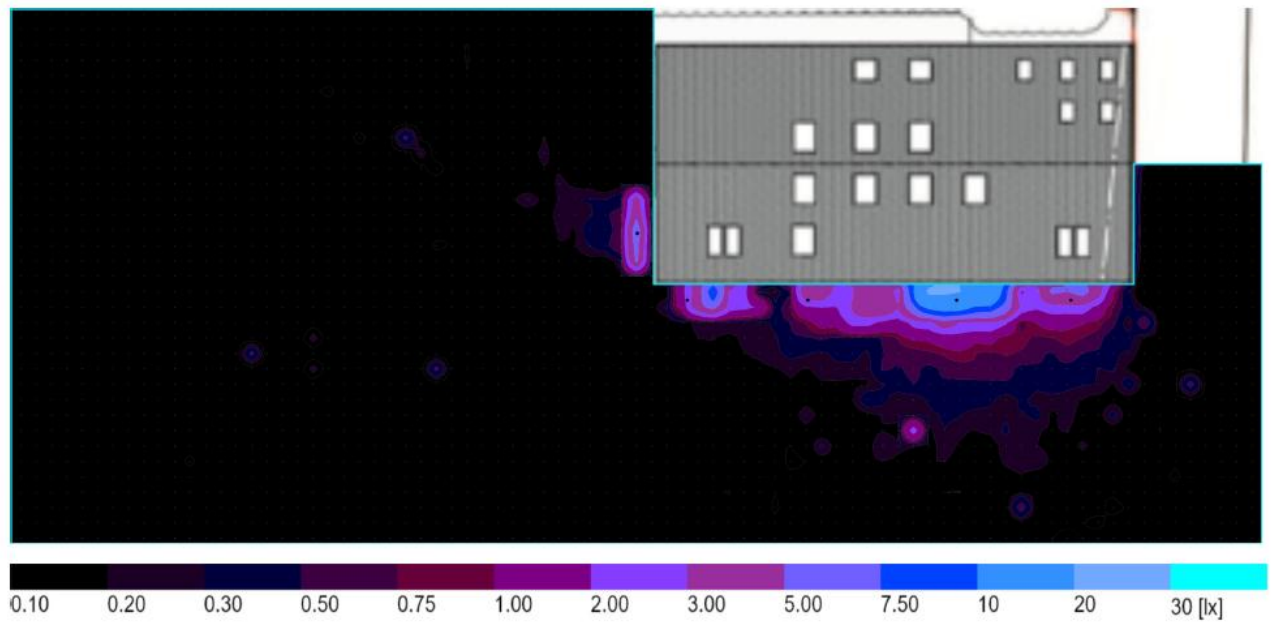
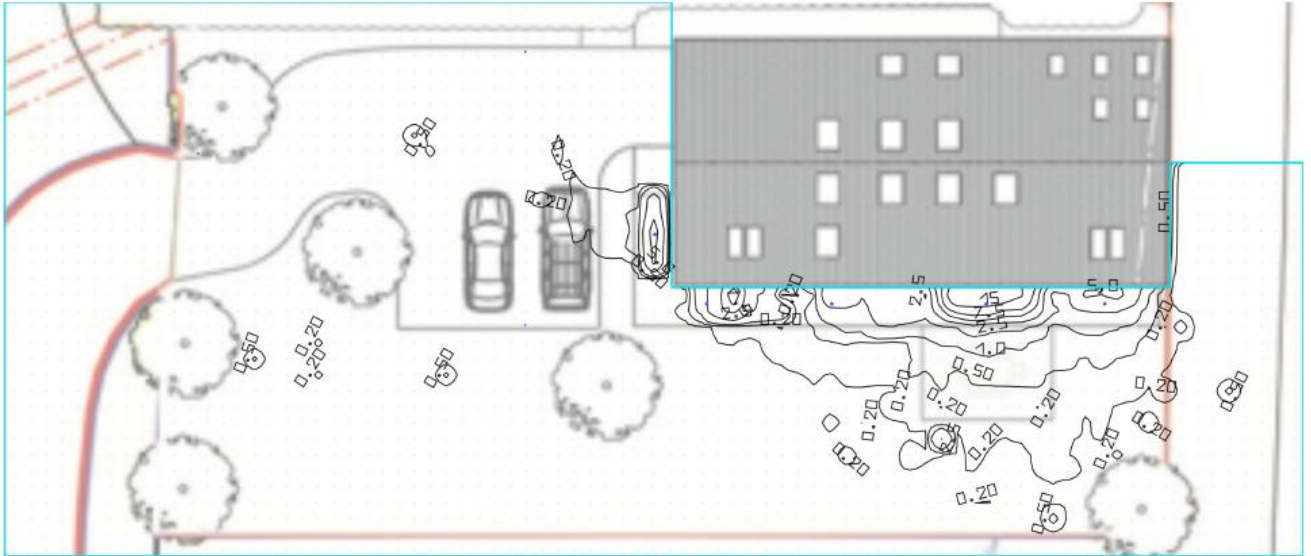
Vertical spill from north bollard No 6



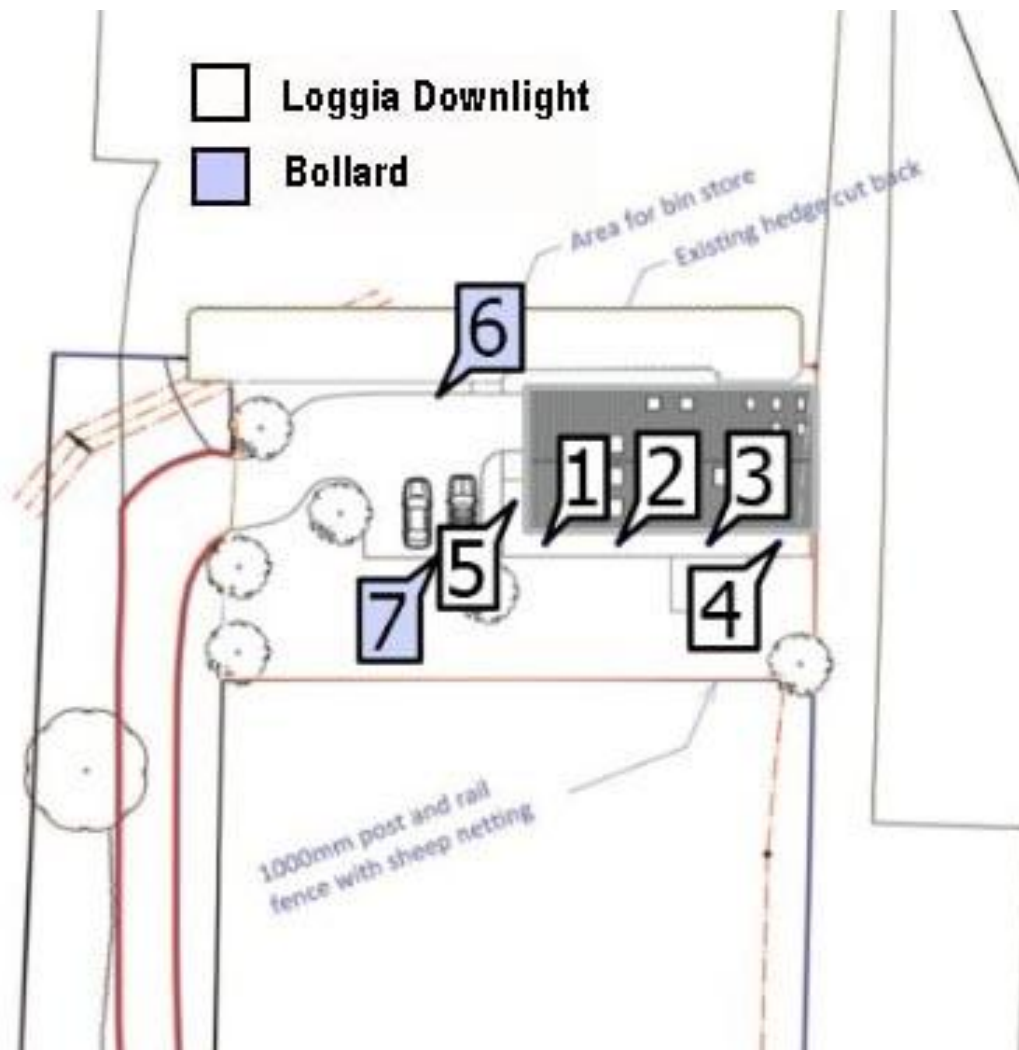
These values are likely to be reflected light off the ground.

Spill from house only.

External lighting, inc. loggia, OFF. Horizontal illumination at ground level.



Luminaire positions



Numbering is arbitrary and purely for reference.

EYE

timberlab



2700K, 2.4W. No upward or rearward light.

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/m². 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.