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Client

Davies Homes Ltd

Report

Street lighting design at Dragon Park, Merthyr Tydfil

Rev E

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Author of this Report

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 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.

Issue date: as front cover.

Contents

Rev D: This report is substantially as our report of 13 April 2023. However, the River footpath, E-W dark corridor and SUDS lighting are redesigned.

Rev E: As above but with additional isolux contours down to 0.2 lux including river path and SUDS pond. Column 11A is changed to Amber. New note on lighting during construction.

As before, this report comprises two parts.

The first part, this Word document, is a description of the lighting scheme. It considers issues such as ecology, light spill, conformance to standards, assumptions made, mitigation measures, description of the equipment used etc.

The second part is the detailed lighting layout from the manufacturer, TRT, showing the position of each luminaire. It also shows isolux contour lines (the spread of illumination) down to 0.2 lux. The S38 and S278 are shown separately.

These two files are approximately 6Mb and are attached as separate PDFs.

Summary of the lighting design and ecological impact

The S38 roads are illuminated to an average of 5 lux. This is classified as P4 in BS 5489.

The existing southern entrance road, S278, to the site is illuminated to 7.5 lux, P3, since this will receive the highest traffic flow.

Generally, 6m columns are used throughout except for some 8m on the southern roundabout. The riverside path uses wayfinding studs set into the ground.

Warm, 2700K LEDs are used for most of the streetlighting. Ecologically sensitive areas are illuminated with Amber 1750K LEDs.

The SUDS pond to the south receives very little light, most is below 0.5 lux and we show values down to 0.2 lux. Rear visors are fitted to the streetlighting lanterns on the nearby roads to reduce spill still further.

The results are shown on the attached PDFs.

The streetlights emit zero upward light.

Background and site location

Davies Homes Ltd are proposing to build a residential development of 200 homes on land adjacent to the River Taff, Merthyr Tydfil. The site is currently disused industrial land situated between the river and the A470 dual-carriageway.

Whilst the area is predominantly industrial, bat activity has been recorded on the site. As such, Natural Resources Wales, has asked for full details of a Lighting Plan. This will include the siting and type of all external lighting. It should also include drawings setting out the light spillage in key sensitive areas, in particular the River Taff corridor, all retained vegetation surrounding the site, and the proposed new SUDS pond to the south.

Alan Tulla Lighting is an independent lighting consultancy specialising in the exterior environment and has been asked to provide such a design.

Location

The proposed development runs alongside the river Taff on the opposite side to the Hoover Factory.



Merthyr Tydfil Council advise us that this location is considered to be an E3 Environmental Zone and our design and report are based on this classification. Other Environmental Zones are described below:

Zone	Surrounding	Lighting environment	Examples
E0	Protected	Dark (SQM 20.5+)	Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places
E1	Natural	Dark (SQM 20 to 20.5)	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc.
E2	Rural	Low district brightness (SQM ~15 to 20)	Sparsely inhabited rural areas, village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Well inhabited rural and urban settlements, small town centres of suburban locations
E4	Urban	High district brightness	Town / City centres with high levels of night-time activity

Table taken from ILP Guidance Note, GN01/2021

Environmental considerations

A residential development such as this will require some form of road and outdoor lighting for the safe movement of residents and visitors. Lighting will be required for the main distributor roads and might also be required for the cul-de-sacs, shared surfaces and footpaths.

The Alder Ecology report of November 2022 confirms that this is an E3 zone and that the main bat foraging routes are north/south along the boundaries. There is also some movement E/W.

Note that the Landscape, Biodiversity and Amenity strategy by Catherine Etchell Associates recommends that the N/S footpath along the eastern boundary, between the housing and the river Taff, should have low level or no lighting along the footpath. We propose that it is illuminated using wayfinding type lights set into the path. There are no columns or bollards.

The Bat Conservation Trust document “Bats and Lighting in the UK” 2023 recommends no more than 0.5 lux along foraging routes. In this case, this would apply to the river corridor. We show values down to 0.2 lux.

Again, the BCT document recommends LED light sources with a colour temperature, CCT, of Warm White, preferably 2700K. This lighting design uses Warm, 2700K LEDs throughout. The exception is where the spine road crosses the E – W dark corridor. Here, PC Amber 1750K LEDs are used. These contain <4% light below 550nm.

During construction, the proposed dark areas will remain dark.

Lighting buffer zones to minimise impact on bats.

Extract from the Bat Conservation Trust document “Bats and Lighting in the UK” 2023.

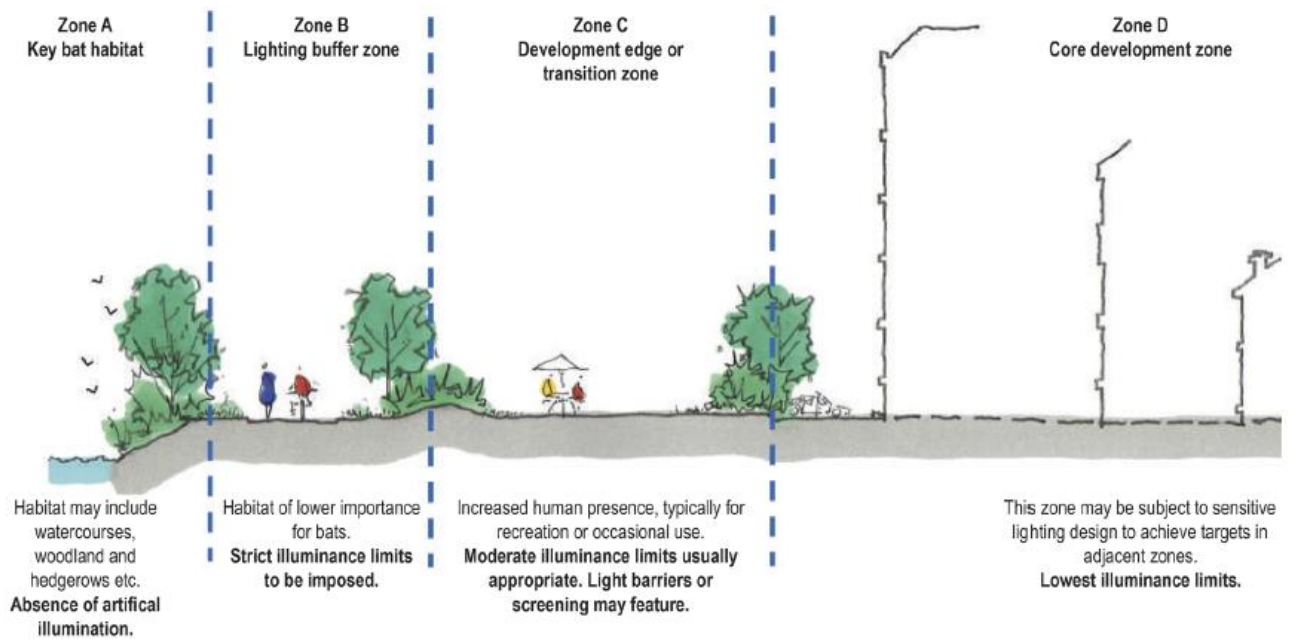


Figure 4. Example of illuminance limit zonation.

Sensitive ecological areas.

We understand that light spill from the properties that face the ecologically sensitive areas will be discussed with the project ecologist to ensure control measures are implemented and these will then be managed through the legal process.

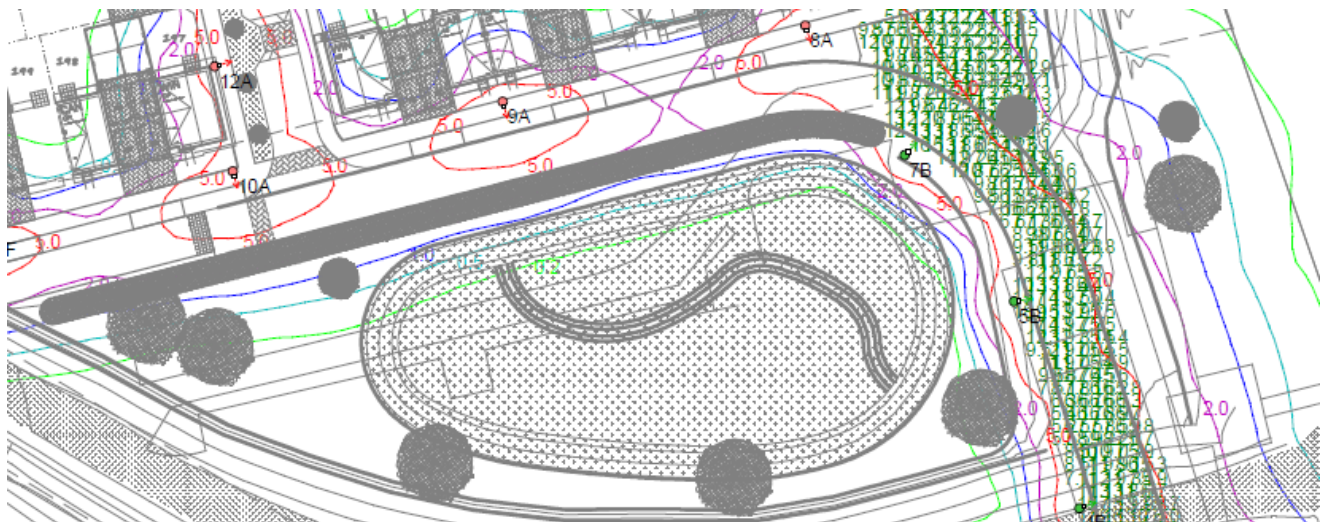
We also understand that there will be restrictive covenants placed on houses where external security lighting faces ecologically sensitive areas.

Bat and Bird boxes

These are located in the zones shown in the document showing the elevations of the various house types. The final locations to be agreed with the project ecologist in relation to the streetlighting luminaires, to ensure dark routes are provided.

SUDS water storage

This is located at the south of the development



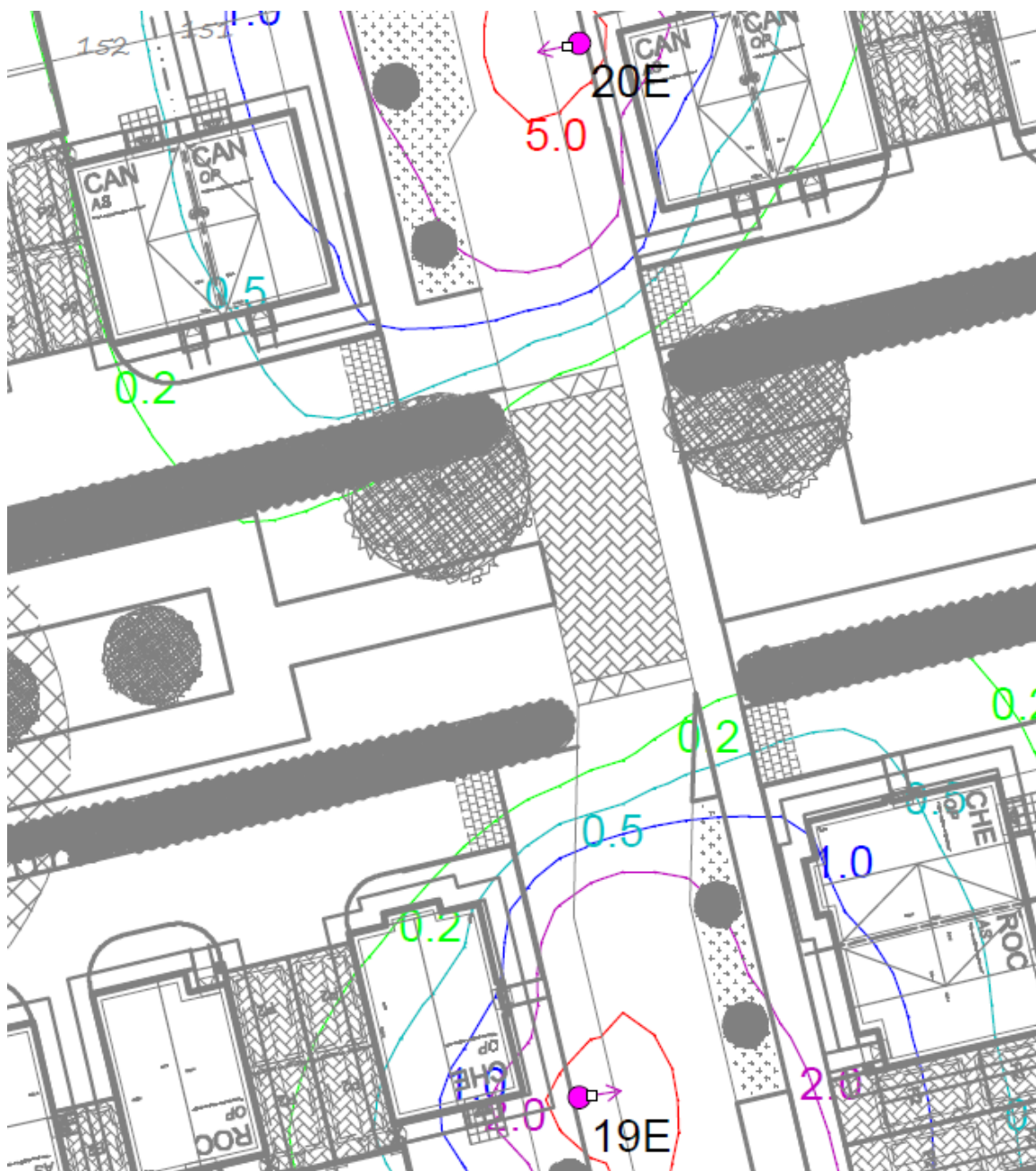
There is street lighting on both the northern and eastern flanks. These are fitted with rear visors to prevent backspill. The innermost line is the 0.2 lux contour but it does not include the mitigating effects of the rear visors. A Maintenance Factor of 0.87 has been used but this will not materially affect the extent of the contour lines.

There is no lighting on the southern and western faces sides.

Central dark corridor running East-West.

At one point, this corridor runs across the main spine road running North-South. This spine road needs to be illuminated for Health and Safety reasons. Most of the streetlighting on this road uses 2700K LEDs.

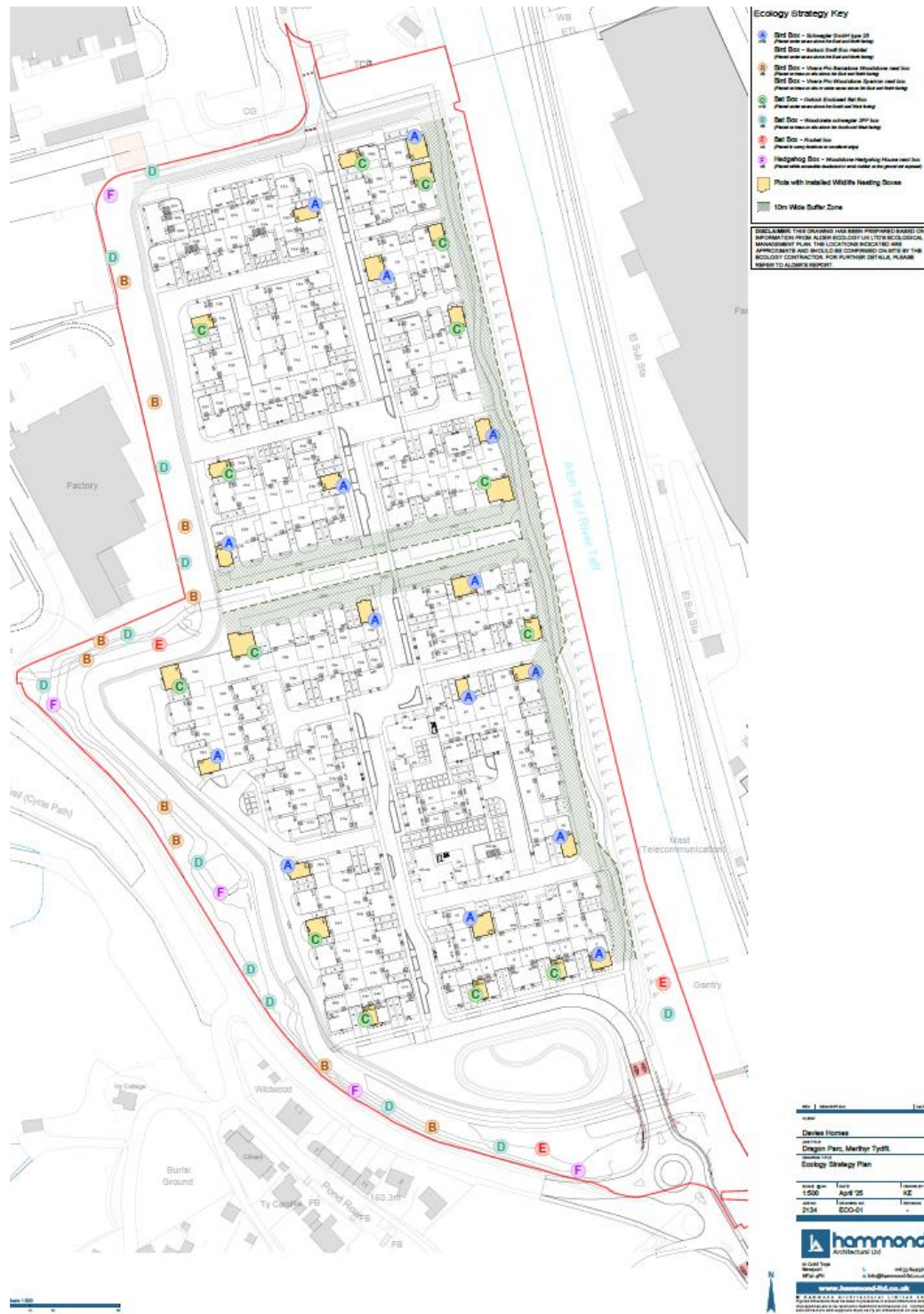
Whilst 2700K, is acceptable to the Bat Conservation Trust, we propose that Amber 1750K LEDs are used where it crosses the dark corridor. Note that only two columns are affected, 19A and 20A. These two columns are also fitted with side shields to minimise spill. Thus, this short section of road between the two columns receives less than 0.2 lux and is Amber in colour.



The green line represents the 0.2 lux contour.

Riverside path

This is a winding pedestrian route situated between the housing and the river Taff. As recommended by the BCT, the path uses wayfinding lights recessed into the path. These emit light through 180 degrees horizontally and so no light is directed rearwards towards the river Taff. These 1.3W units use 2700K LEDs and emit just 20 lm. They are typically spaced 10m apart and controlled by PIR sensors at access points along the route. I.e. the lights only switch on when someone uses the path.



Hatched grey line indicates 10m wide ecological buffer zone to which any light spill will be controlled and managed.

Lighting design criteria

We are advised by the Council to use 6m columns. The Council has also specified the type of TRT streetlighting lantern to be used.

We assume from the BS 5489 Table below that being in an E3 environmental zone that the internal roads would have a P4 classification (average of 5 lux with a minimum of 1.0 lux).

Note that the entrance road to the site from the roundabout is illuminated to P3 classification (average of 7.5 lux with a minimum of 1.5 lux). This is because it will receive more traffic than the inner roads.

LIGHTING CLASSES FOR SUBSIDIARY ROADS BS5489-1: 2020 TABLE A.5

TRAFFIC FLOW	LIGHTING CLASS		
	E1 TO E4 ^{A)}	E1 TO E2 ^{A)}	E3 TO E4 ^{A)}
	PEDESTRIAN AND CYCLISTS ONLY	SPEED LIMIT $\leq$ 30MPH	SPEED LIMIT $\leq$ 30MPH
BUSY ^{B)}	P5	P4	P3
NORMAL ^{C)}	P5	P5	P4
QUIET ^{D)}	P6	P5	P4

The streetlighting luminaires are a “flat glass” type which emit no upward light. External house lights (not part of this design) should emit no more than 2.5% upward light.

A Central Management System, CMS, control will be used in accordance with the Local Authority streetlighting specifications.

Equipment used

OPTIO MICRO 16 LED



 IP66
Ingress Protection

 IK08
Impact Resistance

 5.5kg Weight

 Electrical Class I

 0.05m² Wind Area

 -20 to 30°C Ambient

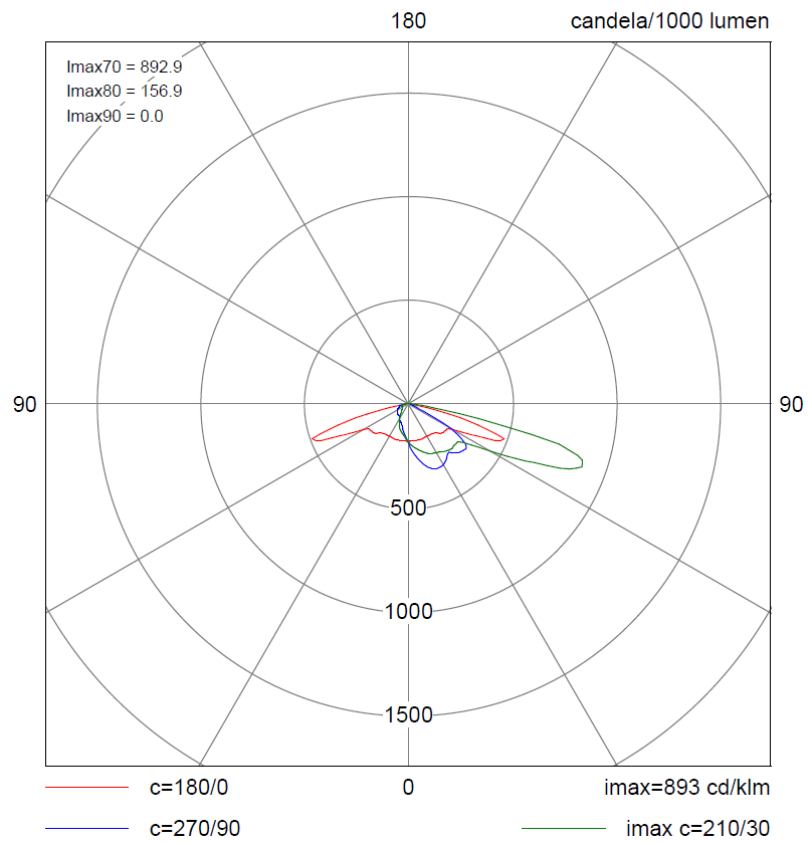
SPECIFICATION

- ✓ LED colour temperature PC-Amber*, 2200K, 2700K, 3000K or 4000K
- ✓ Colour rendering index >70 (*>55)
- ✓ Projected L90 after 100,000 hours
- ✓ Power factor >0.95 at full load
- ✓ Polyester powder coat finish in light grey, dark grey, black or a bespoke colour
- ✓ High quality high pressure die cast LM6 aluminium components
- ✓ Stainless steel fixing screws with stainless steel inserts in pivot
- ✓ Toughened flat safety glass cover
- ✓ In-built ventilation (breather) plug for pressure equalisation in the LED module and gear housing
- ✓ Easily replaceable 'plug and play' light engine
- ✓ CLO available
- ✓ PowerSet feature - Field adjustable, integral power output selection device (optional)
- ✓ Controls - NEMA 3, 7, Miniature Photocell and Zhaga Book 18 (SR) socket (top and bottom)
- ✓ Part Night Dimming (PND) with manual dimming override option
- ✓ DALI compatible for use with CMS
- ✓ Optional surge protection 10kV/10kA
- ✓ MountSet (patent granted) - Universal mounting system to interface with multiple column/bracket diameters or length
- ✓ Luminaire levelling indicator
- ✓ UMSUG codes available for full product range



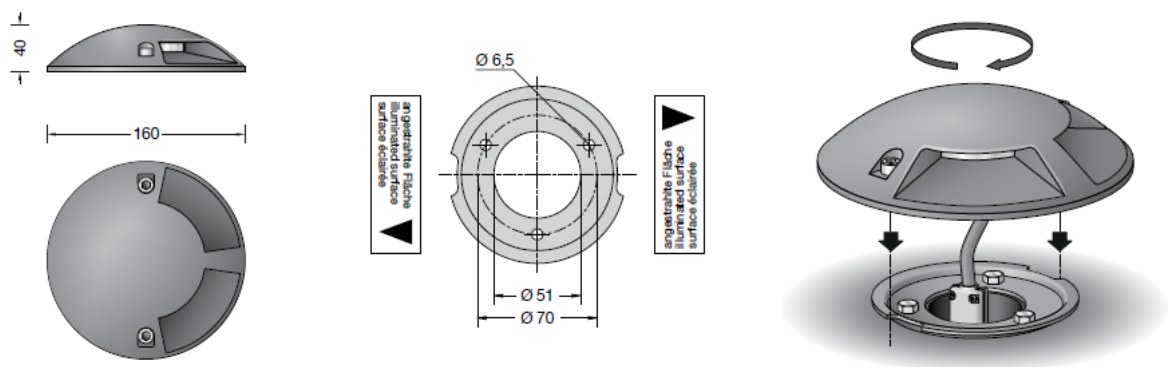
Various versions of wattage and optic are used. All are 2700K on 6m columns. DALI compatible with CMS.

Luminaire C ASM4 LED 19W GR2 3000K EXP



Several different types of optic are used and this shown is the most typical.

Riverside Footpath lighting



Bega Model 77 069, 20 lm 1.3W, 2700K.

Lighting mitigation measures

The actual dimming and/or switching regime should be discussed Merthyr Tydfil Council at the detailed design stage. A typical regime is suggested below:

Peak time, dusk to 20.00 hrs – 100% light output.

20.00 to midnight – 50% output.

Midnight to sunrise – switch off.

Note that actual hours of operation will depend on the season.

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 8w LED “bulb” emits 700 lumens; a 1.5m fluorescent tube emits around 5,500 lm.

Lux: is defined as an illuminance of 1 lumen/m². A residential road is typically 3 – 10 lux, a major traffic route 20 – 30 lux. A typical tennis court would be 300 -500 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, light fitting or lantern are other commonly used terms. These terms are used to distinguish them from the actual light source or lamp.