



Bats and Artificial Lighting Symposium

Tuesday 21 May 2019



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Bats and Artificial Lighting Symposium 2019

PROGRAMME

Tuesday 21st May 2019 (10.00 – 16.45)

Intro: Kit Stoner, CEO at Bat Conservation Trust and

LUNCH

Keynote: Prof. Kevin Gaston (Professor of Biodiversity and Conservation at University of Exeter)

Session 3 intro: Chair 3 – James Miles, Kingfisher Lighting

Session 1 intro: Chair; Marcus Vongpraseuth, Signify

Topic 1: LATEST RESEARCH

- Jack Merrifield, Southampton University – ‘Establishing barriers to urban-dwelling bats’
- Julie Day, University of Exeter / JNCC – ‘Lighting up the Landscape’
- Fiona Matthews, Sussex University – ‘Modelling the barrier effect of lighting on the movement of bats at a landscape scale’

Topic 3: LATEST TECHNOLOGY

- Maurice Donners, Signify – ‘Reducing the impact on night time behaviour of nocturnal mammals’
- Sean Kielthy, Hoare Lea – ‘Live reporting of light level monitoring to an interactive website’
- James Fletcher, Kingfisher Lighting – ‘Smart Cities’

BREAK

BREAK

Session 2 intro: Chair 2; Kevin Gaston, University of Exeter

Session 4 intro: Chair 4 – Kit Stoner, CEO Bat Conservation Trust

Topic 2: MULTI-DISCIPLINARY WORKING

- Jack Merrifield & Chris Emberson, Southampton University – ‘Strategic planning for bats on Southampton Common’ as an introduction to ‘Lights, Crime, Action! Correlations of crime and levels of street lamp illumination’
- Karl Jones, Crestwood Environmental – ‘The effects of artificial lighting on landscape character and visual amenity: assessment and interdisciplinary working’
- Cody Levine, Worcestershire County Council and Stuart Morton, Jacobs – ‘A4440 lighting scheme’

Topic 4: CASE STUDIES

- Harry Fox, Clarkson and Woods – ‘Developing guidance to balance the needs of bats and development in a landscape city’
- Lee Gunner, Brentwood Associates – ‘Best practice lighting assessment’
- Jenny Singh, Arup – ‘A120 Little Haddenham Bypass’

Closing Remarks: Kit Stoner, CEO Bat Conservation Trust

Topic 1

Latest Research

Jack R. Merrifield MSc. PGCE. BSc (Hons). GradCIEEM.

Current PhD student. Faculty of Environmental and Life Sciences,
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Identifying barriers to urban-dwelling bats

The problem:

Understanding pollutants in urban ecosystems is a complex issue given the interplay between multiple sources and factors that may influence the level of impact at relatively fine spatial resolutions. Light and sound (audible and ultrasonic) from anthropogenic sources are particularly pervasive, highly correlated features of human-dominated landscapes. These may present a considerable challenge for nocturnal fauna, such as Chiroptera. British bats and their roosts are protected by law. However, the combined effect of artificial light and ultrasonic sound pollution remains unknown making it difficult to effectively mitigate for them during urban planning and development projects.

This ongoing research investigates the responses of different urban-dwelling bats to combinations of artificial light and ultrasonic sound using robust, spatially explicit, field-based experiments.

Understanding the influence of these pollutants has important implications for effective bat mitigation and conservation, and can aid in the identification of crucial habitat for these ecologically important species at multiple spatial scales.



Key aims & objectives:

To understand how combinations of light and ultrasonic sound pollution affect (i) the species richness, and (ii) the abundance of urban-dwelling UK bat species.

This is achieved by:

- Establishing real-world levels of these pollutants.
- Identifying important areas for urban bats using spatially-explicit modelling and acoustic surveys.
- Reproducing real-world combinations of pollutants using field-based experiments to investigate the responses of bats.



Project outcomes:

The research outcomes have yet to be formally published but it is our hope that they will facilitate resilient urban planning schemes and enhance robust bat management and mitigation strategies. It is intended that this work will be utilised by ecological practitioners, urban planners and developers regarding best practice for bat mitigation and conservation, and by informing policy makers involved in environmental management.



Acknowledgements:

This research was funded by The Engineering and Physical Sciences Research Council and supervised by Dr Patrick Osborne, Prof. Patrick Doncaster and Prof. Phillip Newland. Thanks go to Dr Chris Jackson, Hampshire Bat Group, Scottish & Southern Energy Enterprise, Active Nation, Southampton City Council, and Open Acoustic Devices: AudioMoth.

Julie Day (Jon Bennie, Kate Barlow, Kevin Gaston, Fiona Mathews)

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Lighting up the Landscape

Artificial light at night is estimated to be increasing at 6% per year and yet we still don't understand the impact it has on wildlife. Research has started to emerge on the effects of street lighting at local scales, disrupting commuting and affecting foraging behaviour. These changes in activity could potentially lead to long-term effects on colonies. This study presents long-term data on roost location and size from the National Bat Monitoring Programme paired with satellite data on light levels. Bat species that take advantage of insects around street lights had higher light levels around roosts than bat species that avoid street lit areas. Surprisingly, when comparing light levels around bat roosts with randomly generated locations, bat roosts had higher light levels. Despite this finding (which could suggest bats show some preference for lit areas around their roosts), larger colonies were found in darker areas. Overall, the light levels around bat roosts did not increase over time. Globally, urban areas are expanding at twice the rate of bat populations, increasing the probability that street-lighting will encroach further into dark areas. Artificial light at night may restrict population sizes of bat roosts and impact the resilience and persistence of those roosts.

Fiona Mathews (Domhnall Finch, Julie Day, Kevin Gaston, Henry Schofield)

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Modelling the barrier effect of lighting on the movement of bats at a landscape scale

Lighting is known to have adverse effects on the activity of many bat species. It frequently presents an issue when new residential developments and roads are planned, particularly in South-West England where lighting could adversely affect the integrity of SAC sites designated for horseshoe bats by fragmenting habitat and disrupting commuting routes. However, most research has focused on locations in very close proximity to bat roosts, and the impact of lighting in the wider landscape is unclear. Here we show that lighting has a negative impact on horseshoe bat activity at sites distant from maternity and hibernation roosts, and consider how the effect of lighting depends on habitat conditions. We also outline an approach that models the barrier effect of lighting on the movement of bats at a landscape scale.

Topic 2

Multi-disciplinary Working

Chris Emberson & Jack Merrifield

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Lights, Crime, Action!

Correlations of crime and levels of street lamp illumination

A broad public perception exists that increased levels of street lamp illumination will lead to a reduction in levels of crime. In the current economic climate Local Planning Authorities (LPAs), faced with budgetary restraints, are switching street lamps off or reducing illumination levels at night in order to reduce their electricity spend, which has led to a public concern that levels of crime will increase. Do levels of street lamp illumination actually influence crime, and if so, to what extent?

To date there are few studies that address this question in detail. Of those studies, most (if not all), group all types of crime together, with the assumption that the drivers of different crime types are the same.



Precision lighting

The University of Southampton (Atkins et al. 1991)¹ conducted one of the first studies to address the question of a possible correlation between illumination and crime when Wandsworth replaced its lighting in 1985. This study found no significant relationship between crime levels and lighting, but found a positive benefit in reducing the fear of crime. Nearly thirty years later, as the drive towards Smart City economies progresses, we have the opportunity to take our understanding of this relationship to the next level given that new LED lighting has increased the ability to be controlled.

Most LPAs in the UK have or are at present implementing street lamp replacement schemes towards efficient LED lighting. A Central Management System (CMS) is used to set the illumination levels for LED lamps, which allows them to be controlled on an individual lamp basis, including the ability to be dimmed from 0-100%. Hampshire County Council (HCC) are leading the way in this respect having already completed their transition to LED illumination in 2015; Southampton City is currently in the planning stages of an implementation strategy to optimise this.

The benefits of implementing LED lighting systems are multi-faceted. However, achieving optimum levels of illumination is a difficult problem to solve as the human factors of road safety, criminal activity and the fear of crime must also be considered alongside the environmental benefits in terms of reduced carbon emissions as well as natural habitats and levels of biodiversity.

Southampton Common is a designated Site of Special Scientific Interest and an important habitat for urban wildlife, including many species of bat. It is also an important greenspace in the heart of an urban area. A number of multidisciplinary collaborations are underway at the University to understand the best way to achieve optimum levels of lighting efficiency on the Common in a way that will not exacerbate crime levels and also maintain critically important habitats for bats.

¹ The Influence of Street Lighting on Crime and Fear of Crime, Stephen Atkins, Sohail Husain and Angele Store

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Interdisciplinary Assessment of the Effects of Artificial Light

Artificial light (in this case referring to visible light) can have a multitude of effects on different (and interrelated) environmental receptors (e.g. ecology, landscape, heritage, night sky and people) and 'light' can also be considered to be an environmental aspect in its own right. Lighting professionals will usually undertake assessments (and designs) of lighting schemes with an understanding of the (positive [usually intended] or negative) **impact** of artificial light on a location, without necessarily being professionally trained to understand the importance (or significance) of this impact with regards to the (positive or negative) **effect** on a variety of environmental receptors. To fully consider this, a coordinated approach between Lighting Impact Assessments and other assessments (i.e. an **interdisciplinary approach**) is required.

Landscape as an environmental receptor

One example area of interdisciplinary overlap is that between lighting and landscape professionals, and an understanding of each other's perspective can help to define overlaps and result in more comprehensive assessments and holistic design solutions, so good communication from the start of a project is imperative.

Best practice guidance on how to undertake an assessment is largely specific to each environmental aspect, and generally relies on professionals who specialise in each particular area to undertake their own specific assessment. This process, naturally, should (through good communication) facilitate improvements to the design of the plan or project to avoid or minimise adverse effects (especially those that are deemed 'significant').

Landscape professionals (usually landscape architects) are regularly required to undertake landscape and visual impact assessments (LVIAs), as part of their role, but there will often be overlaps in the assessment areas (for example the effects on ecology from lighting) adding another level of complexity to the process. Landscape, ecology and lighting interact in a number of ways, including:

- Habitat connectivity – Dark Green Infrastructure (GI);
- Tranquillity – effects of noise and human disturbance;
- 'Wildness' – apparent absence of human influence;
- Landscape Value – habitats, species, designations (e.g. AONBs);
- Ecosystems Services – including 'healthy places', interaction with nature, biophilic design and mental wellbeing; and
- Landscape Design and Management – effective mitigation, maximising ecological value, and biodiversity (and environmental) net gain.

In undertaking LVIA's, landscape professionals assess the effects on two individual (but interrelated) aspects:

- Views; and
- Landscape

Changes in views (and visual amenity) result in effects upon people, whereas 'landscape' is an environmental resource (and receptor) in its own right.

The European Landscape Convention (ELC) defines landscape as: *'...an area, as perceived by people, whose character is the result of the action & interaction of natural and/or human factors.'* Importantly, landscape does not only relate to the countryside, but also includes areas such as new towns, industrial areas, seascapes and the urban fringe.

The landscape at a locality can be described through a combination of visible elements (for example vegetation and buildings present), and non-visible elements (for example geology, smells and cultural history connections). Overall, this creates an experiential association with a place, affecting its perception (this being most influenced by the views gained of a landscape). The sources of influences on the perception of landscape do not need to be present at the locality, they can also be more remote (for example, a mountain backdrop, or distant views of urban areas).

Together, the combination of the various contributing landscape characteristics result in the description of the landscape character of a locality. This in turn gives it an identity, which will likely have a number of associated key characteristics. Changes to these (for example through new development) are more likely to result in what would be assessed as being a 'significant effect', and thus would be a material consideration in the land-use planning decision-making process.

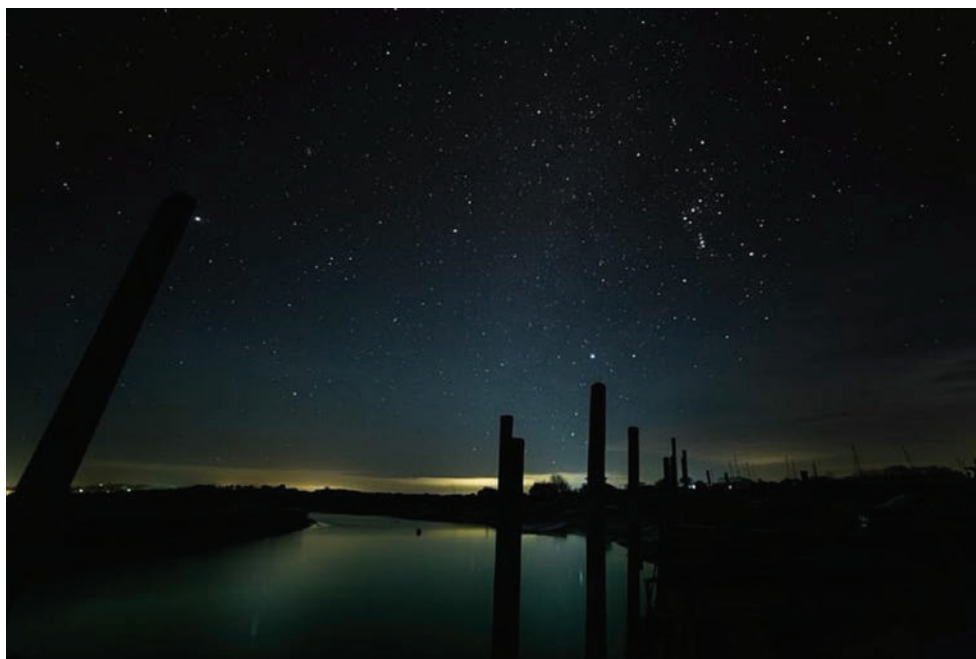
Assessment of landscape and visual effects

Landscape character and changes to landscape character (and views) have usually most often been assessed and described in relation to the daytime landscape; the landscape character at other times of the day often being poorly considered – but this is changing. It is becoming more widely recognised that the description of a landscape and the experience of being there immediately after dusk, during the night and immediately prior to dawn (or the nightscape character) are likely to be different in many ways to the description for the daytime, and from place to place, and that this has been poorly considered in landscape character assessments and related work.

Assessment of landscape effects takes 'landscape value' into account to determine landscape sensitivity to change. This reflects the desirability of landscape characteristics (for example dark skies) and the acceptability of their loss to different stakeholders (people with different perspectives).

Landscape value has many contributing elements, including scenic beauty, tranquillity, cultural associations, and conservation interests, and may be reflected by landscape designations (for example Areas of Outstanding Natural Beauty (AONB) and National Parks) with more stringent planning policies attached. But all landscape character areas have intrinsic landscape value of differing degrees and for different reasons. In relation to nightscapes, examples relate to vibrant cityscapes which may be transformed, and come alive at night through spectacular lighting, and conversely a starlit sky in a tranquil area may have inspired poets, songwriters and artists in relation to a place providing an additional valued cultural aspect to a locality.

A 'landscape of natural light' is typified by the influence of natural light from the sun and lunar cycles, clear air and dark skies undisturbed by artificial light. 'Dark skies' have become an increasingly rare and valued resource in the UK and are a key characteristic of areas where they still exist, providing important contributions to perception of tranquillity and 'wildness'. Dark skies (for example in AONBs) can be adversely affected by sources of light tens of kilometres away, which may bring cross-boundary effects into consideration.



The majority of populated areas have a night-time character that lies somewhere between the darkest of skies to the brightly lit city. This absence of dark skies removes a key component of our natural environment and part of a healthy, enjoyable, uplifting landscape that forms our habitat. It is a natural and cultural asset worthy of preservation where it is, and restoration where it is not (like other forms of pollution). So ahead lies the opportunity, through interdisciplinary working between planning professionals, landscape professionals and lighting professionals to work together to reverse adverse effects, restore darker night skies and improve environmental quality.

More specifically, the challenges in relation to landscape character and views are to:

- Prevent (or at least minimise) artificial lighting sources at one location (where it may be appropriate for that location's landscape character) exerting adverse effects in other landscape character areas (for example through effects on sky glow at that location, or by affecting perceived 'remoteness', through 'urbanising' influences); and
- Ensure that artificial lighting does not have adverse effects on the landscape character where they are located (either directly from the presence of the lighting itself, or indirectly via resultant knock-on effects, such as reduced tranquillity, loss of dark green infrastructure or reduced contribution of visible starlit skies).

The LVIA process is separate from that undertaken for Lighting Impact Assessments (LIAs). Nevertheless, both landscape professionals (and other environmental professionals) and lighting professionals should be encouraging one another to work together to ensure that the inter-relationship between the two aspects are understood by the project co-ordinators, and taken into account at the start of a project, as the benefits of this may not be immediately obvious to non-specialists.

Environmental professionals should therefore be encouraged to inform the lighting professionals about the receiving environment (in terms of their specific aspect, and the outline aims in relation to night-time effects), but will then need expert input from lighting professionals on:

- Lighting impacts (in other words the change experienced by the receptor) via the effective understanding and communication of these; and
- Design solutions.

The assessment of the effects should be undertaken by the relevant suitably qualified professional (for example a landscape architect for LVIA, and a lighting professional for LIAs) using input from one another on the impacts and receptors, in accordance with their relevant guidance, such that the iterative design and assessment process provides the best multi-aspect design solution.

The joint overall aim should be to ensure that the quantity, quality, location, visibility and timing of light, has been sufficiently considered and optimised to minimise adverse effects on night time environments and receptors at and distant to that location, and to maximise the positive opportunities through great lighting design.

Summary of the interdisciplinary working process:

At the start of the project:

1. Ensure that lighting is considered! Outline design – allow initial assessment.
2. Ensure that the right environmental professionals are involved:

- Architect / Engineer
- Landscape Architect
- Ecologist
- Lighting Professional
- Heritage Professional
- Planning Professional etc.

Determine likely design and assessment considerations

and

Agree responsibilities / contributions of each professional



Agree:

- Co-ordination of work / outputs
- Requirements from each professional (to allow each to undertake their own assessment work)

Provide feedback to project team on initial findings and requirements to meet objectives or targeted mitigation



- Access final scheme and present in individual assessments or
- Provide agreed input into combined Lighting Impact Assessment

Cody Levine

Worcestershire County Council: CLevine@worcestershire.gov.uk

Stuart Morton

Jacobs: Stuart.Morton@jacobs.com

A4440 lighting scheme

Worcester 6 is a strategic development site in the heart of Worcestershire. A planning condition of the site development is that a toucan crossing will be implemented on the A4440 to link an existing M5 bridleway overbridge with Warndon (to the east) and the development site (to the west). Due to the speed and volume of traffic flows in the locale the controlled crossing needs to be lit. Existing roundabouts to the north and south of the proposed crossing are currently lit and therefore a continuous scheme of lighting was required to provide adequate uniformity throughout the route. However, the land in the vicinity of the proposed crossing includes several ancient woodlands and designated Local Wildlife Sites. An area close to one of the roundabouts was identified as being regularly used by commuting *Myotis* and *Plecotus* bat species.

The initial solution proposed was a 'dark corridor' to protect a crossing point where the largest diversity of species and largest number of passes was detected. However, this currently dark location also coincided with an approach to a roundabout with historic accident data statistics. A dark area of lighting required a departure from standards and the County Council's Network Controller indicated they were unable to support such an approach.

The Jacobs design team proposed a revised mitigation strategy, consisting of 'warm white' TRT LED lanterns with two Signify Clearfield lanterns located at the point of the bat 'corridor'. Together, these lanterns meet the required lighting standards, therefore avoiding the need for a departure from standards while providing an experimental 'red corridor' for commuting light-intolerant bat species. Installation of ducting to the corridor also provides an opportunity to remove existing coarse grass verge vegetation and enhance by seeding with a low-height wildflower mix.

Jacobs are working with Worcestershire County Council (WCC) communications team to provide positive press releases. The scheme has been in regular communication with the local councillor, to keep local residents informed of the scheme and any impact regarding traffic management and the 'red light' conditions. There have been a number of letter drops around the scheme extent, detailing any projected impacts to local residents. The scheme also sits on the blue light route to the local hospital; early consultation has occurred with the relevant parties in the hospital and ambulance services to ensure they are aware of any disruption from the proposed works. WCC Ecology team have undertaken baseline surveys comprising walked transects and static detector analysis over 2018 and will continue to monitor the strategy's effectiveness following the anticipated activation of lanterns in June 2019.

Topic 3

Latest Technology

Maurice Donners

Signify

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Reducing the impact on night time behaviour of nocturnal mammals

Signify, formally known as Philips Lighting, released research on the response of bats to different light spectra published in Royal Society Journal Proceedings B – www.royalsocietypublishing.org/doi/10.1098/rspb.2017.0075. The recently launched Philips ClearField LED lighting was used in the research and was proven not to disturb the habitat of light-shy bat species at night. For the study which started in 2012, the Netherlands Institute of Ecology (NIOO-KNAW) and Wageningen University worked closely together with Philips Lighting to research how bat species react to different light colours in their natural habitat.

The use of artificial light at night has increased dramatically worldwide and sky brightness is forecast to grow by 6% per year. For nocturnal animals like bats, which have adapted to forage in darkness, artificial light can dramatically impact their activity levels.

For the experiment, a unique scientific setup of eight field sites in The Netherlands was used to study the response of bats to three different experimental light spectra in an otherwise dark and undisturbed natural habitat. Philips LED light poles were installed emitting red, green and white light using Philips ClearField technology for red LED light and Philips ClearSky technology for the emission of green light. All LED lights produce a light intensity commonly used to illuminate country roads.

“By working together with Philips Lighting we are taking a crucial next step in researching LED lighting technology that doesn’t impact bat species and preserving wildlife and the environment,” says Dr. Kamiel Spoelstra, researcher at the Netherlands Institute of Ecology

“The report is the culmination of five years of research which has highlighted how light can protect bats which are an endangered species group globally. In conjunction with NIOO-KNAW, our next step is to build on this research, and to assess how much of the bats’ habitat is being lost when damaging light is used and how Philips ClearField light can mitigate this,” says Maurice Donners, Senior Scientist at Philips Lighting.

The experiment revealed that white and green lights should be avoided in dark areas and natural habitats as it reduces the activity levels of light-shy bat species, while Philips ClearField LED light doesn’t affect their activity levels to forage at night. To limit the negative impact of light at night on bat species, Philips ClearField lighting can be recommended when illumination is needed in otherwise dark and undisturbed natural bat habitat where bat species assemblage matches that in the experiment carried out in The Netherlands; trials in the UK are ongoing.



Sean Kielthy

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Long term – Live reporting of light level monitoring to an interactive website

Bath and North-East Somerset have planning conditions requiring obtrusive light onto the River Avon to be strictly controlled and monitored for two years post occupancy.

Typically, this would involve an engineer visiting a site multiple times over that period capturing snapshots of data to build up an overview of the lighting profile of the area. However, given the cost and logistics involved in sending an engineer to site, only a limited amount of data can realistically be collected. Over a two-hour period, an engineer might collect the data from 20 positions. This method however is best suited to sites with fixed/non variable forms of light. Residential and office developments especially the interior spaces are much more variable in the light they generate.

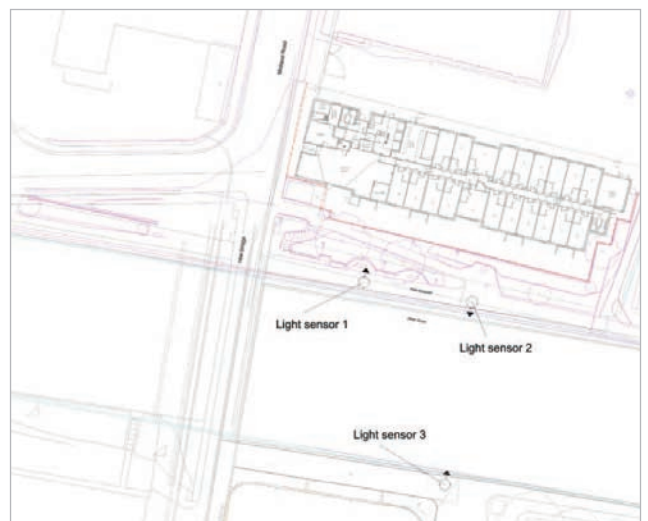
Our solution is to use three (or more) light sensors at fixed positions which monitor the light levels and be capable via an algorithm of inferring the light levels at other positions within the zone of measurement.

The sensors capture data every 10 seconds and relay that information to our web based server which has a client access portal. From three sensors a total of nearly 13,000 separate measurements would be collected over a 12-hour period. The readings are collated and presented in a user-friendly format. Historical data can be downloaded and further interrogated. Patterns of light levels can be examined and flags can be set to show if the required light levels have been exceeded.

The sensors are flexible and can relay data via hard-wire, Wi-Fi or LoRa-WAN. They can be battery or solar powered so remote locations are practical from both a power and data transfer standpoint.



Handheld Light meter



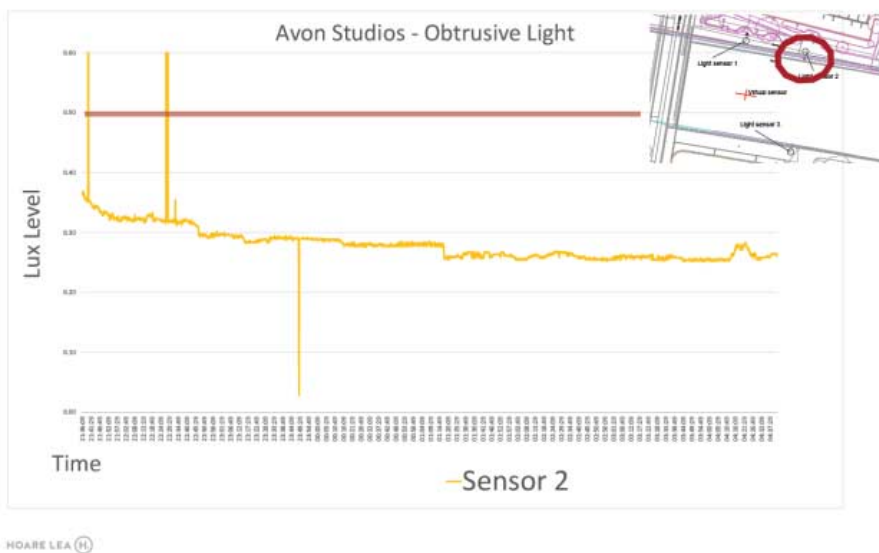
Typical sensor positions



Battery operated Wi-Fi version

We have a live project at Midland Road in Bath where this system is in operation.

Future research: comparing the patterns of light levels to bat activity by comparing our data sets to acoustic or infra-red monitoring equipment and looking for correlation.



Graphical representation of data

James Fletcher

Kingfisher Lighting

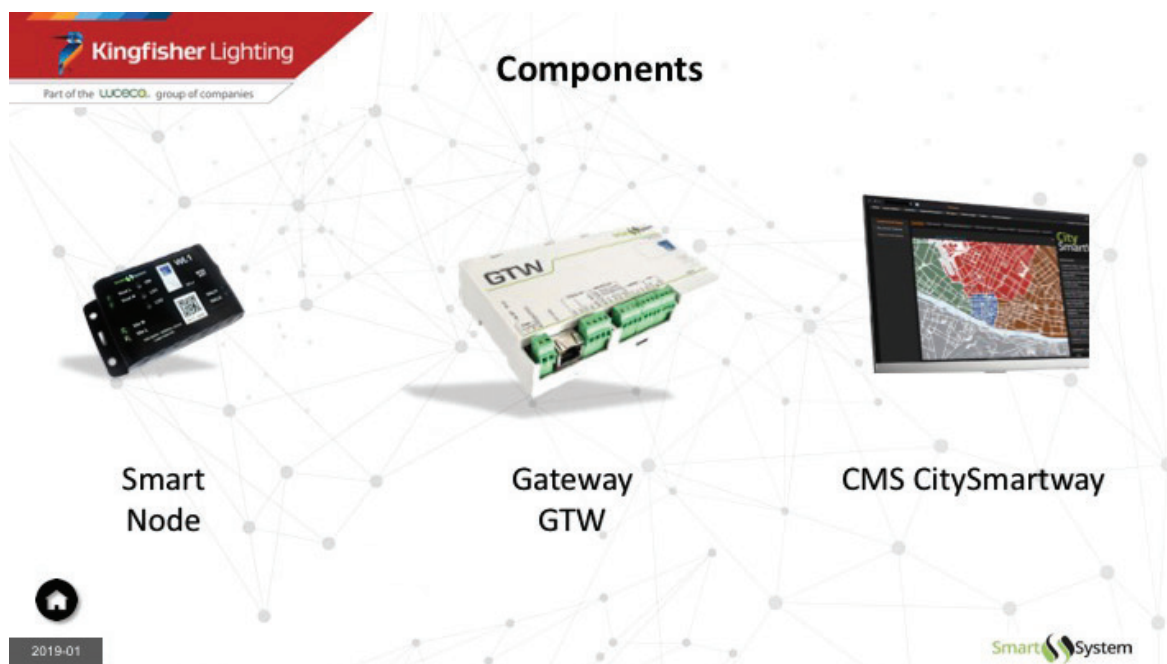
jmiles@kingfisherlighting.com

Smart Cities



With the advent of LED lighting and communications networks with high bandwidth data transfer capabilities the idea of a smart city has become a reality.

Born out of a desire to control the lighting and save energy many local authorities have already adopted systems that give detailed information as to the performance and status of their inventory. However, the Smart city has moved far beyond simple light controls.



To make these systems work you need a smart node to capture information and issue signals to the light fittings, a gateway to transmit information to a computer and a CMS system to monitor the activity of the assets.



AEC SMART NODE

IEEE 802.15.4, 2.4GHz, 16 channels, mesh network
Internal astronomical clock, temperature sensor, inclination/accelerometer
Light control with DALI/1-10
Integrated Auto-Dimming capability (Stand-alone mode)
Power Relay to completely isolate the LED DRIVER
Power measurement, failure signalling
ENEC certified in AEC LUMINARIES
Remote upgrade (OTA)
RS-485 version for external sensors

Internal Node with External Low Profile Antenna

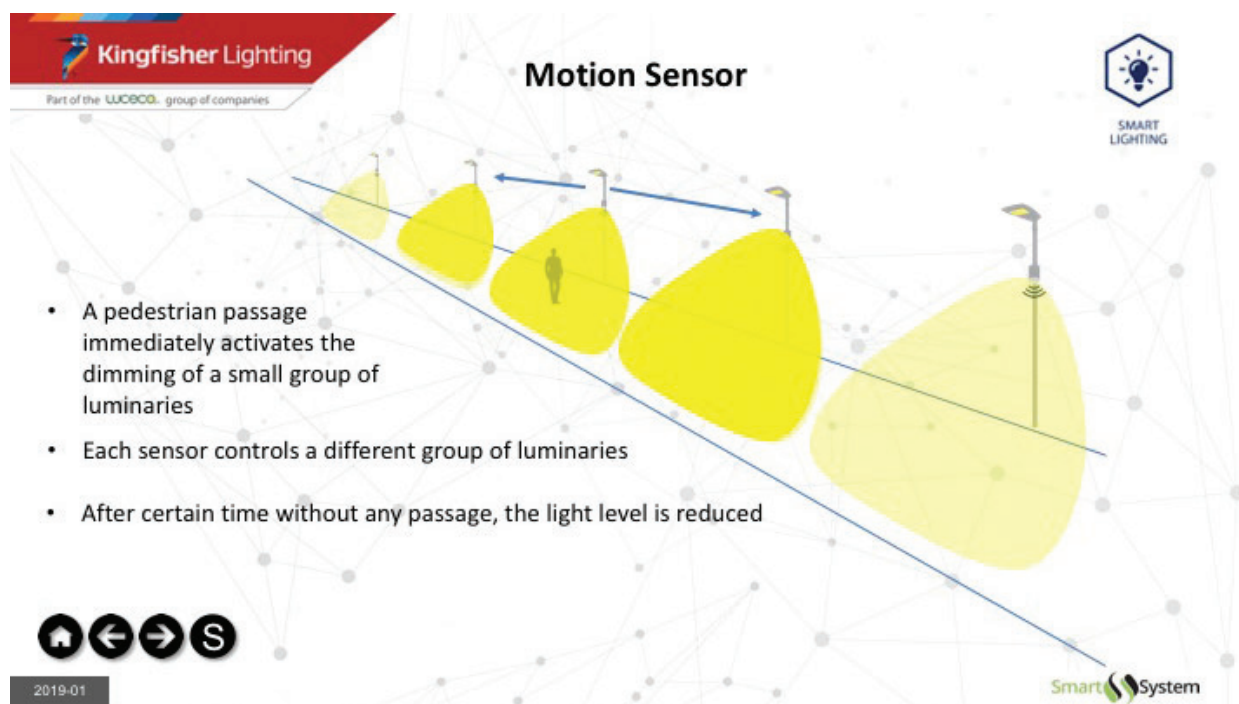
Node for 4-pin ZHAGA Socket (ZHAGA Book 18)

Node for 7-pin NEMA Socket (ANSI C136.41)

SmartSystem

Nodes can come in many different guises, from a more conventional seven pin nema socket to a more discrete node with a low profile antenna, ideal for when you don't want to take away from the aesthetic of the luminaire.

As well as standard light control such as DALI and 1-10v, our nodes come with a number of features built in such as: Internal astronomical clock, temperature sensor, inclination/accelerometer, power measurement and failure signalling.



Motion Sensor

Kingfisher Lighting
Part of the WUCBOL group of companies

SMART LIGHTING

- A pedestrian passage immediately activates the dimming of a small group of luminaries
- Each sensor controls a different group of luminaries
- After certain time without any passage, the light level is reduced

SmartSystem

Because third party sensors can be added this opens up many options on controlling the lighting. Motion sensors can be attached to columns to dim the lighting when a pathway is not in use. Grouping of the luminaires allows for the lighting to detect and follow the user down the path. This maximises energy savings but also reduces the CO₂ impact on the environment.

Reduced lighting levels will also have benefits to local wild life to minimise: disruption of foraging behaviour, suppression of melatonin and light pollution.


Kingfisher Lighting
Part of the LUCECO group of companies

Smart Metering and detection





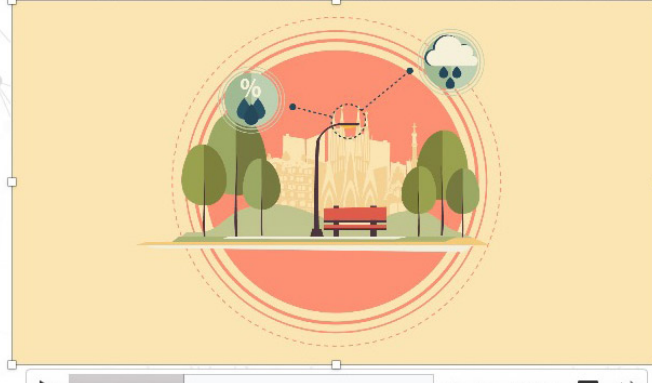
- Gas meters and water meters can be integrated in the system
- Detection of leaks can be reported back in real time easing the strain on resources and the environment


2019-01


By introducing smart sensors to gas, water and sewage pipes we can detect faults much quicker, cutting costs but more importantly reducing waste and minimising our use of natural resources.


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Smart Irrigation





- AEC Smart Node can command the opening/closure of irrigation circuits
- It is possible to implement automatic irrigation profiles
- Using data from weather sensors it is possible to decide to stop the irrigation in case of rain in order to optimize the natural resources


2019-01


In a similar way we can use weather information that is gathered to automate irrigation systems for public areas, ensuring they are watered when needed but not wasting water when it is not required.


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Part of the LUCECO group of companies

Waste Management





- A specific sensor transmits the level of filling of public bins through the mesh network
- Emptying operations can be optimised using the data collected by the CMS


2019-01

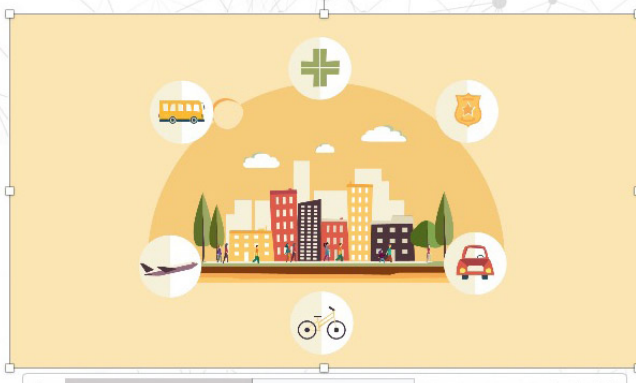


It could be argued that one of the most important issues we face along with climate change is waste management. Ensuring that our waste is disposed of properly is essential to ensure we protect our environment. If bins are full the likelihood of waste being dropped increases. Similarly wasting resource over emptying is an issue; with smart management efficiencies can be improved.


Kingfisher Lighting
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Smart Information





- It is possible to provide geo-referenced information
- Smart systems are green systems


2019-01



With smarter more reliable information we can encourage greener behaviours with things like better public transport, moving people away from taxis and their cars in favour of cheaper more reliable and better bus or train routes. Building apps that can plan where you need to be and how to get you there with payment built in could replicate the success of things like the London Underground service to other parts of the country.

Every aspect of Smart systems are to the benefit of the environment, from less light to less waste to less CO₂.

Topic 4

Case Studies

Harry Fox

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Karen Renshaw

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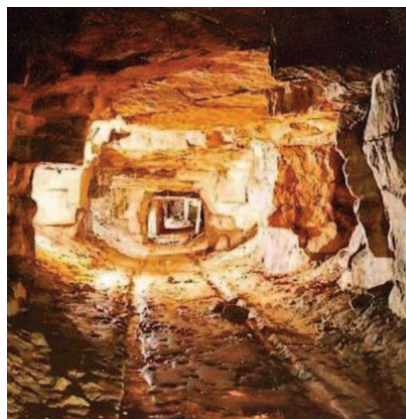
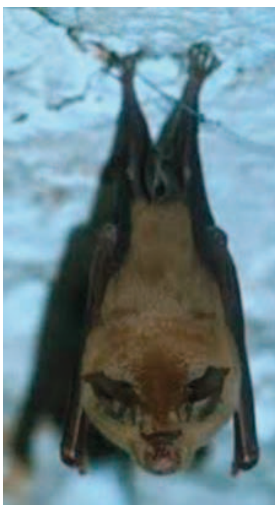


Creating Guidance to Balance the Needs of Bats and Development in a Landscape City

The context

Bath is a UNESCO 'World Heritage City' famous for its Georgian city landscape set among the Cotswold Hills divided by the River Avon.

The city features strong natural habitat connections permeating its centre, like the river which runs close to the various component caves and mines which make up the Bath and Bradford-on-Avon Bats Special Area of Conservation, a vital site for the conservation of horseshoe bats. A 'gut feeling' was held by Bath and North East Somerset ecologists about the role the river plays in local bat ecology.



The Challenge

Local Planning Policy commits Bath and North East Somerset to:

- The preservation and enhancement of designated sites, green infrastructure and the favourable conservation status of protected and notable species within developments.

and

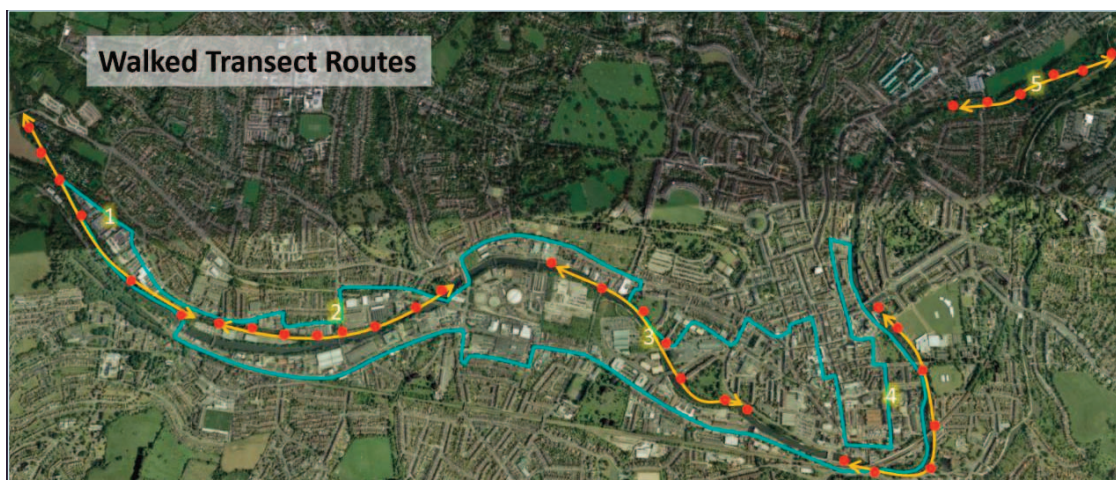
- The sustainable redevelopment and utilisation of high-value post-industrial riverside land within the city. This land has been allocated largely to accommodate the city's growing population (including students from two universities).

Reconciling both commitments was problematic and had led to an inconsistency of approach to ecological survey and bat mitigation in planning, especially the limitation of artificial lighting. Overall, the protection of the river corridor in planning terms was weak. Reliable data was required on which to base new policy. Furthermore, the general understanding among professional ecologists of lighting terminology was poor.

The research

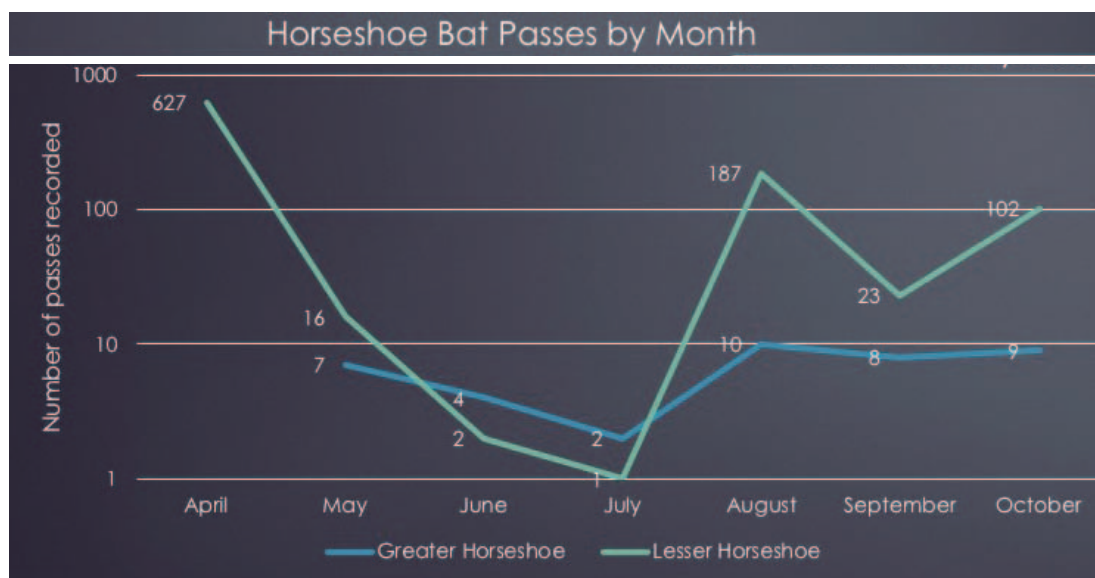
To address this, the following survey work was carried out:

- Survey area: 5km stretch of river corridor through the city centre.
- Static detector survey: 10 locations along the river within towpath and bankside occupying a mix of habitats and split between north and south banks. Each detector recorded for seven nights/month for 12 months.
- Walked transect survey: Five c.1Km transects along towpath through survey area were surveyed for three hours each month between April and October.
- A baseline lighting survey taking 79 ad-hoc light meter readings (horizontal at 0m, four compass points at 1.2m on vertical plane).



The findings of this research were:

- Lesser horseshoe bats recorded at every static detector location and on three out of five transects, some significant activity rates. Greater horseshoe bats recorded on six out of 10 static detector locations. Activity focussed within first 5m either side of the water's edge.
- Locations of greatest horseshoe bat activity recorded all the most dark survey and/or vegetated locations. Evidence suggested horseshoe bats crossed some lit areas, most probably at speed.
- Horseshoe bat activity rates peaked at the beginning (April) and end (August-October) – spring and autumn fluxes. Activity persisted in every winter month at a low level.
- At least 12 other species recorded including Nathusius pipistrelle and barbastelle which migrate. Intense general activity throughout study area. Widespread species activity peaked in activity in the summer months.
- Consequently, the River Avon supports a significant diversity of bats throughout the year and most likely facilitates the migration of rare species between winter and summer sites.
- The absence or low level of artificial lighting and presence of strong natural habitat cover best indicators of horseshoe bat activity.
- For the first time, the River Avon was formally established as Supporting Habitat to the SAC and therefore protected at same level.



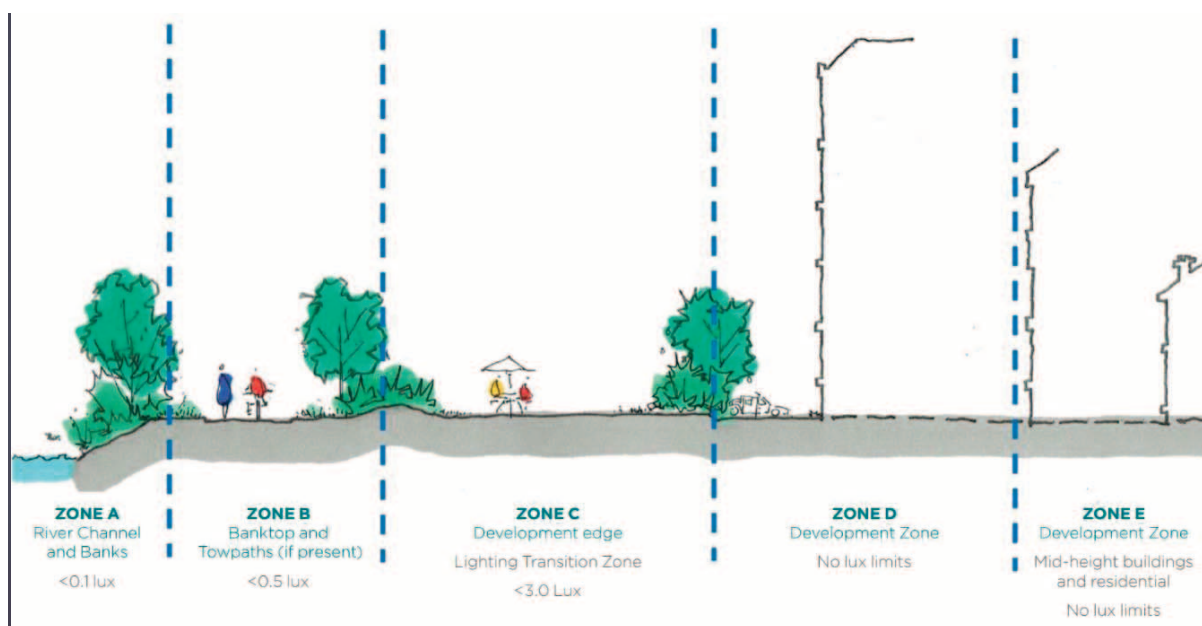
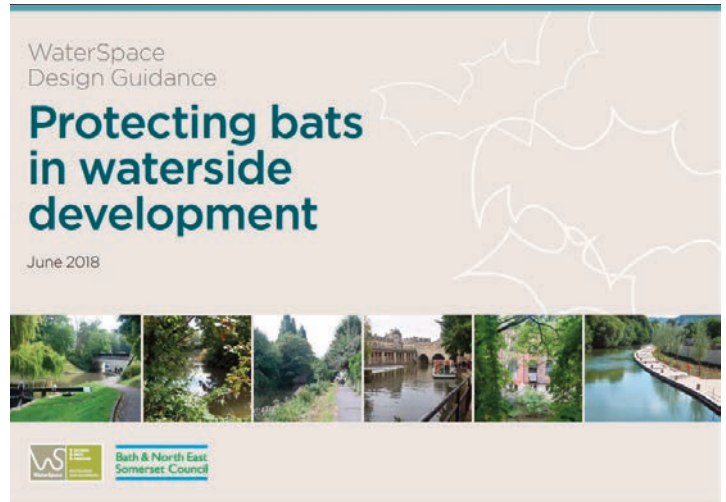
The solution

A user-friendly guidance document was produced which unified advice on the preservation of bat habitat, the mitigation of lighting impacts and the provision of detailed lighting modelling.

The guidance enabled developers to avoid having to carry out bat surveys to support their application as long as they could demonstrate they had sufficiently designed out any lighting impacts and habitat loss upon the river corridor.

Limits on lux levels at certain guideline distances from the river were imposed. This encouraged the pushing back of development edge from the river and the implementation of hard screening and landscaping.

The guidance provided a level playing field to all developers, enabling the avoidance of costly and time-consuming bat surveys. Consequently, the time taken to assess ecological impacts of development could be reduced. The guidance should enable more efficient production of higher quality developments which protect Green Infrastructure and promote the health and wellbeing benefits of the river corridor in development.



What next?

Little experience of the use of guidance so far – awaiting applied feedback.

Need to monitor outcomes, but budget difficulties may preclude this.

The baseline lighting survey highlighted opportunities to remediate existing developments with poorly designed lighting. Potentially an avenue for CIL funding derived from new development.

Download at tinyurl.com/yay53o2e

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BRENTWOOD
LIGHTING DESIGN

Best Practice Lighting Assessment and Case Study

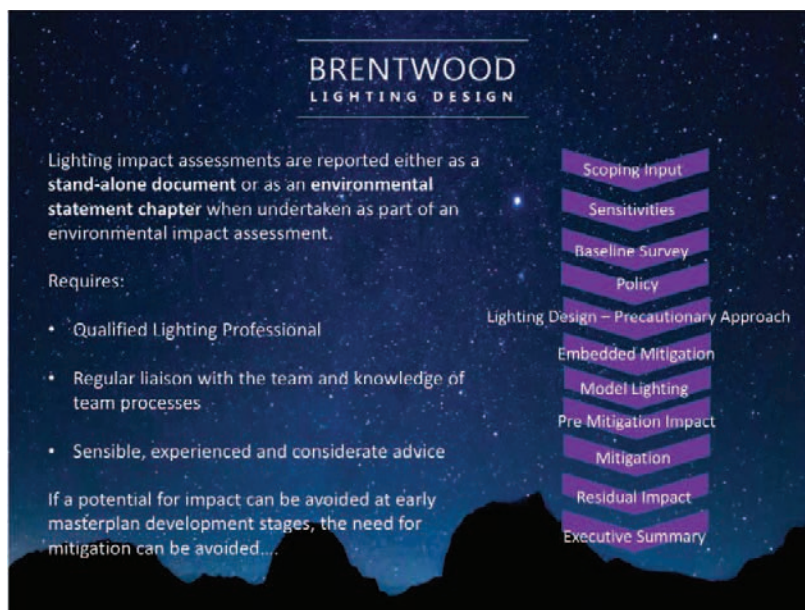
The principles behind lighting assessment are not just about ticking a box. The aspects of the lighting approach, assessment and proposed mitigation need to be considered in tandem with other disciplines as part of the proposed development process.

This process can potentially influence the operational lighting approach, building design, internal space allocation, façade treatments and landscape measures in order to ensure that a negligible impact is achieved with regards to ecology sensitivities.

This presentation provided a methodology of best practice, do's and don'ts and provides examples of how outputs should be undertaken, presented and understood with clarity.

Part 1 – What is a lighting assessment?

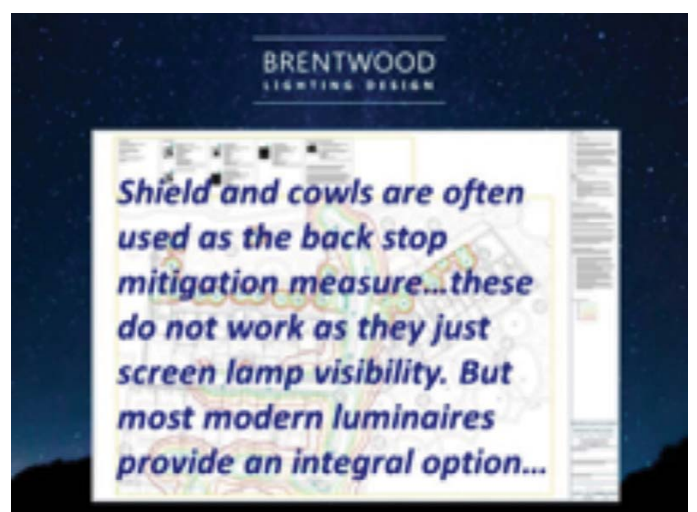
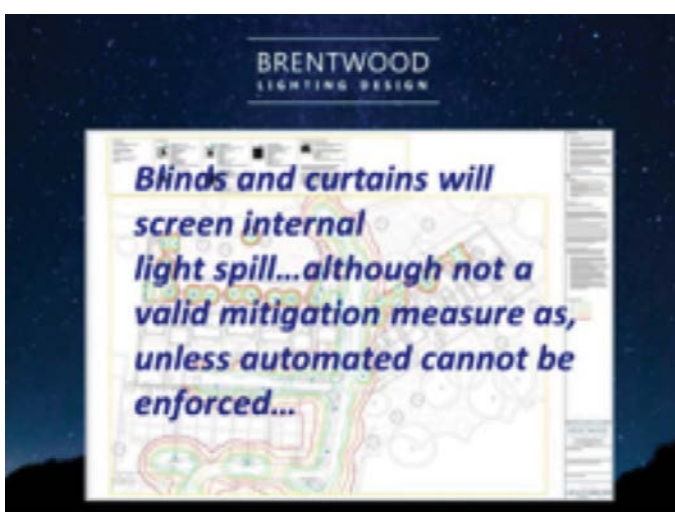
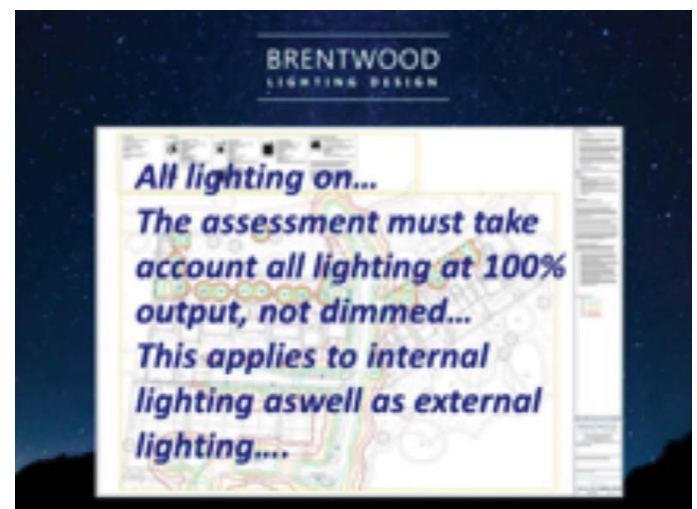
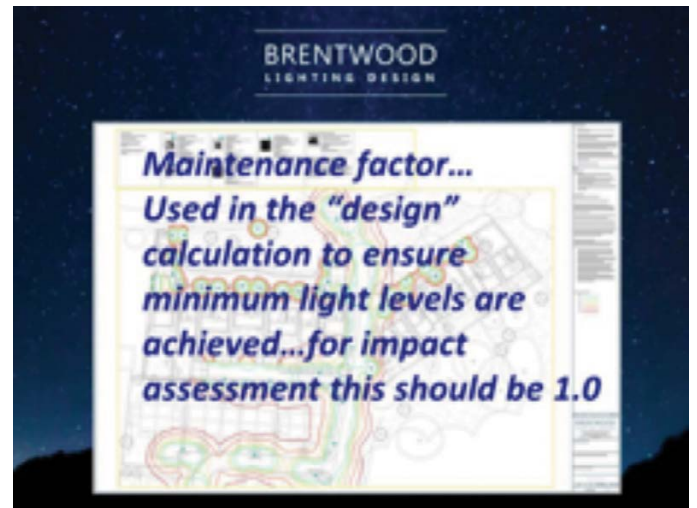
The opening discussion explains the process of a lighting assessment and provides the reasons for 'why and when' a lighting assessment is required.



Part 2 – Common pitfalls and errors

Discussed the normal pitfalls that are encountered when an assessment is provided and what to ask for and to question...

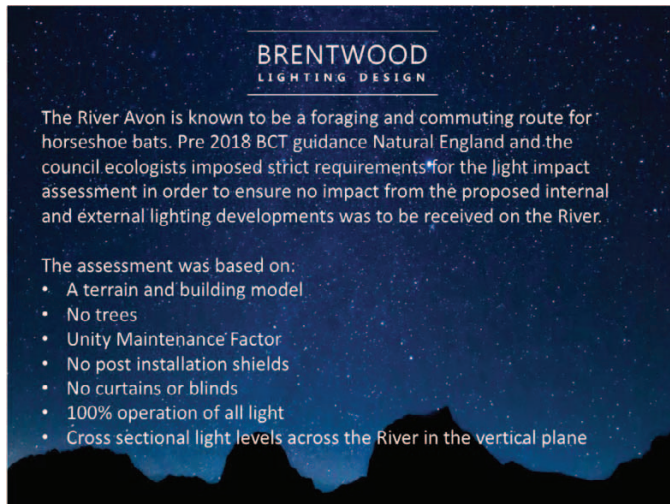
- The assessment plane;
- The first day installed condition;
- Shields and cowls, copy and paste....
- Terrain changes;
- All operational;



Part 3 – Case Study – Avon Riverside Development, Bath City

Demonstrated a case study of where a series of assessments were required, within an iterative process, for factors involving the lighting strategy, the building approach and the landscape design in order to determine the best mitigation strategy for the development proposals.

The process undertaken was pre BCT 2018 guidance but supports and includes much of the current content:



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The River Avon is known to be a foraging and commuting route for horseshoe bats. Pre 2018 BCT guidance Natural England and the council ecologists imposed strict requirements for the light impact assessment in order to ensure no impact from the proposed internal and external lighting developments was to be received on the River.

The assessment was based on:

- A terrain and building model
- No trees
- Unity Maintenance Factor
- No post installation shields
- No curtains or blinds
- 100% operation of all light
- Cross sectional light levels across the River in the vertical plane



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Through various iterations the scheme was developed and incorporated the following mitigation measures:

External Lighting Mitigation

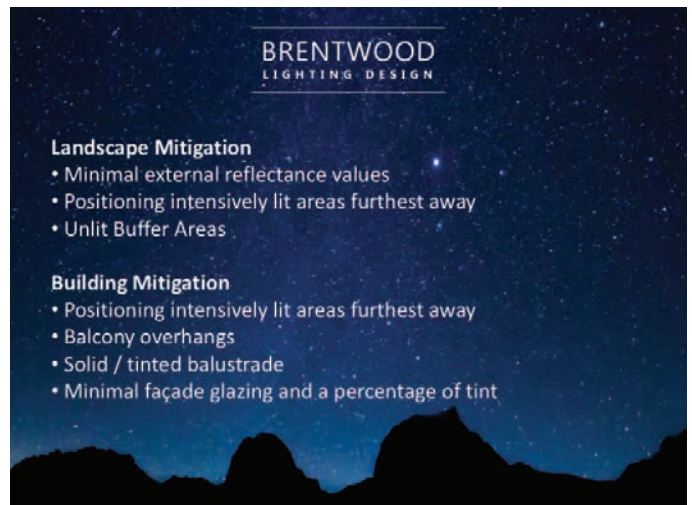
- Minimal lighting levels, did it need to be lit?
- Directional light
- Minimal columns heights
- 2700K colour temperature
- Minimal columns heights
- Positioning of luminaires
- Luminaires with integrated shielding



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Internal Lighting Mitigation

- Minimal lighting levels
- Directional light at window locations
- An internal buffer zone of no lighting at window locations
- 2700K colour temperature
- Positioning of luminaires behind structure
- Luminaires with integrated shielding



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Landscape Mitigation

- Minimal external reflectance values
- Positioning intensively lit areas furthest away
- Unlit Buffer Areas

Building Mitigation

- Positioning intensively lit areas furthest away
- Balcony overhangs
- Solid / tinted balustrade
- Minimal façade glazing and a percentage of tint



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The submitted scheme proposals and light impact assessment were approved with conditions for secondary assessment and post construction monitoring to ensure light impact levels were appropriate.

Jenny Singh

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Case Study: A120 Little Hadham Bypass

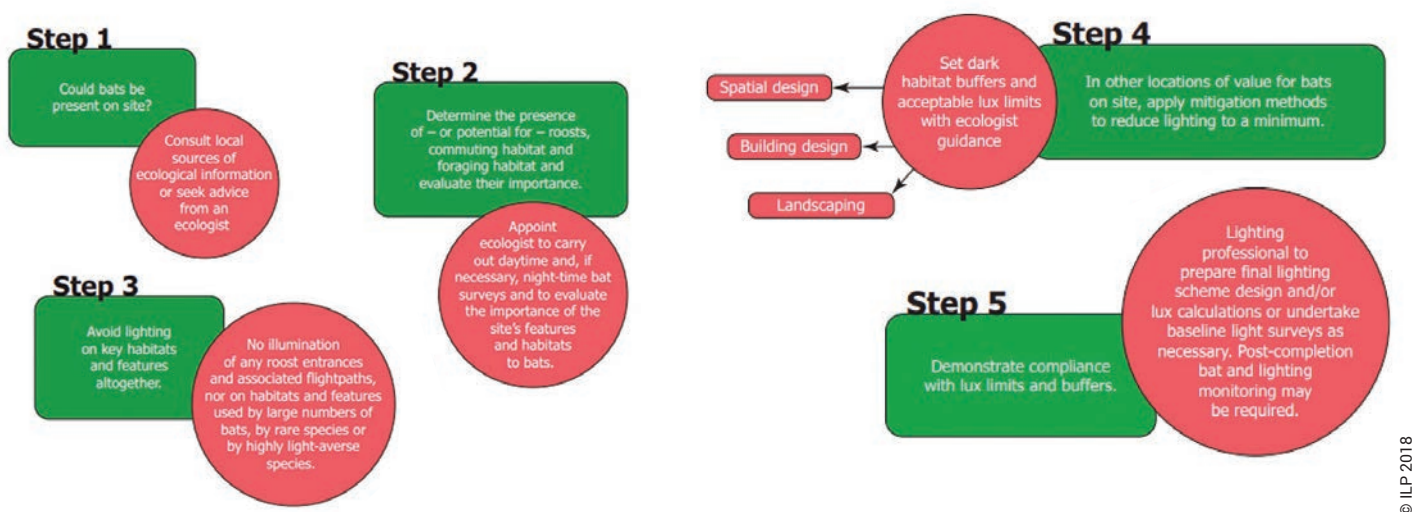
Introduction

Working on a 3.9km bypass for the A120 around Little Hadham the local bat group highlighted the presence of a barbastelle maternity roost in a woodland immediately adjacent to the proposed scheme. This was confirmed by surveys during 2016. Due to the introduction of two roundabouts at the start and end of the bypass section, the installation of lighting was required in these locations for health and safety reasons.



© BCT

This scheme was assessed prior to the Institute of Lighting Practitioners Guidance Note 08/18 on Bats and Artificial Lighting in the UK (ILP, 2018). This guidance sets out a simple five-step process, to identify and assess potential impacts of lighting on bats as well as best practice advice on lighting scheme design. A review of the approach taken for the A120 (prior to comprehensive guidance being issued) shows that our assessment was broadly in line with this guidance and illustrates how useful this note is in undertaking a robust assessment of the potential lighting impacts a development will have on bats.



© ILP 2018

Stage 1: Could bats be present on site

Records and surveys confirmed barbastelle maternity roosting activity in Bloodhounds Wood, making this a highly important roost as the only maternity roost recorded within Hertfordshire at the time. Surveys also identified the presence of a regular barbastelle flight path through and over the existing A120 underpass south of Hadham Lodge.

Barbastelle are Annex II species and are highly light-averse, therefore the main concerns were plans to light the new roundabout potentially causing:

- light trespass into vegetated areas;
- reduced available crossing points, and
- prey resources to be drawn away.

Stage 2: Determine presence of roosts, commuting and foraging habitat

A radio-tracking study was undertaken to establish how bats were moving between woodlands north and south of the existing road, and to determine roost locations wherever possible. The study identified that barbastelle bats were using a series of woodlands as a 'woodland complex' and regularly moving roost between these locations. The bats were also heading out of Bloodhounds Wood in multiple directions to their respective foraging areas. The results of this study enabled us to more accurately assess the potential impact of lighting along the proposed scheme.



© ARUP 2016

Stage 3: Avoid lighting on key habitats

The environmental assessment concluded that the proposed lighting scheme had the potential to have a significant impact on a nationally rare bat species (barbastelle). Through collaborative discussions the scheme design was amended so that lighting was restricted to the new roundabouts with dark corridors to be retained around the existing underpass and woodland complex. However, eliminating the requirement for lighting along the scheme was not an option in this case so avoiding lighting of key habitats, which were immediately adjacent to the proposed roundabout by Hadham Lodge, was not possible by designing out the requirement for lighting.

Step 4: Set dark habitat buffers and lux levels

Potential lighting options were explored with our lighting engineers, which resulted in us selecting the Urbis Ampera light (from a list of potential options) based on the following criteria:

- LED with a warm white spectrum (ideally <2700Kelvin) to reduce blue light component;
- Peak wavelength >550nm to avoid component of light most disturbing to bats;
- Column height of 5m and mounted on the horizontal (no upward tilt);
- Baffles, hoods and louvres can be fitted to reduce light spill.

Detailed modelling work and real-world testing undertaken in 2017 concluded that lighting along the eastern approach to the Roundabout by Hadham Lodge could be significantly reduced from 120m to 30m from the roundabout, whilst delivering the required safety standards.

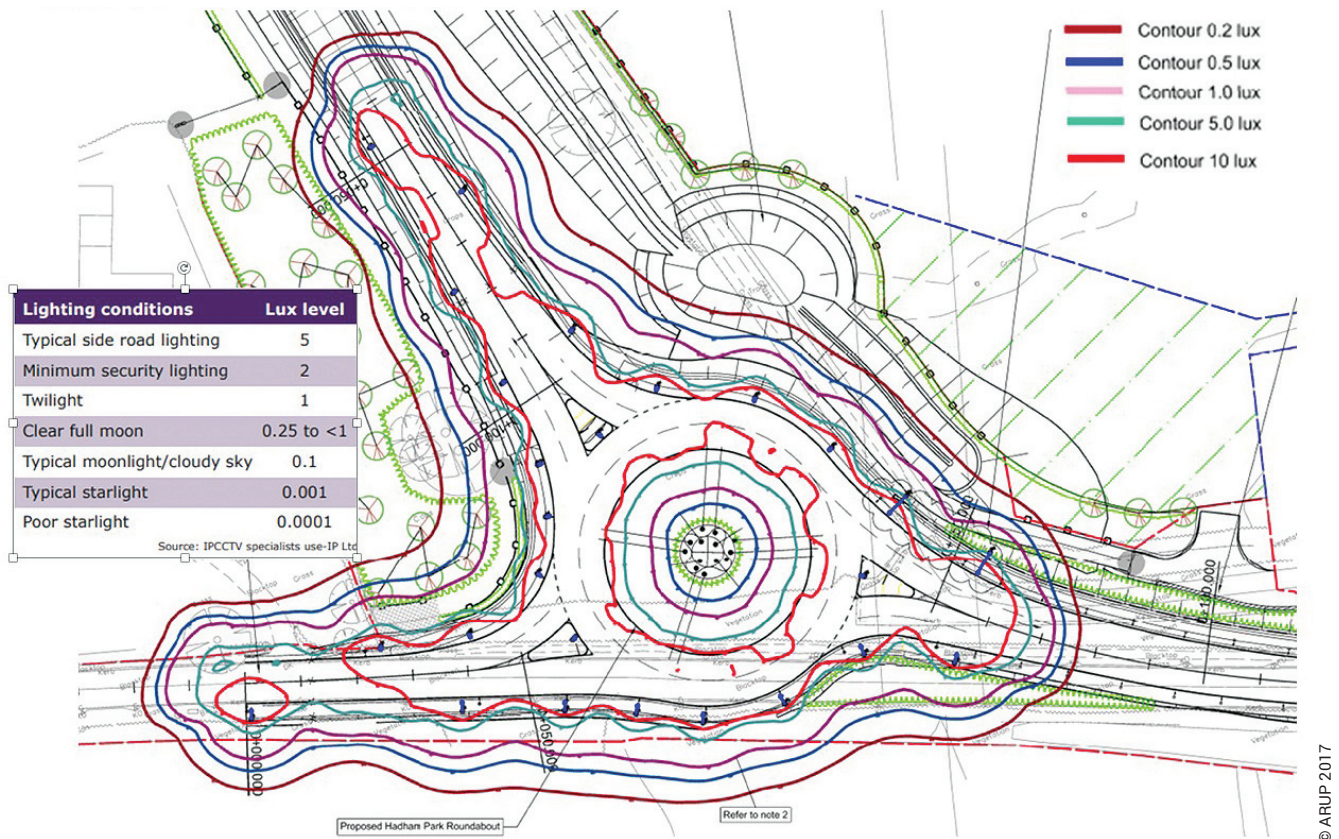
Lower mounting height columns were also proposed in order to mitigate potential disruption to bats. Best effort to avoid important bat habitat was made whilst ensuring that light levels were adequate for highway safety.

The lanterns proposed support integral louvres to direct lighting, supplemented by physical shielding to the rear of the column. This serves to omit backlight and reduce glare, by directing light to where it is required and avoiding undesirable light spill.

In addition to this, mitigation planting was proposed to provide a buffer to existing habitat and enhance the existing commuting / foraging route.

Step 5: Demonstrate compliance with lux limits / buffers

The ILP guidance provides a list of requirements to help demonstrate that the proposed lighting will comply with required light limits / screening as part of the environmental assessment. This includes the preparation of horizontal and vertical (where applicable) illuminance contour plans by a suitably experienced and competent lighting professional. The guidance states that contours for 0.2, 0.5, 1, 5, and 10 lux must be clearly shown as well as appropriate contours for values above these. as illustrated below.



Looking at these contours, 10 lux is equivalent to sunset and 0.1 lux is equivalent to a typical moonlit / cloudy sky. Illuminance below 0.2 lux is therefore considered to be sufficient for a 'dark corridor', which is in line with research undertaken by Emma Stone in relation to foraging behaviour by lesser horseshoe bats (Stone, 2012).

Conclusions

Despite having limited guidance available at the time of our assessment, the outputs were broadly similar. It was clear that having a lighting engineer involved in conversations about alternative design and mitigation measures was essential, and that they should be engaged at an early stage in the design process. The ILP guidance is a useful tool for ecologists to use as a means of communication of our requirements with the lighting engineer.

In this case the result of engaging and questioning the lighting engineer and client was that no EPS licence was needed. The mitigation strategy and proposed monitoring was accepted in Nov 2018. This will continue to monitor the barbastelle population through various survey techniques, to determine any changes in distribution / behaviour during construction and operation of the scheme.

The proposed monitoring, which will include repeat radiotracking studies, will reveal whether there are any short / long term impacts on the barbastelle population.

The key message is to think outside of the box when assessing potential lighting impacts of developments and prescribing mitigation. It may be that the lighting design can be challenged, and standards adapted to avoid significant impacts to bats.

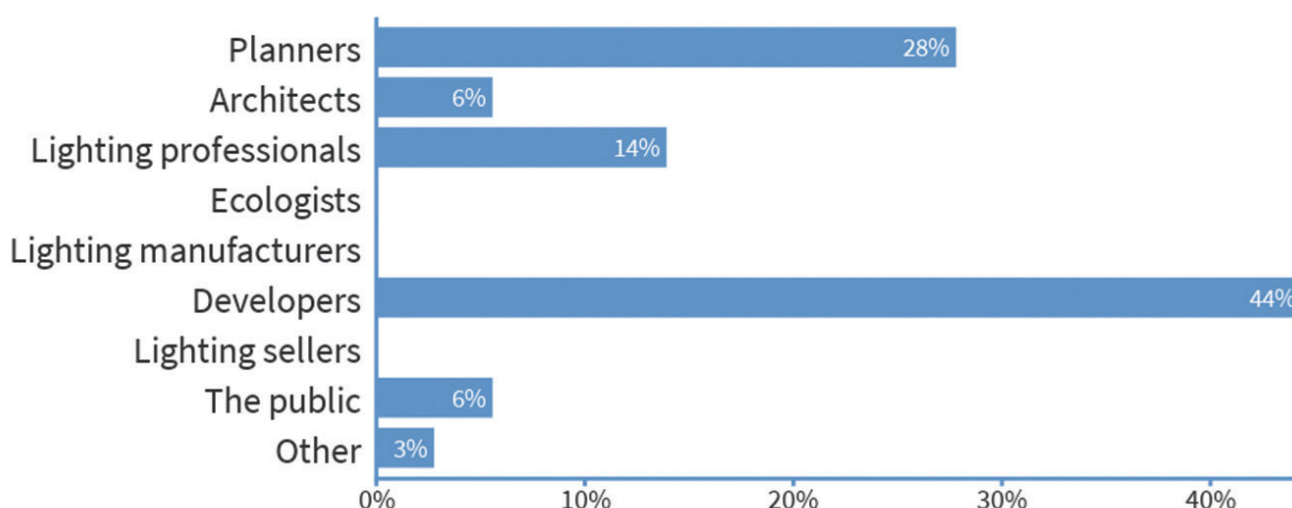
Poll Everywhere

Summary of Poll Everywhere

Live Polling Results

Who do you think would benefit from better engagement on this topic?

Poll locked. Responses not accepted.



What word best describes the challenges we need to overcome to improve outcomes for bats from the impacts of lighting?

 Poll locked. Responses not accepted.



Bat Conservation Trust



This symposium and publication has been sponsored by



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