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Stephen Robinson
stephen-t.robinson@arup.com

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Stephen Robinson
stephen-t.robinson@arup.com

Abstract

This paper describes the lighting design and rationale for the Mardyke Garden project. It is realised through accentuating the historic buildings and integrating the local biodiversity issues such as the park's bat population. Many new modern structures have been added to this historic park such as a pavilion bandstand, called the "Pavilion of Light", with colour-changing luminaries and in-ground, star-scape, fibre-optic lighting in the children's play area.

This paper discusses the background behind the final lighting design and how integral elements such as the walkway bollards were designed so that bats would avoid the area involved, thereby sustaining their participation in the local ecology. Furthermore, the bandstand is now used as a reflector that not only changes the colour of the stage but as a projector into the sunken garden, synergising performance with the experience of patrons.

Also discussed will be how the lighting designer drew from localised landscaping in maximising optimal experience. Lighting controls are also discussed. Cork City Council can now manage this complex lighting design so that patron's experiences can evolve based on multi-faceted elements such as season, event and even occasion.

Key Words:

Innovative lighting, colour-changing lighting, LEDs, ecological friendly lighting.

1. Introduction

The redevelopment of Fitzgerald's Park has created a state-of-the-art public facility in the heart of the city. The thoughtful re-imagining of the space, driven by the relocation of the bandstand to the front lawn, was integral to the success of the scheme and of reinventing the park. The Pavilion is now a modern landmark, conjuring memories of the grand bandstand of the international exhibition held at the site in 1902. Its success has acted as a catalyst for community engagement and has facilitated a range of events enjoyed by locals and tourists alike. As an icon of collective memory, it forms the heart of a wider community, designed to serve diverse ages and interests. It is a wonderful facility, whose flexibility of use will attract visitors from near and far for years to come as the park evolves and grows.

This paper discusses the lighting design of the Mardyke Gardens and covers many aspects of outdoor lighting. The bandstand is up-lit with RGB LEDs to allow automated colour change of the Pavilion, which can subsequently be reflected onto the garden performance viewing area because of the reflective nature of the Pavilion. The walkway lighting is designed to be low energy and architecturally coherent with the surrounding design. The children's play area features fibre-optic lighting in the ground to form a "Starscape" at night and the *POD*, which was originally Dermot Gavin's award-winning Hanging Garden at the Chelsea Flower Show in 2011, is now fixed firmly to the ground. Mounted on a podium, wide angle low-level luminaires illuminate this structure from below to accentuate the elevated "floating" *POD* effect.

The controls bring all of these separate lighting aspects together into one coherent design. The lighting controls use manual and Dali devices, along with an astronomical timer and web app facilities to ensure maximum flexibility of when and where these luminaires can be controlled or configured. This gives the City Council great scope to adapt and adjust the lighting design to suit the current need within the spaces.

The need to create an effective design in harmony with the existing environment was a key part of this project and introduced some challenges with regard to a local bat roost.

The complexity of working with bespoke structures provides challenges when attempting to calculate or model such areas. Parts of this lighting design did not rely on calculations but rather the experience of the designer. These challenges are also discussed within.

2. Background

The Mardyke Gardens was founded in 1845 by the building of Shrubbery House on its land by local brewer Charles Beamish before being bought by the Bon Secours Sisters in 1861. In 1902 it played host to the International Cork Exhibition for more than a year. Once the International Exhibition was finished, the park was handed over to the corporation for the people of Cork with Shrubbery House later becoming a Museum in 1942. Since then the citizens of Cork have enjoyed walking through the park and enjoying the gardens. In 2011 Cork City Council and Fáilte Ireland



Figure 1: Pavilion of Light and front lawn with the Museum in the background leading to the Gallery Garden.

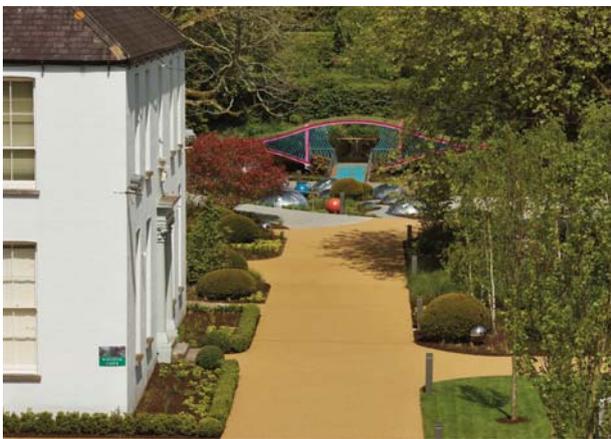


Figure 2a: Walkway, Gallery Garden, POD and Landscape Spheres.



Figure 2b: Children's play area with clear canopy (above).

agreed to fund a renovation of the park and to focus attention on two separate areas;

(1) Relocating the bandstand and creating a new pavilion in front of a viewing lawn to facilitate public access to numerous stage performances throughout the year;

(2) The addition of the *POD* in the Gallery Garden overlooking the river Lee to the rear of the park with a new walkway linking it to the main entrance. The Gallery Garden area also includes a new children's play area in and around new and exciting landscape spheres (Figure 2a and Figure 2b).

3. Methodology

The objective of the lighting design was primarily to improve the experience associated with the architecture and to carry this heightened experience into the evening and night for the occupants of the park. This was broken down into four main areas of light.

Firstly, the Pavilion of light is a bespoke structure with smooth curves and high reflectance to enhance acoustic performance of bands playing by directing sound outwards towards the front garden. The objective was to use this structure to enhance the visual experience also by using the white surface as both a canvas and a reflector. The challenges this posed was the fact that it was such a complex structure that modelling it or calculating it would not prove to be an accurate estimate. The design was largely based on manual estimations and mock-ups on site.

The second lighting task was to highlight some of the new trees planted in the garden. For this, narrow beam LEDs are used with a 40° cut-off to ensure only the targeted tree is illuminated.

The third area of interest from a lighting design perspective was the children's play area. This area is open-plan between the *POD* and the museum with a clear canopy structure located within it. Fibre-optics are used to create a starscape in the ground which can twinkle in the dark, replicating the night sky on the ground.

The fourth area of interest was the *POD*, located at the rear of the park beside the children's play area. The *POD* was originally suspended from a crane at the Chelsea Flower Show but, as this could not be replicated in a public park, the *POD* was mounted on a podium. The lighting design in this area was designed to illuminate the *POD* from below to highlight the structure without

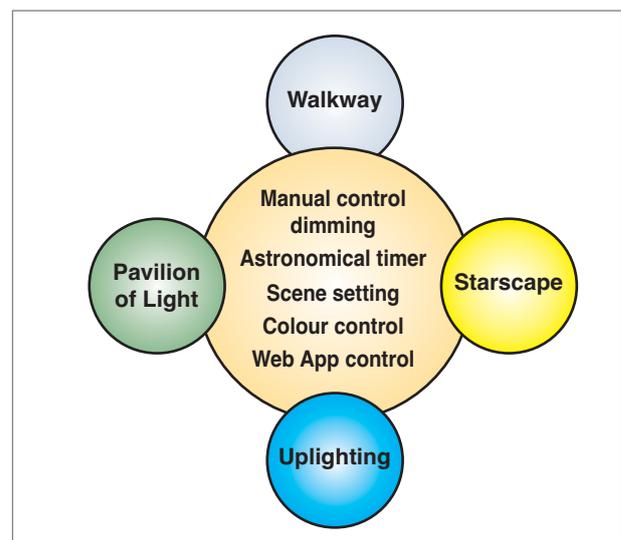


Figure 3: Design approach incorporating control elements for each facet of the project.

attracting emphasis on the mounting. This approach provided the illusion (at night time) of a floating structure as the light shining beneath it was evenly distributed along the front of the object and its linear length. The podium it was mounted on was not the focus of illumination.

Finally, the walkway from the main entrance to the *POD* and surrounding areas was designed to ensure adequate light to pedestrians walking through the park, but also to not interfere with the local bat population in the park. Cork City Council required assurances that local bat life would not be effected by the lighting in all of the circulation spaces that the public would frequent. The design approach is illustrated in Figure 3 (page 45).

The four separate aspects of the design were all integrated onto a common control platform (Philips Dynalite) that brought together control protocols; such Dali protocols outlined in IEC Standard 60929 are used for dimming and switching, and DMX controls for colour-changing to DMX 512. The control strategy developed ensured all the above criteria were met. It also complemented the vision of the new landscape architecture.

3.1 The Pavilion of Light

The Pavilion of Light is illuminated via nine 900mm-long in-ground asymmetric RGB (18W x 3) LEDs spaced evenly across the underside of the structure. The structure is white, giving an accurate reflection of the light being directed towards it. The Pavilion reflects the light outward onto the front lawn giving a spectacular light show each night. The luminaires are Dali controlled from within the museum and are set on the colour-changing loop each night. The colours and sequence can also be controlled via Cork City Council's office, or from an iPhone/Android app. This allows the bandstand to change to any colour of the spectrum at anytime from anywhere.



Figure 4: Pavilion of Light (top) and some spot lighting highlighting new trees (below).

3.2 Up lighting of the new horticulture

As part of this project many new trees and foliage were planted and the landscape architect wished to highlight some of these at night time. To do this, in-ground IP67 LEDs with a colour temp of 3000K were used. In order to limit upward light pollution a narrow beam angle of 40° was chosen (Figure 45). The lamp was also recessed down inside the fitting to limit glare to pedestrians.

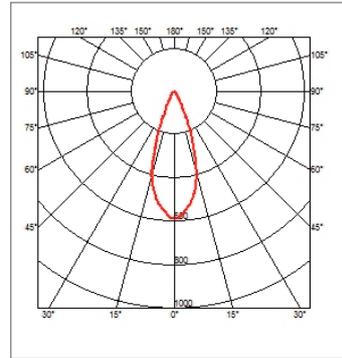


Figure 5: Narrow beam angle of uplighter.



Figure 6: Narrow beam uplighters focus light on trees and limit upward glare.

3.3 Starscape

The Starscape is located in the children's play area of the park. The idea behind this is to create some in-ground lighting that would



Figure 7: Starscape employing bespoke sculpture as well as shrubbery in the cobble lock area.

add a sense of fun to the space. The light engine was located in a dry enclosure hidden within the new shrubbery and the light was carried by sheathed end-emitting polymer optical fibre. These fibres were located within the cobble lock of the play area.

3.4 Walkway Lighting

The walkway from the main entrance of the park to the rear (towards the *POD*) posed some concern to Cork City Council as a known bat roost was in the area. The walkway lighting was designed to ensure the bat flight pathways between the roost and the river Lee where unaffected.

To achieve this it is important to understand what effects bats and their feeding habits with regard to the surrounding light.

Bats are nocturnal and only come out at night after the sun has set and light levels are low. Most bat species are photophobic and bright lights near or around a bat roost have been known to impact the population in the area. *“The direct and artificial illumination of a bat roost area may reduce activity resulting in later emergence, giving bats less time to forage which may result in bats being underweight, thereby increasing the risk of mortality during winter hibernation (Bat Conservation Trust, 2009)”*.

Light emitted at one wavelength with no ultraviolet light helps to maintain the bats’ environment as normal. Low temperature luminaires are recommended for use in areas of known bat activity due to the low levels of UV emitted. Light at this colour temperature does not attract insects and thus does not interfere with the bats usual feeding habits.

It is also recommended that lighting in these areas be kept low and focused on the task area to minimise light spill. The UK bat organisation recommends that luminaires should not exceed eight metres tall and that a 10-metre corridor adjacent to the illuminated area should be maintained to allow bats to travel in parallel.

For this project, 1-metre tall LED bollards were used with a colour temperature of 3000K. The light level on the pathway was kept to the required minimum of 5 lux. This was achieved by specifying dimmable luminaires and physically calibrating (dimming down) each one in position to gain the correct minimum light level, and to eliminate any unnecessarily high levels along this pathway.

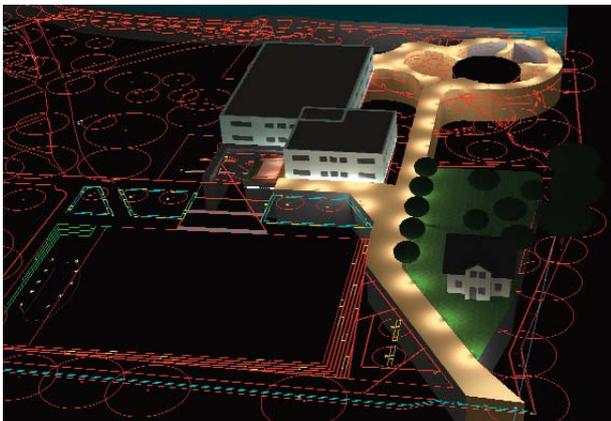


Figure 8: Bollard lighting model – 10m bat corridor to the right, low level direct light on the pathway at 300K minimises the impact on the bats’ habitat.

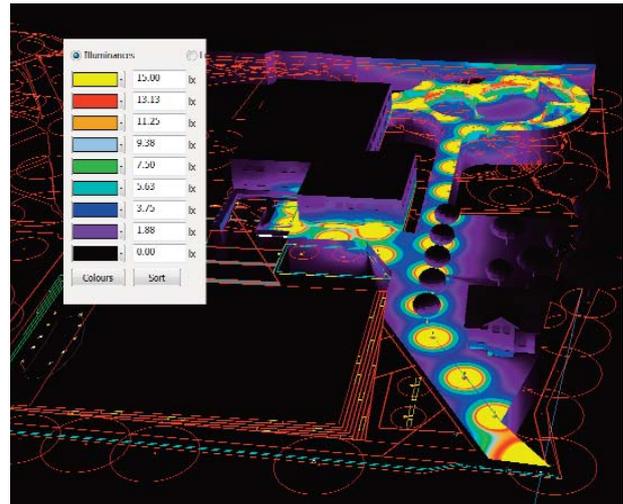


Figure 9: Dialux calculation to achieve 10 lux average if required, luminaires are running at 50% of this value on site.

After occupied hours the luminaires, which are controlled via an astronomical clock, ramp down even further to give a 3 lux average. This is to further improve the bats’ night time environment and also not to attract unwanted anti-social behavior. The bollards are IP67 and IK10 which are particularly suited to this project.

Under CIBSE Guidelines (CIBSE, 1991) 10 lux for primary pathways and 5 lux for secondary pathways in public parks is required. The lighting calculation was designed to meet the 10 Lux but, as the luminaires were dimmable, a derogation was allowed by Cork City Council to designate this pathway a secondary route and the luminaires’ outputs were dimmed down to meet this requirement.

3.5 The *POD*

The emphasis on lighting the *POD* was to evenly distribute the light across the front of the *POD* but, at the same time, to ensure the mounting platform stays in some darkness. To do this wide-angle luminaires were positioned at each end of the structure, mounted slightly in front and hidden from view behind some shrubbery. The luminaires adequately light the structures’ façade facing the occupants of the park and do not highlight the mounting brackets underneath.



Figure 10: The *POD* illuminated by wide angle floodlights at each end from below.

5. Discussion

This lighting design had many challenging aspects, most notably the local fauna. This was successfully overcome with the use of 3000K low UV output lighting mounted at one metre from ground level. The selection of the LED bollards not only fitted well with the architectural landscape furniture, but also allowed the light to be distributed at low level under the recommended guidelines, and within the 5 lux maximum level. The use of an astronomical timer ensured the luminaires were only on for the minimum required duration.

At the beginning of the design stage the Pavilion represented a large unknown as this was a bespoke structure. The lighting design for this object developed with the pavilion design and turned out to be very effective and achieved its objectives. The use of cloud-based Dali controllers ensured full adaptability for the Pavilion to change colour and output levels easily to suit any band/stage act.

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