

**For: Portal Asset Holdings Ltd.
Port Road, Killarney**

PROPOSED RESIDENTIAL DEVELOPMENT



Public Lighting Design Assessment

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MHL & Associates Ltd.
Consulting Engineers



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1 NON-TECHNICAL SUMMARY

In response to the proposed Large-Scale Residential Development in Killarney, Co. Kerry, MHL & Associates Ltd. on behalf of Portal Asset Holdings Ltd. has conducted a comprehensive assessment and design of public lighting for this site. This assessment describes the existing and proposed lighting designs, lighting pollution, and mitigation measures while ensuring lighting standards are conformed to. In this non-technical summary, we'll outline our findings and mitigation measures for the proposed public lighting infrastructure. Best practice design and mitigation measures have been employed to ensure the sensitive ecological receptors (Bat) / habitats have been accounted for in the site's proposals.

As part of our assessment, MHL has collaborated closely with the project ecologist to examine the potential lighting impacts. The assessment has considered and incorporated the recommendations of the 'Bat Eco Services. The design focused on two primary areas. Firstly, lighting within the development site to contain light and prevent general spillage, particularly at the new junction where it meets Port Road. Secondly, attention was given to the existing public lighting along Port Road, which has historically caused light spillage into the national park, particularly at vulnerable zones along the boundary of the Park. Final lighting specification to be agreed between the applicant/appointed contractor and the Kerry County Council with input from National Parks and Wildlife Service (NPWS), as required.

The three primary mitigation measures proposed for reducing light spill and the impacts of artificial lighting for this application, as noted in the planning applications Bat Report are:

- **Lighting Design with BCT Specifications:** Designing the lighting for the proposed development site according to BCT (2023) specifications helps ensure that the light is contained within the site boundaries, reducing spillage into neighbouring areas and minimizing light pollution. By using fixtures and design practices that comply with these specifications, the development can achieve its lighting goals while mitigating potential negative impacts on the surrounding environment.
- **Landscaping along River Deenagh:** Implementing landscaping, such as new planting along the River Deenagh at the new site junction on the Port Road, serves as a natural barrier to prevent vehicle glare from entering the national park. Vegetation helps to shield and diffuse light, reducing its intensity and minimizing its impact on sensitive ecosystems and wildlife habitats. This approach not only mitigates light spill but also enhances the visual aesthetics of the area.
- **Relocation of existing lighting and use of BCT-compliant Luminaires:** Moving existing lighting/luminaires along the Port Road to the western side and ensuring that new luminaires meet BCT (2023) specifications are effective measures for reducing lighting spill. By relocating existing fixtures away from sensitive areas and using fixtures that are designed to minimize light spill, the overall impact of artificial lighting can be significantly reduced. This approach improves lighting efficiency and safety while minimizing potential negative effects on the environment and nearby communities.

1.1 Development Site

For this lighting assessment, the adopted design integrates all essential measures within the housing scheme, effectively restricting light dispersion within the site as illustrated by the light spill/penetration assessments noted in this document. Moreover, the spatial separation, topography, and existing treeline encircling the development site guarantee that there are no concerns stemming from that specific area or location, as containment remains intact. The design of the project, informed by the ecological inputs from the project team, prioritizes public lighting within the development estate that minimizes the impact of artificial light through measures such as selecting lantern heads with suitable optics, incorporating lighting hoods/shields, mounting luminaires horizontally with zero degrees vertical tilt, using warm white spectrum (2700k) lanterns, opting for flat glass lanterns, employing LEDs with sharp cut-offs and dimming capability, and options for dimming and part-night lighting based on diurnal, seasonal, and human activity factors.

1.2 Port Road

Port Road existing lighting design was reviewed and evaluated against with new LED luminaires proposed. The revised design notes improved lighting quality, coverage, energy usage and overall road and pedestrian safety along the route above the modelled existing "do-nothing scenario". Compliance is demonstrated through the lux contour plan of the proposed public lighting for the roadway. This plan not only verifies adherence to the specified limits but also provides insights the light spread and control through use of the selected lantern head optic and lighting classification. The lighting plan encompasses the expected horizontal illuminance at ground level across all areas of the site, presenting lux contours. Coupled with this is the reduction of light spill in comparison to the existing older lantern heads on site, noting a net gain in comparison to the existing scenario.

The proposed development lighting plan notes a demonstrable improvement on light spill into the park (benefits of both relocation and through the use sensitive 2700K Led lanterns with zero up light (Uo). The proposed lighting columns are to be situated to the back of the western footpath along Port Road with an additional column installed directly opposite the development entrance, as noted in the supporting lighting design layouts / sections.

1.2.1 Port Road Junction

At the junction onto Port Road, existing public light standards emit light across the road towards the national park, particularly concerning is the fixture on the right (north) side and another further north. Discussions with NPWS highlighted concerns about cars leaving the housing site at night and the potential for light spillage. To address this, a solution was agreed upon between MWP and NPWS: planting a 40-meter-long double line of semi-mature species along the pathway edge to serve as an additional barrier against light spillage. Please refer to the "Proposed Landscaping Plan for the reduction of vehicle highlight spread into the national park" produced" by MWP.

1.3 Domestic Light Sources from the development

Although it falls outside the scope of the public lighting design, to mitigate potential light trespass from development unit windows, measures have been employed at optimizing site configuration to minimize domestic spill lighting, implementing screening through soft landscaping and physical barriers.

Internal luminaires can be recessed (as opposed to using a pendant fitting) where installed in proximity to windows to reduce glare and light spill. Low transmission glazing treatments to achieve further reduced illuminance targets from internal domestic sources at specified locations are also proposed and are to be agreed between the applicant and Kerry County Council at preconstruction stage. The measures proposed can be incorporated by way of condition in a grant of planning.

By implementing these mitigation measures, the project can effectively address concerns related to light spill and contribute to the preservation of natural habitats and the reduction of light pollution in the surrounding area.

Notwithstanding that it has been demonstrated that lighting design will ensure that lighting within the proposed development will be contained within the site and no light spill will occur, the potential to reduce lighting glare from elevated windows / those nearest sensitive ecology receptors can also be offset through the use of recessed internal luminaires near windows and / or use of glazing treatments on west and south facing windows, where necessary, to restrict any lighting trespass. The BCT guidelines advise that where needed, low transmission glass may be a suitable option in achieving reduced illuminance targets. It may not be necessary having regard to height and position of windows, as well as intervening built form or landscape screening. A range of glazing specification options exists in respect of lower light transmission of glass, and where deemed necessary, a final specification can be agreed with the project ecologist.

2 INTRODUCTION

M.H.L. & Associates Ltd. Consulting Engineers have been engaged by Portal Asset Holdings Ltd. to produce a Public Lighting Design Assessment to supplement an LRD planning application for a Large-scale Residential Development at Coollegrean, Port Road, Killarney, Co. Kerry. Portal Asset Holdings Ltd is seeking planning permission for the construction of a new housing development at the site.



Figure 2.1: Main Residential Development Site

Portal Asset Holdings Ltd. intend to apply for planning permission for a Large-Scale Residential Development (LRD) at Port Road and St Margaret's Road, Coollegrean, Inch, Knockreer, Ardnamweely, Derreen (townlands), Killarney, Co. Kerry.

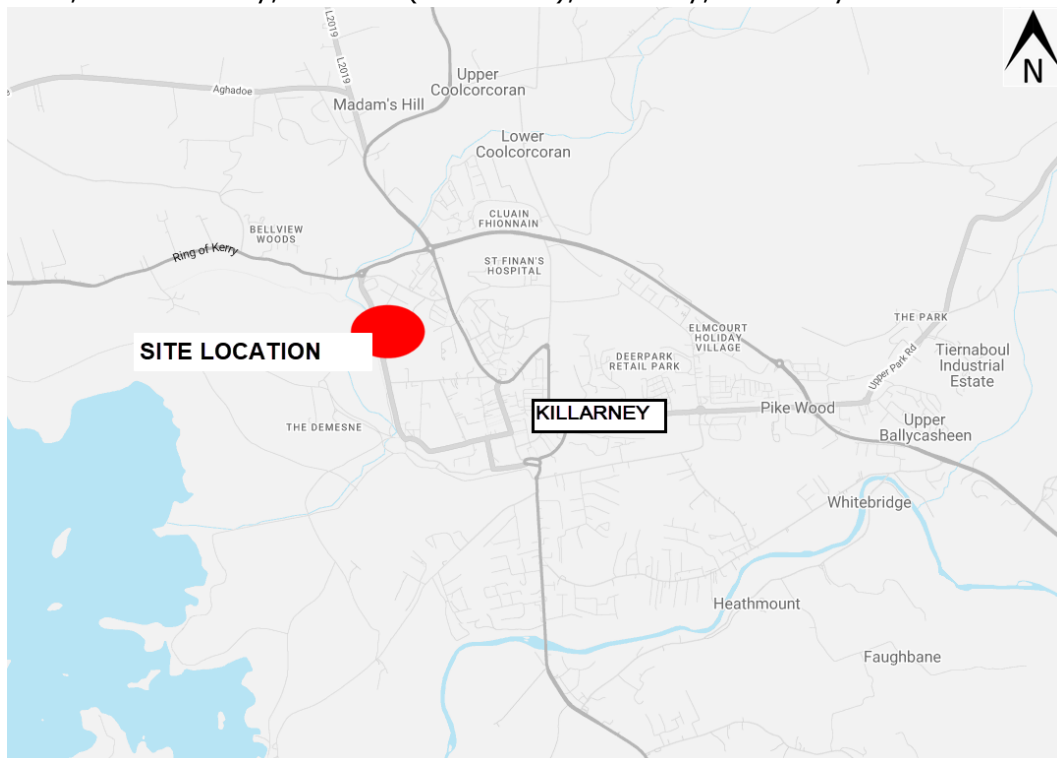


Figure 2.2 Site Location – wider context.

2.1 Report Structure

This report has been prepared to assess the lighting levels within the vicinity of the development site and develop a sensitive lighting design to support the applicant's planning application. The report has been prepared by MHL to the best of our knowledge using the information provided by Kerry County Council and the client. The report assesses the potential effects of obtrusive light that could arise from outdoor artificial lighting at the proposed development.

The principal objective is to identify the effects of the new lighting plan on identified sensitive receptors and propose suitable mitigation measures. Obtrusive light or light pollution is any light that strays to areas other than where it is intended and can include light intrusion (spill light) into neighbouring properties, upward light (which can create sky glow) and visual source intensity (glare). Light pollution can create negative effects on ecological receptors in the area, particularly concerning bat roosts and foraging corridors.

This lighting impact assessment considers the scenario of installing new proposed artificial lighting, to assess the significance of the potential effects compared to existing baseline scenarios.

3 ASSESSMENT METHODOLOGY

3.1 Environmental Zone Classification

All standards consulted are nationally recognised documents, (some internationally also) which deal with all design issues associated with external lighting.

CIE Standards, the CIBSE and the Society of Light & Lighting guidance documents, all apply a common Environmental Zoning system, which is summarised in the table below.

Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	UNESCO Starlight Reserves, IDA Dark Sky Parks
E1	Natural	Intrinsically dark	National Parks, Areas of Outstanding Natural Beauty etc
E2	Rural	Low district brightness	Village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Small town centres or suburban locations
E4	Urban	High district brightness	Town/city centres with high levels of night-time activity

Figure 3.1 Environmental Zone (ILP)

3.2 Obtrusive Light

- Obtrusive light (or sometimes referred to as light pollution) refers to any light emitted in a direction in which it is not required or wanted and as such is detrimental to other users.
- Light intrusion refers to the spilling of light beyond the boundary of the area to be lit. This includes the intrusion of light into bedroom windows.
- Skyglow refers to the brightening of the sky above towns cause by direct or reflected upward light.
- Glare refers to the uncomfortable brightness of a light source when viewed against a dark background. The figure below illustrates the different types of obtrusive light.

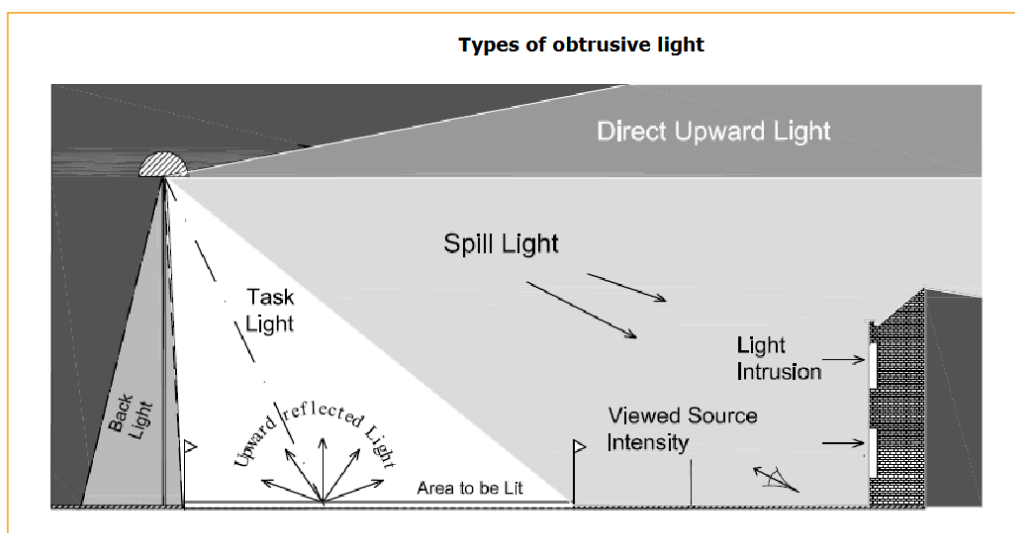


Figure 3.2 Types of Obtrusive light (ILP)

3.3 Potential Effects

Poorly designed public lighting can contribute the following obtrusive light components:

- Light spill into windows: this is typical of wall-mounted luminaires with high tilt angles.
- Upward light causing sky glow: this is typical of up-lighting.
- Glare: due to high light source intensity from floodlights
- Intrusive light affecting ecology: caused by excessive height and tilt.

Poorly designed lighting consists of the installation of a limited number of luminaires that are being used to light a wide area. Due to this, the lighting is normally installed with tilt angles that are too great, because there is a need to spread the light as far as possible, lighting the intended area, as well as surfaces where the lighting was not intended.

Many of the potential effects of artificial lighting can be effectively mitigated by a suitable lighting strategy, good design and choice of suitable lighting equipment. It is proposed that the lighting impact is to be limited by using accepted methods of lighting control, limiting illuminance, and controlling light spill. Lighting shall be selected to provide safety and security without polluting the surrounding environment.

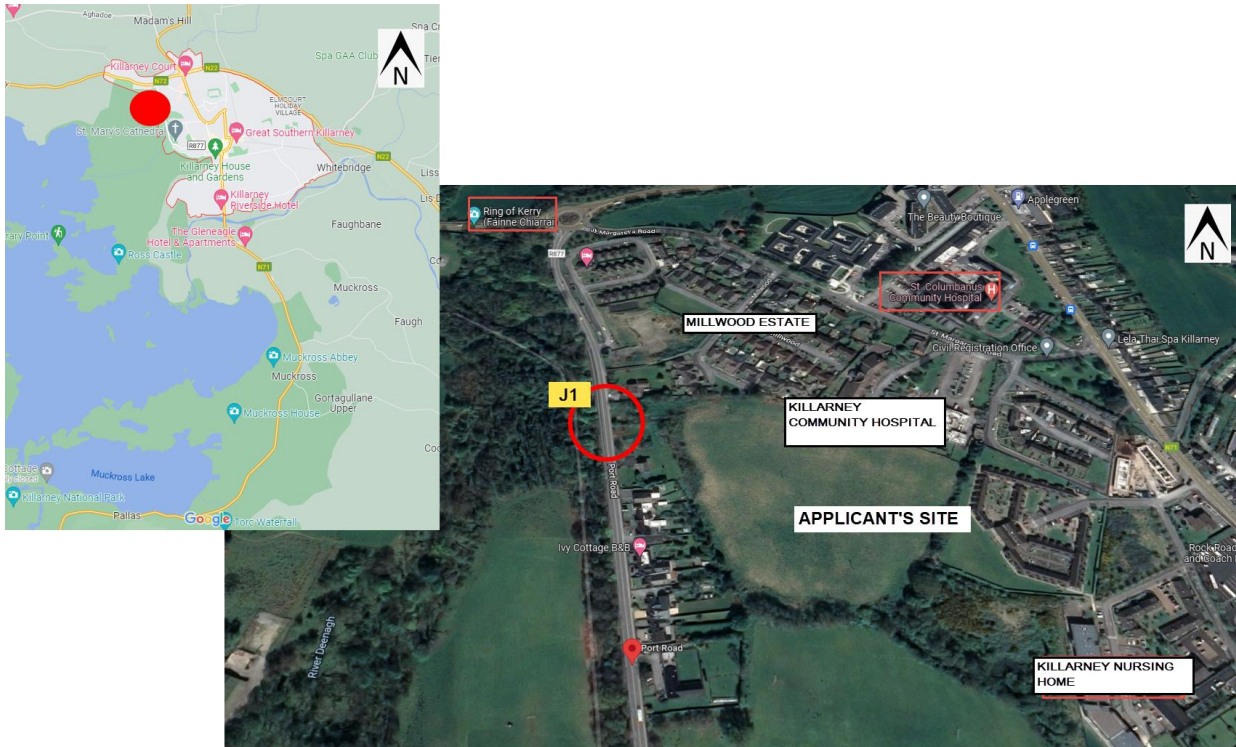
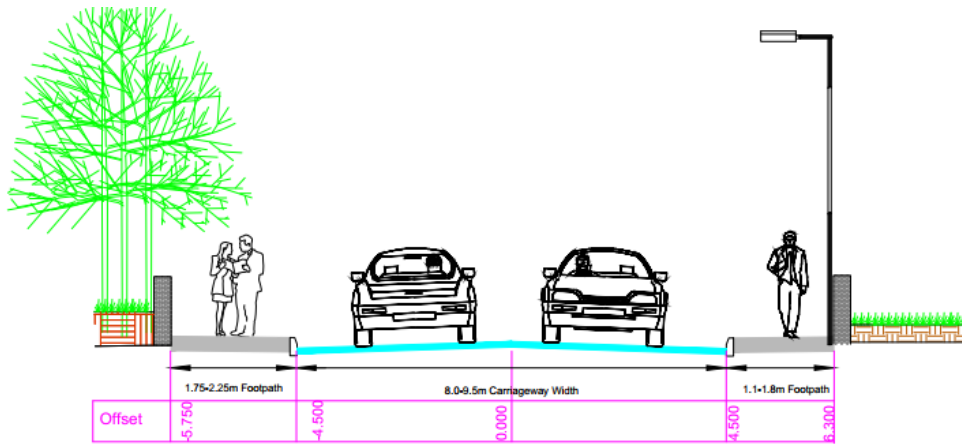


Figure 4.2 Site access.

4.4 Existing Port Road Carriageway

The existing Port Road is a wide single carriageway (c. 8-9.5m in width) with footways of varied widths both sides of its section along its length.



Typical Existing Road Cross Section

Figure 4.3 Existing Carriageway X Section

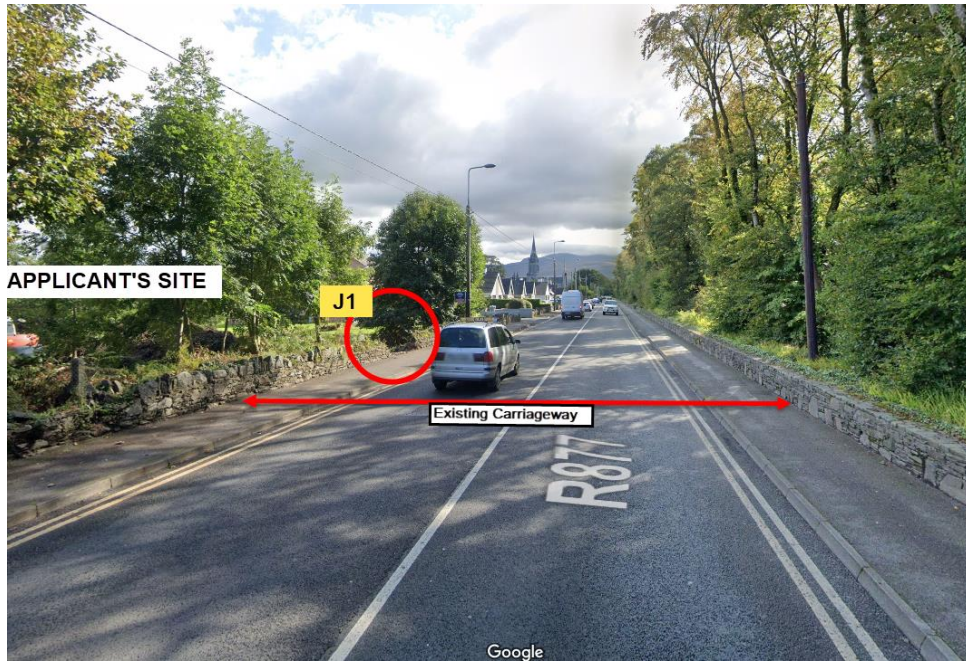


Figure 4.4 Existing Carriageway

Historically the most common types of lamps installed in residential areas and on traffic routes were high pressure sodium lights (SON), which replaced Low Pressure Sodium (SOX), and to a lesser degree Metal Halide (MH). From site surveys it was determined that existing Son streetlights are located for the entire extent of Port Road, along its eastern road edge. These older types of luminaire/ streetlights have higher wattages and higher photopic lumens than the newer LED variants.

5 DEVELOPMENT PROPOSALS

5.1 Proposed Development

Portal Asset Holdings Ltd. intend to apply for planning permission for a Large-Scale Residential Development (LRD) at Port Road and St Margaret's Road, Coollegrean, Inch, Knockreer, Ardnamweely, Derreen (townlands), Killarney, Co. Kerry.

The proposed development will consist of 224 no. units comprising 76 no. two storey houses (8 no. 2 bed units, 38 no. 3 bed units and 30 no 4 bed units), 52 no. duplexes over 3 no. storeys (14 no. 1 bed units, 26 no. 2 bed units and 12 no. 3 bed units) and 96 no. apartments in 3 no. 4 no. storey buildings (16 no. 1 bed units and 80 no. 2 bed units), and a 2 no. storey creche (334 sq. m). Ancillary site works include public and communal open spaces, hard and soft landscaping, the relocation/undergrounding of ESB powerlines, wastewater infrastructure including foul pumping station, surface water attenuation, water utility services, public lighting, bin stores, bicycle stores, ESB substation, and all associated site development works.

Vehicular access to the development will be via a new entrance from Port Road. The proposed development includes upgrade works to Port Road, a pedestrian connection to Millwood Estate, and improvements to the stormwater network on St. Margaret's Road, as part of enabling infrastructure for the project.

The proposed development will provide for a new vehicular access and pedestrian entrances onto Port Road, upgrades to Port Road comprising reduction in carriageway widths, provision of shared pedestrian/cycle path and uncontrolled pedestrian crossing, and a pedestrian connection to Millwood Estate.

It is proposed to upgrade the stormwater network on St. Margaret's Road (approximately 140 metres north of the main development site) to support the development. Ancillary infrastructure development works will include relocation/undergrounding of ESB powerlines, wastewater infrastructure including foul pumping station, surface water storage/infiltration, water utility services, public lighting, bin stores, bicycle stores, ESB substation, and all associated site development works.



Figure 5.1 Site Layout

See drawing Proposed Site Layout accompanying the application produced by Deady Gahan Architects Co Ltd for the layout of the development.

5.2 Proposed Development Access

The proposed entrance is located at the northwest section of the site, connecting onto Port Road within a 60kph speed zone. The design of the development entrance has been a particular focus of the design team, with lighting provided to ensure light spill in the location is kept to a minimum whilst ensuring the lighting standard specified is appropriated to the level of traffic passing on the adjoining roadway.

5.3 Shared Surface on Port Road

The site's proximity to both existing schools and the Killarney National Park, noted in the figure below means that it is a prime location to provide sustainable transport facilities. As part of this scheme and following consultation with both KCC and TII, it is proposed to install a 3.0m wide shared surface along Port Road. This 3.0m shared surface will replace the existing 1.1m footpath on the eastern side of Port Road.

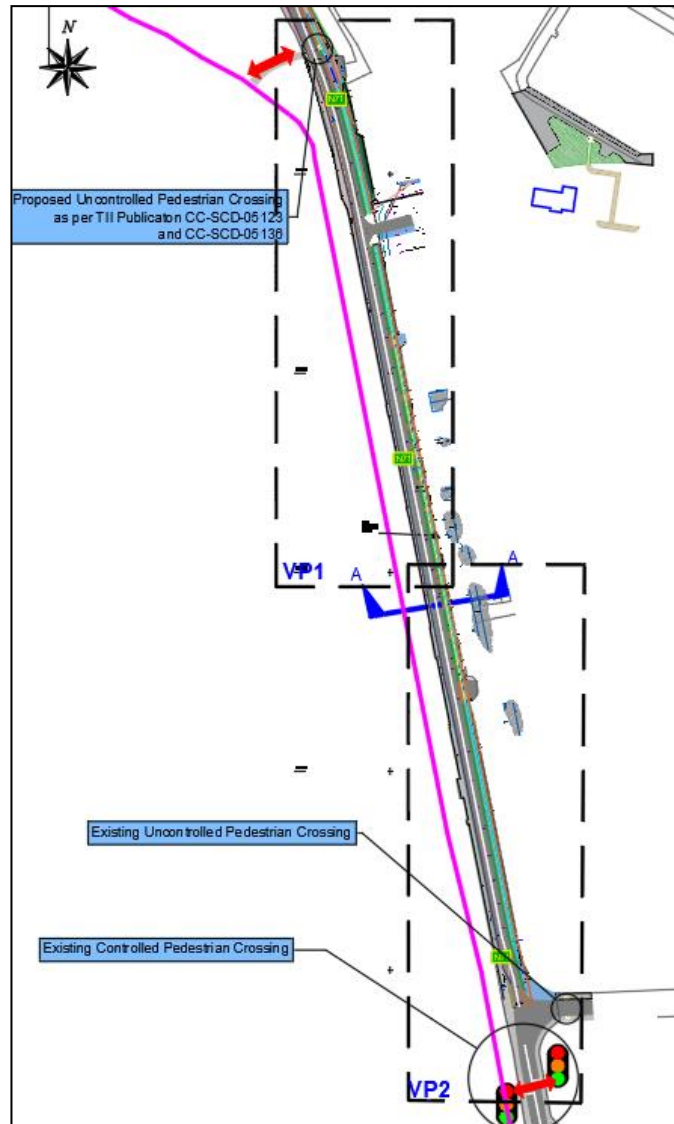


Figure 5.2 Proposed Shared Surface along Port Road

To the north of the development entrance, it is proposed that the shared surface will terminate at a new uncontrolled pedestrian crossing to the Fossa Cycleway. To the south of the development entrance the shared surface will extend as far as the junction of Port Road and New Road. This facility will provide pedestrian and cyclist linkage between Killarney Town and the Fossa Cycleway/National Park, providing excellent connectivity to the wider cycle network throughout the town and environs. The new lighting plan takes account of these proposals.

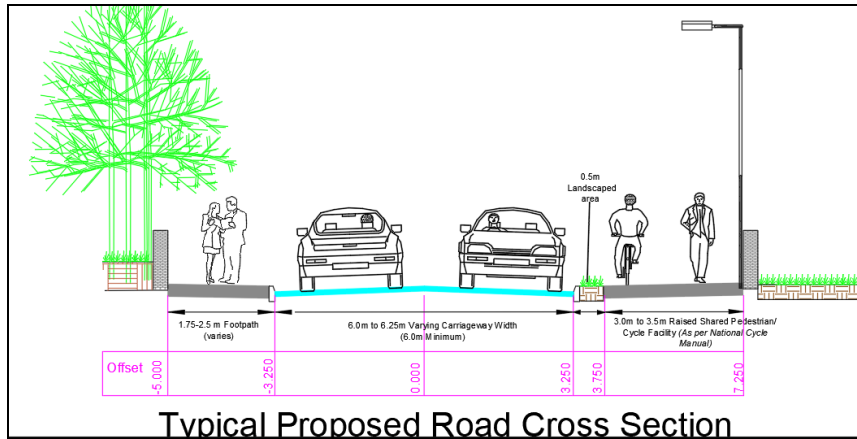


Figure 5.3 Proposed Shared Surface Cross Section

Please refer to N72 Port Road Shared Surface Proposal for the site in Planning Drawing Pack accompanying this report.

6 LIGHTING ASSESSMENT

6.1 Lighting Brief

The lighting assessment aim is to ensure that lighting is fit for its purpose and to ensure safety and security for vehicles and pedestrians during the hours of darkness, whilst minimising the potential for obtrusive light.

MWP provided an ecology report which identifies sensitive areas adjacent to the proposed development particularly the national park near Port Road.

It is this woodland section that has been identified as a sensitive receptor.

Lighting performance details outlined in this section of the document are to be considered in conjunction with the submitted lighting design layouts.

6.2 Lighting Calculations and Modelling

An external lighting calculation has been prepared by MHL & Associates Ltd for the proposed development along Port Road. The site was modelled using industry-standard software Lighting Reality. Lighting Reality is a software package which utilises the manufacturer's luminaire photometric data files to simulate the lighting output of lighting units.

It is to be noted that the lighting calculation report has been produced with a luminaire maintenance factor of 1.0 as specified in the ILP publication, Public Lighting Guide 04 – Guidance on undertaking an Environmental Assessment Report. It defines a maintenance factor of 1.0 as being the worst-case scenario as all the outdoor lighting will be performing at peak intensity.

Light spill calculations are based on the luminaires at full output, with a maintenance factor of 1.0, as this will represent the worst-case scenario. The light spill model does not consider physical obstructions and provides light spill details for the initial light output, therefore disregarding the maintenance factor used for ensuring the lighting design performs as required at the end of its life. Considering this, the light spill diagram provides an exaggerated and absolute worst-case scenario with regards to the light spill at ground level, assuming no light limiting features are present.

The calculation model (illustrated by illuminance levels and Isolux contour lines on the layout drawing) does not include any proposed or existing planting/hedgerows/ trees on site, or in the surrounding area.

6.3 Sensitive Receptors

There is an existing woodland facing the proposed development entrance which has been identified in the ecology report as an area which has foraging bats.

7 OUTDOOR LIGHTING REQUIREMENTS

7.1 Lighting Classification

The design is a residential estate comprising of housing units and apartments. All internal estate roads have been designed to lighting Class P3. Isolated footpaths and Plaza Areas have been designed to lighting Class P4. As part of this application, it is proposed to replace the existing public lighting heads along Port Road for the length of the proposed shared surface works along Port Road.

7.2 Lighting plan

Lighting plans must provide a 'worst case scenario' plot, whereby light from proposed sources, should be modelled at a 100% illumination state, all external lights on and at operational dimming levels. This will be the key for examination of whether proposals meet prescribed lux maxima by zone. This will also allow an assessment of the likely impact of soft and hard landscaping attenuation. This 100% lighting state will be necessary in order to allow for any unforeseen future loss of soft landscaping or alterations to the external layout of the site which may remove screening features.

8 DEVELOPMENT SITE LIGHTING

The proposed public lighting for the new development has been designed using Lighting Reality Public Lighting Reality. This lighting design software provides lighting compliant designs to EN13201:2015. The design is a residential estate comprising of housing units and apartments.

All internal estate roads have been designed to lighting Class P3.

Isolated footpaths and Plaza Areas have been designed to lighting Class P4.

All internal lighting is to Philips Luma luminaires on 6.0m columns. Isolated footpath columns are to be hinged type.

It has been demonstrated that the lighting design within the main residential development site will not result in light spill outside the boundary of the site, rather the design specification ensures it will be contained.

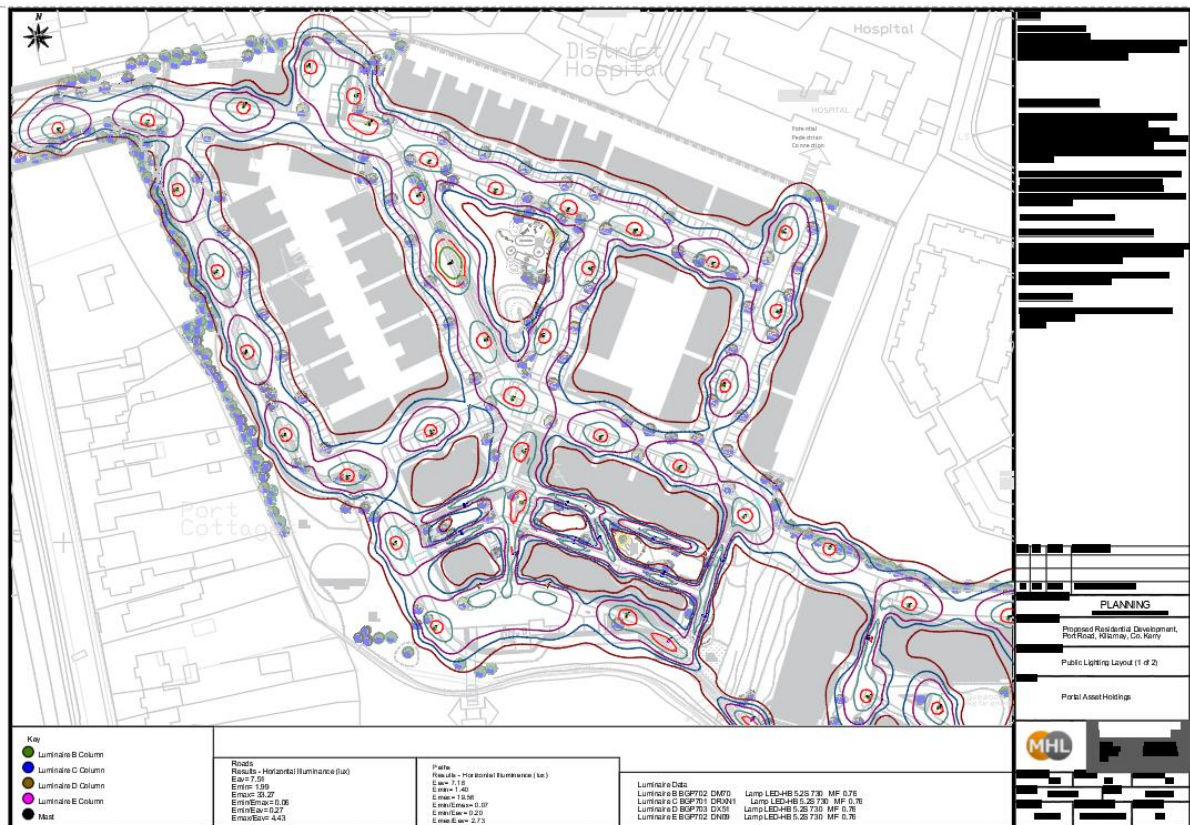


Figure 8.1 Proposed Public Lighting Design

Please refer to Proposed Services- Public Lighting layouts for the site in Planning Drawing Pack accompanying this report.

Lighting Specification:

- Lanterns should comply with IS EN 60598-2-3
- Columns are to have a double locked framed door and should be multisided galvanised to Kerry County Council specification.

- Columns shall be manufactured to BS 5649.
- Public lighting to be fed from new power supply connections.
- Minimum lux level on public roads, paths, and playgrounds within the housing estate to be 1.5 lux.
- The S/P ratio can be applied to the internal estate lux levels depending on lantern type.
- The proposed internal estate public lights are to be dimmable from 12.00 midnight to 06.00 as per dimming class 2A in housing estates.

8.1 Notes on Landscaping:

No trees to be located within 1.5 times the height of the lighting columns.

i.e. Not within 10m of all estate lighting including pathways and playground areas.

8.2 Notes on Ecology:

All ecological constraints as raised in the Ecology Report as produced by Malachy Walsh & Partners have been accounted for by optimising the revised design to cater for the protection of wildlife (EC Habitats Directive and the Wildlife Act), ensuring the impact of artificial light is mitigated against and controlled.

The approach to lighting has been directly informed by the recommendations of the project ecologists, including bat specialist.

Light spillage is to be kept to a minimum by:

- Lighting with suitably chosen lantern heads where optics selected stop indirect lighting.
- Inclusion of lighting hoods/shields to direct light only where it is needed.
- Luminaires design to be mounted on the horizontal with zero degrees vertical tilt, reducing spill light and preventing backlighting.
- All luminaires to lack UV elements.
- The proposed lighting design has been designed using warm white spectrum (2700k) lanterns to reduce the blue light component.
- Lanterns to be flat glass type to limit the amount of upward light and spill light onto the surrounding area.
- The LEDs proposed have sharp cut offs, lower intensity, good colour rendition and dimming capability.
- An option for dimming and part-night lighting, controlled diurnally, seasonally, and according to human activity can be employed

Design Drawings:

Drawings have been compiled showing the lantern types, column locations and lux contours for 1.5, 3.0, 5.0, 10, 15 and 20, as appropriate. The drawings are scaled at 1:500 @ A1.

9 PUBLIC LIGHTING DESIGN REVIEW- PORT ROAD

This report assesses the development lighting proposed within the applicant’s site and the arrangement proposed along the Port Road. The review compares the new design for Port Road to the existing historic SON lanterns that are currently installed.

On review of new traffic counts undertaken in 2023, the AADT for Port Road has been approximated at 11,000 veh/day with the lighting class designed to M4/ C4. As part of this application, it is proposed to replace the existing public lighting heads along Port Road for the length of the proposed shared surface works along Port Road, please refer to the accompanying lighting design report for Port Road.

9.1 Proposed Public Lighting within applicant’s site.

The proposed public lighting for the new development has been designed using Lighting Reality Public Lighting Reality. This lighting design software provides lighting compliant designs to EN13201:2015. As part of this application, it is proposed to replace the existing public lighting heads on Port Road for the length of the shared surface works proposed, improving lighting quality, coverage, energy usage and overall road and pedestrian safety along the route.

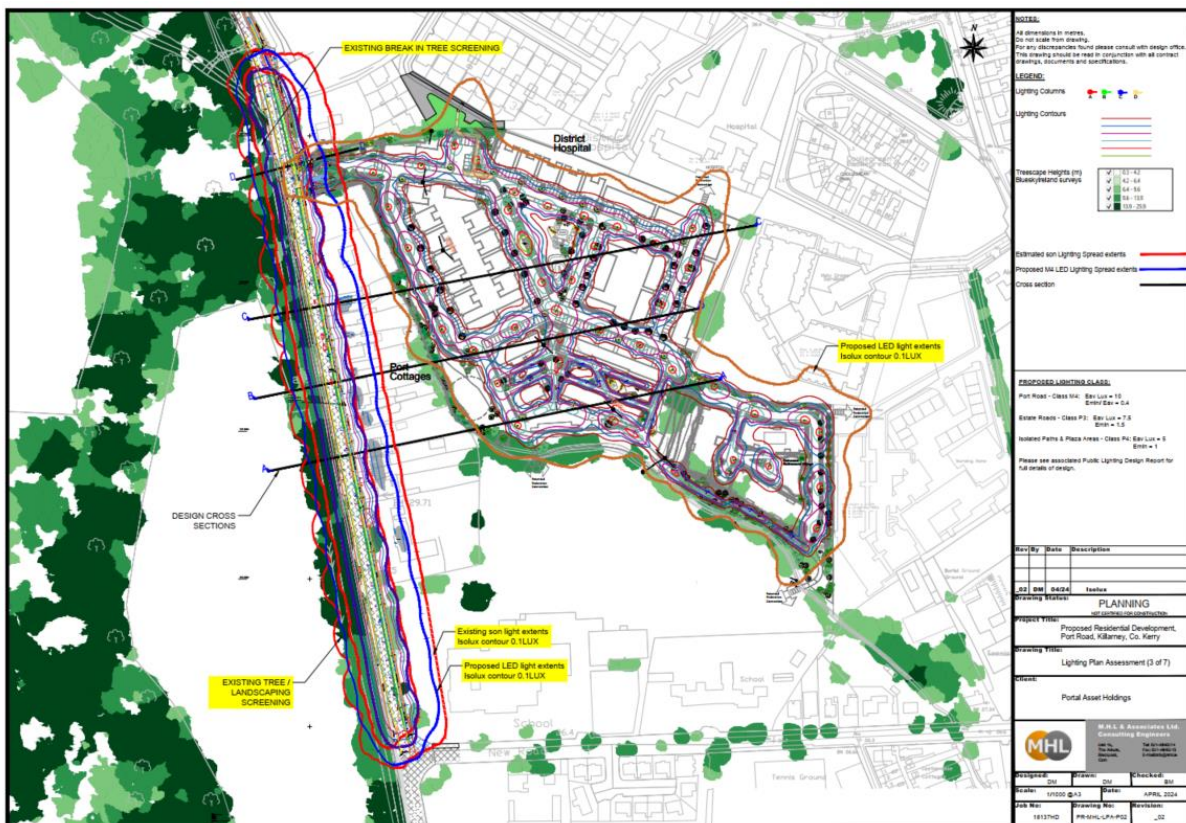


Figure 9.1 Proposed Internal Development Lighting Isolux extents (0.1lux)

As noted in the figure above, the modelled Isolux extents (0.1lx) is confined to the site, as noted by the orange line. This provides clarity regarding the extent spill lighting from the development.

9.2 Public Lighting along Port Road


Existing lighting records were provided by Kerry County Council noting location and wattage level. An option of replacing the existing lighting by installing lighting columns to the opposite side of the Port Road carriageway was also reviewed. These have been tabulated and are noted below.

The contour lux extents have been designed to curtail the lighting envelope within the immediate roadway surrounds, to reduce/limit backscatter and lighting spread where not required. As can be seen in the lux contour lighting layouts, the proposed lighting envelope is well defined and curtailed along the Port Road and is an improvement over the existing SON design in terms of spread lighting.

The lighting design results are detailed for the following options assessed:

- Existing Nearside (8m column height, 1.5m outreach)
- Proposed Farside (western boundary of Port Road) (8m column height, 1.5m outreach)

9.2.1 Existing Public Lighting along Port Road (estimated existing along Port Road)



Luminaire D Data

Supplier	_Historic Lanterns
Type	SGS203 PC P1
Lamp(s)	SON-TPP150W
LampFlux(klm)/Colour	17.50 -/
File Name	SGS203 1xSON-TPP150W PC P1.ltd
Maintenance Factor	1.00
Imax70,80,90(cd/klm)	382.0, 24.0, 6.0
No. in Project	12

Figure 9.2: Existing Public Road Lighting Lantern

Eav	18.20
Emin	2.50
Emax	52.06
Emin/Emax	0.05
Emin/Eav	0.14

Figure 9.3: Estimated existing Public Road Lighting Class results**

(**Existing Column positions do not provide Uo of 0.4 due to variable column locations)

9.3 Proposed Options

9.3.1 Proposed Option: Public Lighting along Port Road (Farside)

☺



Luminaire A Data

Supplier	Philips
Type	BGP292 DW50
Lamp(s)	LED-HB 5.2S 730
Lamp Flux (klm)	10.50
File Name	LumiStreet Gen2 Mini_BGP292_DW50_10500_40LED_5.2S_CLO_L90_730.ies
Maintenance Factor	0.84
Imax70,80,90(cd/klm)	609.4, 39.0, 0.0
No. in Project	12

Figure 9.4: Proposed Public Road Lighting Lantern

☺

Results

Eav	10.00
Emin	5.01
Emax	15.41
Emin/Emax	0.32
Emin/Eav	0.50

www.mhl.ie

Figure 9.5: Proposed Public Road Lighting Class results.

9.3.2 Overall comparison

From a lighting design perspective, the proposed upgrade to LED lighting for either the footpath side or opposite side of the road are comparable from a lighting standard perspective, meeting the requirement of M4/C4 classification.

Option	Lighting Model Results		
	Eav	Emax	Emin/Eav
Existing	18.2	52.06	
Proposed LED (Class M3)	15.22	23.62	0.46
Proposed LED(Class M4)	10.00	15.41	0.50

Figure 9.6: Public Road Lighting Class option results.

Upgrading the design to a LED lighting variant would be of benefit by reducing the Emax. Historic lantern’s maximum lighting level Emax is over twice that of the LED equivalent for the same lighting class standard / design uniformity. Further benefit is the option of locating lighting to the opposite site of the road as this would allow for cowling of lanterns to reduce backscatter into the park, reducing the lighting spread/ envelope even further.

The following figure notes the extents of the lux lighting envelopes for the assessed lanterns, comparing existing estimated SON lighting with comparable modern LED variants of a similar LUX output. As is evident in the figure, the lighting extents of the new LED provides an improvement to that of older SON. The lighting extents for the nearside LED upgrade(blueline) falls closely within the extents of the SON (redline). This

shows that the upgrade to LED lighting will be comparable if not a general improvement above that which is in situ.

Coupled with these improvements, it should be noted that the current treeline that runs along the boundary with Port Road also screens the park of intrusive light spread. The impact to these trees and associated habitats would require comment from the ecologist. but from a lighting perspective the light spread would be maintained/reduced to that present and the Emax would be significantly reduced.



Figure 9.7: Existing and Proposed Public Road Lighting extents/ treescape.

9.4 Port Road lighting:

The light spread from the proposed lighting columns/ luminaires are contained within the immediate area of Port Road as noted.

9.5 Residential Lighting:

Ground Levels proposed within the site show how light spread from the estate would be mitigated against due to the existing surrounding topography and heights of the nearby treeline. External security lighting to be set on motion-sensors and short (1min) timers. Taller buildings are located to the farthest location on site, sufficiently set back from key habitats to limit light spill. Street lights internally within the development are located so that the rear shields and optics selected stop back light thereby directing light into the task area where needed.

10 NOTES ON ECOLOGY:

All ecological constraints as raised in the Ecology Report as produced by Malachy Walsh & Partners have been accounted for by optimising the revised design to cater for the protection of wildlife (EC Habitats Directive and the Wildlife Act), ensuring the impact of artificial light is limited to acceptable levels.

Tree survey data of the area was obtained from BlueSky Ireland to determine the screening extents of the existing treeline / hedge line along Port Road. It can be seen from the figure below and the submitted drawing pack that the treescape is quite substantial, with average heights more than 14m and average depth into the park of 16m. This existing screening coupled with targeted light optics/ cowling ensures mitigation of light spread into the park to what is noted.



Treescape Heights (m)
Blueskyireland surveys

✓	0.3 - 4.2
✓	4.2 - 6.4
✓	6.4 - 9.6
✓	9.6 - 13.9
✓	13.9 - 25.9

Figure 10.1: Boundary Treescape extents along Port Road.

A region of particular focus is the partial break in the treeline coverage noted below. This break in vegetation is due to an existing accessway to the park.

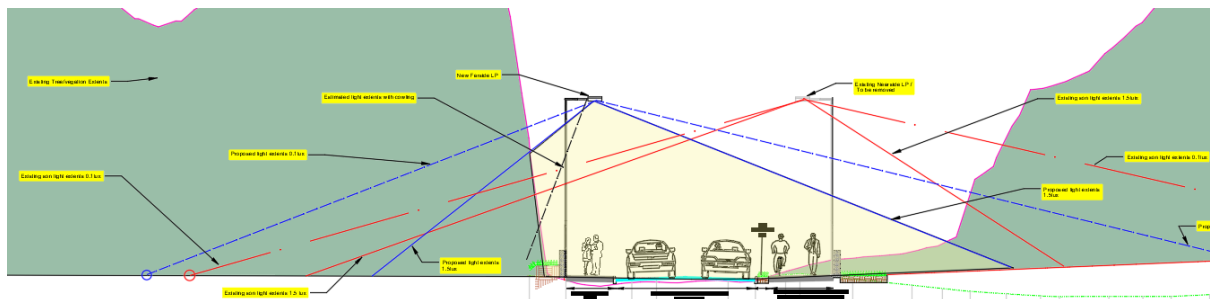
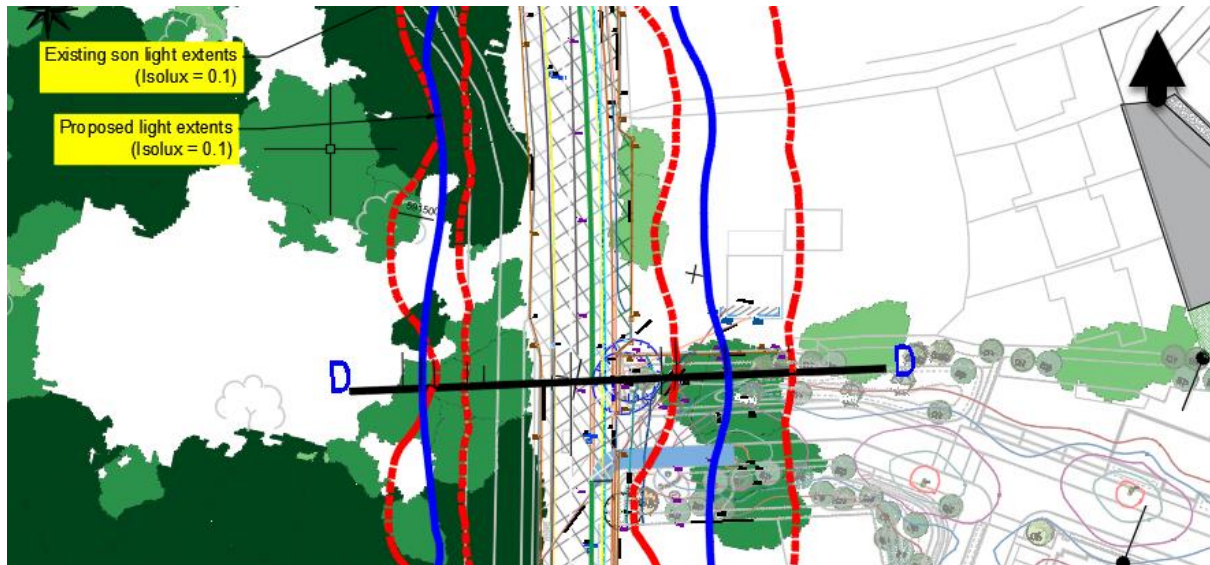


Figure 10.2: Section DD- Cross section – light spread.

Proposed mitigation at this location:

- Position columns to the farside of the road(western side)
- Cowl installation
- Zero tilt optics/ recessed optics
- Luminaire type as proposed

As can be seen in the contour lux lighting extents and Section DD, the light spread will be limited by the mitigation proposals noted above. The proposed lighting spread is lower than the estimated SON extents (existing spread indicated by the red dashed line). The mitigation measures, light optic type / position chosen will allow for a buffer to separate park habitats from the regional road lighting.

Engagement between the project ecologists and NPWS identified concerns in respect of existing public lighting on Port Road, which has been assessed. It has been confirmed that the existing 'do-nothing' scenario results in theoretical light spill into the Park (discounting landscaping). It has been demonstrated that the relocation of the lighting columns to the opposite side of the road as part of the planned upgrade works will result in a direct improvement in respect of this. In addition to this, the upgrade works allow for the use of a sensitive lantern in accordance with (reference bat guidelines) thereby reducing any potential for impact.

11 RECOMMENDATIONS FOR AVOIDANCE AND MITIGATION OF EFFECTS

As part of this exercise, it is suggested that land extending inland from the water's edge of Port Road is divided into discrete zones according to their intended land use. These zones can then be used to determine the boundaries of different surface illuminance limits to be imposed at the outset of scheme design. Each zone would accord with one of the Environmental Lighting Zones as outlined by the Institute of Lighting Professionals Guidance Note GN01:2011 where E1 is an 'intrinsically dark area' and E4 is an urban zone with high district brightness.

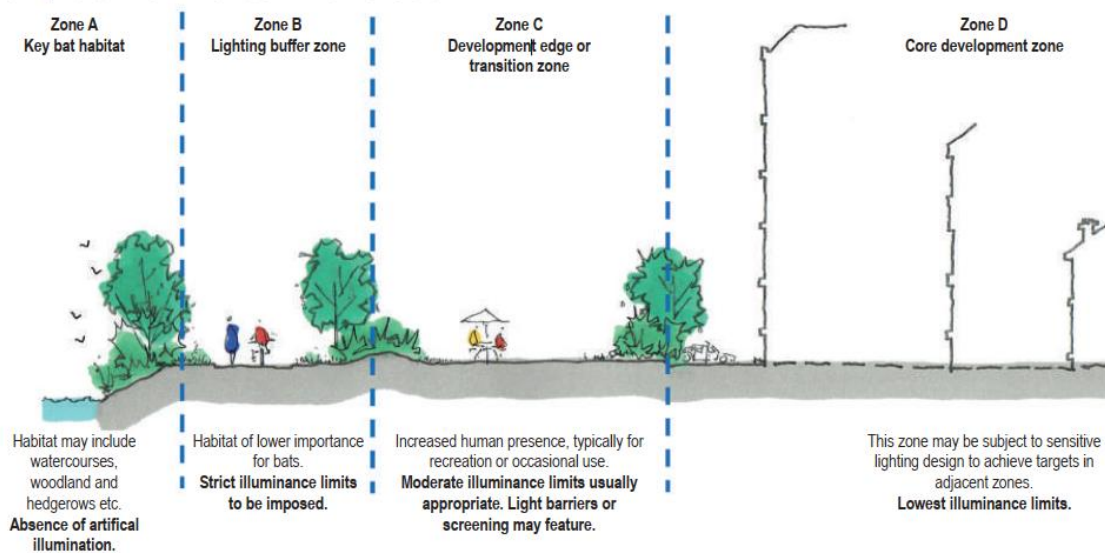


Figure 11.1: Zonation. (ILP)

The aim of assessing the Port Road area with Lighting Zones is to maintain a continuous dark corridor along the riverbank suitable for bats to use for navigation year-round and thereby preserve the value of the river as a key component of the SAC. An absence of lighting (considering the potential for sources of illumination from both banks) is the priority in Zones A and B. Applying Zonation with offset distances and different treatment options assist in reducing the impacts of proposed lighting.

Key habitats suitable for bats immediately adjacent to the site which may be impacted must also be taken into consideration.

- Lux contour plans include an output with no Maintenance Factor applied, i.e. full ('Day 1') lighting efficiency and this should be clearly stated.
- 'Warm white' LED luminaires with colour temperatures of 2700K or less is to be used wherever possible due to their reduced UV spectrum component. The presence of glare acting upon Zones A and B is considered, with direct line of sight between a relatively intense light source (or group of light sources) to the flight corridors within Zones A and B is to be avoided through the luminaire type, location, angle/direction or use of blinds and cowls.



Figure 11.2: Port Road- Proposed Zonation

Light spillage is to be kept to a minimum by:

- Lighting with suitably chosen lantern heads where optics selected stop indirect lighting.
- Inclusion of lighting hoods/shields to direct light only where it is needed.
- Luminaires design to be mounted on the horizontal with zero degrees vertical tilt, reducing spill light and preventing backlighting.
- All luminaires to lack UV elements.
- The proposed lighting design has been designed using warm white spectrum (2700k) lanterns to reduce the blue light component, with peak wavelengths greater than 550nm. Lower colour temperature lanterns can be employed 2200k, subject to KCC approval. Lantern manufacturer confirmed assessment Isolux extents for 2200k, 3000k and 4000k lanterns are equivalent to one another.
- Lanterns to be flat glass type to limit the amount of upward light and spill light onto the surrounding area.
- The LEDs proposed have sharp cut offs, lower intensity, good colour rendition and dimming capability.
- Luminaires to be mounted on the horizontal, i.e., no upward tilt. Only luminaires with an upward light ratio of 0% and with good optical control be used – See ILP Guidance for the Reduction of Obtrusive Light.



Figure 11.3: Street View Port Road

Please refer to the project ecologist for further commentary on ecological aspects of the project.

11.1 Design Conformity

Conformity to these limits is demonstrated via a lux contour plan of the proposed development prepared by a qualified lighting engineer. To demonstrate that these limits have been met, including information on the contribution and glare from more distant, intense sources, the following should be noted:

- The lighting plan includes the anticipated horizontal illuminance at ground level within all areas of the site, with actual lux figures or contours displayed.
- Upwards lighting is not be permitted in zones A-C.
- Light trespass from windows to be mitigated against, with the design focused on development units location, FFL, building height, specification, orientation with respect to the national park.
-

11.2 Domestic Lighting

This report focuses on the public lighting design aspect of the scheme but notes mitigation measures to account for domestic lighting spill light. Mitigating light spill involves several steps aimed at reducing the amount of light that spills beyond the intended area of illumination. Measures to reduce the impact of light trespass from private properties, can include:

- Sensitive site configuration: Ensuring FFL and unit type are located optimally to reduce domestic spill lighting.

- Screening: screened through soft landscaping and the installation of walls, fences and bunding.
- Glazing treatments: low transmission glazing treatments are suitable option in achieving reduced illuminance targets.
- Fixture Selection: Lighting fixtures with proper shielding and optics to minimize light spillage. Full cutoff fixtures are particularly effective in directing light downward and reducing spillage.
- Optimal Placement: Fixtures installed at appropriate heights and angles to ensure that light is directed where it's needed without unnecessary spillage into neighboring properties or the night sky.
- Lighting Design: Design plan takes into account the specific requirements of the space and minimizes overlighting through the use a combination of lighting techniques such as task lighting, accent lighting, and ambient lighting to achieve desired illumination levels with minimal spill.
- Timers and Sensors: Utilize timers, motion sensors, or photocells to control when lights are on, ensuring they are only activated when necessary and reducing the duration of unnecessary light spillage.
- Dimming and Control Systems: Implement dimming and lighting control systems that allow for precise adjustment of light levels based on time of day, occupancy, or ambient light conditions.
- Vegetation and Landscaping: Landscaping features such as trees, shrubs, and hedges help shield and diffuse light, reducing the visibility of light spill from adjacent properties.
- Community Engagement: Engage with the community to raise awareness about the importance of reducing light spill and encourage participation in mitigation efforts through responsible lighting practices.

The upper storey windows of housing units and apartments will be subject to appropriate glazing treatments on west and south facing windows to restrict and reduce light trespass. Specification is to be agreed with the appointed Lesser horseshoe bat specialist, the applicant and KCC.

By implementing these mitigation measures, it's possible to significantly reduce light spill from domestic properties and its associated impacts on the environment, wildlife, and human health while still providing adequate illumination for safety and security.

12 CONCLUSION

12.1 Design Commentary

This lighting assessment outlines the lighting design criteria for the proposed development, to ensure that the lighting is fit for purpose whilst maintaining sensitivity towards the environment. This is achieved through compliance with relevant lighting industry standards and ecological guidance.

Compliance with this lighting strategy will allow a safe and sensitive level of light for the movement of pedestrians/drivers at night, whilst reducing the potential for obtrusive light and limiting this to a negligible level.

In addition to mitigating the potential effects of lighting on residential amenities, ecologically sensitive receptors have been considered using warm white light sources with lower blue light content and through minimising boundary light spill as far as reasonably practicable. The sensitive receptors as shown in the supporting ecological assessment identify the existing woodland which shall remain when the proposed development has been completed.

The proposed development is planned to be built off Port Road in the vicinity of substantial woodland and a river, both of which needed to be considered during the lighting design. Isolux lines of 0.1 lux have been shown on the lighting layouts in the Appendix. These values are all taken with a maintenance factor of 1.0 as a conservative worst-case approach, whereas in normal operation, the maintenance value would be reduced to 0.80. Using a reduced maintenance factor provides typical 'realistic' light levels which uses lumen depreciation, driver degradation and lens grime.

Final lighting specification to be agreed between the applicant/appointed contractor, bat specialist and the Kerry County Council with input from National Parks and Wildlife Service (NPWS) as required.

In summary it is our considered opinion that the proposed lighting installation will not have a significant negative impact on the immediate environment concerning lighting pollution or energy usage, that the lighting upgrade to LED on Port Road is an improvement over the current scenario and that all sensible steps, through consultation with the project ecologist and bat conservationist, have been taken within the design stage of this lighting scheme to keep the impact to the environment to a minimum.

13 REFERENCE

- BS5489-1: Code of practice for the design of road lighting- Part 1: Lighting roads and public amenity areas
- EN13201:2015 Road Lighting
- Lighting Reality software
- Google Aerial Photography
- Recommendations for site development works for housing areas. Dept. of Environment
- DMURS: Design Manual for Urban Roads and Streets
- Kerry County Council Development Plan 2022-2028
- Code of Practice for Avoiding Danger from Overhead Electricity Lines, May 2019, ESB Networks.
- Avoidance of Electrical Hazards When Working Near Overhead Electric Lines, ESB Networks
- GN08/23 Guidance Note. Bats and Artificial Lighting at Night. ILP
- GN08/18 Bats and artificial lighting in the UK. ILP.

Conditions

MHL & Associates Ltd accept no responsibility or liability for:

- The consequence of this documentation being used for any purpose or project other than that for which it was commissioned.
- The issue of this document to any third party with whom approval for use has not been agreed.
- Ahead of construction stage, lighting manufacturer/contractor to confirm lux optics before installation.

14 APPENDIX

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15 A. GLOSSARY OF TECHNICAL TERMS

ID		
1	Cowl	Physical light spill control accessory.
2	Diffuse	Term describing dispersed light distribution referring to the scattering of light.
3	Efficacy	A measure of light output against energy consumption measured in lumens per watt.
4	Glare	The sensation produced by luminances within the visual field that are sufficiently greater than the luminance to which the eyes are adapted, which causes annoyance, discomfort, or loss in visual performance and visibility.
5	Hood	Physical light spill control accessory.
6	Illuminance	Illuminance is the quantity of light, or luminous flux, falling on a unit area of a surface. It is sometimes designated by the symbol E. The unit is the lux (lx). Luminance refers to the light given off from a source while illuminance refers to the amount of light hitting a surface.
7	Lamp	Light source.
8	Light cone	The angle at which the beam falls off to 50% of peak intensity.
9	Light pollution	The spillage of light into areas where it is not required. Also known as obtrusive light.
10	Light spill	The light that falls outside the light cone.
11	Light trespass (nuisance)	Light that impacts on a surface outside of the area designed to be lit by a lighting installation. The correct legal term is nuisance.
12	Louvres	Physical light spill control accessory.
13	Lumen	The unit of light power emitted from a light source
14	Luminaire	Lighting enclosure, lantern, or unit designed to distribute light from a lamp or lamps.
15	Luminance	The physical measurement of the stimulus that produces the sensation of brightness measured by the luminous intensity reflected in a given direction. The unit is the candela per square metre (cd/m ²). Luminance refers to the light given off from a source while illuminance refers to the amount of light hitting a surface.
16	Lux	This is 'illuminance' or the quantity of light (luminous flux), falling on a unit area of a surface in the environment. It is sometimes designated by the symbol E.
17	Maintenance Factor	A correction applied to a lighting calculation to allow for the build-up of dirt on a luminaire and the depreciation of the lumen output of a lamp over time. 1=100% output, 0.9=90% etc.
18	Optic	The components of a luminaire such as reflectors, refractors, and protectors which make up the directional light control section.
19	Photocell	A unit which senses light to control luminaires.
20	Reflector	A device used to reflect light in a given direction.
21	Shield	A device used to redirect the light output from a lamp when the light passes through it. It is usually made from prismatic glass or plastic.
22	Sky Glow	Physical light spill control accessory.
23	Symmetric beams	The brightening of the night sky caused by artificial lighting. Lamp mounted in the centre of the reflector.
24	Voltage	The difference in electrical potential between two points of an electrical circuit.
25	Watt (W)	The unit for measuring electrical power.
26	Upward light Output Ratio ULOR	The proportion of direct light transmitted from the luminaire above 90° in the vertical plane

16 B. SITE TOPOGRAPHICAL SURVEY

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Please refer to planning pack layout for further details.



17 C. LIGHTING DESIGN CALCULATIONS

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DATE: 23 February 2023
DESIGNER: MHL & Associates Ltd.
PROJECT No: 18137HD
PROJECT NAME: Proposed Residential Development, Port Road Killarney



Lighting Classification

Grid 2: Port Road -

Existing estimated

Outdoor Lighting Report

PREPARED BY: Design Software from:
Lighting Reality Ltd
Park Business Centre
Wood Lane
Erdington
Birmingham
B24 9QR
United Kingdom
e-mail: sales@lightingreality.com
website: www.lightingreality.com

Layout Report

General Data

Dimensions in Metres Angles in Degrees

Calculation Grids

ID	Grid Name	X	Y	X' Length	Y' Length	X' Spacing	Y' Spacing
1	Grid 1	495720.81	591042.78	81.15	546.37	1.48	2.19

Luminaires



Luminaire D Data

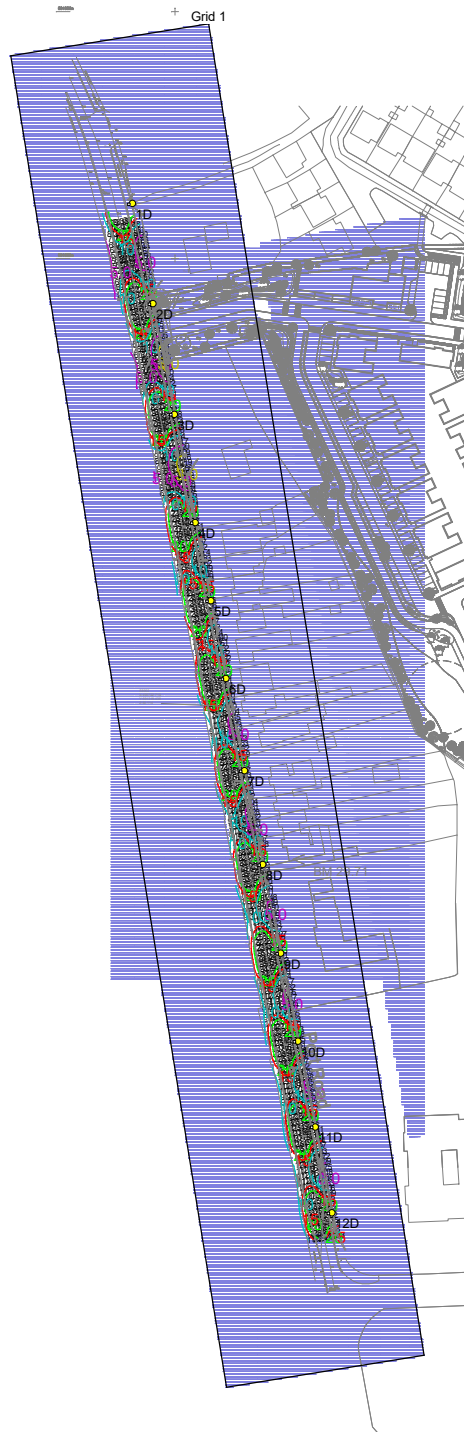
Supplier	_Historic Lanterns
Type	SGS203 PC P1
Lamp(s)	SON-TPP150W
LampFlux(klm)/Colour	17.50 -I
File Name	SGS203 1xSON-TPP150W PC P1.ltd
Maintenance Factor	1.00
Imax70,80,90(cd/klm)	382.0, 24.0, 6.0
No. in Project	12

Layout

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
1	D	495682.72	591522.34	8.00	196.00	0.00	0.00	1.50			
2	D	495691.07	591481.75	8.00	191.00	0.00	0.00	1.50			
3	D	495699.74	591436.92	8.00	186.00	0.00	0.00	1.50			
4	D	495708.21	591393.12	8.00	190.00	0.00	0.00	1.50			
5	D	495714.49	591361.35	8.00	190.00	0.00	0.00	1.50			
6	D	495720.62	591329.95	8.00	190.00	0.00	0.00	1.50			
7	D	495728.07	591292.49	8.00	189.00	0.00	0.00	1.50			
8	D	495735.57	591254.56	8.00	189.00	0.00	0.00	1.50			
9	D	495742.79	591218.65	8.00	189.00	0.00	0.00	1.50			
10	D	495749.80	591182.93	8.00	191.00	0.00	0.00	1.50			
11	D	495756.80	591148.26	8.00	189.00	0.00	0.00	1.50			
12	D	495763.53	591113.51	8.00	191.00	0.00	0.00	1.50			

Horizontal Illuminance (lux)

Grid 1



Results

Eav	18.20
Emin	2.50
Emax	52.06
Emin/Emax	0.05
Emin/Eav	0.14

DATE: 24 April 2024
DESIGNER: MHL & Associates Ltd.
PROJECT No: 18137HD
PROJECT NAME: Proposed Residential Development, Port Road Killarney



Lighting Classification
Grid 2: Port Road - M4 /C4
Proposed
Installation farside of existing column locations

Outdoor Lighting Report

PREPARED BY: MHL & Associates Ltd.
Unit 1B,
The Atrium,
Blackpool,
Cork

Layout Report

General Data

Dimensions in Metres Angles in Degrees

Calculation Grids

ID	Grid Name	X	Y	X' Length	Y' Length	X' Spacing	Y' Spacing
1	Grid 1	495720.81	591042.78	81.15	546.37	1.48	2.19

Luminaires



Luminaire A Data

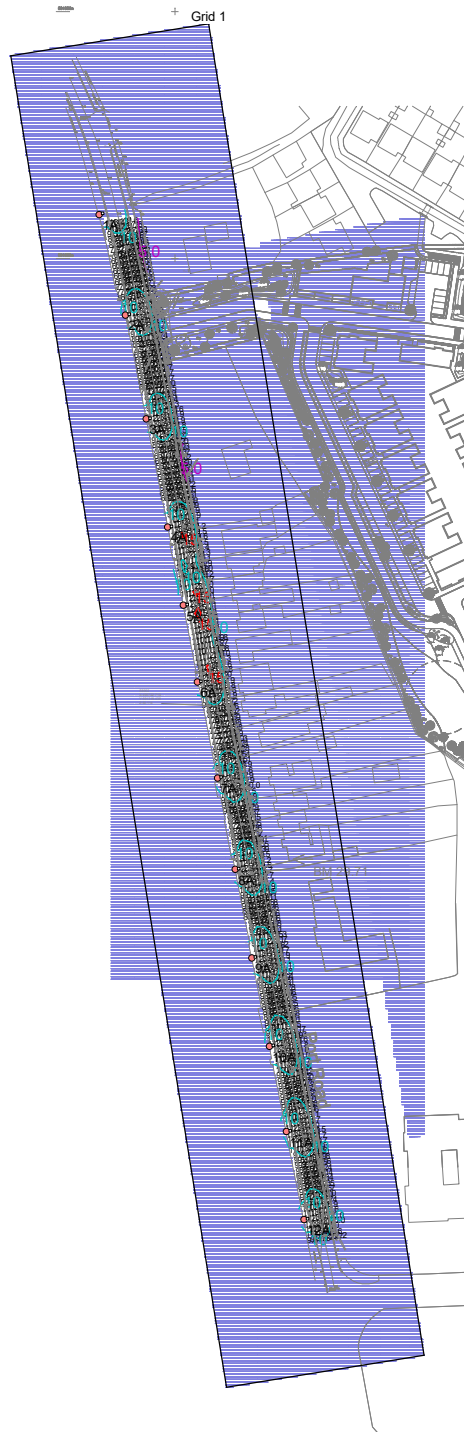
Supplier	Philips
Type	BGP292 DW50
Lamp(s)	LED-HB 5.2S 730
Lamp Flux (klm)	10.50
File Name	LumiStreet Gen2 Mini_BGP292_DW50_105 00_40LED_5.2S_CLO_L90_730.ies
Maintenance Factor	0.84
Imax70,80,90(cd/klm)	609.4, 39.0, 0.0
No. in Project	12

Layout

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
1	A	495669.29	591517.82	8.00	18.00	0.00	0.00	1.50			
2	A	495679.93	591477.11	8.00	13.00	0.00	0.00	1.50			
3	A	495688.36	591435.05	8.00	9.00	0.00	0.00	1.50			
4	A	495697.02	591391.22	8.00	11.00	0.00	0.00	1.50			
5	A	495703.38	591359.58	8.00	9.00	0.00	0.00	1.50			
6	A	495709.05	591328.49	8.00	10.00	0.00	0.00	1.50			
7	A	495717.18	591289.61	8.00	11.00	0.00	0.00	1.50			
8	A	495724.36	591252.62	8.00	11.00	0.00	0.00	1.50			
9	A	495731.13	591216.69	8.00	13.00	0.00	0.00	1.50			
10	A	495738.30	591180.89	8.00	13.00	0.00	0.00	1.50			
11	A	495745.16	591146.36	8.00	13.00	0.00	0.00	1.50			
12	A	495752.20	591110.72	8.00	11.00	0.00	0.00	1.50			

Horizontal Illuminance (lux)

Grid 1



Results

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Emin	5.01
E _{max}	15.41
E _{min} /E _{max}	0.32
E _{min} /E _{av}	0.50

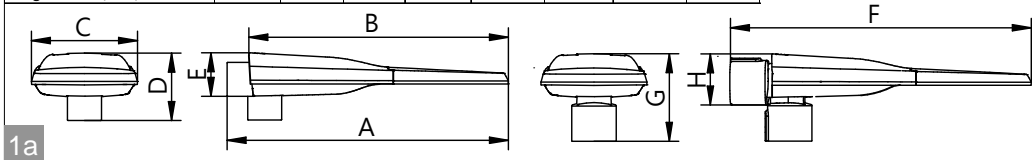
18 D. LIGHTING DESIGN LAYOUTS

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19 E. PRODUCT SPECIFICATIONS

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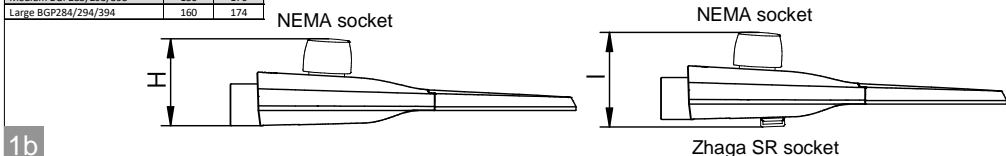
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Micro BGP281/291/391	520	472	234	150	95	564	195	110
Mini BGP282/292/392	620	573	234	150	95	664	195	110
Medium BGP283/293/393	626	579	340	150	95	670	195	110
Large BGP284/294/394	865	819	340	150	100	910	195	120



1a

Dimensions in [mm] with 48/60 spigot		
Luminaire	H	I
Nano BGP280/290/390	155	163
Micro BGP281/291/391	155	169
Mini BGP282/292/392	155	169
Medium BGP283/293/393	156	170
Large BGP284/294/394	160	174

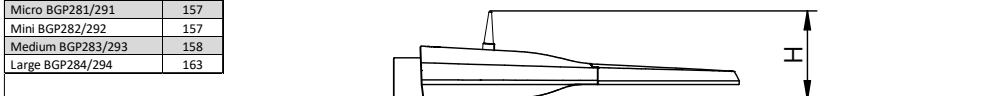
Interact OLC NEMA



1b

Dimensions in [mm] with 48/60 spigot	
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Mini BGP282/292	157
Medium BGP283/293	158
Large BGP284/294	163

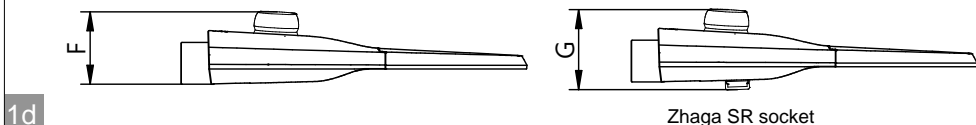
RF Antenna



1c

Dimensions in [mm] with 48/60 spigot		
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Micro BGP281/291/391	128	142
Mini BGP282/292/392	128	142
Medium BGP283/293/393	129	143
Large BGP284/294/394	134	148

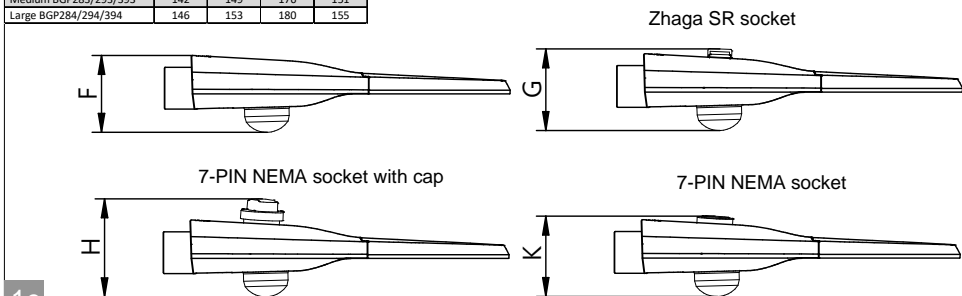
Interact OLC Zhaga SR



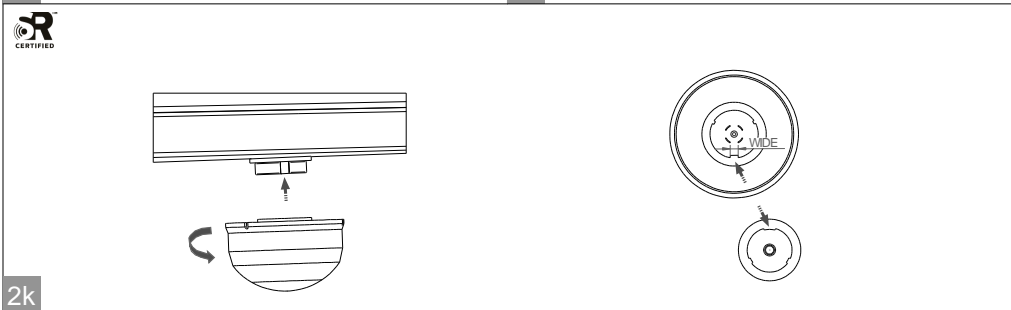
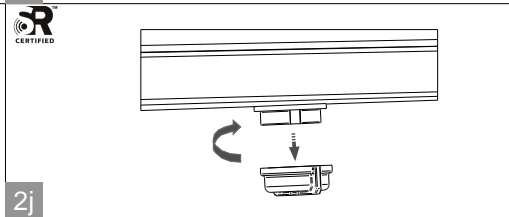
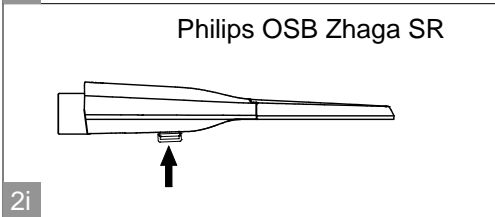
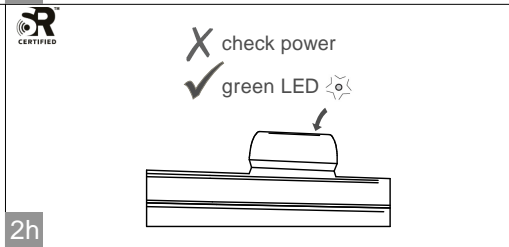
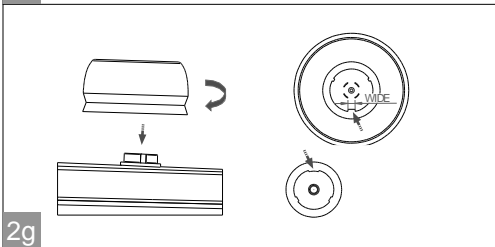
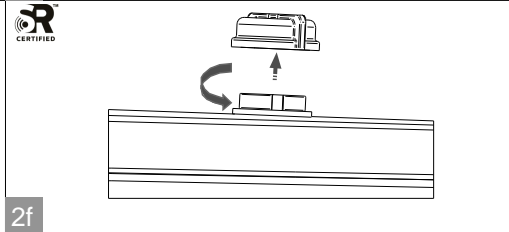
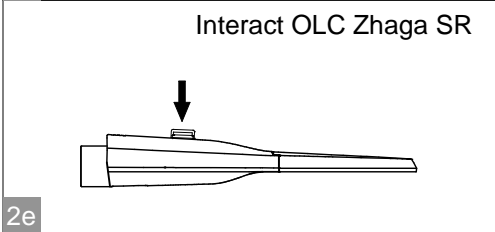
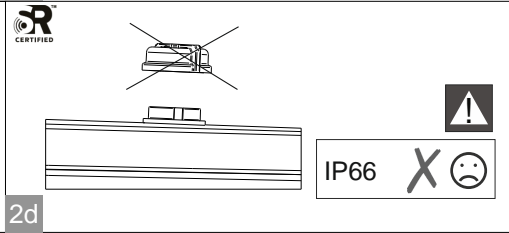
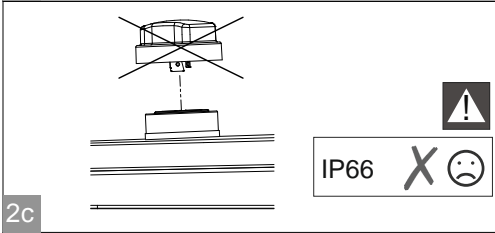
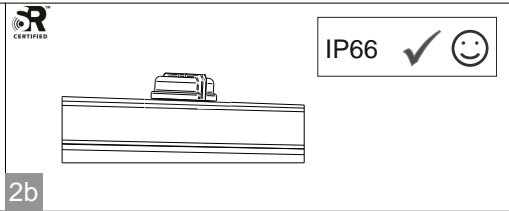
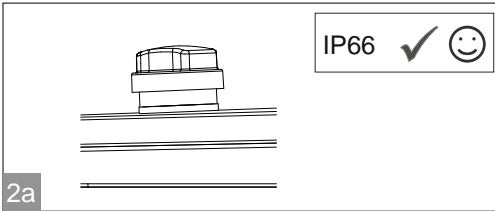
1d

Dimensions in [mm] with 48/60 spigot				
Luminaire	F	G	H	K
Nano BGP280/290/390	140	148	175	150
Micro BGP281/291/391	141	148	175	150
Mini BGP282/292/392	141	148	175	150
Medium BGP283/293/393	142	149	176	151
Large BGP284/294/394	146	153	180	155

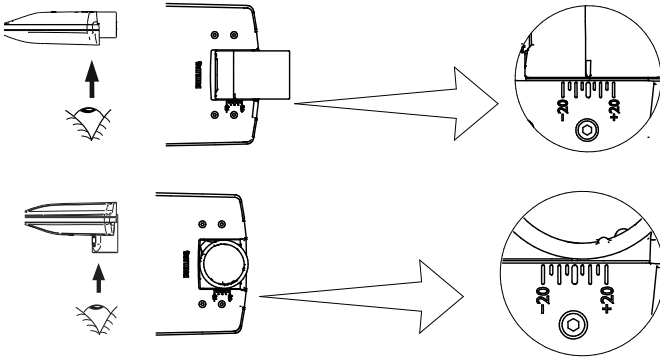
Philips OSB Zhaga SR



1e



3

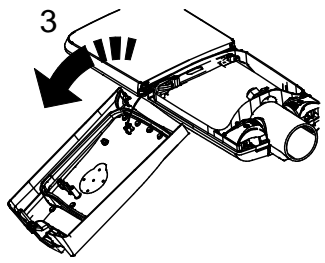
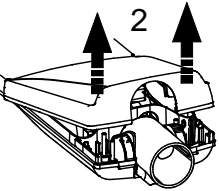
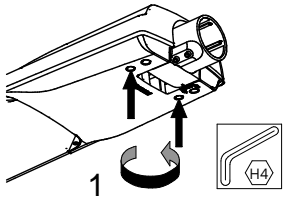


Version without cable



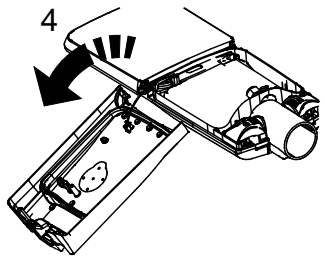
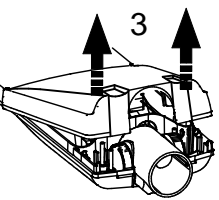
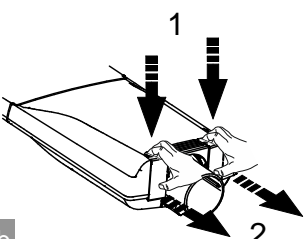
- | | | |
|---|--|---|
| GB - Disconnect before servicing | DK - Frakobl, før service | IT - Togliere tensione prima di fare manutenzione |
| FR - Mettre hors tension avant intervention | NO - Koble fra før service | SP - Desconectar antes de manipular |
| DE - Öffnen nur spannungsfrei | FI - Irrota pistoke ennen huolto | SE - Bryt strömmen före lampbyte |
| NL - Stroom afsluiten voor onderhoud | CZ - Před servisem se odpojte | SK - Odpojiť pred udržbou |
| LT - Pirms apkopes atvienojiet no elektros | TR - Servis yapmadan önce bağlantıyı kesin | SI - Pred servisiranjem izključite svetilko |
| EE - Katkesta elektril toide enne valgusti hooldust/remonti | HR - Prije servisiranja isključite | HU - Karbantartás előtt húzza ki a csatlakozót |
| PT - Desconecte antes de fazer a manutenção | GR - Αποσυνδέστε πριν από τη συντήρηση | PL - Odłącz przed serwisowaniem |
| | BG - Изключете преди сервис | RO - Deconectați-vă înainte de întreținere |
| | RS - Отключите перед обслуживанием | |
| | LV - Pirms apkopes atvienojiet to | |

BGP28x/29x

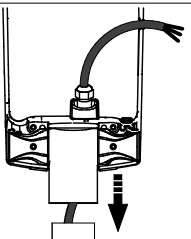


4a

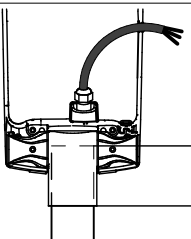
BGP39x



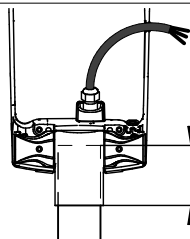
4b



Ø32/48
Ø48/60
Ø32/60



70-100mm



Ø76
Ø32/76
Ø48/76

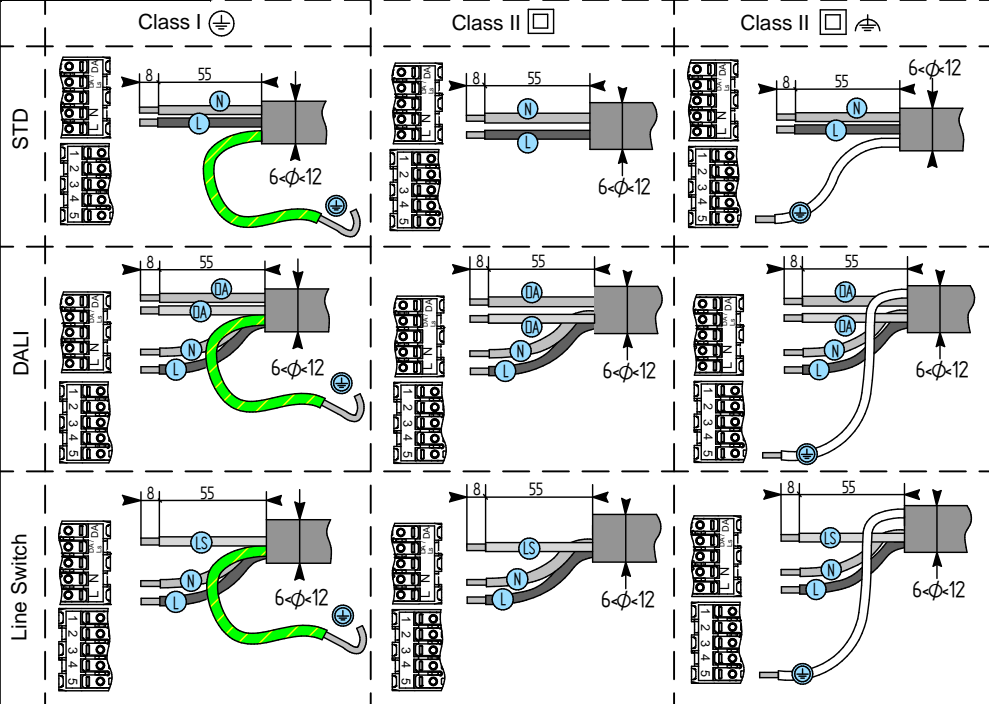
70-80mm

5a

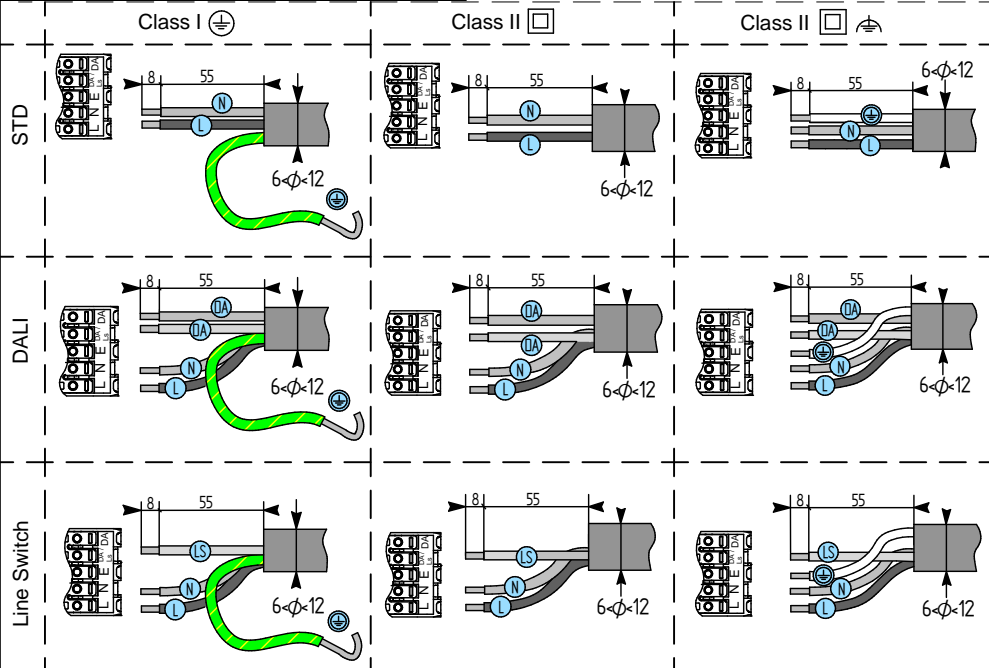
5b

5c

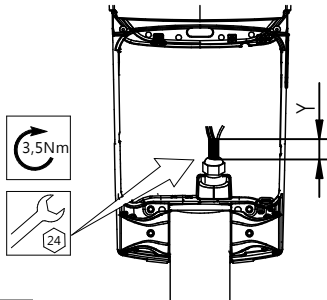
BGP280/290/390



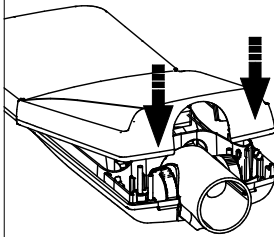
BGP28X/29X/39X (except 280/290/390)



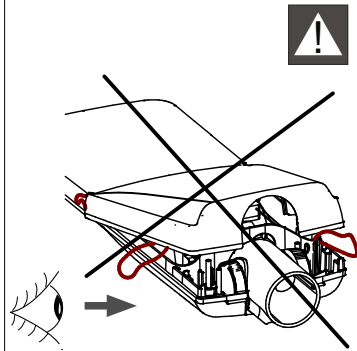
Luminaire	Y
BGP280/290/390	20 mm
BGP281/291/391	40 mm
BGP282/292/392	40 mm
BGP283/293/393	40 mm
BGP284/294/394	40 mm



6b

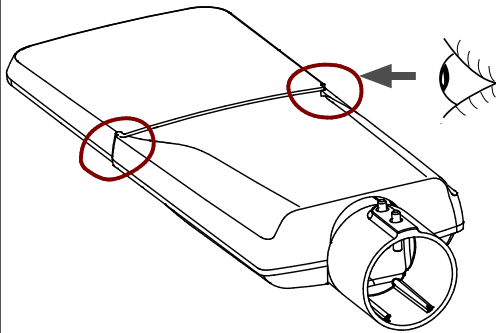


7a



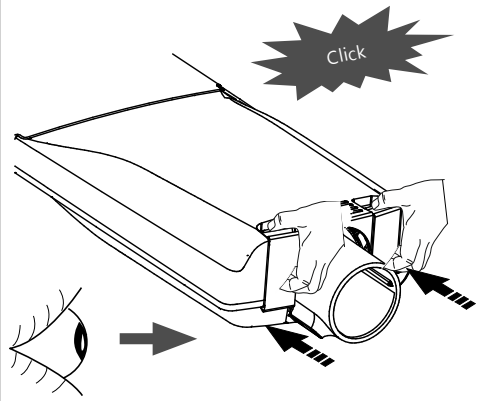
7b

BGP28x/29x/39x



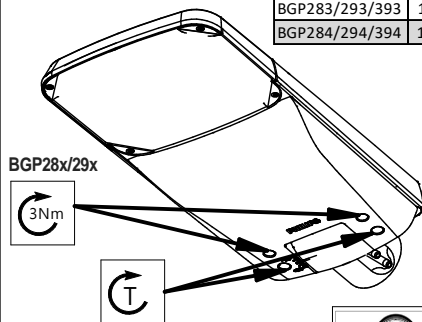
7c

BGP39x

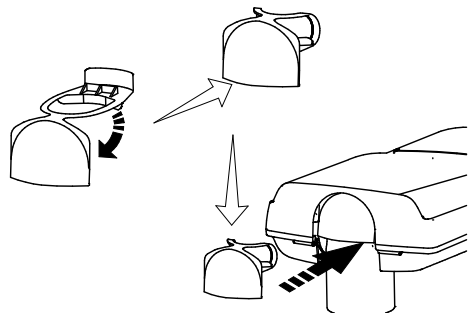


7d

Luminaire	T
BGP280/290/390	10Nm (M8)
BGP281/291/391	15Nm (M8)
BGP282/292/392	15Nm (M8)
BGP283/293/393	15Nm (M8)
BGP284/294/394	15Nm (M8)



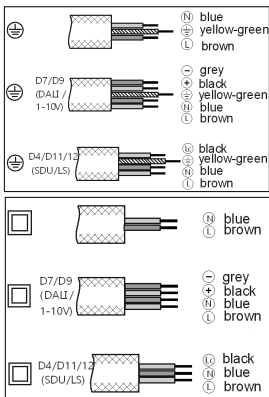
7e



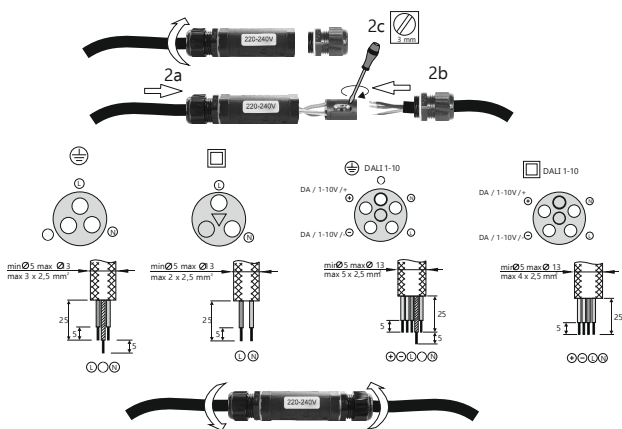
8

910925866469 -
A LUMISTREET POLE
CAP RAL7035 (5 PCS)

For version with cable

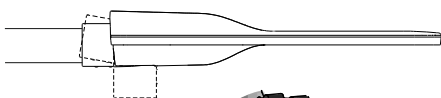


For specific cable connector



9

+ 15° Not for version 39X with 76 SE

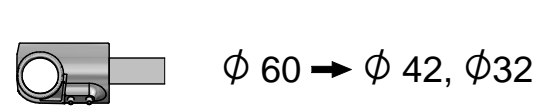
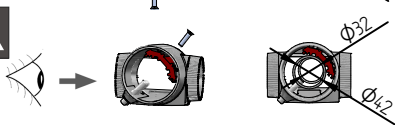
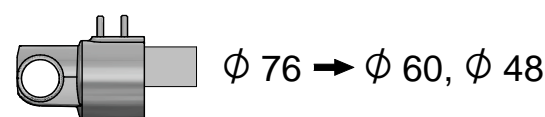
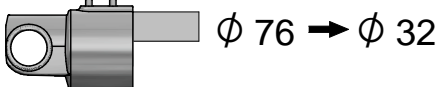
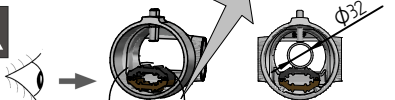


- 90°

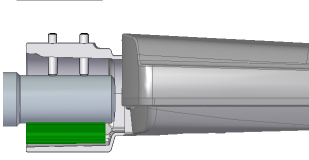
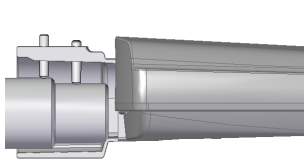
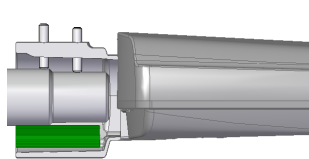
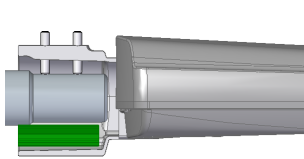


	Ø 32-48		Ø 48-60		Ø 76
	Ø 32-48		Ø 48-60		Ø 76

992200113062 AGP203/4/13/14 AGP307 SPIGOT ASSY 32-48
 992200113063 AGP203/4/13/14 AGP307 SPIGOT ASSY 48-60
 992200113064 AGP203/204AGP307AGP281/284 SPIGOT ASSY76
 910925864608 ZGP203 SP INSERT_DIGI_UNI_LUMISTR 1(50pcs)
 910925867694 ZGP281SP INSERT_CLEARW_UNI_LUMISTR 2(20)

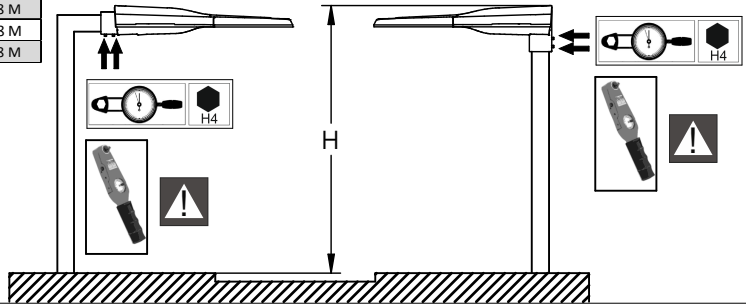


10

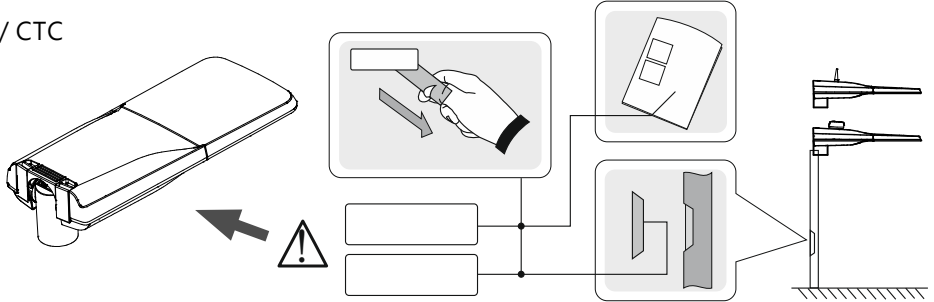


11

Luminaire	Spigot/pole	H
BGP280/290/390	10Nm (M8)	8 M
BGP281/291/391	15Nm (M8)	18 M
BGP282/292/392	15Nm (M8)	18 M
BGP283/293/393	15Nm (M8)	18 M
BGP284/294/394	15Nm (M8)	18 M

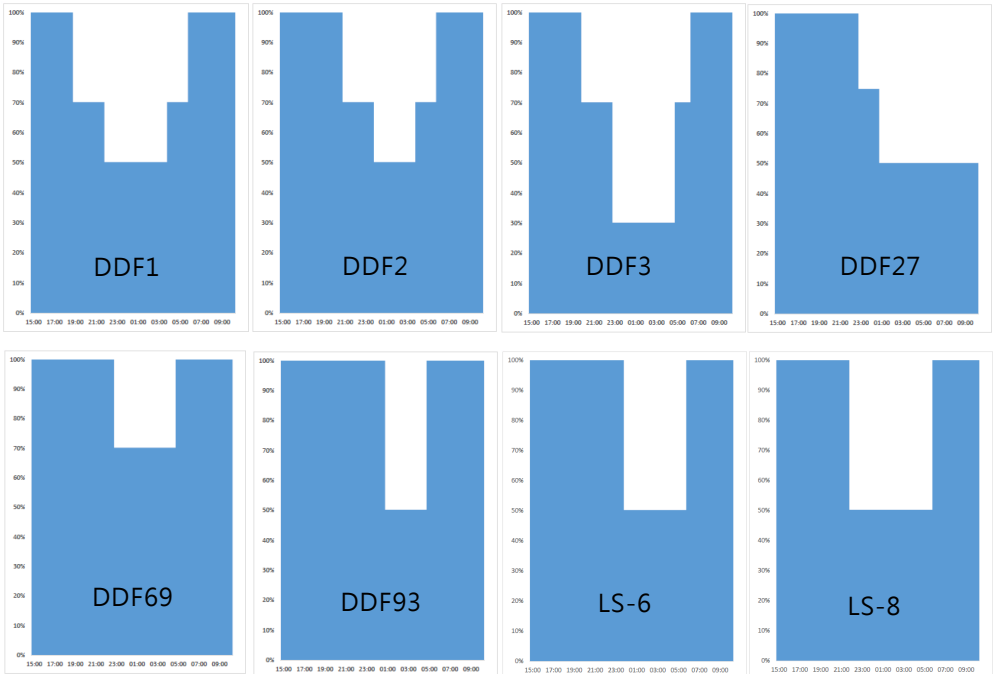


RF/ CTC



12

DDFx - DynaDimmer LS-x - LumiStep



13

STD


STDE

SRG10

SRG10E


SDM10

SDM10E

 + **STD**

6 kV
L/N - 

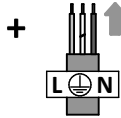
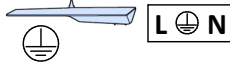
6 kV
L - N

 + **SRG10**

10 kV
L/N - 

10 kV
L - N

PHILIPS



 + **STD(E)****

6 kV
L/N - GND

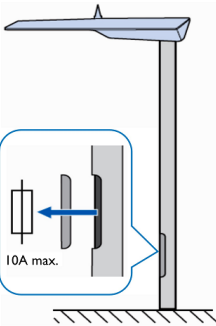
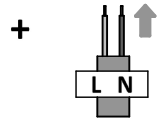
6 kV
L - N

 + **SDM10(E)****

6-10*kV
L/N - GND

10 kV
L - N

PHILIPS



 + **SRG10(E)****

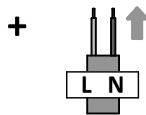
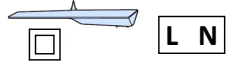
6-10*kV
L/N - GND

10 kV
L - N

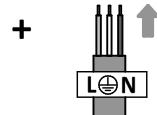
8-10*kV
L/N - GND

10 kV
L - N

PHILIPS



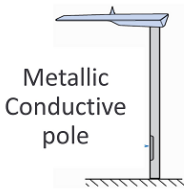
PHILIPS



STD

SRG10

SDM10



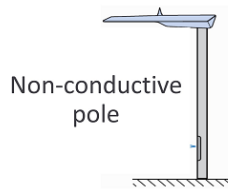
Metallic
Conductive
pole

STDE

SRG10E

SDM10E

**



Non-conductive
pole

*10kV for L/N - GND non-conductive connection

**E - ESD protection - bleeder resistor



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