Specialist Engineering Technical Services

Working on behalf of

Conwy County Borough Council

Levelling Up Funding

Glan Conwy to Llandudno Junction Active Travel Scheme

Outline Lighting Assessment

August 2024

Document Control

Notice

This report was produced by Specialist Engineering Technical Services Limited for the Conwy County Borough Council for the purpose of assessing the illumination requirements for the proposed active travel route between Glan Conwy and Llandudno Junction.

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Details of document of history and revisioning.

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Non-Technical Executive Summary

Conwy County Borough Council have secured funding from the UK government Levelling Up Fund to construct a new active travel route between Glan Conwy and Llandudno Junction.

In accordance with the Welsh Governments Active Travel Act Guidance, the path should be illuminated to promote walking and cycling as an around-the-clock means of transport and to provide an adequate level of safety, both real and perceived.

This document is an outline assessment of the proposed lighting, including an outline design, which has been produced by Specialist Engineering Technical Services Limited on behalf of Conwy County Borough Council.

This outline assessment briefly sets-out the key legislation, policy, standards & guidance which relate to road lighting and highlight how these have been considered during the design process and the production of this assessment.

An Ecological Impact Assessment has been produced by the Environment Partnership and a few key points from the Ecological Impact Assessment have been addressed within this outline assessment, including supporting the recommendation to [redacted] and also the acknowledging that the lighting design be undertaken in accordance with the process laid-out in the Institution of Lighting Professionals – Guidance Note 08 (2023) – Bats and Artificial Lighting at Night as recommended.

The environmental considerations of the scheme in terms of environmental zone, sky glow, obtrusive light, and light spill have been detailed. This also includes details explaining the selection of an amber light source for the scheme which will partially mitigate the impact of the scheme upon fauna, flora, and sky glow.

Example of the Amber Light Source (Image © *Ignialight*)

As part of the outline assessment, the criteria of the relevant British and European Standards have been used to determine the correct levels of light for the proposed scheme. This includes the option of increasing the lighting levels subject to a future review of how and when the path is used.

The outline assessment and accompanying outline design proposes the use of illuminated bollards for the paved sections of the scheme. The bollards will be located on a single side (estuary side) of the

path and will be approximately spaced every 11 meters for the entirety of the paved section. The bollard will feature an optics and shielding to ensure that only illuminate the path and not the surrounding area. The bridge / ramp sections of the scheme will feature an illuminated handrail on both sides which will have integrated lights approximately every 6 meters. The integrated lights will face towards the ground will feature an optics which limit backward light spill.

The initial specification for the bollards and illuminated handrails are included and initial lighting calculations have been undertaken to ensure the products meet the required performance criteria detailed within this outline assessment. Copies of the datasheets for the selected products along with the lighting calculations are included in the appendices.

This outline assessment will be provided to supplement the planning application for the scheme (development) for review and consultation.

This assessment will also be provided to the Environment Partnership for review to ensure that the proposed lighting is suitable for the flora and fauna before the detailed design is undertaken.

1. Introduction

1.1. Background

On the 19th of January, the UK Government announced the successful bids from round two of the Levelling Up Fund, with one of the successful bids being the 'Coast to Valley – Transport Bid' submitted by Conwy County Borough Council for the improvement of transport connections in the Conwy Valley [1].

The bid comprised of two schemes aimed at improving links between communities by the introduction & improvement of shared use walking and cycling paths and a third scheme providing flood resilience.

The three schemes forming part of the bid are:-

- the Glan Conwy to Llandudno Junction scheme which will link the two communities by a shared use walking and cycling path;
- the Llanrwst to Betws y Coed scheme which will provide an improved river crossing for walking and cycling, replacing the existing footbridge (Sappers' Bridge) which is currently closed on safety grounds;
- the Trefriw Resilient Roads scheme which will provide a flood resilient route in and out of the village.

Figure 1 – Overview of Coast to Valley Schemes (Mapping © OpenStreetMap contributors) [2]

1.2. Scope

This outline lighting assessment has been prepared by Specialist Engineering Technical Services on behalf of Conwy County Borough Council.

The purpose of this outline lighting assessment is to supplement the planning application for the Glan Conwy to Llandudno Junction proposed active travel route (development).

The objectives of this outline lighting assessment are:

- to demonstrate the requirement for lighting the proposed active travel route;
- to detail how the design aims to comply with the relevant legislation and standards;
- to detail how the design meets the objectives of current local & national policy;
- to detail how this design follows industry best practice and the relevant applicable guidance;
- to present an initial outline design proposal which will be used as the basis of the detailed design.

The assessment contains the outline lighting design only which may be subject to minor revision during the detailed design phase of the project.

2. Active Travel in Wales

This section briefly covers the introduction of the legislation and associated guidance surrounding active travel in Wales.

2.1. Active Travel (Wales) Act 2013

In 2013, the Welsh Parliament (formally National Assembly for Wales) introduced the Active Travel (Wales) Bill which places a requirement on local authorities to continuously improve facilities and routes for walkers and cyclists and to prepare maps identifying current and potential future routes for their use. The Bill will also require new road schemes to consider the needs of pedestrians and cyclists at design stage.

The bill was passed into law November of the same year [3].

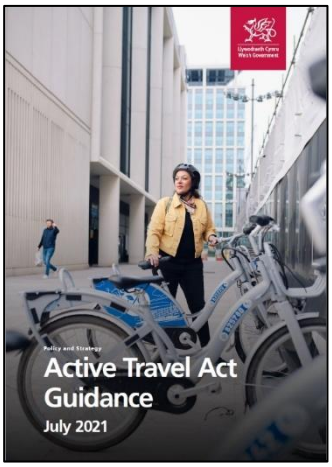
2.2. Guidance

In 2014, the Welsh Government published the following guidance documents to assist both local authorities and designers with the implementation of the act.

- Statutory Guidance for the Delivery of the Active Travel (Wales) Act 2013 [6]
- Design Guidance Active Travel (Wales) Act 2013 [7]

However, in 2021 the guidance was revised and into a single guidance document titled 'Active Travel Act Guidance (July 2021)' [3].

2.3. Active Travel Act Guidance (July 2021)



The Active Travel Act Guidance (July 2021) [6] is published by the Welsh Government for use throughout Wales and the contents must be considered when planning, designing and maintaining active travel routes and related facilities, enhancing provision for walkers and cyclists as part of other highway schemes (including planned maintenance work), or when considering the needs of walkers and cyclists as part of new developments, traffic management and road safety schemes.

It is beyond the narrow scope of this assessment to explore the guidance in detail, however it's important that the guidance is acknowledged and that the specifics of the guidance relating to lighting understood to ensure the design process and overall lighting proposal complies with the technical advice.

2.4. Lighting

Chapter 15 of the Active Travel Guidance (July 2021) [6] provides guidance on the construction, maintenance and management of any pedestrian or cycle facility and

associated matters. It also provides guidance on the specific considerations for pedestrians and cyclists where streetworks and construction sites affect their space within the highway.

Section 15.5 of chapter 15 provides guidance on lighting which can be summarised as follows:-

15.5.1. Walking and cycling must be promoted as around-the-clock means of transport, rather than just a daylight activity. This is especially true during the winter months.

15.5.2. Active travel routes should normally be lit to provide an adequate level of safety, both real and perceived.

15.5.3. Lighting should be considered at an early stage in the design process.

Efforts to minimise light pollution and spillage in rural areas will be particularly important.

Where lighting is proposed in a previously unlit area, the impact on light sensitive species such as bats which are protected by law must be carefully considered

15.5.4. Routes along urban and many rural highways will be lit by the existing highway lighting but specific lighting will be needed for off-highway routes. However, in lighting such routes consideration also needs to be given to wider factors, including:

a. limiting levels of light pollution;
b. level of ambient brightness in the surrounding area;
c. the visual impact of the lighting equipment;
d. intrusion on nearby properties;
e. the needs of visually impaired users for uniform illumination at surface level;
f. vandalism issues;
g. proximity of electricity supply;
h. energy usage and cost;
i. costs of installation, operation and maintenance.

2.5. Conclusion

Conwy County Borough Council. have commissioned Specialist Engineering Technical Services to undertake an outline lighting assessment and full detailed lighting design for the proposed active travel route which it to be undertaken in accordance with the Active Travel Act Guidance (July 2021) [6] and as detailed above in section 2.4.

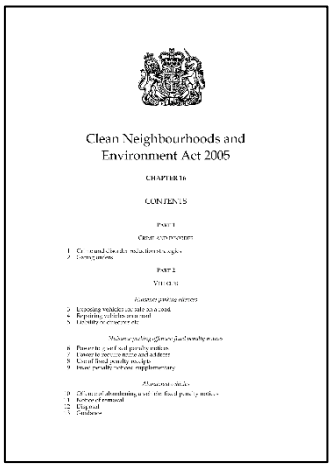
The outline lighting assessment (this document) includes an initial outline design.

A full detailed design will be undertaken following planning and consultation.

3. Legal, Policy, Standards & Guidance

The following legislation, policies, standards and guidance have been considered in the production of this outline lighting assessment and accompanying outline design.

3.1. Clean Neighbourhoods and Environment Act (CNEA) 2005


Clean Neighbourhoods and Environment Act 2005

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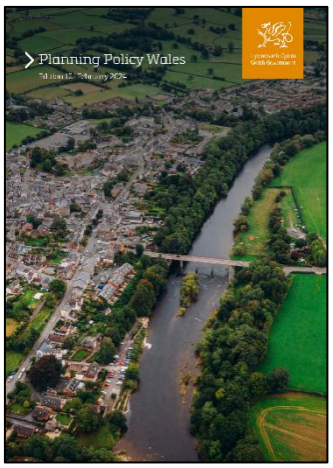
The Clean Neighbourhoods and Environment Act 2005 [7] introduced artificial light as a statutory nuisance in England and Wales. Specifically, section 102 of the Act added paragraph (fb) into section 79(1) of the Environmental Protection Act (EPA), defining the statutory nuisance as "artificial light emitted from premises so as to be prejudicial to health or a nuisance".

This means that artificial light that is harmful to health or causes a nuisance, emitted from certain premises, can be considered a statutory nuisance. There are several exceptions to this provision, including light emitted from an airport, harbour, railway, tramway or bus station.

The Act gives Local Authorities and the Environment Agency additional powers to deal with a wide range of issues by classifying such artificial light as a statutory nuisance. The terms ‘nuisance’ and ‘prejudicial to health’ are given their common law meanings.

This outline assessment aims to satisfy the local authority planners and other consultees that there is a clear requirement for lighting of the proposed active travel route and that the proposed lighting is appropriate, and has been designed considerately will not cause a nuisance or be prejudicial to health.

3.2. Planning Policy Wales (Edition 12 – February 2024)



Planning Policy Wales (PPW) [8] advises of the need to balance lighting for safety and crime prevention with environmental protection, dark sky protection, glare prevention, and carbon emission reduction.

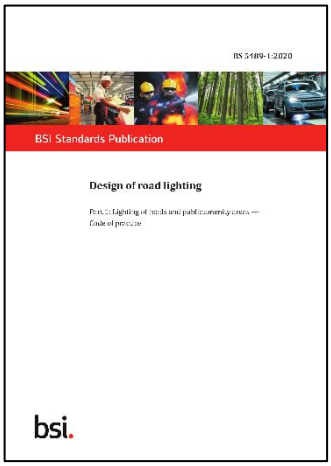
The policy also highlights that places like Snowdonia and Brecon Beacons are international dark sky reserves, which are important for both economic and environmental benefits.

Finally, the policy states that authorities may set conditions on new developments to ensure lighting systems are energy-efficient and do not contribute to light pollution.

This outline assessment aims to satisfy the local authority planners and other consultees the proposed lighting is required to provide an adequate level of safety, both real and perceived,

in order to promote walking and cycling as a round-the-clock means of transport. The assessment also aims to demonstrate that environmental, carbon emission reduction, glare prevention and dark sky protection have been considered.

3.3. Design of Road Lighting - Part 1: Lighting of roads and public amenity areas - Code of practice (BS 5489-1:2020)



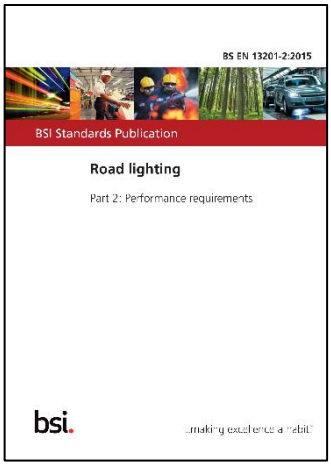
BS 5489-1:2020 [9] provides recommendations on the principles of road lighting, its aesthetic and technical aspects, and guidance on operation and maintenance.

The standard offers guidance on minimising energy consumption and limiting environmental impact and impact on adjacent properties.

The standard gives recommendation for the design of lighting for all types of highways and public thoroughfares, including those for pedestrians and cyclists, as well as pedestrian subways and bridges.

This outline assessment and the accompanying outline design apply the recommendation and guidance of the standard, more of which is covered in section 6.

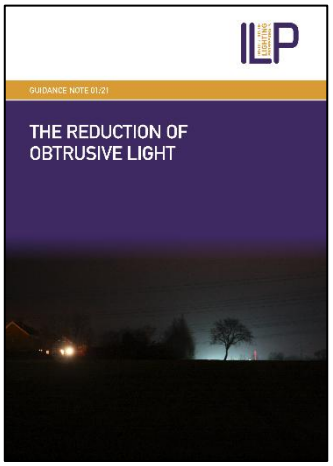
3.4. Road Lighting - Part 2: Performance requirements (BS EN 13201-2:2015)



BS EN 13201-2:2015 [10] is part of the European Standard which outlines the performance criteria, classified as lighting classes, for road lighting. It targets the visual requirements of road users and takes into account the environmental implications of road lighting.

This outline assessment and the accompanying outline design apply the performance criteria of the standard, more of which is covered in section 6.

3.5. Institution of Lighting Professionals (ILP) – Guidance Note 01 (2021) – The Reduction of Obtrusive Light



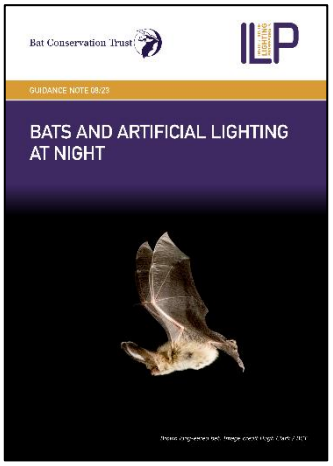
Institution of Lighting Professionals Guidance Note 01 (2021) [11] is a revised document that reflects changes in international guidance regarding obtrusive light, as detailed in CIE 150:2017. It provides recommendations for reducing obtrusive light, which is sometimes referred to as light pollution.

The guidance note emphasises the importance of good lighting practice, which involves providing the right light, at the right time, in the right place, controlled by the right system and it acknowledges that while artificial light has greatly enhanced our night-time environment, if not properly controlled, obtrusive light can cause serious physiological and ecological problems.

The document offers advice and examples of good practice to minimise the effect artificial lighting can have on the environment, the night sky, flora, fauna, and neighbours. It covers various forms of obtrusive light, including sky glow, glare, light spill, and light intrusion, all of which may cause nuisance to others, adversely affect fauna & flora, and waste money and energy.

The relevant advice and good practice from the guidance note have been applied to the outline lighting design, more of which is covered in section 5.

3.6. Institution of Lighting Professionals (ILP) – Guidance Note 08 (2023) – Bats and Artificial Lighting at Night



Institution of Lighting Professionals Guidance Note 08 (2023) [12] is a document aimed at raising awareness of the impacts of artificial lighting on bats and potential solutions to avoid and reduce this harm. It acknowledges that Artificial Light at Night (ALAN) is increasing at an alarming rate, estimated to have risen over 49% in the last 30 years. This has negative impacts on bats, other wildlife, and people, as well as wasting precious energy.

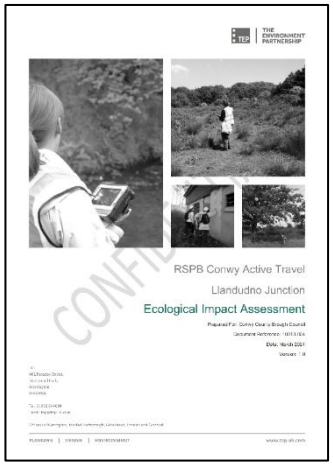
The guidance note has been updated to cover modern LED light sources and their control, the effect of different light wavelengths of different species, and introduces a mitigation hierarchy for lighting where bats could be or are present. It also provides advice and examples of good practice to minimise the effect artificial lighting can have on the environment, the night sky, flora, fauna, and neighbours.

The 2023 edition has a strong focus on avoidance as a key tool to mitigate impacts from lighting on bats. It also includes a range of case studies to demonstrate principles outlined in

the document. The guidance note emphasises the importance of new development projects utilising the updated guidance along with advice from suitably experienced ecological consultants and lighting experts from the start of a project.

This outline assessment gives due consideration to the potential impacts of artificial lighting on bats along with other flora and fauna. The proposed lighting has been considerately designed in order to minimise the impact upon flora and fauna whilst providing the required illumination. Both the Institution of Lighting Professionals Guidance Note 08 (2023) and the scheme Ecological Impact Assessment (EcIA) have been considered as part of this outline assessment and accompanying outline design, of which is covered in section 4.

4. Ecology



The Environment Partnership (TEP) have been commissioned to undertake an Ecological Impact Assessment and a copy has been provided and considered as part of the lighting design [13].

The Ecological Impact Assessment is extensive and considers the ecological effects of the scheme upon any notable habitats or species which may be present on or near the site.

It's important that any potential impacts of the scheme as detailed Ecological Impact Assessment are fully considered with respect to proposed lighting and any recommended mitigation measure are implemented to minimise the impact of the proposed lighting on this important site.

The key points noted within the report which are relevant to the lighting of the scheme along with the proposed mitigations are as detailed below.

4.1. Badgers

[redacted]

4.1.1. Ecological Impact Assessment Recommended Mitigations (Scheme)

[redacted]

4.1.2. Proposed Mitigations (Lighting)

The Ecological Impact Assessment makes no specific recommendations with regards to lighting however, artificial lighting can impact upon badgers and their setts and therefore should be avoided.

[redacted]

[redacted] the lighting design will ensure that the lighting is confined to the path and that light spill is minimised through careful design and where necessary, via the use of light shielding and landscape screening.

4.2. Bats

All bat species and their roosts are legally protected in the UK. This protection is provided by both domestic and international legislation, including the Wildlife & Countryside Act 1981 (as amended). Additionally, bats are considered European Protected Species under The Conservation of Habitats and Species Regulations 2017.

The Ecological Impact Assessment identified six trees and a cutting / slope over which the proposed railway bridge is to be constructed as having bat roosting suitability.

4.2.1. Ecological Impact Assessment Recommended Mitigations (Scheme)

The Ecological Impact Assessment recommends that the impact on the six trees with bat roosting suitability should be minimised and if works on the trees cannot be avoided, a precautionary inspection by a licensed bat consultant and the with the works supervised by an ecologist.

The Ecological Impact Assessment also details that the cutting / slope over the railway was not accessible during the survey but that the presence of any suitable crevices/voids for bats cannot be fully discounted. The report recommends that consultation is undertaken with Conwy County Borough Councils Ecologist and Natural Resources Wales to determine if further surveys are required and how these surveys can be undertaken given the access constraints and liaison required with Network Rail.

4.2.2. Proposed Mitigations (Lighting)

The Ecological Impact Assessment recommends that lighting design be undertaken in accordance with Institution of Lighting Professionals Guidance Note 08 (2023).

The result of further guidance or surveys in relation to any bat roosting on the cutting / slope over the railway will need to be shared with then lighting designer as there is potential for the proposed railway bridge lighting to disrupt the roosts and / or flightpaths.

The mitigation hierarchy and guidance detailed the Institution of Lighting Professionals Guidance Note 08 (2023) have been followed during the production of this outline lighting assessment and accompanying outline design.

5. Environmental

Theis section addresses the environmental considerations of the proposed scheme in relation to light and light pollution.

5.1. Environmental Zone

The proposed site is within 2 miles of the Eryri National Park (Snowdonia) which is an International Dark Sky Reserve as recognised by DarkSky International. The site is also within the Eryri National Parks 5-mile external transition for Dark Sky Place Protection [4].

The proposed site is also adjacent to the Conwy RSPB Nature Reserve and the Aber Afon Conwy Site of Special Scientific Interest (SSSI).

Using zenith sky brightness reading from the World Atlas 2015, we can observe that the site had sky quality meter (SQM) readings of between 19.95 and 20.43 in 2015 as shown in Figure 2. It should be highlighted that as of the time of writing, the data is 9-years old, however observing the yearly trends from the NASA VIIRS/NPP Lunar BRDF-Adjusted Nighttime Lights data (Figure 3) it's possible to see a downwards trend in radiance levels at the site and therefore the it can be safely assumed that the sky quality meter readings is likely higher today than in 2015.

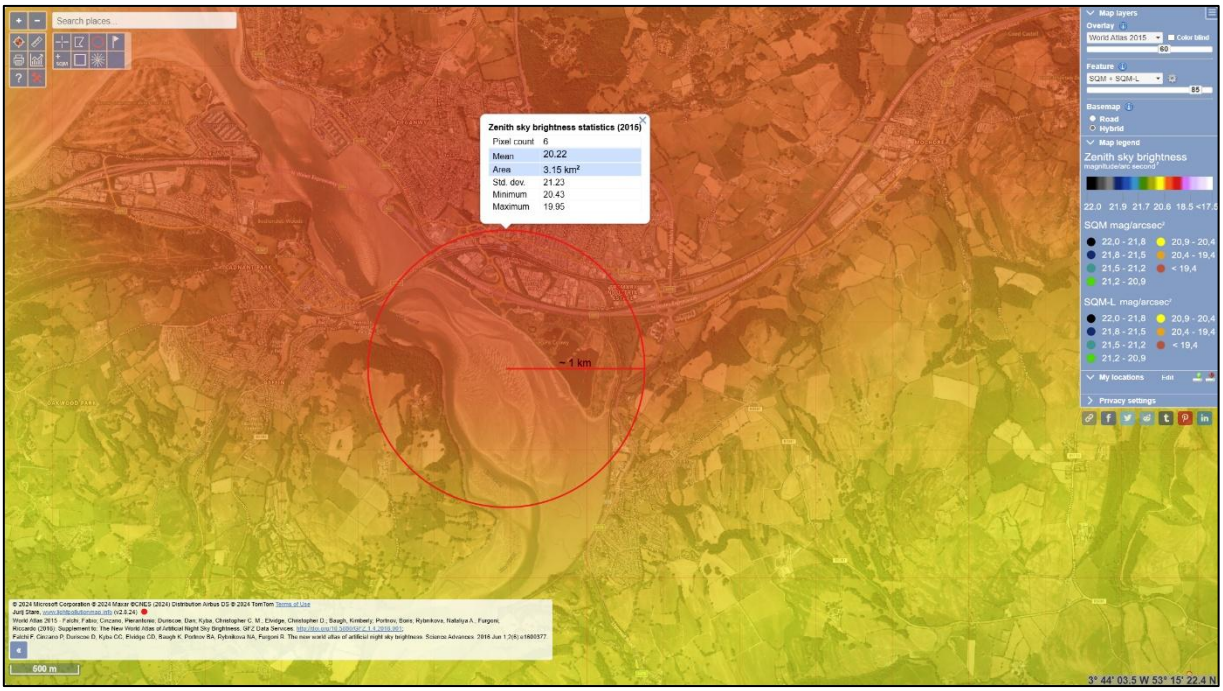


Figure 2 – World Atlas 2015 data (Overlaid using lightpollutionmap.info)

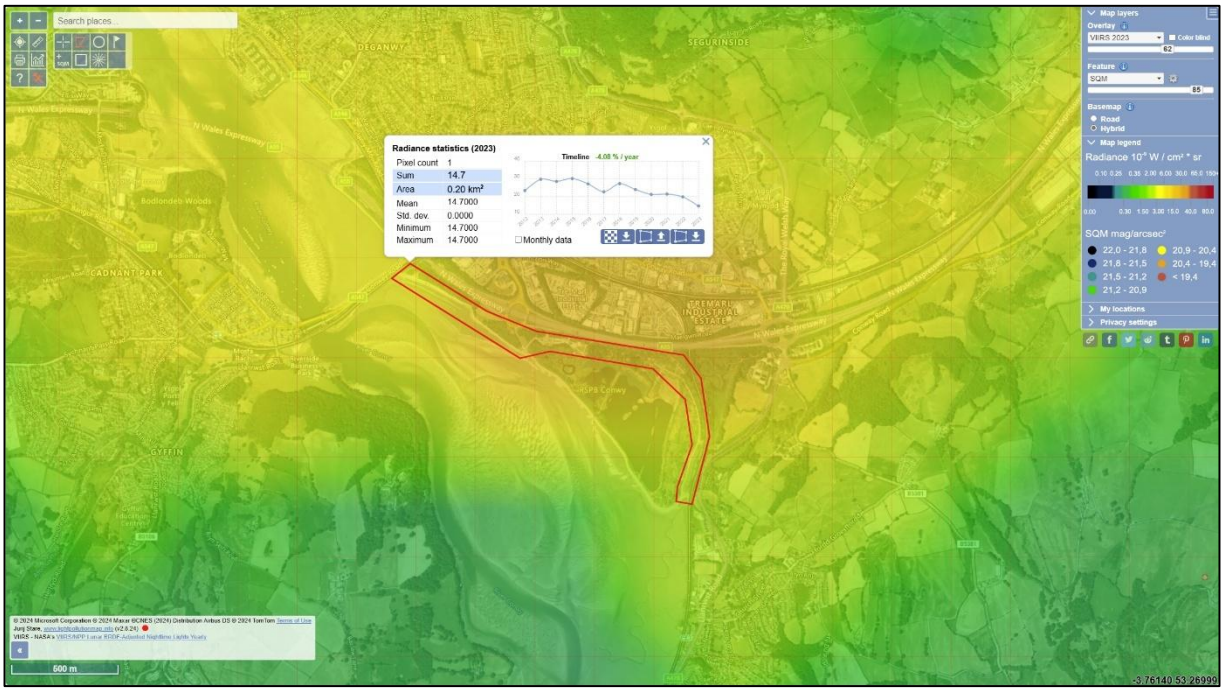


Figure 3 – NASA VIIRS/NPP Lunar BRDF-Adjusted Nighttime Lights data (Overlaid using lightpollutionmap.info)

The Institution of Lighting Professionals Guidance Note 01 (2021) [5] offers practical guidance regarding obtrusive light as specified in CIE 150:2017 Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations [6].

Using Table 2 of the Institution of Lighting Professionals Guidance Note 01 (2021) [5], we can see that the highest (best) sky quality meter reading of 20.43 places our site within environmental zone E1. This is re-affirmed by the example within the table which refers to 'IDA buffer zone' as environmental zone E1.

The table of Environmental Zones from the Institution of Lighting Professionals Guidance Note 01 (2021) [5] have been reproduced in Table 1.

In conclusion, the environmental zone E1 has been selected and used as a basis of the design.

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

NOTE 1 - Where an area to be lit lies close to the boundary of two zones the obtrusive light limitation values used should be those applicable to the most rigorous zone (see comment below)

NOTE 2 - Rural zones under protected designations should use a higher standard of policy.

NOTE 3 - Zone E0 must always be surrounded by an E1 Zone

NOTE 4 - Zoning should be agreed with the local planning authority. Due to local requirements a more stringent zone classification may be applied to protect special / specific areas

NOTE 5 - Sky Quality Meter (SQM) is referenced by the International Dark Sky Association (IDA). Sky Quality Meter is an instrument used to measure the luminance of the night sky. It is typically used by astronomers to quantify skyglow, using units of magnitudes per square arcsecond. the scale is between 16:00 (a bright night sky) and 22:00 (the least light pollution). The criteria for zone E0 was revised in mid 2019, with the new requirements not being made Retrospective.

NOTE 6 - Astronomical Observable Dark Skies will offer clearer views of the Milky Way and of other objects such as the Andromeda Galaxy and the Orion Nebula.

NOTE 7 - Although values of Sky Quality Meter 20 to 20.5 may not offer clear views of astronomical dark sky objects such as the Milky Way, these skies will have their own relative intrinsic value in the UK

Table 1 – Institution of Lighting Professionals Guidance Note 01 (2021) [5] – Table 2: Environmental Zones

5.2. Limitation of Illumination on Surrounding Premises (Light Intrusion / Nuisance)

There is only a single dwelling within the area which will unlikely be significantly impacted by the proposed illumination however, the maximum values of vertical illuminance on premises given in Table 3 of the Institution of Lighting Professionals Guidance Note 01 (2021) (reproduced in Table 2) will be verified during the detailed design to ensure that they do not exceed the maximum values.

Light technical parameter	**Application Conditions**	**Environmental zone**				
		E0	E1	E2	E3	E4
Illuminance in the vertical plane (E_v)	Pre-curfew	n/a	2 lux	5 lux	10 lux	25 lux
	Post-curfew	n/a	<0.1 lux*	1 lux	2 lux	5 lux

Table 2 – Institution of Lighting Professionals Guidance Note 01 (2021) [5] – Table 3: Maximum values of vertical illuminance on premises

5.3. Limitation of Skyglow

It is important to limit the impact of the scheme upon skyglow, particularly given the environmental zone.

Utilising the upward lighting ratio (ULR) percentages given Table 6 of the Institution of Lighting Professionals Guidance Note 01 (2021) (reproduced in Table 3), it can be determined that zero upward light ratio is required given the environmental zone.

Lighting Technical Parameter	**Environmental zone**				
	E0	E1	E2	E3	E4
Upward light ratio (ULR) / %	0	0	2.5	5	15

Table 3 – Institution of Lighting Professionals Guidance Note 01 (2021) [5] – Table 6: Limitation of Skyglow

5.4. DarkSky Internationals International Dark Sky Reserve Program Guidelines

With the site being within the Eryri National Parks 5-mile external transition for Dark Sky Place Protection, DarkSky Internationals International Dark Sky Reserve Program Guidelines [16] have also been considered as part of this outline lighting assessment and accompanying outline design.

The key requirements, which are summarised below, have been applied to the outline design.

- The use of outdoor light at night is only prescribed when it is strictly needed, where it is needed, and in the appropriate amount for a specific task. The purpose of outdoor light that is allowed under the policy should be specifically to ensure public safety.
- All outdoor lighting fixtures >500 initial lamp lumens must be fully shielded and make appropriate use of timers and motion sensors. Lighting of ≤500 initial lamp lumens may be left unshielded for special purposes, such as historical preservation.
- Lighting must be chosen to minimize the amount of short-wavelength light emitted into the nighttime environment. The lighting policy must restrict lighting in this respect according to one of the following prescriptions:
  a. The correlated colour temperature (CCT) of lamps must not exceed 3000 Kelvins; OR
  b. Allowed lighting must not emit more than 25% of its total spectral power at wavelengths < 550 nanometers; OR
  c. The scotopic-to-photopic (S/P) ratio of allowed lighting must not exceed 1.3.

5.5. Correlated Colour Temperature (CCT)

Correlated Colour Temperature is a specification of the colour appearance of light emitted by a light source, relating its colour to the colour of light from a reference source when heated to a defined temperature. Correlated Colour Temperature is measured in degrees Kelvin (K).

Higher Correlated Colour Temperatures (above 3000 Kelvin) feature more blue light components which can contribute to light pollution and can impact flora & fauna.

Table 4 shows a range of Correlated Colour Temperatures along with descriptions, cross referenced with the relevant guidance. We can observe that there is maximum recommended Correlated Colour Temperature of 2700 Kelvin.

A low Correlated Colour Temperature range of 1750 Kelvin to 1800 Kelvin has been selected as the final Correlated Colour Temperature for the scheme which goes beyond the guidance referenced in Table 4.

The overall benefits of using this low Correlated Colour Temperature include:-

- **Reduced Disruption to Nocturnal Animals:** Artificial light at night, particularly blue light, can disrupt the behaviours of nocturnal animals. Lower Correlated Colour Temperatures emit less blue light, which can help reduce these disruptions [17].
- **Less Attractive to Insects:** Many insects are attracted to light, particularly blue light. Lights with a lower Correlated Colour Temperature can help reduce the number of insects attracted to the light, which can have benefits for both humans and the ecosystem [18].

- **Reduced Impact on Bird Migration:** Artificial light can disrupt bird migration patterns. Birds are particularly sensitive to blue light, so using lights with a lower Correlated Colour Temperature can help reduce this impact [19].

Scheme Selected Correlated Colour Temperature								↓	
Indicative Colour									
Colour Temperature	6500 Kelvin	5500 Kelvin	4800 Kelvin	4000 Kelvin	3000 Kelvin	2800 Kelvin – 2700 Kelvin	2000 Kelvin – 2200 Kelvin	1800 Kelvin – 1700 Kelvin	1000 Kelvin
Colour Description	Daylight / Overcast	Daylight	Direct Sunlight	Natural White	Warm White	Soft White	Sunset / Sunrise	Candle / Match Flame	Red
Dark Sky Reserve Program Guidelines [16]					Must not exceed 3000 Kelvin →				
DarkSky Values-centered Outdoor Lighting [17]						Recom - mends 2700 Kelvin			
ILP GN08 [12]						Ideally less than 2700 Kelvin →			

Table 4 – Indicative Colour / Temperature Relationships & Descriptions

6. Lighting Class

This section details the selection of the appropriate lighting class for the scheme based upon the 5-step process in Annex A of BS 5489-1:2020 [4]

6.1. Step 1 – Selection of Initial Lighting Class

Select the lighting class from the relevant table (Table A.2 to Table A.6 of BS 5489-1:2020 [4]).

Table A.5 - Lighting classes for subsidiary roads is selected as the most appropriate table.

Table A.2	Lighting classes for traffic routes (v > 40 mph)
Table A.3	Lighting classes for traffic routes (v ≤ 40 mph)
Table A.4	Lighting classes for conflict areas
Table A.5	Lighting classes for subsidiary roads
Table A.8	Lighting classes for city and town centres

Table 5 – BS 5489-1:2020 Annex A – Selection Process – Step 1

To conclude Step 1, an assessment was made as to the lighting class utilising Table A.2 of Annex A of BS 5489-1:2020 [4] which has been reproduced as Table 6.

Traffic Flow	Lighting Class		
	E1 to E4 [A)]	**E1 to E2 [A)]**	**E1 to E2 [A)]**
	Pedestrian and cyclists only	**Speed limit v ≤ 30 mph**	**Speed limit v ≤ 30 mph**
Busy [B)]	P5	P4	P3
Normal [C)]	P5	P5	P4
Quiet [D)]	P6	P5	P4

NOTE 1 Table A.5 assumes no parked vehicles; see risk assessment in A.3.3.2 of BS 5489-1:2020.

NOTE 2 An EV lighting class using vertical illuminance, from BS EN 13201-2:2015, Table 6, can be specified in addition to the general lighting class when there are particular concerns about crime and personal safety. EV is calculated at the typical height of a human face (1.5 m) and in relevant viewing orientations.

NOTE 3 To ensure adequate uniformity, the actual value of the maintained average illuminance is not to exceed 1.5 times the value indicated for the class.

NOTE 4 The actual overall uniformity of illuminance, Uo, needs to be as high as reasonably practicable (see 7.2.6 of BS 5489-1:2020).

NOTE 5 The ambient luminance descriptions E1 to E4 refer to the environmental zone as defined in ILP GN01 [5].

NOTE 6 The illuminance classes are suggested minimum levels. A risk assessment needs to be carried out to ensure that the light levels are adequate, particularly for pedestrians and cyclists.

[A)] Environmental zone, as given in ILP GN01 [5].

[B)] Busy traffic flow refers to areas where the traffic usage is high and can be associated with local amenities

[C)] Normal traffic flow refers to areas where the traffic usage is of a level equivalent to a housing estate access road.

[D)] Quiet traffic flow refers to areas where the traffic usage is of a level equivalent to a residential road, and is mainly associated with the adjacent properties or properties on other equivalent roads accessed from this road.

Table 6 – Table of Lighting Classes for Subsidiary Roads (Table A.5 of Annex A of BS 5489-1:2020)

Based upon Table 6, it is possible to see the selected lighting class can either be P5 or P6. Two lighting classes have been specified as the actual traffic flow could fall within either the Normal or Quiet descriptions.

6.2. Step 2 – Risk Assessment

Undertaking a risk assessment to identify specific lighting needs for the road.

The risk assessment should consist of the relevant parameters as detailed in paragraph A.3.1.3 in Annex A of BS 5489-1:2020 [4] along with any other parameters specific to the section of road, local custom and practice, and topology.

Table 7 contains the risk assessment and any outcomes which should be fed back into the design process as part of Step 3.

Parameter	Assessment	Outcome
Traffic Composition: where the traffic consists of a high percentage of slow-moving vehicles, cyclists and pedestrians, it might be beneficial to increase the lighting level.	The site consists solely of pedestrians and cyclists with minimal interface with vehicular traffic.	No change to lighting class based upon this parameter.
Parked vehicles, bus stops and pedestrian crossings: where there are bus stops, frequent parked vehicles or pedestrian crossings, the driving task becomes more complex and a higher lighting level might be justified.	The site consists solely of pedestrians and cyclists with minimal interface with vehicular traffic.	No change to lighting class based upon this parameter.
Ambient luminance or environmental zone: Table A.2[1] and Table A.3[1] assume a moderate ambient luminance. If the ambient luminance is high or very high, a higher lighting class might be justified; conversely if the ambient luminance is low or very low then a lower lighting level might be justified.	Not applicable as Table A.2 and Table A.3 are not used.	No change to lighting class based upon this parameter.
Visual guidance/traffic control: Table A.2[1] and Table A.3[1] assume good visual guidance. If visual guidance is poor, then a higher lighting level might be justified.	Not applicable as Table A.2 and Table A.3 are not used.	No change to lighting class based upon this parameter.
Crime: Anti-social behaviour, violence and sexual offences, criminal damage and arson, drugs	There are currently no public footways / cycleways through the proposed development area therefore there is no crime data available within the confines of the proposed development.	As lighting can both attract and deter crime, it' s advised that the lighting class remains as P5 / P6. Should there any ongoing issues with crime, the base lighting level P6 could be increased from P5 in response to this.

Table 7 – Risk Assessment

[1] *Annex A of BS 5489-1:2020* [4]

6.3. Step 3 – Adjust the Lighting Class

If necessary, adjust the lighting class up or down based upon the risk assessment.

Link Section	Lighting Class (Before Risk Assessment)	Lighting Class (After Risk Assessment)
Llandudno Junction to Glan Conwy	P5 / P6	P5 / P6

Table 8 – Lighting Class (after Risk Assessment)

6.4. Step 4 – Adjustment of lighting class due to the light source (mesopic vision)

The proposed light sources have a low Colour Rendering Index (Ra) (<60) and a high S/P ratio (≥ 1.00) therefore we can increase the lighting level to improve the visual performance however, the lighting class(es) remain unchanged.

Link Section	Lighting Class (Before Adjustment)	Lighting Class (After Adjustment)
Llandudno Junction to Glan Conwy	P5 / P6	P5 / P6

Table 9 – Lighting Class (after Adjustment)

6.5. Step 5 – Adjustment of Lighting Classes

Adjustment of the lighting class will be possible; however, it will require a review of traffic flows (pedestrian / cyclist) once the route is active.

6.6. Conclusion

It's proposed that the lighting initially be configured to lighting class P6.

Its recommends that the option of increasing the lighting class to P5 or potentially implementing part-night dimming should be explored once the route is active and the pedestrian / cyclist traffic flows, volume and usage profiles are understood.

The performance requirements of the lighting classes P5 and P6 are detailed and highlighted within Table 10.

Class	Horizontal illuminance		Additional requirement if facial recognition is necessary	
	$\bar{E}$ [a] **[minimum maintained]** lux	E_{min} **[maintained]** lux	$E_{v,min}$ **[maintained]** lux	$E_{sc,min}$ **[maintained]** lux
P1	15,0	3,00	5,0	5,0
P2	10,0	2,00	3,0	2,2
P3	7,50	1,50	2,5	1,5
P4	5,00	1,00	1,5	1,0
P5	3,00	0,60	1,0	0,6
P6	2,00	0,40	0,6	0,2
P7	performance not determined	performance not determined		

[a] To provide for uniformity, the actual value of the maintained average illuminance shall not exceed 1,5 times
the minimum □ value indicated for the class.

Table 10 – Table of P lighting classes reproduced from Table 3 of BS EN 13201-2:2015 [6].

7. Proposed Equipment

The following products have been selected to meet the design requirements detailed within this assessment.

7.1. TRT Lighting VIA Bollard

Figure 4 & 5 – Photos of the VIA Bollard[2] (Photos extracted from the ILP GN08 [2023], © 2023 ILP)

The VIA is a highly robust LED bollard produced in the UK by an established street lighting manufacturer.

The bollard can be configured with a wide range of options to suit various applications.

7.1.1. Correlated Colour Temperature (CCT)

The VIA bollard is available in with four different Correlated Colour Temperatures (1750 Kelvin, 2700 Kelvin, 3000 Kelvin and 4000 Kelvin)

In accordance with the ecological and environmental considerations detailed within this outline assessment, the bollard variation with a Correlated Colour Temperature of 1750 Kelvin (PC-Amber) has been selected as the most suitable.

7.1.2. Lighting Classes

The VIA bollard can be configured to illuminate pedestrian footways / cycleways to the P lighting classes as defined in BS EN 13201-2:2015 and BS 5489-1:2020.

As per section 6, the assessment process has identified the lighting class P6 as being a suitable initial lighting class for the active travel route however, utilising the PowerSet option

[2] Note the photo shows the warm white (3000 Kelvin) variation of the bollard rather than the PC-Amber (1750 Kelvin) variation being proposed. The photographed bollards also do not feature the 180 degree.

of the VIA bollard, it will be possible to increase the lighting class to P5 subject to any future reviews.

7.1.3. Obtrusive & Upwards Lighting

The VIA bollard features a 0 degree tilt which limits any upwards light pollution and when used with the colour temperature 1750 Kelvin, the bollard is Dark Sky Approved by DarkSky International.

The VIA bollard can be configured with asymmetric light distribution and fitted with a 180 degree shield, optimising the lighting of the footway / cycleway and minimising light spillage.

7.1.4. Environment

The VIA bollard features a robust aluminium housing which is sealed to IP66 (Able to protect against powerful water jets) and features an impact rating of IK10 (protected against 20 joules of impact).

7.1.5. Maintenance and Warranty

The LEDs within the VIA bollard has a projected LED lifetime of L85 after 100,000 hours meaning the LEDs should retain around 85% of their initial luminous flux after 100,000 hours of operation (approx. 23 years of night-time operation).

The VIA bollards also come with a 10-year warranty.

7.1.6. Datasheet

A copy of the datasheet for the VIA bollard is included in Appendix A.

7.2. DW Windsor Garda Handrail

Figure 6 & 7 – Photos of the Garda Handrail [3] (Photos extracted from the DW Windsor Brochure, © 2021 DW Windsor Ltd)

The DW Windsor Garda is a versatile illuminated handrail system which integrates seamlessly with handrails in any environment and is also produced in the UK by another established street lighting manufacturer.

The handrail can be configured with a wide range of lighting options and can be manufactured bespoke to the project's requirements.

7.2.1. Correlated Colour Temperature (CCT)

The Garda handrail is available in with four different Correlated Colour Temperatures (1800 Kelvin, 2200 Kelvin, 2700 Kelvin, 3000 Kelvin and 4000 Kelvin)

In accordance with the ecological and environmental considerations detailed within this outline assessment, the handrail variation with a Correlated Colour Temperature of 1800 Kelvin has been selected as the most suitable.

7.2.2. Lighting Classes

The Garda handrail can be configured to illuminate pedestrian footways / cycleways to the P lighting classes as defined in BS EN 13201-2:2015 and BS 5489-1:2020.

As per section 6, the assessment process has identified the lighting class P6 as being a suitable initial lighting class for the active travel route however, utilising the dimming control options of the Garda handrail it will be possible to increase the lighting class to P5 subject to any future reviews.

[3] Note the photos shows the warm white (3000 Kelvin & 4000 Kelvin) variations of the handrail rather than the 1800K variation being proposed.

7.2.3. Obtrusive & Upwards Lighting

The Garda handrail can be configured with a 0 degree tilt which limits the any upwards light pollution and is also Dark Sky Approved by DarkSky International.

The Garda handrail can also be configured with asymmetric light distribution to minimise light spillage.

7.2.4. Environment

The Garda handrail light modules are sealed to IP66 (Able to protect against powerful water jets) and have an impact rating of IK10 (protected against 20 joules of impact) [18].

7.2.5. Maintenance and Warranty

The LEDs within the Garda handrail light modules have a projected LED lifetime of L80 after 100,000 hours meaning the LEDs should retain around 80% of their initial luminous flux after 100,000 hours of operation (approx. 23 years of night-time operation) [19].

The Garda handrail can also come with up to a 10-year warranty where the product is installed by DW Windsor [19].

7.2.6. Datasheet

A copy of the datasheet for the Garda handrail is included in Appendix B.

8. Outline Design Summary

The following provides a summary of the outline design proposal.

8.1. Unsegregated Shared Use Path

The majority of the scheme consists of 2 kilometre of 3 meter wide paved unsegregated shared use path which will be bounded by fencing and a planted screen segregating the path from the Conwy RSPB Nature Reserve.

The outline design consists of TRT Lighting VIA bollards located at 11 meter intervals (approx. 182) for the full distance of the path, with the exception of the ramp / bridges detailed below.

The VIA bollards will be primarily located on the estuary side of the path and they will be fitted with 180 degree rear shields to prevent any light spill towards the Conwy RSPB Nature Reserve.

The VIA bollards feature a 0 degree tilt which limits the any upwards light pollution. The asymmetric optics are configured in such a way as to only illuminate the path with very little light spill beyond the confines of the path.

The bollards with have a CCT of 1750 Kelvin (PC-Amber) providing an orange glow and minimising the amount of short-wavelength (blue) light which both reduces light pollution and provides a better environment for fauna and flora by reducing the harmful effects of artificial light.

Initial calculations have been undertaken to ensure the bollards meet the performance criteria detailed within this assessment and are included in Appendix C.

8.2. Unsegregated Shared Use Path (Ramp and Bridges)

The remainder of the scheme will consist of a 35 meter bridge across the Afon Ganol and a 100 meter ramp & 35 meter bridge across the railway.

These will continue the route for the 3 meter shared use path across the river & railway towards Glan Conwy.

The outline design consists of DW Windsor Garda illuminated handrail installed on both sides of the ramp & bridges in a staggered configuration.

The Garda illuminated handrail will be configured with a 0 degree tilt which limits the upwards light pollution. The asymmetric optics will only illuminate the path with very little light spill beyond the confines of the path.

The current proposal is for the ramp and bridges to feature glass infill parapets and therefore there will some minor illumination visible externally of the structures however, it will provide negligible back light.

The illuminated handrails with have a Correlated Colour Temperature of 1800 Kelvin providing an orange glow and minimising the amount of short-wavelength (blue) light which both reduces light pollution and provides a better environment for fauna and flora by reducing the harmful effects of artificial light.

Initial calculations have been undertaken to ensure the illuminated handrails meet the performance criteria detailed within this assessment and are included in Appendix C.

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Appendix A - TRT Lighting VIA Bollard

TRTLIGHTING

VIA
Bollard LED

IP66
Ingress Protection

IK10
Impact Resistance

10.5kg Weight

Electrical Class I

-20 to 45°C Ambient

LED Light Source

SPECIFICATION

- ✓ LED colour temp. PC-Amber*, 2700K, 3000K or 4000K
- ✓ Colour rendering index >70 (*>55)
- ✓ Projected L85 after 100,000 hours
- ✓ Power factor 0.95 at full load
- ✓ Polyester powder coat finish in light grey, dark grey, black or a bespoke colour
- ✓ High pressure die cast LM6 aluminium and high quality extruded 6063T6 aluminium housing
- ✓ UV stabilised polycarbonate lens
- ✓ In-built ventilation (breather) plug for pressure equalisation
- ✓ CLO available
- ✓ In-built OptiSet switch for asymmetric and symmetric distribution selection
- ✓ In-built PowerSet switch for high, medium and low output
- ✓ Optional Miniature Photocell available
- ✓ Part Night Dimming (PND)
- ✓ DALI compatible for use with CMS
- ✓ Optional surge protection 10kV/10kA
- ✓ Optional non-fused or fused isolators available
- ✓ Feeder pillar version available
- ✓ Root, socket or flange mount
- ✓ Anti-tamper door fixing as standard
- ✓ EN40 compliant door location, size and cable entry slots
- ✓ UMSUG codes available for full product range

MADE IN BRITAIN

DARKSKY APPROVED · Reduces light pollution · Certified by DarkSky.org

International Dark-Sky Association approved Via bollard. Compliant when using a colour temperature of 1750K (PC Amber) only.

VIA Bollard LED

TRTLIGHTING

RANGE OVERVIEW

Type	System Power	CCT	Lumen Output	CRI
Via Asymmetric	4-19W	PC-Amber*, 2700K, 3000K or 4000K	Up to 950lm	>70 (*>55)
Via Symmetric	4-19W	PC-Amber*, 2700K, 3000K or 4000K	Up to 1,100lm	>70 (*>55)
Via PowerSet & OptiSet Asymmetric	5-14W	PC-Amber*, 2700K, 3000K or 4000K	Up to 750lm	>70 (*>55)
Via PowerSet & OptiSet Symmetric	5-14W	PC-Amber*, 2700K, 3000K or 4000K	Up to 868lm	>70 (*>55)

ELECTRICAL CHARACTERISTICS	Via Asymmetric	Via Symmetric
System Power	4-19W	
LED CCT	PC-Amber*, 2700K, 3000K or 4000K	
LED CRI	>70 (*>55)	
Lumen Output	Up to 950lm	Up to 1,100lm
Lumen Maintenance	Projected L85 after 100,000 hours	
Drive Current	160-695mA	220-700mA
Driver Output	Constant current output with AM dimming	
Power Factor (Full Load/Half Load)	0.95/0.90	
Operational Voltage	220-240VAC rms	
Operating Frequency	50/60Hz	
Inrush Current (Apk/50%-µS)	25A/150µS	
Running Current (max)	60mA	
Surge Protection (COM/DIF)	10kV/6kV	
Additional Surge Protection (on request)	10kV/10kA	
Lighting Controls Options	Miniature Photocell, PND and CMS compatible	
Dimming Protocols	DALI	

MECHANICAL CHARACTERISTICS

Housing Material	High pressure die cast LM6 aluminium and high quality extruded 6063T6 aluminium
Housing Finish	Chromate free pre-treatment, polyester powder coat, light grey (RAL9006), dark grey (RAL7022), black (RAL9005) or bespoke colours on request
Lens Material	UV stabilised polycarbonate
Ingress Protection Rating	IP66
Weight	10.5kg
Impact Resistance Rating	IK10
Mounting Methods	Root, socket or flange

SHIELD OPTIONS

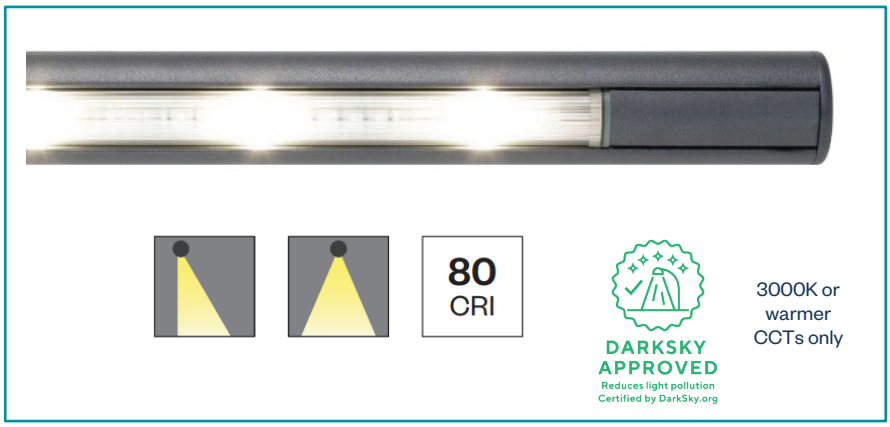
Universal Front/Rear	04GSK71899
Side	04GSK71725

FOR MORE INFORMATION

+44 (0) 1527 521 162
www.trtlighting.co.uk

Appendix B - DW Windsor Garda Handrail

Garda Classic



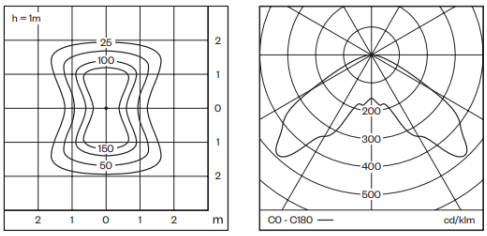
Our most versatile module, Garda Classic offers both symmetric and asymmetric distributions in a variety of colour temperatures, making it suitable for a wide range of handrail applications.

Typical applications: stairwells, bridges, architectural.

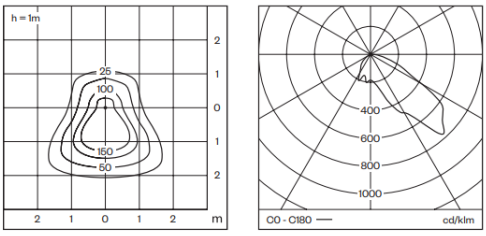
Performance

	2700K	3000K	4000K
Symmetric Module			
300mm	201lm	281lm	335lm
600mm	402lm	563lm	670lm
900mm	602lm	843lm	1004lm
1200mm	803lm	1126lm	1338lm
Asymmetric Module			
300mm	146lm	204lm	244lm
600mm	293lm	410lm	489lm
900mm	440lm	616lm	733lm
1200mm	586lm	821lm	977lm

Symmetric Module



Asymmetric Module



Mechanical

Housing	Stainless steel Aluminium
Glazing	Polycarbonate
Colours	Brushed stainless steel Powder coated aluminium (Other RAL colours on request)
IP Rating	IP66
IK Rating	IK10

Electrical

	48V AC	48V DC	24V AC	24V DC
300mm	3.6W	3.6W	4.2W	3.6W
600mm	7.2W	7.2W	8.3W	7.2W
900mm	10.8W	10.8W	12.5W	10.8W
1200mm	14.4W	14.4W	16.7W	14.4W

Class	Class III
Control	Variable resistance dimming 1-10V DALI DMX (via DALI converter)
Lifetime	100,000 hours
Certifications	UKCA, CE

DW Windsor Ltd, Pindar Road, Hoddesdon, Hertfordshire, EN11 0DX, United Kingdom // +44 (0)1992 474600 // info@dwwindsor.com // www.dwwindsor.com

Appendix C - Outline Lighting Designs for the TRT Lighting VIA Bollard

DATE: **26 April 2024**

DESIGNER: **Peter Carrie**

PROJECT No: **24009CCBC**

PROJECT NAME: **Glan Conwy to Llandudno Junction Active Travel Scheme**

Designed to BE EN 130201-2:2015 Class P5 for 3m unsegregated shared use path.

Bollard setback = 650mm (from bollard face to edge of path).

TRT VIA Bollard with PowerSet and Asymmetric distribution configured as:-
High - 10w (P4) - NOT USED
Medium - 7w (P5) - This Design
Low - 5w (P6)

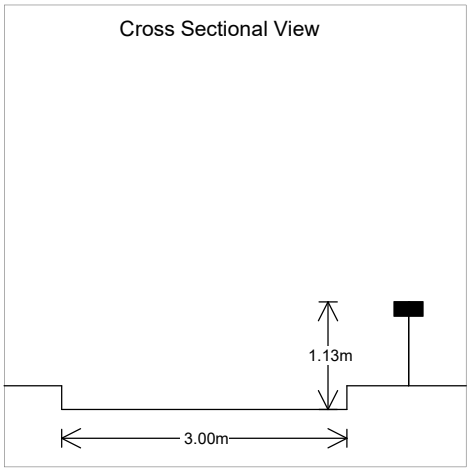
Maintenance Factor = 1.00 (Day 1)

Lighting Report

PREPARED BY: Peter Carrie

Roadway Report Summary

Layout



Road Data

Calculation Grid	2015:EN13201 Illuminance
Width (m)	3.00
No. of Lanes	1
Road Surface	R2
Q0	0.07
Left Footpath(m)	0.00
Right Footpath(m)	0.00

Main Lighting

Column Data

Configuration	Single Sided Right
Spacing (m)	11.00
Height (m)	1.13
Tilt (deg)	0.00
Setback (m)	0.65
Outreach (m)	0.00
Overhang (m)	-0.65

Luminaire Data

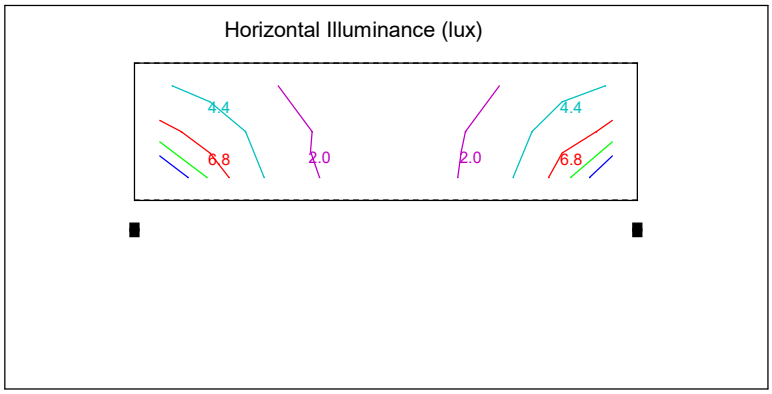
Supplier	TRT Lighting
Type	VIA ASY 440mA PowerSet/OptiSet PCA LED
Lamp(s)	42 0007 0000 100
Lamp Flux (klm)	0.26
File Name	VIA_ASY_440mA_PS_OS_257LM_PCA.ies
Maintenance Factor	1.00
Lum. Int. Class	None

Results

Main

Complies with P5

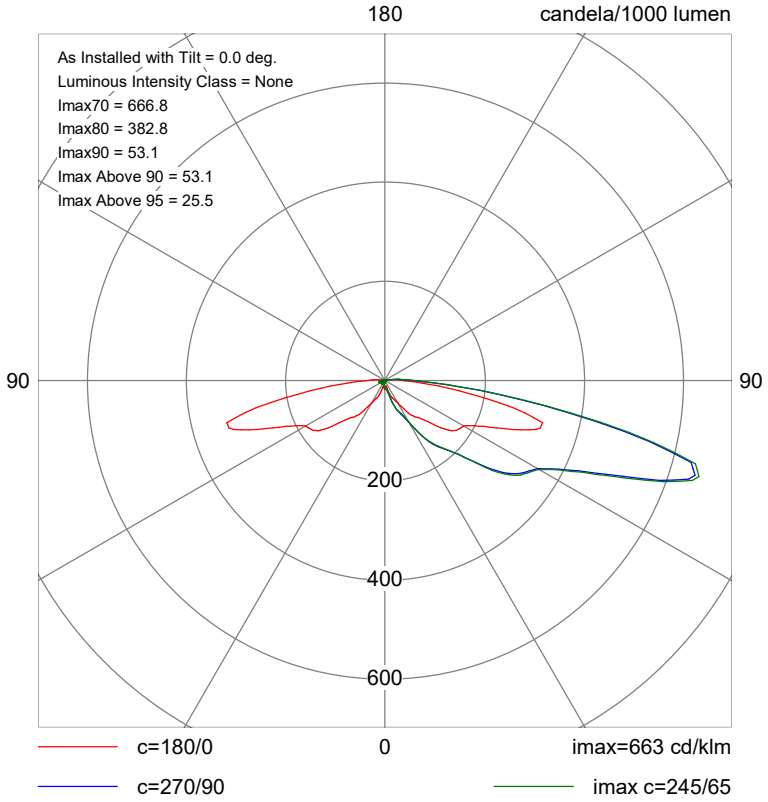
Eav	4.23
Emin	0.82
Emax	15.19
Emin/Emax	0.05
Emin/Eav	0.19



9196537860

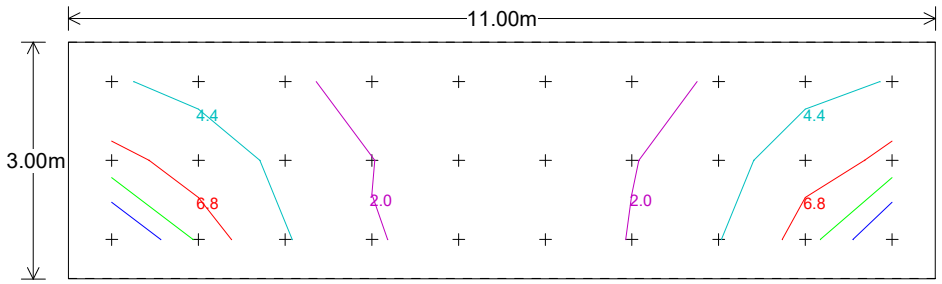
Polar Diagram

Main Luminaire VIA ASY 440mA PowerSet/OptiSet PCA LED



9196537860

Horizontal Illuminance (lux)



Main Results

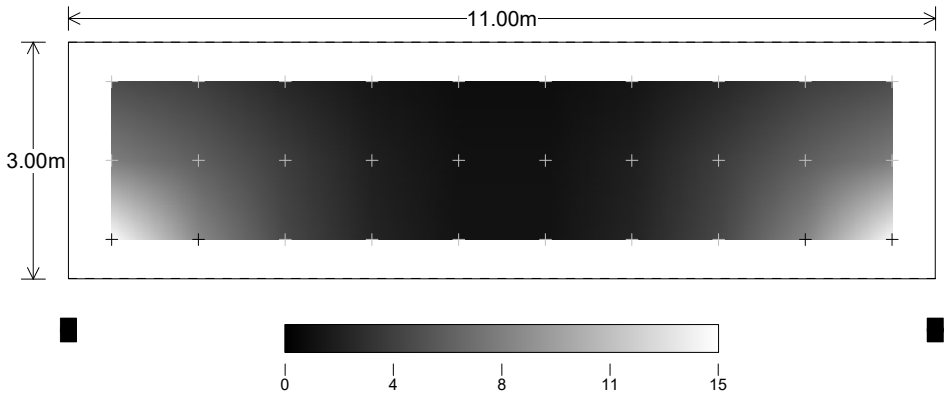
Eav	4.23
Emin	0.82
Emax	15.19
Emin/Emax	0.05
Emin/Eav	0.19

9196537860

DATE: 26 April 2024 DESIGNER: Peter Carrie

PROJECT No: 24009CCBC PROJECT NAME: Glan Conwy to Llandudno Junction Active Travel Scheme

Horizontal Illuminance (lux)

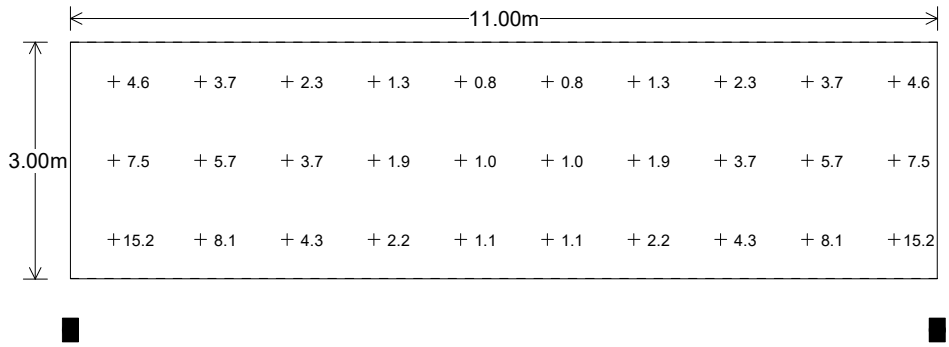


9196537860

DATE: 26 April 2024 DESIGNER: Peter Carrie

PROJECT No: 24009CCBC PROJECT NAME: Glan Conwy to Llandudno Junction Active Travel Scheme

Horizontal Illuminance (lux)



9196537860

DATE: **26 April 2024**

DESIGNER: **Peter Carrie**

PROJECT No: **24009CCBC**

PROJECT NAME: **Glan Conwy to Llandudno Junction Active Travel Scheme**

Designed to BE EN 130201-2:2015 Class P5 for 3m unsegregated shared use path.

Bollard setback = 650mm (from bollard face to edge of path).

TRT VIA Bollard with PowerSet and Asymmetric distribution configured as:-
High - 10w (P4) - NOT USED
Medium - 7w (P5) - This Design
Low - 5w (P6)

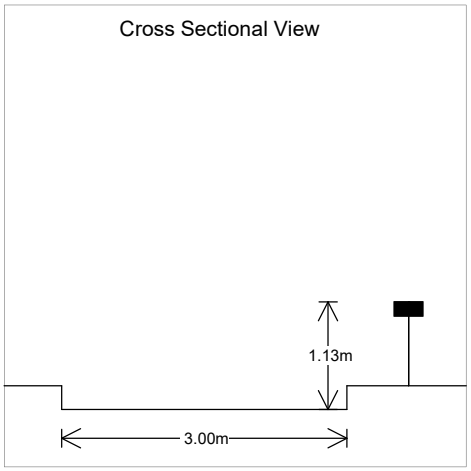
Maintenance Factor = 0.81 (6 Year)

Lighting Report

PREPARED BY: Peter Carrie

Roadway Report Summary

Layout



Road Data

Calculation Grid	2015:EN13201 Illuminance
Width (m)	3.00
No. of Lanes	1
Road Surface	R2
Q0	0.07
Left Footpath(m)	0.00
Right Footpath(m)	0.00

Main Lighting

Column Data

Configuration	Single Sided Right
Spacing (m)	11.00
Height (m)	1.13
Tilt (deg)	0.00
Setback (m)	0.65
Outreach (m)	0.00
Overhang (m)	-0.65

Luminaire Data

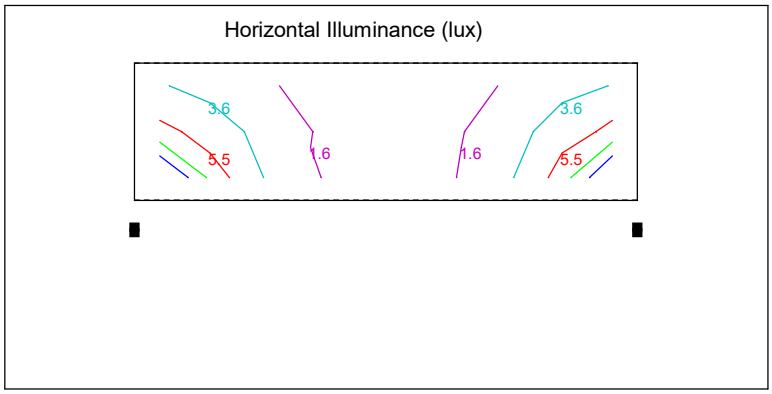
Supplier	TRT Lighting
Type	VIA ASY 440mA PowerSet/OptiSet PCA LED
Lamp(s)	42 0007 0000 100
Lamp Flux (klm)	0.26
File Name	VIA_ASY_440mA_PS_OS_257LM_PCA.ies
Maintenance Factor	0.81
Lum. Int. Class	None

Results

Main

Complies with P5

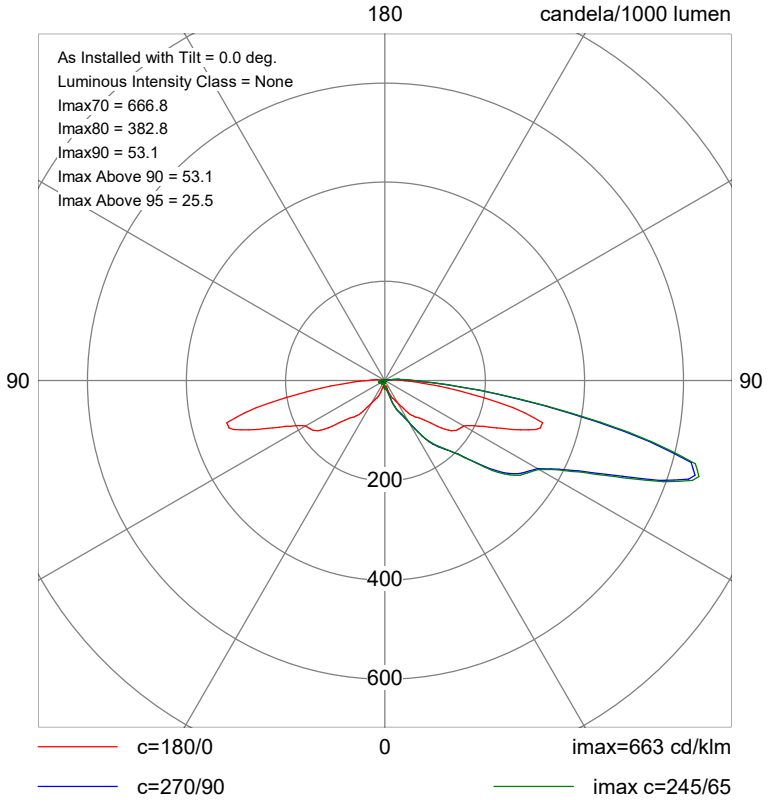
Eav	3.42
Emin	0.66
Emax	12.30
Emin/Emax	0.05
Emin/Eav	0.19



9196537860

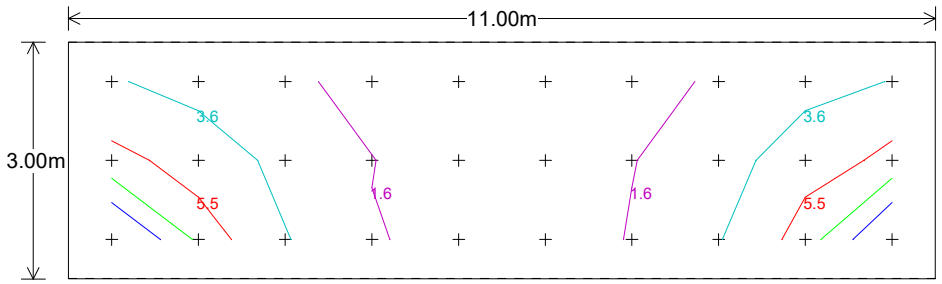
Polar Diagram

Main Luminaire VIA ASY 440mA PowerSet/OptiSet PCA LED



9196537860

Horizontal Illuminance (lux)



Main Results

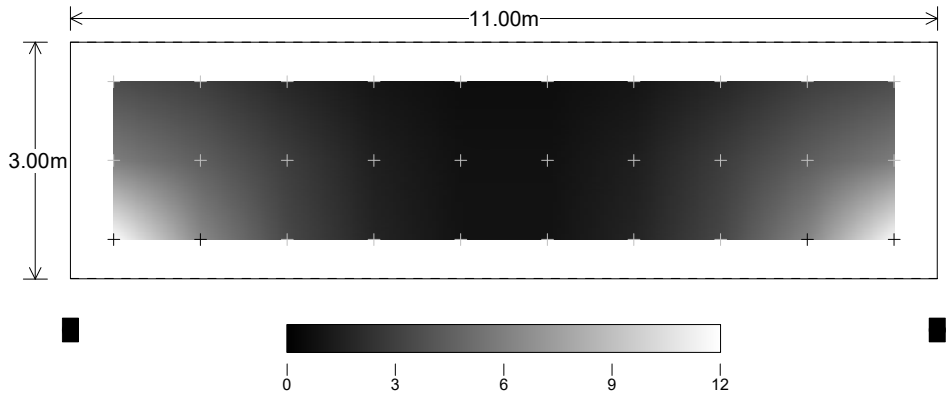
Eav	3.42
Emin	0.66
Emax	12.30
Emin/Emax	0.05
Emin/Eav	0.19

9196537860

DATE: 26 April 2024 DESIGNER: Peter Carrie

PROJECT No: 24009CCBC PROJECT NAME: Glan Conwy to Llandudno Junction Active Travel Scheme

Horizontal Illuminance (lux)

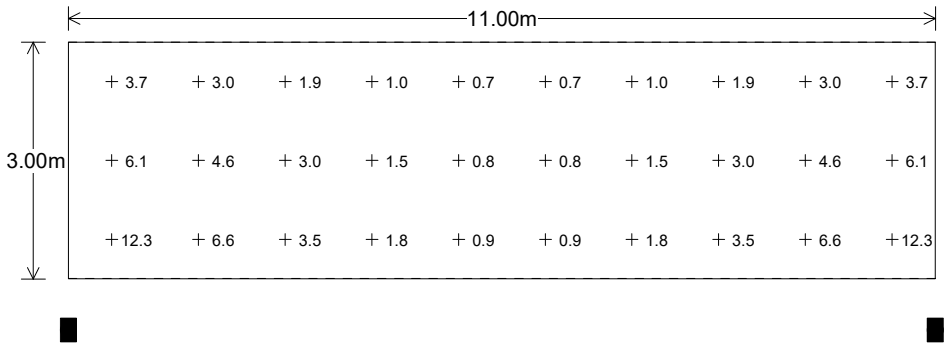


9196537860

DATE: 26 April 2024 DESIGNER: Peter Carrie

PROJECT No: 24009CCBC PROJECT NAME: Glan Conwy to Llandudno Junction Active Travel Scheme

Horizontal Illuminance (lux)



9196537860

DATE: **26 April 2024**

DESIGNER: **Peter Carrie**

PROJECT No: **24009CCBC**

PROJECT NAME: **Glan Conwy to Llandudno Junction Active Travel Scheme**

Designed to BE EN 130201-2:2015 Class P6 for 3m unsegregated shared use path.

Bollard setback = 650mm (from bollard face to edge of path).

TRT VIA Bollard with PowerSet and Asymmetric distribution configured as:-
High - 10w (P4) - NOT USED
Medium - 7w (P5)
Low - 5w (P6) - This Design

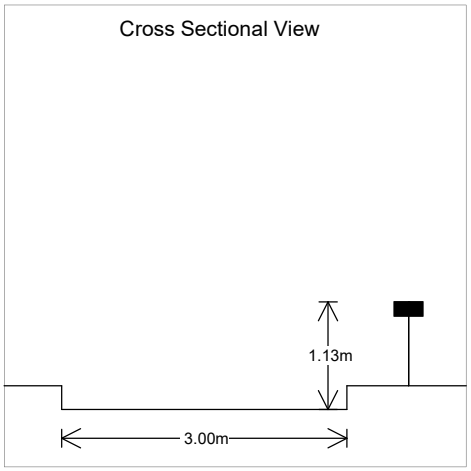
Maintenance Factor = 1.00 (Day 1)

Roadway Lighting Report

PREPARED BY: Peter Carrie

Roadway Report Summary

Layout



Road Data

Calculation Grid	2015:EN13201 Illuminance
Width (m)	3.00
No. of Lanes	1
Road Surface	R2
Q0	0.07
Left Footpath(m)	0.00
Right Footpath(m)	0.00

Main Lighting

Column Data

Configuration	Single Sided Right
Spacing (m)	11.00
Height (m)	1.13
Tilt (deg)	0.00
Setback (m)	0.65
Outreach (m)	0.00
Overhang (m)	-0.65

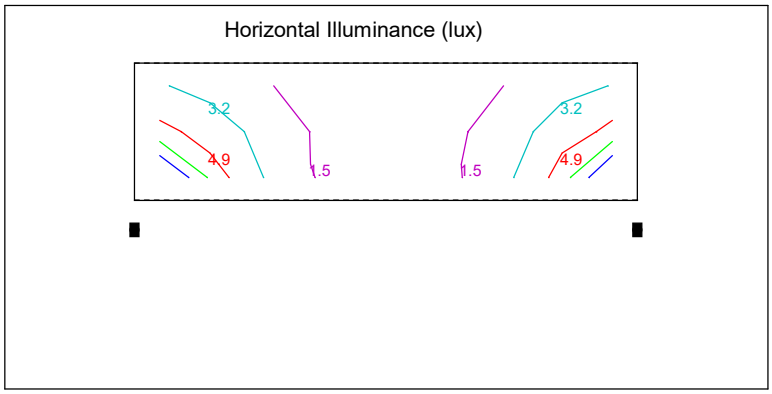
Luminaire Data

Supplier	TRT Lighting
Type	VIA ASY 310mA PowerSet/OptiSet PCA LED
Lamp(s)	42 0005 0000 100
Lamp Flux (klm)	0.18
File Name	VIA_ASY_310mA_PS_OS_183LM_PCA.ies
Maintenance Factor	1.00
Lum. Int. Class	None

Results

Main

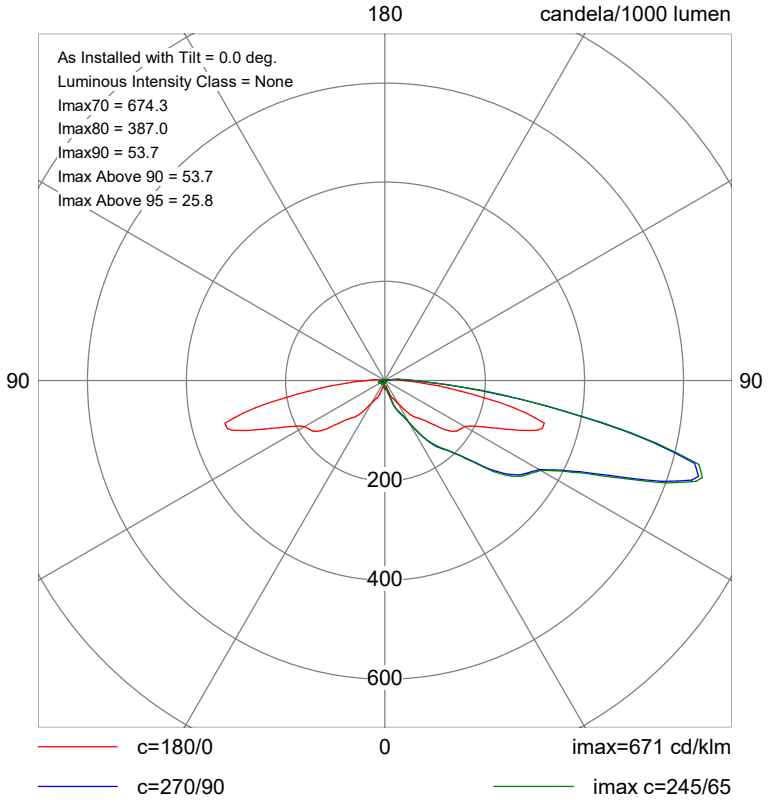
Eav	3.04
Emin	0.59
Emax	10.93
Emin/Emax	0.05
Emin/Eav	0.19



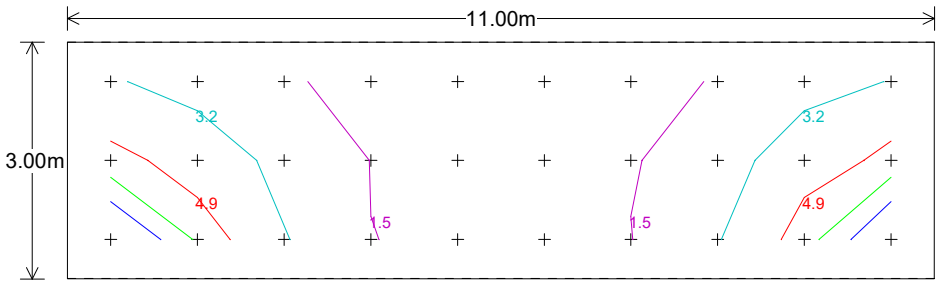
9196537860

Polar Diagram

Main Luminaire VIA ASY 310mA PowerSet/OptiSet PCA LED



Horizontal Illuminance (lux)



Main Results

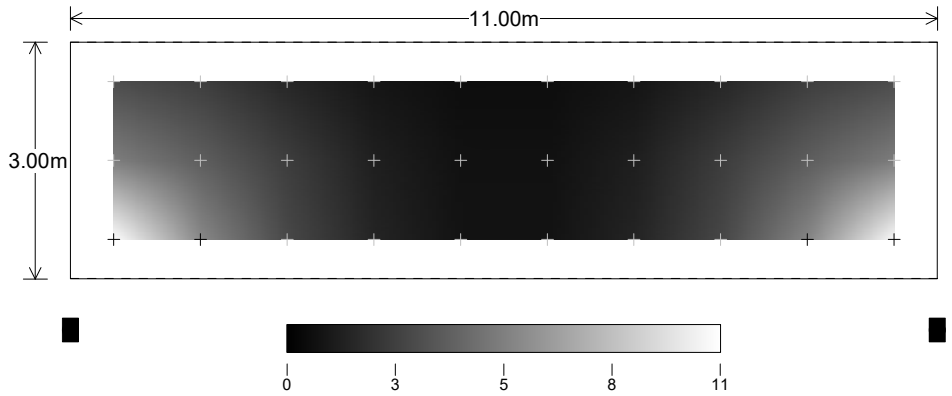
Eav	3.04
Emin	0.59
Emax	10.93
Emin/Emax	0.05
Emin/Eav	0.19

9196537860

DATE: 26 April 2024 DESIGNER: Peter Carrie

PROJECT No: 24009CCBC PROJECT NAME: Glan Conwy to Llandudno Junction Active Travel Scheme

Horizontal Illuminance (lux)

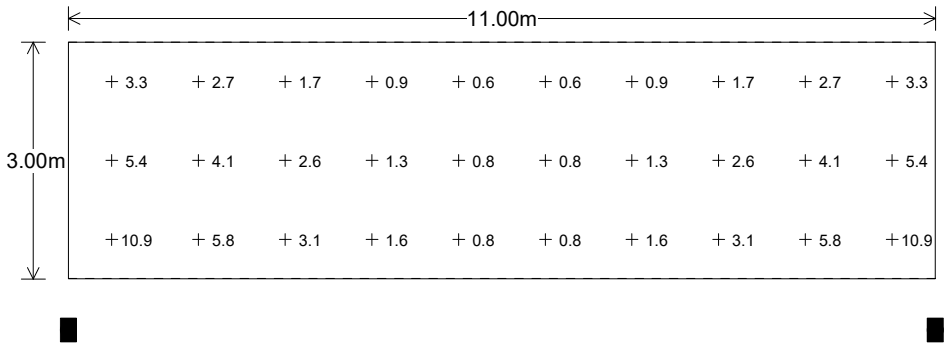


9196537860

DATE: 26 April 2024 DESIGNER: Peter Carrie

PROJECT No: 24009CCBC PROJECT NAME: Glan Conwy to Llandudno Junction Active Travel Scheme

Horizontal Illuminance (lux)



9196537860

DATE: **26 April 2024**

DESIGNER: **Peter Carrie**

PROJECT No: **24009CCBC**

PROJECT NAME: **Glan Conwy to Llandudno Junction Active Travel Scheme**

Designed to BE EN 130201-2:2015 Class P6 for 3m unsegregated shared use path.

Bollard setback = 650mm (from bollard face to edge of path).

TRT VIA Bollard with PowerSet and Asymmetric distribution configured as:-
High - 10w (P4) - NOT USED
Medium - 7w (P5)
Low - 5w (P6) - This Design

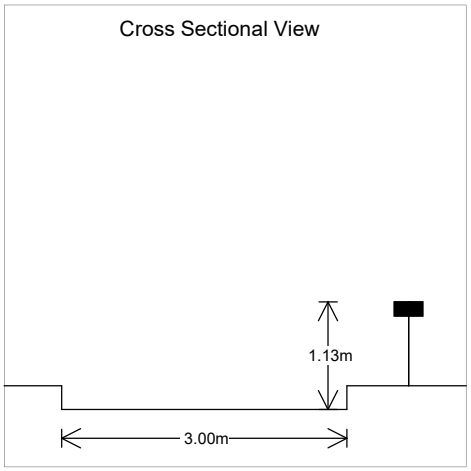
Maintenance Factor = 0.81 (Year 6)

Roadway Lighting Report

PREPARED BY: Peter Carrie

Roadway Report Summary

Layout



Road Data

Calculation Grid	2015:EN13201 Illuminance
Width (m)	3.00
No. of Lanes	1
Road Surface	R2
Q0	0.07
Left Footpath(m)	0.00
Right Footpath(m)	0.00

Main Lighting

Column Data

Configuration	Single Sided Right
Spacing (m)	11.00
Height (m)	1.13
Tilt (deg)	0.00
Setback (m)	0.65
Outreach (m)	0.00
Overhang (m)	-0.65

Luminaire Data

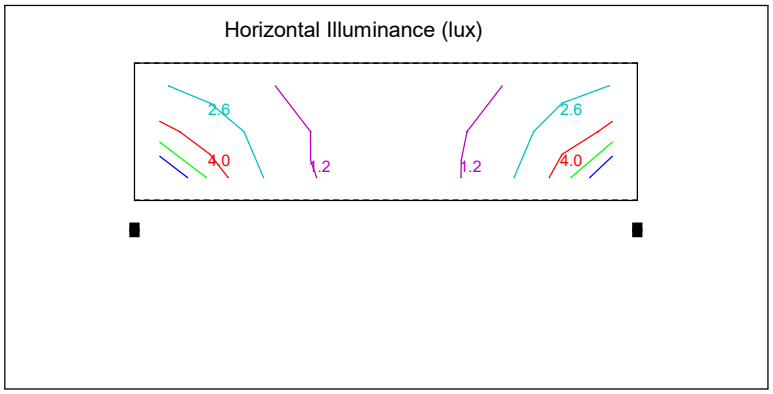
Supplier	TRT Lighting
Type	VIA ASY 310mA PowerSet/OptiSet PCA LED
Lamp(s)	42 0005 0000 100
Lamp Flux (klm)	0.18
File Name	VIA_ASY_310mA_PS_OS_183LM_PCA.ies
Maintenance Factor	0.81
Lum. Int. Class	None

Results

Main

Complies with P6

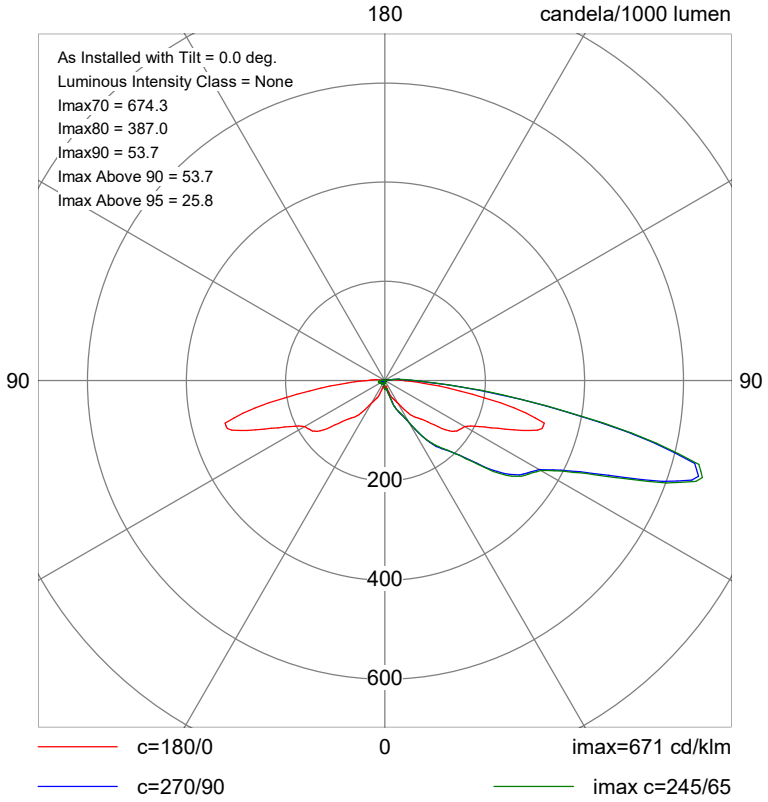
Eav	2.47
Emin	0.48
Emax	8.86
Emin/Emax	0.05
Emin/Eav	0.19



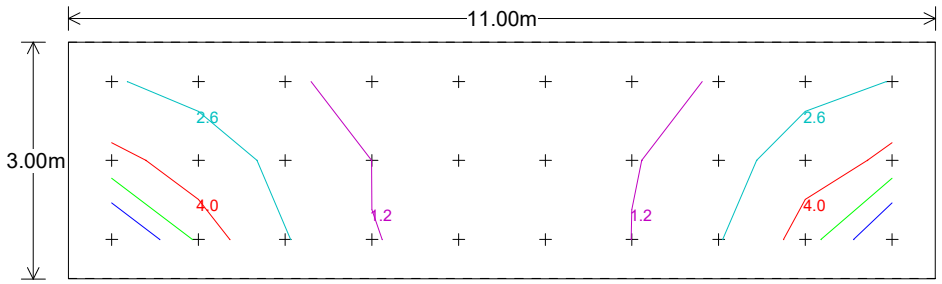
9196537860

Polar Diagram

Main Luminaire VIA ASY 310mA PowerSet/OptiSet PCA LED



Horizontal Illuminance (lux)



Main Results

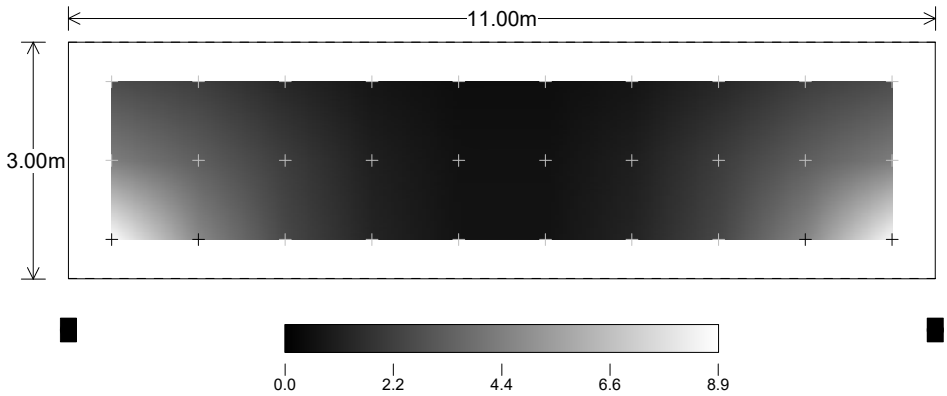
Eav	2.47
Emin	0.48
Emax	8.86
Emin/Emax	0.05
Emin/Eav	0.19

9196537860

DATE: 26 April 2024 **DESIGNER: Peter Carrie**

PROJECT No: 24009CCBC **PROJECT NAME: Glan Conwy to Llandudno Junction Active Travel Scheme**

Horizontal Illuminance (lux)

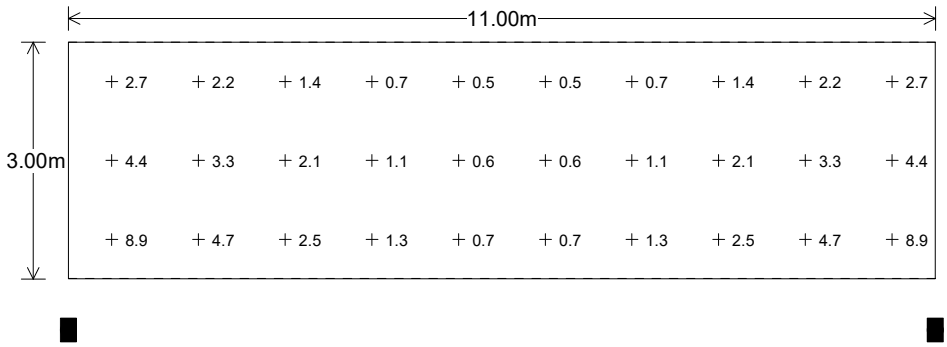


9196537860

DATE: 26 April 2024 DESIGNER: Peter Carrie

PROJECT No: 24009CCBC PROJECT NAME: Glan Conwy to Llandudno Junction Active Travel Scheme

Horizontal Illuminance (lux)



9196537860

Appendix D - Outline Lighting Designs for the DW Windsor Garda Classic Handrail

DATE: **14 May 2024**

DESIGNER: **Peter Carrie**

PROJECT No: **24009CCBC**

PROJECT NAME: **Glan Conwy to Llandudno Junction Active Travel Scheme**

Designed to BE EN 130201-2:2015 Class P5 for 3m unsegregated shared use path.

Handrail setback = 250mm (from face to edge of path).
DW Windsor Garda Classic handrail dimmed to 54% with a 0 degree tilt and
6m opposite spacing.

Maintenance Factor = 1.00 (Day 1)

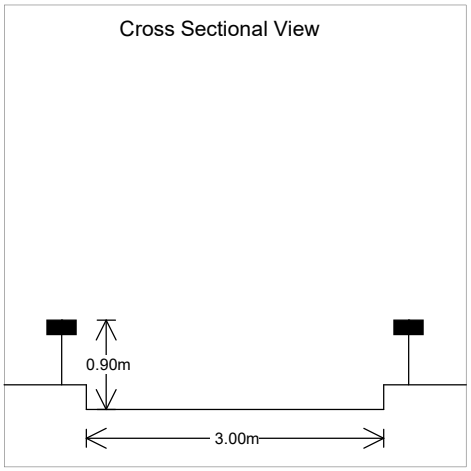
NOTE:- This design is for the 3000K - 4000K variation and will require revision for the detailed design upon receipt of the 1800K photometry from DW Windsor.

Lighting Report

PREPARED BY: Peter Carrie

Roadway Report Summary

Layout



Road Data

Calculation Grid	2015:EN13201 Illuminance
Width (m)	3.00
No. of Lanes	1
Road Surface	R2
Q0	0.07
Left Footpath(m)	0.00
Right Footpath(m)	0.00

Main Lighting

Column Data

Configuration	Opposite
Spacing (m)	6.00
Height (m)	0.90
Tilt (deg)	0.00
Left Setback (m)	0.25
Left Outreach (m)	0.00
Left Overhang (m)	-0.25
Right Setback (m)	0.25
Right Outreach (m)	0.00
Right Overhang (m)	-0.25

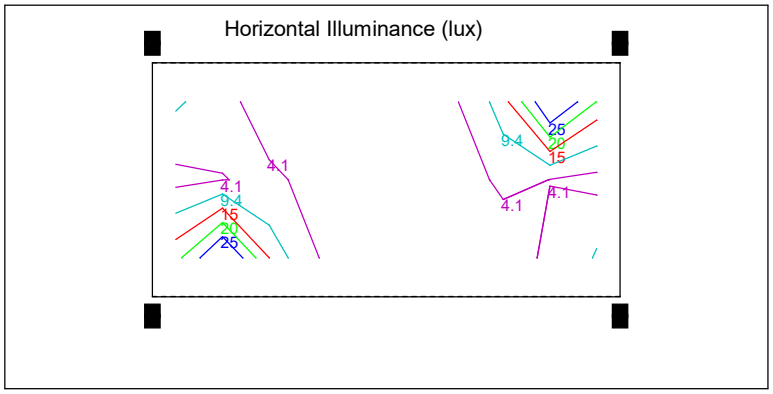
Luminaire Data

Supplier	D W Windsor
Type	Garda 300 - 3LED -3k- 4W- Asymmetric-
Lamp(s)	3x 3K LED 4W
Lamp Flux (klm)	0.20
File Name	Garda 300- 3LED - 3k - 4W- assymmetrical. ies
Maintenance Factor	1.00
Lum. Int. Class	None

Results

Main

Eav	7.07
Emin	1.39
Emax	33.39
Emin/Emax	0.04
Emin/Eav	0.20



9196537860

Road Report Summary Dimmed

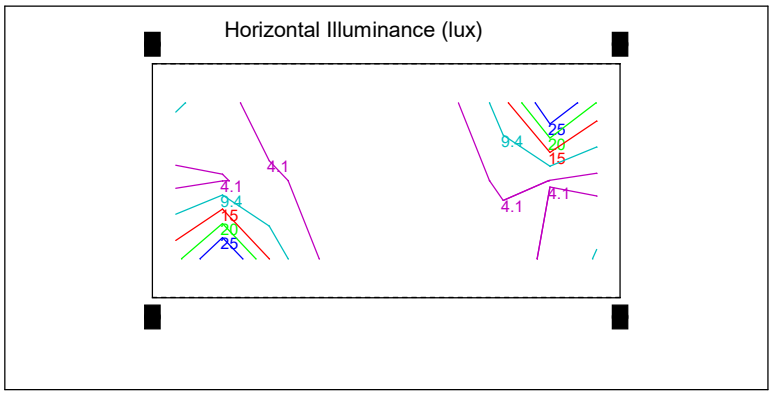
Main Luminaire Dimmed to 54%

Results

Main

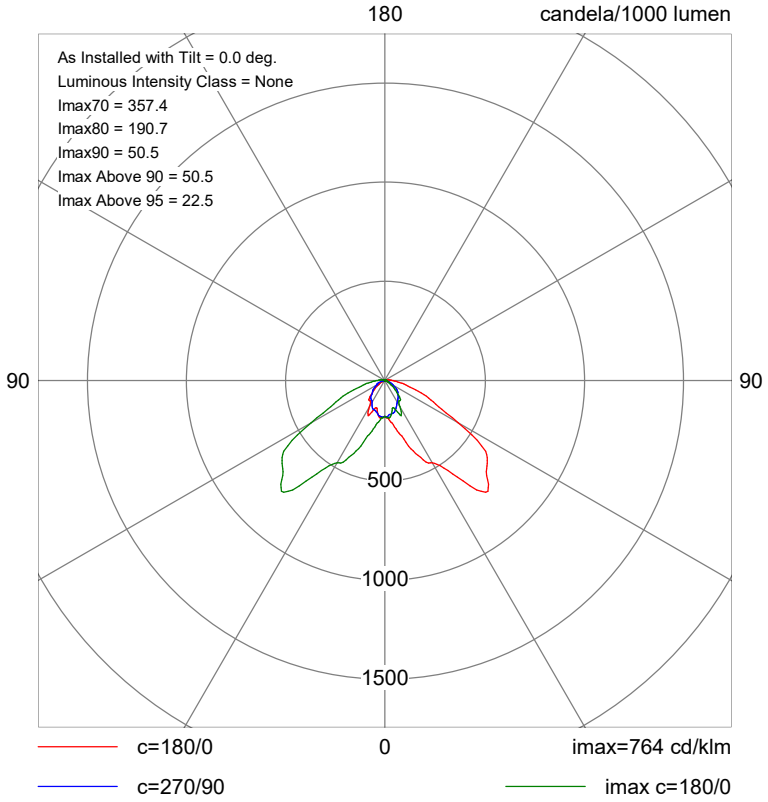
Complies with P5

Eav	3.82
Emin	0.75
Emax	18.03
Emin/Emax	0.04
Emin/Eav	0.20



Polar Diagram

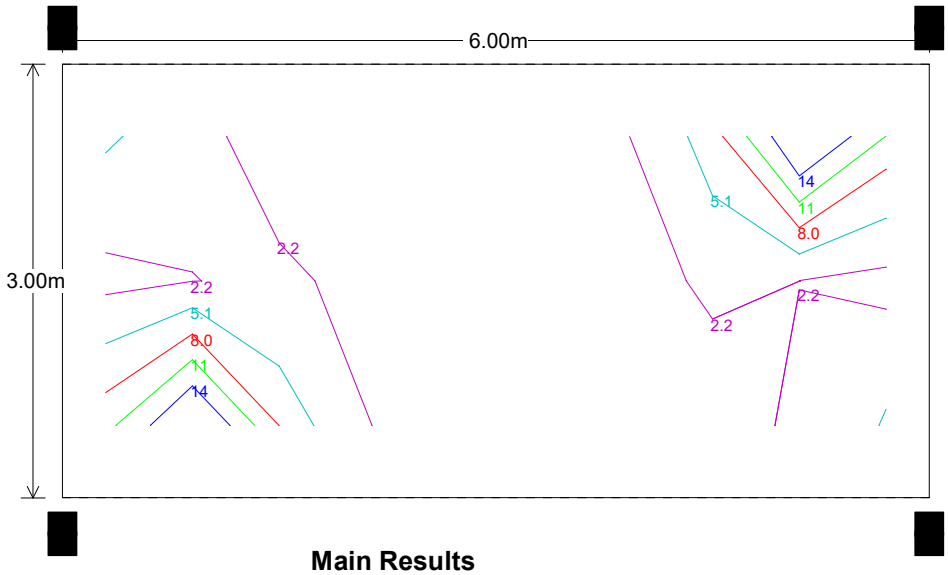
Main Luminaire Garda 300 - 3LED -3k- 4W- Asymmetric-



9196537860

Dimmed Horizontal Illuminance (lux)

Main Luminaire Dimmed to 54%



Main Results

Eav	3.82
Emin	0.75
Emax	18.03
Emin/Emax	0.04
Emin/Eav	0.20

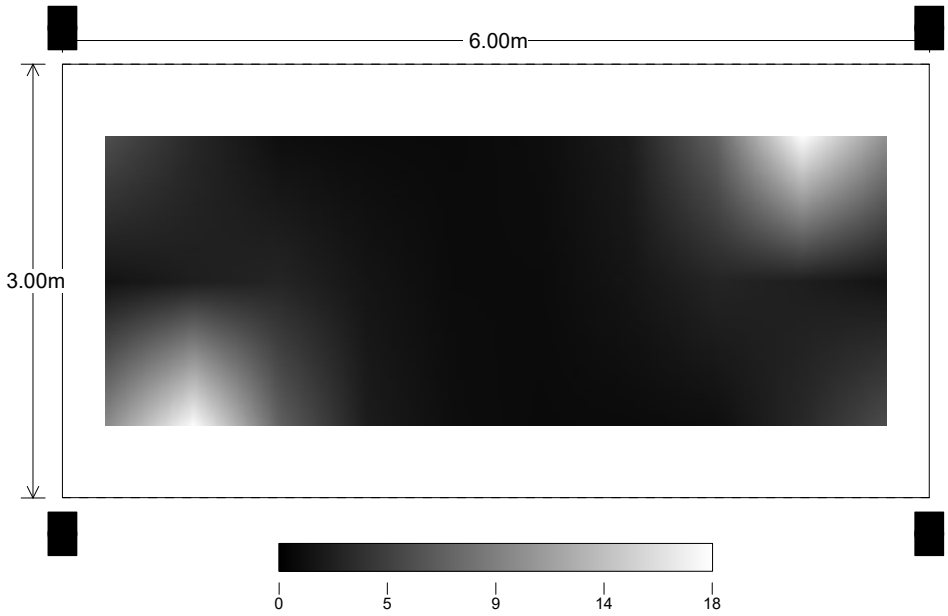
9196537860

DATE: 14 May 2024 DESIGNER: Peter Carrie

PROJECT No: 24009CCBC PROJECT NAME: Glan Conwy to Llandudno Junction Active Travel Scheme

Dimmed Horizontal Illuminance (lux)

Main Luminaire Dimmed to 54%



Main Results

Eav	3.82
Emin	0.75
Emax	18.03
Emin/Emax	0.04
Emin/Eav	0.20

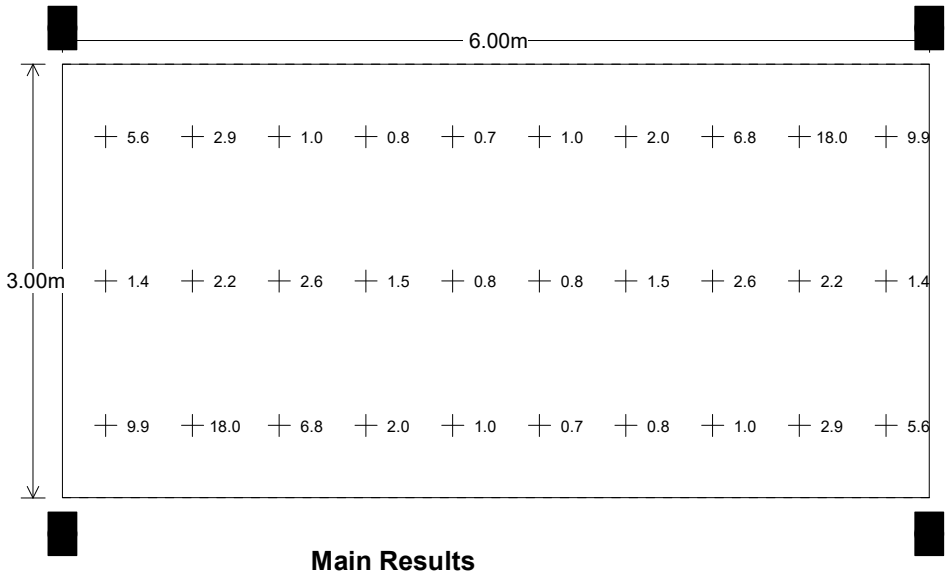
9196537860

DATE: 14 May 2024 DESIGNER: Peter Carrie

PROJECT No: 24009CCBC PROJECT NAME: Glan Conwy to Llandudno Junction Active Travel Scheme

Dimmed Horizontal Illuminance (lux)

Main Luminaire Dimmed to 54%



Main Results

Eav	3.82
Emin	0.75
Emax	18.03
Emin/Emax	0.04
Emin/Eav	0.20

9196537860

DATE: **14 May 2024**

DESIGNER: **Peter Carrie**

PROJECT No: **24009CCBC**

PROJECT NAME: **Glan Conwy to Llandudno Junction Active Travel Scheme**

Designed to BE EN 130201-2:2015 Class P5 for 3m unsegregated shared use path.

Handrail setback = 250mm (from face to edge of path).
DW Windsor Garda Classic handrail dimmed to 54% with a 0 degree tilt and
6m opposite spacing.

Maintenance Factor = 0.81 (6 Year)

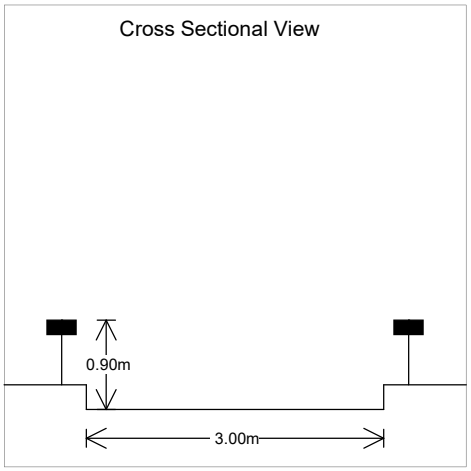
NOTE:- This design is for the 3000K - 4000K variation and will require revision for the detailed design upon receipt of the 1800K photometry from DW Windsor.

Lighting Report

PREPARED BY: Peter Carrie

Roadway Report Summary

Layout



Road Data

Calculation Grid	2015:EN13201 Illuminance
Width (m)	3.00
No. of Lanes	1
Road Surface	R2
Q0	0.07
Left Footpath(m)	0.00
Right Footpath(m)	0.00

Main Lighting

Column Data

Configuration	Opposite
Spacing (m)	6.00
Height (m)	0.90
Tilt (deg)	0.00
Left Setback (m)	0.25
Left Outreach (m)	0.00
Left Overhang (m)	-0.25
Right Setback (m)	0.25
Right Outreach (m)	0.00
Right Overhang (m)	-0.25

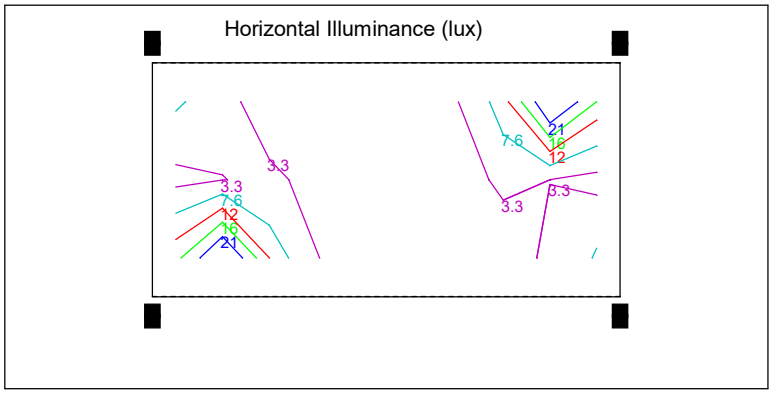
Luminaire Data

Supplier	D W Windsor
Type	Garda 300 - 3LED -3k- 4W- Asymmetric-
Lamp(s)	3x 3K LED 4W
Lamp Flux (klm)	0.20
File Name	Garda 300- 3LED - 3k - 4W- assymmetrical. ies
Maintenance Factor	0.81
Lum. Int. Class	None

Results

Main

Eav	5.73
Emin	1.12
Emax	27.05
Emin/Emax	0.04
Emin/Eav	0.20



9196537860

Road Report Summary Dimmed

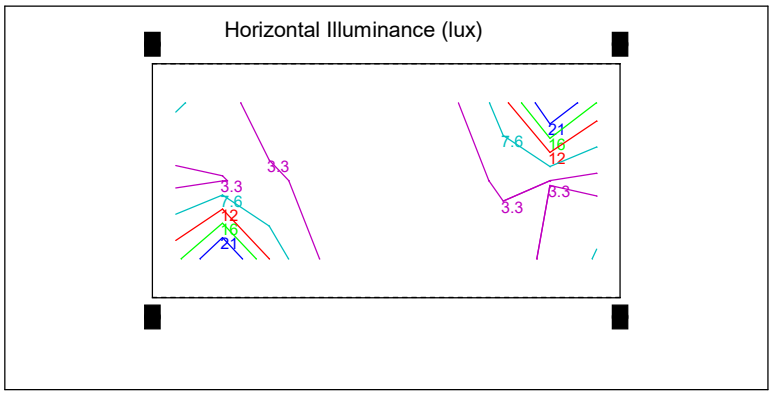
Main Luminaire Dimmed to 54%

Results

Main

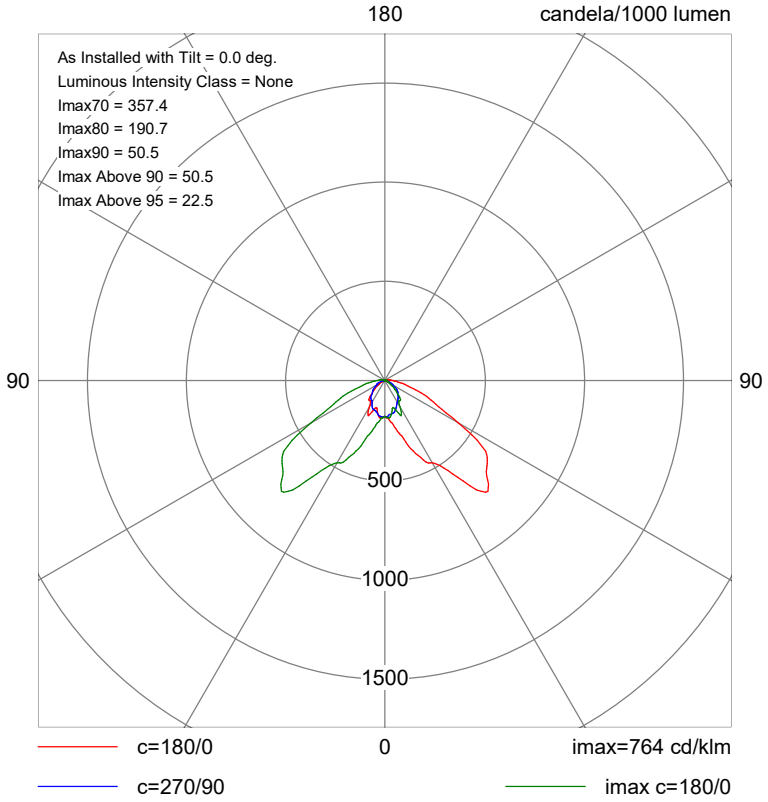
Complies with P5

Eav	3.09
Emin	0.61
Emax	14.61
Emin/Emax	0.04
Emin/Eav	0.20



Polar Diagram

Main Luminaire Garda 300 - 3LED -3k- 4W- Asymmetric-



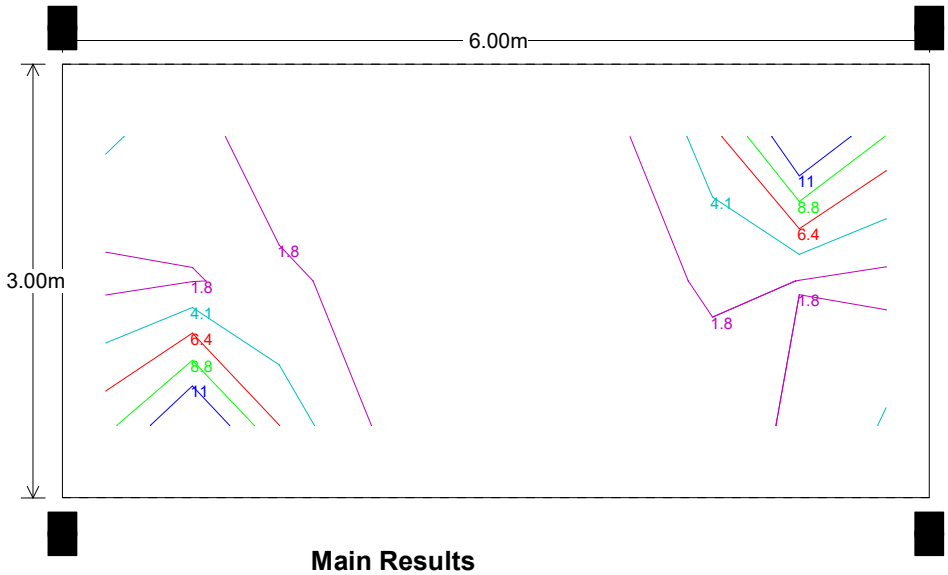
9196537860

DATE: 14 May 2024 DESIGNER: Peter Carrie

PROJECT No: 24009CCBC PROJECT NAME: Glan Conwy to Llandudno Junction Active Travel Scheme

Dimmed Horizontal Illuminance (lux)

Main Luminaire Dimmed to 54%



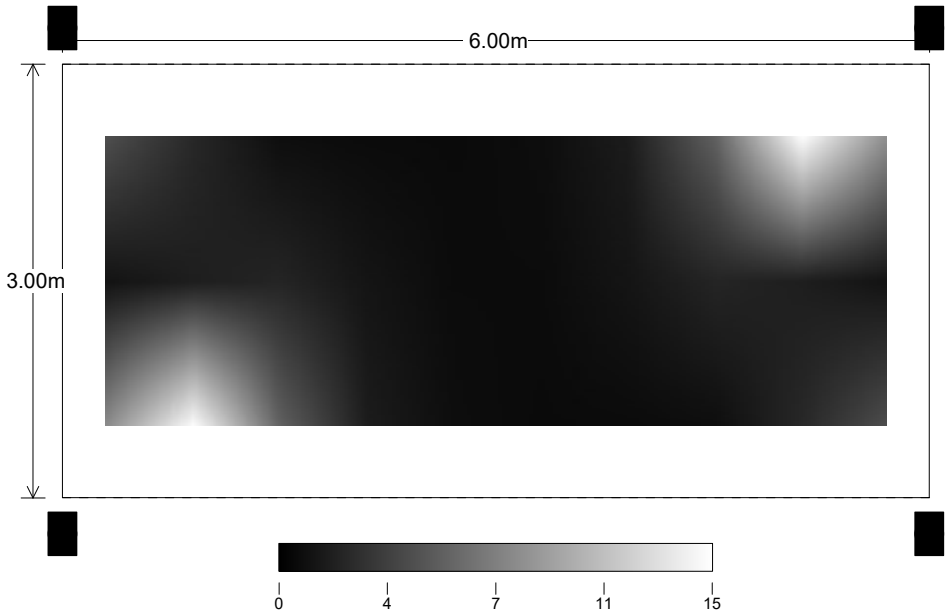
Main Results

Eav	3.09
Emin	0.61
Emax	14.61
Emin/Emax	0.04
Emin/Eav	0.20

9196537860

Dimmed Horizontal Illuminance (lux)

Main Luminaire Dimmed to 54%



Main Results

Eav	3.09
Emin	0.61
Emax	14.61
Emin/Emax	0.04
Emin/Eav	0.20

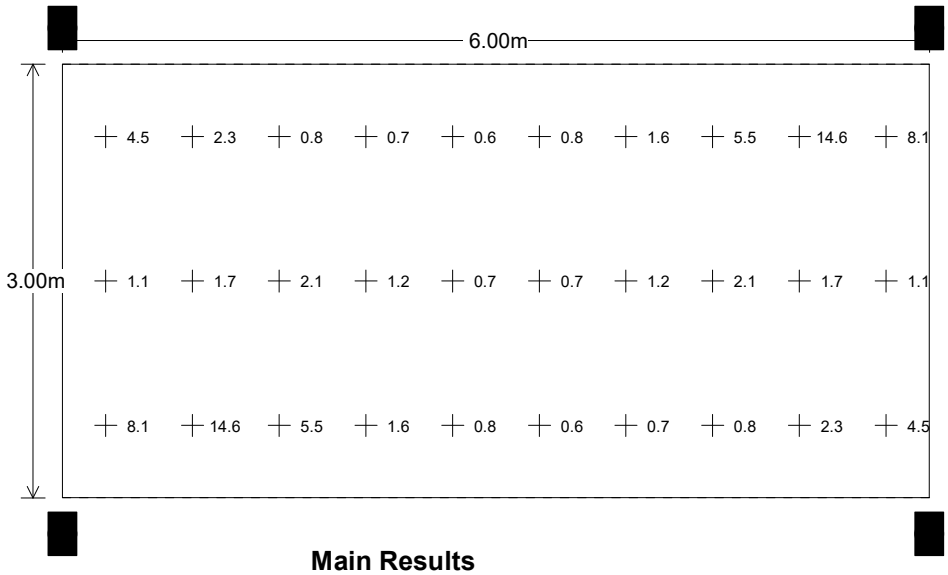
9196537860

DATE: 14 May 2024 DESIGNER: Peter Carrie

PROJECT No: 24009CCBC PROJECT NAME: Glan Conwy to Llandudno Junction Active Travel Scheme

Dimmed Horizontal Illuminance (lux)

Main Luminaire Dimmed to 54%



Main Results

Eav	3.09
Emin	0.61
Emax	14.61
Emin/Emax	0.04
Emin/Eav	0.20

9196537860

DATE: **14 May 2024**

DESIGNER: **Peter Carrie**

PROJECT No: **24009CCBC**

PROJECT NAME: **Glan Conwy to Llandudno Junction Active Travel Scheme**

Designed to BE EN 130201-2:2015 Class P6 for 3m unsegregated shared use path.

Handrail setback = 250mm (from face to edge of path).
DW Windsor Garda Classic handrail dimmed to 36% with a 0 degree tilt and
6m opposite spacing.

Maintenance Factor = 1.00 (Day 1)

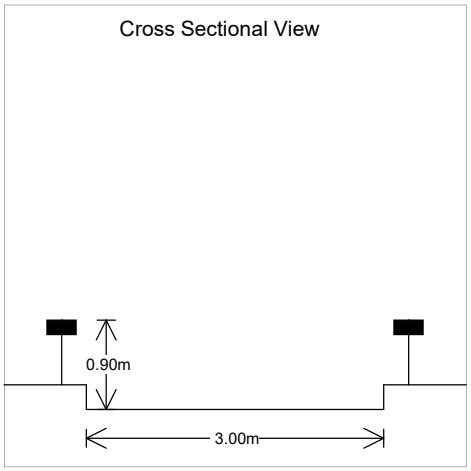
NOTE:- This design is for the 3000K - 4000K variation and will require revision for the detailed design upon receipt of the 1800K photometry from DW Windsor.

Lighting Report

PREPARED BY: Peter Carrie

Roadway Report Summary

Layout



Road Data

Calculation Grid	2015:EN13201 Illuminance
Width (m)	3.00
No. of Lanes	1
Road Surface	R2
Q0	0.07
Left Footpath(m)	0.00
Right Footpath(m)	0.00

Main Lighting

Column Data

Configuration	Opposite
Spacing (m)	6.00
Height (m)	0.90
Tilt (deg)	0.00
Left Setback (m)	0.25
Left Outreach (m)	0.00
Left Overhang (m)	-0.25
Right Setback (m)	0.25
Right Outreach (m)	0.00
Right Overhang (m)	-0.25

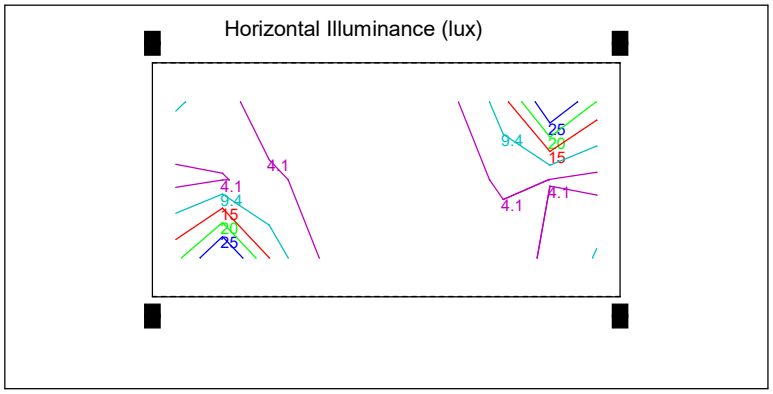
Luminaire Data

Supplier	D W Windsor
Type	Garda 300 - 3LED -3k- 4W- Asymmetric-
Lamp(s)	3x 3K LED 4W
Lamp Flux (klm)	0.20
File Name	Garda 300- 3LED - 3k - 4W- assymmetrical. ies
Maintenance Factor	1.00
Lum. Int. Class	None

Results

Main

Eav	7.07
Emin	1.39
Emax	33.39
Emin/Emax	0.04
Emin/Eav	0.20



9196537860

Road Report Summary Dimmed

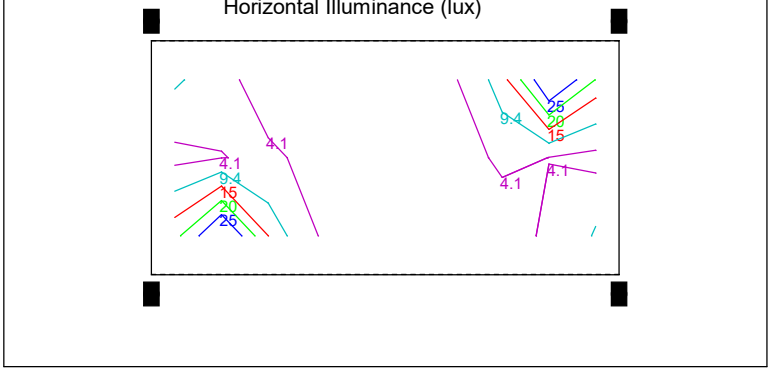
Main Luminaire Dimmed to 36%

Results

Main

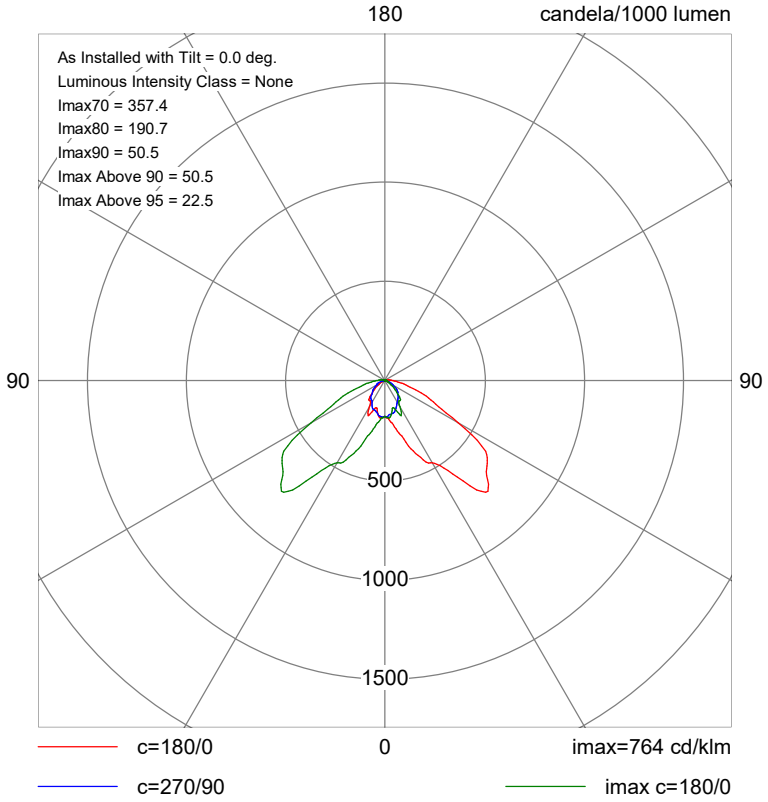
Complies with P6

Eav	2.54
Emin	0.50
Emax	12.02
Emin/Emax	0.04
Emin/Eav	0.20



Polar Diagram

Main Luminaire Garda 300 - 3LED -3k- 4W- Asymmetric-



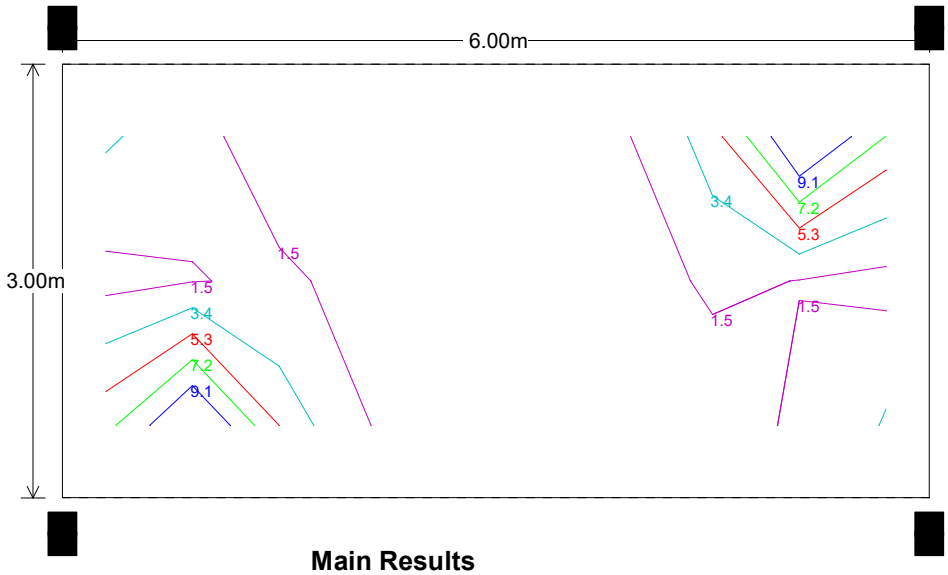
9196537860

DATE: 14 May 2024 DESIGNER: Peter Carrie

PROJECT No: 24009CCBC PROJECT NAME: Glan Conwy to Llandudno Junction Active Travel Scheme

Dimmed Horizontal Illuminance (lux)

Main Luminaire Dimmed to 36%



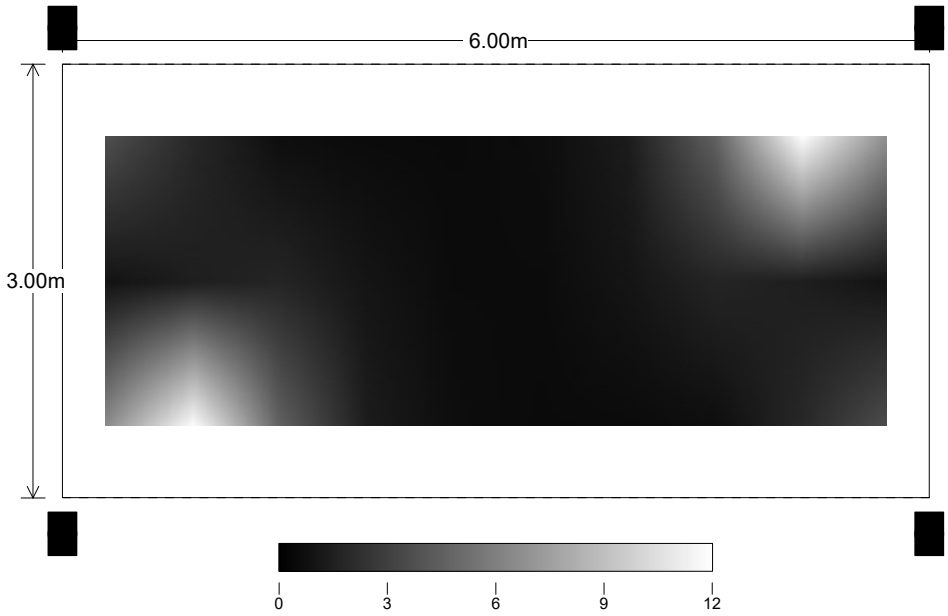
Main Results

Eav	2.54
Emin	0.50
Emax	12.02
Emin/Emax	0.04
Emin/Eav	0.20

9196537860

Dimmed Horizontal Illuminance (lux)

Main Luminaire Dimmed to 36%



Main Results

Eav	2.54
Emin	0.50
Emax	12.02
Emin/Emax	0.04
Emin/Eav	0.20

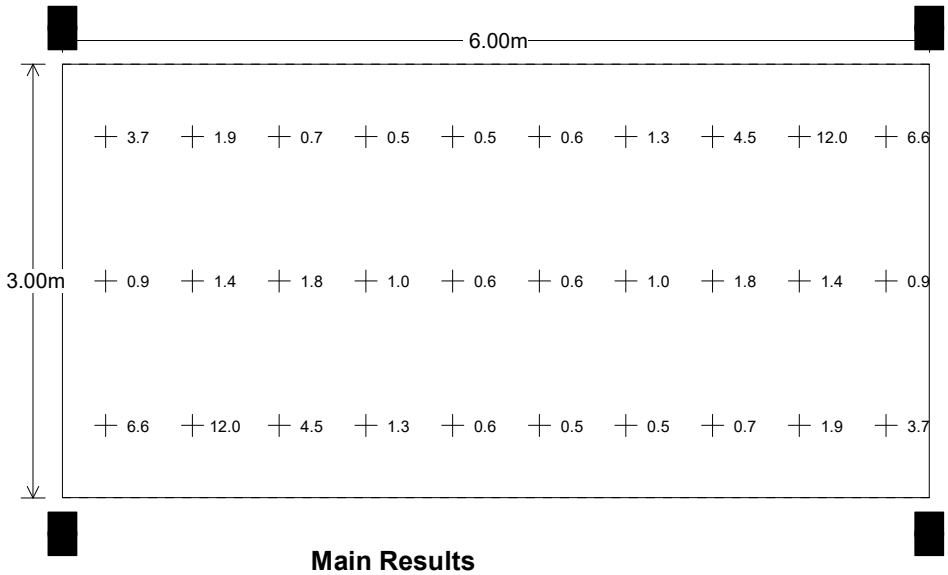
9196537860

DATE: 14 May 2024 DESIGNER: Peter Carrie

PROJECT No: 24009CCBC PROJECT NAME: Glan Conwy to Llandudno Junction Active Travel Scheme

Dimmed Horizontal Illuminance (lux)

Main Luminaire Dimmed to 36%



Main Results

Eav	2.54
Emin	0.50
Emax	12.02
Emin/Emax	0.04
Emin/Eav	0.20

9196537860

DATE: **14 May 2024**

DESIGNER: **Peter Carrie**

PROJECT No: **24009CCBC**

PROJECT NAME: **Glan Conwy to Llandudno Junction Active Travel Scheme**

Designed to BE EN 130201-2:2015 Class P6 for 3m unsegregated shared use path.

Handrail setback = 250mm (from face to edge of path).
DW Windsor Garda Classic handrail dimmed to 36% with a 0 degree tilt and
6m opposite spacing.

Maintenance Factor = 0.81 (6 Year)

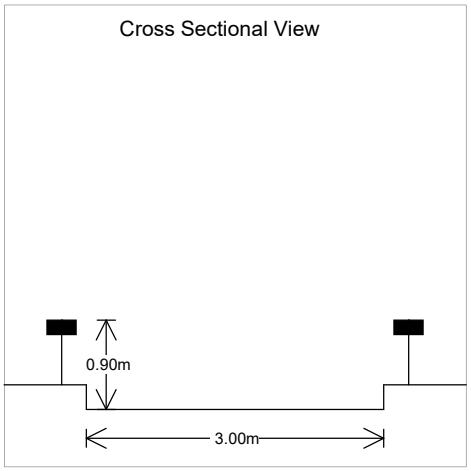
NOTE:- This design is for the 3000K - 4000K variation and will require revision for the detailed design upon receipt of the 1800K photometry from DW Windsor.

Lighting Report

PREPARED BY: Peter Carrie

Roadway Report Summary

Layout



Road Data

Calculation Grid	2015:EN13201 Illuminance
Width (m)	3.00
No. of Lanes	1
Road Surface	R2
Q0	0.07
Left Footpath(m)	0.00
Right Footpath(m)	0.00

Main Lighting

Column Data

Configuration	Opposite
Spacing (m)	6.00
Height (m)	0.90
Tilt (deg)	0.00
Left Setback (m)	0.25
Left Outreach (m)	0.00
Left Overhang (m)	-0.25
Right Setback (m)	0.25
Right Outreach (m)	0.00
Right Overhang (m)	-0.25

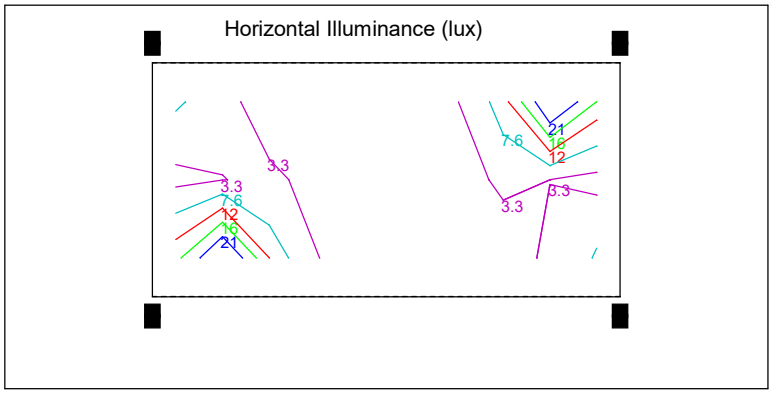
Luminaire Data

Supplier	D W Windsor
Type	Garda 300 - 3LED -3k- 4W- Asymmetric-
Lamp(s)	3x 3K LED 4W
Lamp Flux (klm)	0.20
File Name	Garda 300- 3LED - 3k - 4W- assymmetrical. ies
Maintenance Factor	0.81
Lum. Int. Class	None

Results

Main

Eav	5.73
Emin	1.12
Emax	27.05
Emin/Emax	0.04
Emin/Eav	0.20



9196537860

DATE: 14 May 2024 DESIGNER: Peter Carrie

PROJECT No: 24009CCBC PROJECT NAME: Glan Conwy to Llandudno Junction Active Travel Scheme

Road Report Summary Dimmed

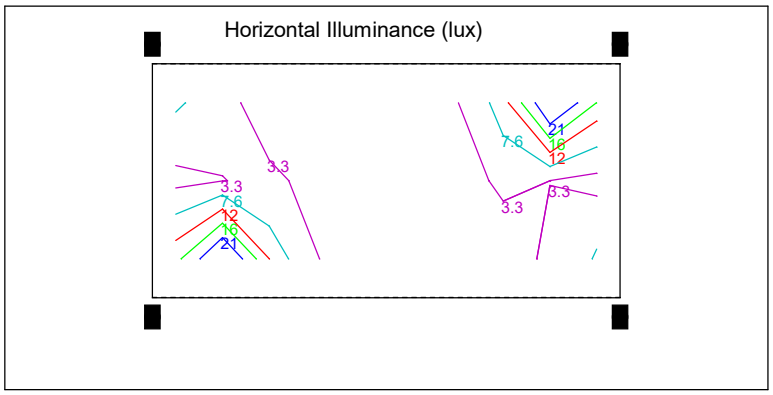
Main Luminaire Dimmed to 36%

Results

Main

Complies with P6

Eav	2.06
Emin	0.40
Emax	9.74
Emin/Emax	0.04
Emin/Eav	0.20



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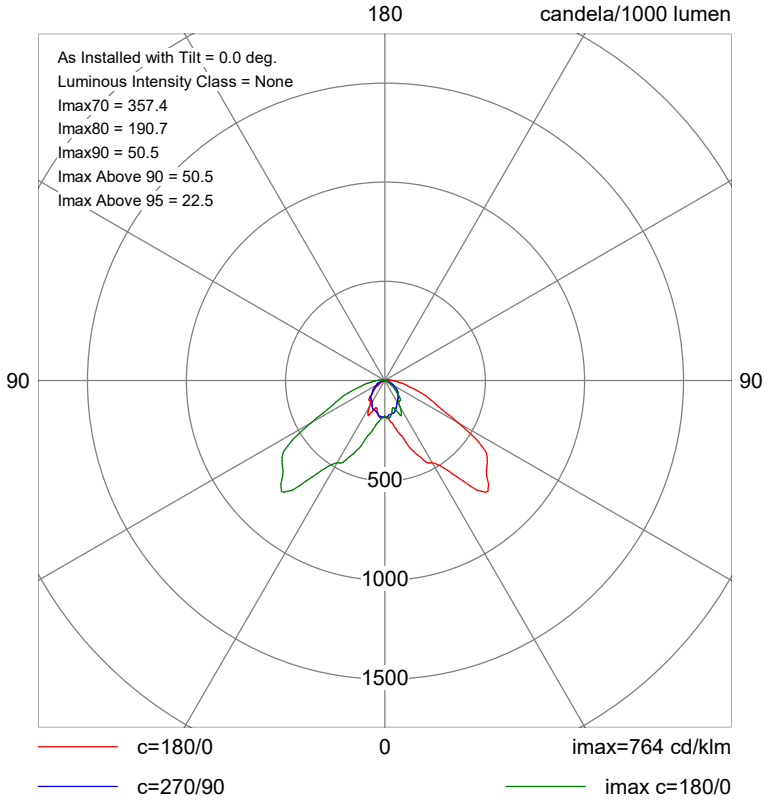
Polar Diagram

Main Luminaire Garda 300 - 3LED -3k- 4W- Asymmetric-



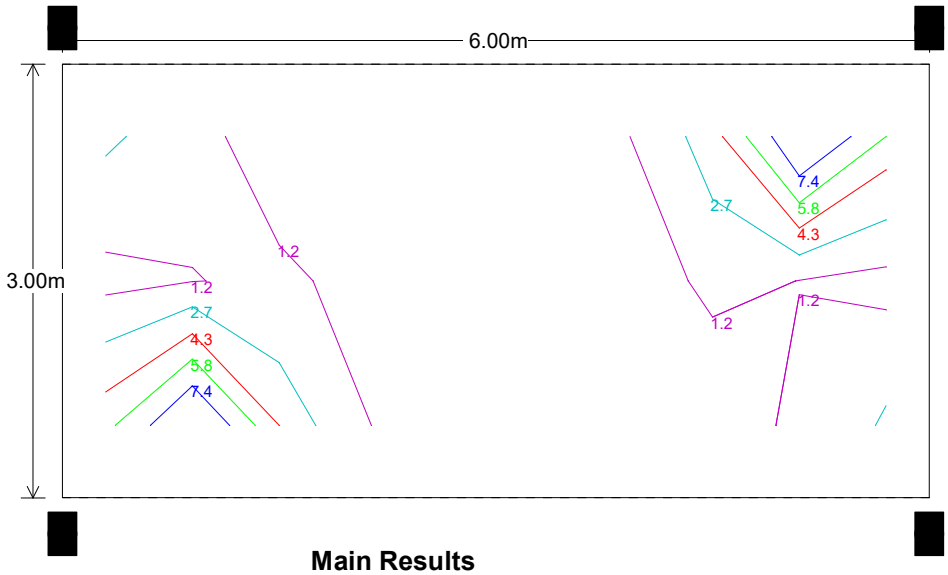
9196537860

DATE: 14 May 2024 DESIGNER: Peter Carrie

PROJECT No: 24009CCBC PROJECT NAME: Glan Conwy to Llandudno Junction Active Travel Scheme

Dimmed Horizontal Illuminance (lux)

Main Luminaire Dimmed to 36%



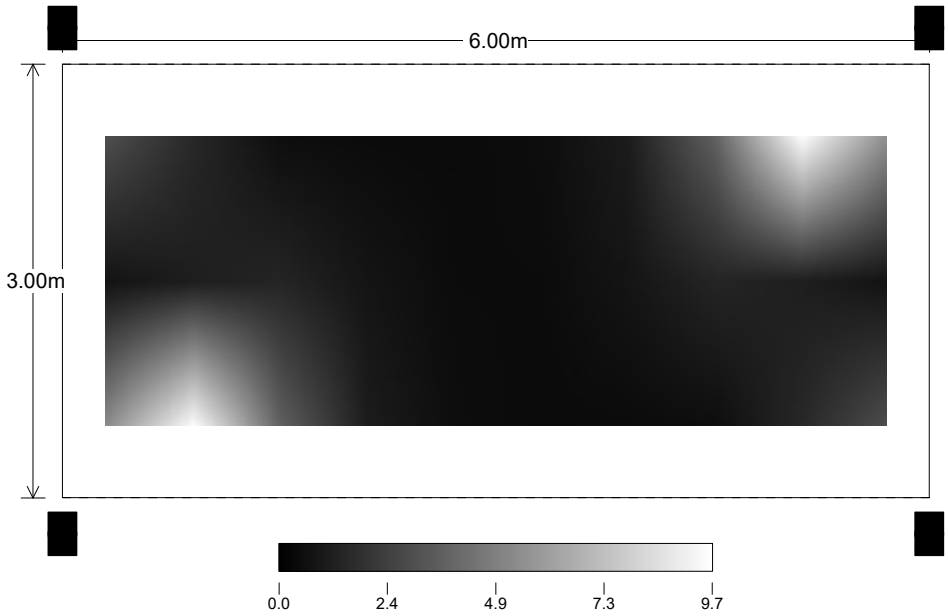
Main Results

Eav	2.06
Emin	0.40
Emax	9.74
Emin/Emax	0.04
Emin/Eav	0.20

9196537860

Dimmed Horizontal Illuminance (lux)

Main Luminaire Dimmed to 36%



Main Results

Eav	2.06
Emin	0.40
Emax	9.74
Emin/Emax	0.04
Emin/Eav	0.20

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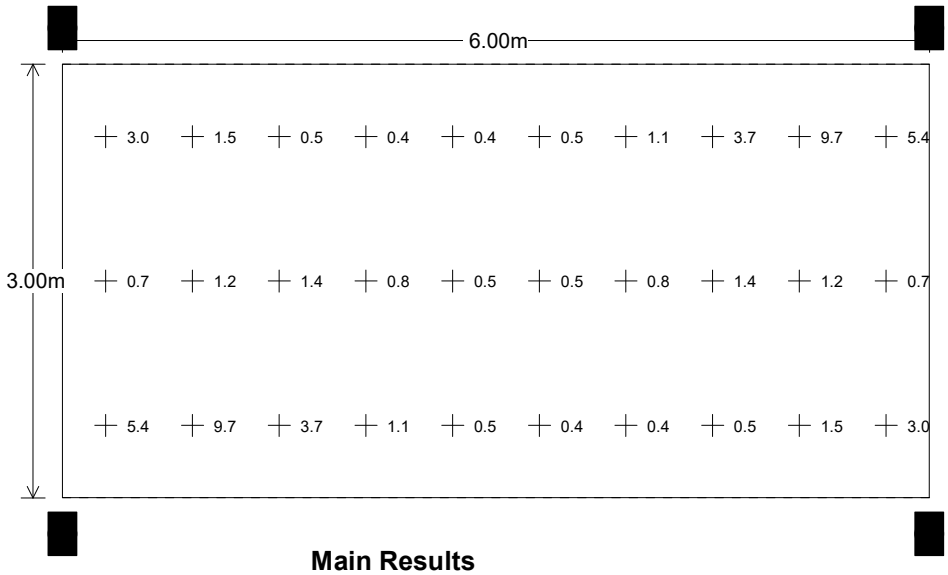
DATE: 14 May 2024 DESIGNER: Peter Carrie

PROJECT No: 24009CCBC PROJECT NAME: Glan Conwy to Llandudno Junction Active Travel Scheme

Dimmed Horizontal Illuminance (lux)

Main Luminaire Dimmed to 36%



Main Results

Eav	2.06
Emin	0.40
Emax	9.74
Emin/Emax	0.04
Emin/Eav	0.20

9196537860

Specialist Engineering Technical Services

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