Civic Offices, **Monaghan Town,** **Co Monaghan** On behalf of: **Monaghan County Council**	HOMAN O'BRIEN Engineering Excellence.

Comhairle Contae Mhuineacháin
Monaghan County Council

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1 Introduction

1.1 Development Description

The subject site for this Lighting Impact Assessment is the proposed civic offices in Monaghan Town, Co Monaghan for our client Monaghan County Council (MCC).

The site is part of a larger development for this area which includes road links and an Active Travel Route which are dealt with by another design consultant DBFL and their technical advisors. The reports, calculations and drawings generated and commissioned by DBFL are included in appendices 2, 3 and 4.

A comprehensive description of the proposed development is set out in the Planning Statement. The Statutory Notices should also be referenced. The proposed development comprises the construction of a new civic office building distributed over three floors which will encompass office accommodation, a Council chamber and a series of supporting spaces, plant, ESB substation and services enclosures. The development will be served by a surface car park, drop-off area and bicycle parking spaces.

Infrastructural works to the existing vehicular route on Slí Ógie Uí Dhufaigh, including the provision of a new clear span bridge over the River Shambles and a new vehicular access 'Quarry Walk' are also proposed. Permeability will be enhanced by a series of pedestrian and cycle links.
Ancillary development works include signage, earthworks, drainage, watermain, utilities, landscaping, boundary treatments, lighting and solar PV panels.

The development will also include the following illuminated furniture and accented points: -

- Branding signage including main sign at vehicle entrance to site.
- Internal wayfinding.
- Private roadway and carpark lighting.
- Plant and associated screening.
- Internal roads and paths.
- Vehicle set down areas.
- Emergency Assembly points.

The easiest and most effective way to protect the night-time environment is not to install any exterior lighting schemes, so the first question has to be whether or not the lighting is necessary or justifiable. In this instance it is a necessity to illuminate the occupied areas of the development. Some landscaped areas in this development, without paths, will not be lit so as not to encourage access by the public in hours of darkness and not to encourage antisocial behaviour.

Exterior lighting is usually provided for one or more of a number of reasons, which can usually be broken down into two categories: need and desire:

1.2 Need:

- Enhance safety of movement, such as roads, cycle routes and pathways.
- Provide security by making surveillance possible, such as a car park.
- Enable work to be carried out, such as a transport hub.
- Traffic volume and traffic speed.
- The reduction in accident rates and severity.
- Road lighting may be justified if there is an inhomogeneous traffic environment, poor road alignment, short spacing of junctions, greater than normal number of crossroads and bus stops, a lack of dedicated pedestrian footways, etc.
- Lighting is provided for social reasons; to improve the general amenity, to give safe passage for pedestrians and to provide a sense of personal security.
- Improve Security lighting levels for CCTV Systems.

1.3 Desire

- Lengthen the time that outdoor facilities can be used, such as sports pitches.
- Extend the economic day of an area, such as a town centre.
- Illuminate landmarks or structures, such as castles or bridges.

We have considered both Need and Desire in the design solution.

2 Proposed Design Approach

There are six key lighting design elements reviewed in advance of carrying out lighting calculations. The lighting design should conform to all standards listed below.

2.1 Design Criteria

- Lighting Lux Levels, and uniformity on walkways.
- Light pollution on surrounding properties.
- Luminaire intensity.
- Up Light Ratio (ULR).
- Lighting Controls.
- Bat disturbance mitigation.

The new development is classified as an 'E3' environment in accordance with IS EN 12464-2:2014. This represents medium district brightness areas, such as industrial or residential suburbs areas. The following lighting criteria must be adhered to when designing a lighting installation for an E3 environment**.**

The development is a public building but in a private site and privately managed. There is no public lighting requirement.

There are four area designations:

- Upper carpark area.
- Lower carpark area with disabled access car spaces, service vehicle entrance to plant areas and footpaths to main entrance to building.
- Lower pedestrian and cyclist entrance from Active Travel Route.
- Series of external steps.

Design principles are as follows –

- Minimum mounting height for columns in carpark areas is 6 Metre.
- No fittings located within 3 Metres of trees.
- Isoline drawing to indicate cut off to 1 Lux.
- Cherry picker access may be needed for wall mounted luminaires for maintenance. This to be taken into consideration when placing fittings.
- Consider columns with raise/lower type throughout for easy maintenance.
- Consider columns to be fitted with solar clock, wiring to be provided for this in design and CCTV operator informed there is no power to poles during daylight hours.
- Particular attention paid to ensure unobtrusive light as outlined in guidance documents.
- Burn hour calendars to be as agreed as per the CRU guidelines (Commission for Regulation of Utilities).

2.2 Standards

List of lighting standards below –

- EN 12464-2 2014 - Light and lighting. Lighting of work places. Outdoor work places.
- SLL Code of Lighting 2012.
- SLL Lighting Handbook 2018.
- SLL Lighting Guide 1: The industrial environment (2018).
- SLL Lighting Guide 4: Sports (2021).
- SLL Lighting Guide 6: The exterior environment (2016).
- SLL Lighting Guide 9 – Lighting for communal residential buildings.
- SLL Lighting Guide 14: Control of electric lighting (2016).
- SLL Lighting Guide 21 - Protecting the night-time environment Guide to limiting obtrusive light (2012).
- Institute of Lighting Professionals (ILP).
- PLG05: The brightness of illuminated advertisements (2015).
- GN01: Guidance notes for the reduction of obtrusive light (2021).
- International Commission for Illumination (CIE): CIE 150:2017: Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations (2nd edn).
- I.S 3217:2013+A1.
- Building Regulations Part M.
- LG21 Protecting the night-time environment.
- IS EN 13201-2:2015 Road Lighting — Part 2: Performance Requirements.
- IS EN 12665:2011 Light and Lighting – Basic Terms and Criteria for Specifying Lighting Requirements.
- IS EN 13201-3:2015 Road lighting — Part 3: Calculation of performance.
- IS EN 13201-4:2015 Road lighting — Part 4: Methods of measuring lighting performance.
- BS 5489.1 2020 - Code of practice for the design of road lighting Part 1: Lighting of roads and public amenity areas.
- DAC requirements specific for this development.
- HSA Regulations for Electricity.
- NSAI National Rules for Electrical Installations IS 10101:2020 5th Edition.
- ESB National Code of Practice for Customer Interface.
- Housing Schemes: Guidebook for ESB Networks Standard for Electrical Services.

2.3 CIE environmental zones (source: CIE 150 (2017) Tables 2, 5 and 7

2.3.1 Zone Lighting Environment Examples

- E0 Intrinsically dark UNESCO Starlight Reserves, IDA Dark Sky Parks, major optical observatories.
- E1 Dark National Parks, Areas of Outstanding Natural Beauty, relatively uninhabited rural areas.
- E2 Low district brightness Sparsely inhabited rural areas.
- E3 Medium district brightness well inhabited town and urban settlements.
- E4 High district brightness Town and city centres, out of town retail parks.

Night-time limit values for different environmental zones (source: CIE 150 (2017)

Time — Maximum values of vertical illuminance on properties (lux) for stated CIE Environmental zone

	E0	E1	E2	E3	E4
Pre-Curfew	0	2	5	10	25
Post Curfew	0	0.1	1	2	5

Item — Maximum permitted values of average surface luminance (cd/m2) for stated maximum values of upward light ratio (ULR) of luminaires (%)

	0	0	2.5	5	15

Building façade	<0.1	<0.1	5	10	25
Signs	<0.1	50	400	800	1000

* If the installation is for public (road) lighting then this may be up to 1 lux

2.4 Light Pollution (Obtrusive Light) on Surrounding Properties

- 10 lux pre-curfew (maximum value of vertical illuminance on properties)
- 2 lux post-curfew (maximum value of vertical illuminance on properties)

2.4.1 Luminaire Intensity (cd - candela)

- 10000 pre-curfew
- 1000 post-curfew

2.4.2 Upward Light (ULR %)

- 15%

The development is classified as an 'E3' environment in accordance with IS EN 12464-2:2014. This represents medium district brightness areas, well inhabited town and urban settlements such as industrial or residential suburbs areas.

2.5 General Lighting Design Values

General Task Lighting allows occupants navigate through the site and around building pedestrian pathways. General lighting is required during the normal operation of the building while emergency lighting is required in the case were the normal lighting operation fails due to power loss. The CIBSE lighting guides and IS EN 12464-2: 2014 recommend lighting values for external roadways & path ways.

Consideration has been given to light colour in this design and we selected 3000K colour lamps in all areas, GRI – 50 (Glare Rating) and Ra – 70 Ra (Colour Rendering).

The installed Luminous Intensity Class for the restriction of Disability Glare for the luminaire shall be as follow:

- For standard residential roads, the luminaire shall have an Installed Luminous Intensity Class for the restriction of Disability Glare of at least G1
- For access roads and distributor roads, the luminaire shall have an Installed Luminous Intensity Class for the restriction of Disability Glare of at least G3
- For main traffic routes and conflict areas, the luminaire shall have an Installed Luminous Intensity Class for the restriction of Disability Glare of G4, G5 or G6 as advised by Public Lighting Services

The CIE has developed a structured model for the selection of the appropriate lighting classes. Lighting Classes are grouped into three categories: Class M, Class C and Class P all of which are detailed in Section 3.3. Class is selected based on the luminance or illuminance concept, taking into account the different parameters relevant for the given visual tasks. Applying for example time dependent variables like traffic volume or weather conditions, the model offers the possibility to use adaptive lighting systems.

Results based on this criterion are as follows –

Location	Classification	Design lux level	Uniformity
Main entrance to site and upper carpark.	P2	10 Lux	0.25

Lower carpark, pedestrian walkways and entrance to building.	P2/Part M	20 Lux	0.25
Pedestrian steps./Ramps	P4/Part M	100 Lux	0.25
Building Access	P4/Part M	20 Lux	0.25
Pedestrian Pathways	P4	5 Lux	0.25

Figure 1 Lighting Design Values

Steps/Pedestrian Ramps need to be compliant with Part M requirements.

2.6 Lighting Controls

Lighting controls are essential for all exterior lights. A photo-electric cell (PEC) is proposed for automatic switch-on at dusk and off with time control. Photocell to have switching at 35/18 lux. LED Driver to be DALI compatible for future dimming profiles.

Presence detection may also be incorporated for safety purposes & bat consideration, e.g. After curfew when no staff or public are outside, after a set interval time, lighting would reduce to a pre-determined level, e.g., 50%, but as soon as human or vehicular movement is detected, full illumination is restored.

We have not proposed any façade illumination.

We have a minimal Landscape illumination design included with negligible Sky Glow resulting.

2.7 Viewpoints

In addition to the setting, we have considered the critical viewpoints which may be affected by the installation. We have reviewed impact on nearby residents, Businesses, Road users. There are no higher ground distant viewpoints to consider for this scheme.

3 Road Lighting

The CIE has developed a structured model for the selection of the appropriate lighting classes (M, C, or P), based on the luminance or illuminance concept, taking into account the different parameters relevant for the given visual tasks. Applying for example time dependent variables like traffic volume or weather conditions, the model offers the possibility to use adaptive lighting systems.

3.1 Terms and Definitions

The terms discussed in this clause are defined in the International Lighting Vocabulary
(CIE DS 017.2/E:2009) or in CIE 140-2000.

3.1.1 Average Luminance of the Road Surface [Lav]

The values of Lav are the minimum values to be maintained throughout the life of the installation for the specified lighting class(es). They are dependent on the light distribution of the luminaires, the luminous flux of the lamps, the geometry of the installation, and on the reflection properties of the road surface. Higher levels are acceptable when they can be environmentally or economically justified.

The calculation of the average luminance of the road surface should be carried out in accordance with CIE 140-2000.

Calculated values should consider the luminaire and lamp maintenance factors.

Luminaire maintenance factors vary according to the intervals between cleaning, the amount of atmospheric pollution, the quality of the sealing of the lamp housing of the luminaire, and the age of the materials. Their values may be established by field measurements. Lamp flux maintenance factors vary according to lamp type and power.

3.1.2 Overall Uniformity of Road Luminance [Uo]

Uo is the ratio of the minimum luminance at a point to the average road surface luminance and should be calculated according to CIE 140-2000. This criterion is important as regards the control of minimum visibility on the road.

3.1.3 Longitudinal Uniformity of Road Surface Luminance [Ul]

Ul is the ratio of the minimum to the maximum luminance along a line or lines parallel to the run of the road and should be calculated in accordance with CIE 140-2000. It is mainly a criterion relating to comfort and its purpose is to prevent the repeated pattern of high and low luminance values on a lit run of road becoming too pronounced. It only applies to long uninterrupted sections of road.

3.1.4 Threshold Increment TI [fTI]

Disability glare results from the scattering of light within the eye, so reducing contrasts of the retinal image. The effect may be explained by the superimposition of a uniform luminance veil over the scene, which is quantified as the equivalent veiling luminance. The magnitude of this depends on the illuminance on the driver's eye from the luminaires and the angles at which they are seen. While the degree of disability glare increases with the equivalent veiling luminance, it decreases as a function of the average road luminance.

TI is a measure of the loss of visibility caused by the disability glare from the road lighting luminaires. The formula from which it is calculated is based on the percentage increase in the luminance difference needed to make the object visible in the presence of glare when it is just visible in the absence of glare, that is, when the luminaires are screened from the view of the observer. The mathematical procedure is given in CIE 140-2000 and the calculation is made for a clean luminaire equipped with a lamp emitting the initial luminous flux.

3.1.5 Surround Ratio SR [Rs]

One of the principal aims in road lighting is to create a bright road surface against which objects can be seen. However, the upper parts of tall objects on the road and objects towards the side of the road, particularly on curved sections, are seen against the surrounds of the road. Thus, adequate lighting on the surrounds helps the motorist to perceive more of the environment and make speed adjustments in time.

The function of the surround ratio is to ensure that light directed on the surrounds is sufficient for objects to be revealed. In situations where lighting is already provided on the surrounds the use of surround ratio is rendered unnecessary.

Surround ratio is defined in CIE 140-2000.

3.1.6 Discomfort Glare

No fully satisfactory method has yet been devised for quantifying discomfort glare to drivers on traffic routes. Formerly G, the Glare Control Mark (CIE 31-1976), was used but resulted in anomalies. Field evidence suggests that installations designed within the limits of threshold increment recommended in Tables 2 and 5 are generally acceptable as regards discomfort glare.

Bright surroundings, such as lighted buildings, tend to mitigate discomfort glare but as the lighting of buildings is variable and may be extinguished during the night, it is not practicable to allow for this in the design of the road lighting

3.1.7 Need

There are three main purposes of road lighting:

- to allow all road users, including operators of motor vehicles, motor cycles, pedal cycles, and animal drawn vehicles to proceed safely.
- to allow pedestrians to see hazards, orientate themselves, recognize other pedestrians, and give them a sense of security.
- to improve the daytime and night-time appearance of the environment.

3.2 Quality Criteria and Lighting Classes

3.2.1 Quality Criteria for Road Lighting

The approach generally used when selecting quality criteria for lighting roads for motor traffic is based on the luminance concept. Illuminance is still used by some countries, but experience has shown this to be an unsatisfactory criterion. In the application of the luminance concept, the aim is to provide a bright road surface against which objects are seen in silhouette. It uses, therefore, level and uniformity of road surface luminance, as well as glare control, as quality criteria. However, many objects on the road are of high reflectance, so they are not seen in silhouette but rather by directly reflected light.

Furthermore, in congested traffic conditions, much of the view of the road surface may be obstructed by vehicles and thus cannot provide a background for revealing objects. Nevertheless, the approach of providing a good level and uniformity of road luminance with adequate glare control has been widely adopted in national and international recommendations. Experience gained in using these criteria for several decades indicates that they provide a satisfactory basis for road lighting design. Although prescribed values of the criteria were originally arrived at because of experimental work, they have been tempered by experience over this time and the approach suggested in this document represents good present-day practice.

However, in special situations called "conflict areas" in this report, the design of the lighting installation can be based on the illuminance concept. The lighting design for pedestrian and very low speed areas is also based on illuminance requirements.

3.2.2 Quality Criteria

The road lighting should enable pedestrians to discern obstacles or other hazards in their path and be aware of the movements of other pedestrians, friendly or otherwise, who may be in close proximity. For this, the lighting on both horizontal and vertical surfaces, as well as the control of glare and the colour rendering, is important. Environmental issues should be taken into account.

3.2.3 Lighting of Horizontal Surfaces

To ensure that the pedestrian can move over the road and footpath surfaces in safety, the horizontal illuminance, Eh, must be adequate. Horizontal illuminance is measured at ground level in terms of average and minimum values, and applies to the whole of the used surface, which usually comprises the footways and the carriageway surface, unless the carriageway is treated separately under the provisions for motorized traffic.

3.2.4 Lighting of Vertical Surfaces

Adequate lighting of vertical surfaces is necessary for facial recognition, which may also enable an act of aggression to be anticipated. The quantification of this presents a difficulty CIE 115:2010 17 because of the multiplicity of planes at each measurement point which must be taken into account. An attempt to overcome this has been made by considering the illuminance on an infinitesimal vertical half cylinder situated at head height (1,5 m). This measure, the semi-cylindrical illuminance, Esc, has been introduced in CIE136-2000, as an adjunct to horizontal illuminance. For its measurement a special adaptation is required to the mounting of the photoelectric detector which is used to measure planar illuminance.

3.2.5 Control of Glare

The control of discomfort and disability glare is not as critical as for the motorist, because speed of movement is much lower, giving a greater reaction time. No method of quantifying glare has been agreed to internationally, but a number of methods are in current use on a national basis. Methods for quantifying and controlling glare in pedestrian and low speed traffic areas are given in Annex D.

3.2.6 Choice of Light Source

Monochromatic light sources should be avoided for areas where the crime risk is high, that are environmentally sensitive, or where pedestrian activities predominate. Using light sources with better colour rendering properties will improve the possibility to see colour contrasts and contributes to a better facial recognition. This could be of particular importance for elderly or visually impaired users of pedestrian and low speed traffic areas. NOTE The use of low-pressure sodium lighting is considered a positive environmental step in areas with sensitive optical astronomical facilities and near sea turtle nesting areas.

Selection of Lighting Classes Tables quantifying the details of different lighting classes and referred to below can be found in the relevant clauses following, where they are discussed in more detail.

3.2.7 Normal Lighting

Normal lighting class is that class which is appropriate if the same level is to be used throughout the hours of darkness. In selecting the normal lighting class the maximum value of the selection parameters likely to occur at any period of operation should be considered, e.g. for traffic volume consider peak hourly value.

3.2.8 Adaptive Lighting

The normal lighting class is selected using the most onerous parameter values, and the application of this class may not be justified throughout the hours of darkness (This might be under changing conditions e.g. weekends, different weather conditions). Temporal changes in the parameters under consideration when selecting the normal lighting class could allow, or may require, an adaptation of the normal level of average luminance or illuminance, usually by reducing the level. The adapted lighting level or levels should be the average luminance or illuminance from a class or classes in the same table from which the normal lighting class has been selected.

It is important that the changes in the average lighting level do not affect the other quality criteria outside the limits given in the system of M, C or P lighting classes. Reducing the light output from every lamp by the same amount using dimming techniques will not affect luminance or illuminance uniformity, or the object contrast, but the threshold contrast increases. Reducing the average level by switching off some luminaires will not fulfil the quality requirements and is not recommended.

The use of adaptive lighting can provide significant reduction in energy consumption, compared with operating the normal lighting class throughout the night. It can also be used to reduce energy consumption by reducing the lamp light output to the maintained value when the installation is clean, and the lamps are new. Where the pattern of variation in parameter values is well known, such as from a record of traffic counts on traffic routes, or can be reasonably assumed, as in many residential areas, a simple time-based control system may be appropriate. In other situations, an interactive control system linked to real-time data may be preferred. This approach will permit the normal lighting class to be activated in the case of road works, serious accidents, bad weather or poor visibility.

3.3 Class M, Class C and Class P Lighting Classes

3.3.1 Class M: Motorised Traffic

CIE 115:2010

Table 1. Parameters for the selection of M lighting class.

Parameter	Options	Weighting Value V_w	V_w Selected
Speed	Very high	1	
	High	0,5	
	Moderate	0	
Traffic volume	Very high	1	
	High	0,5	
	Moderate	0	
	Low	-0,5	
	Very low	-1	
Traffic composition	Mixed with high percentage of non-motorized	2	
	Mixed	1	
	Motorized only	0	
Separation of carriageways	No	1	
	Yes	0	
Intersection density	High	1	
	Moderate	0	
Parked vehicles	Present	0,5	
	Not present	0	
Ambient luminance	High	1	
	Moderate	0	
	Low	-1	
Visual guidance / traffic control	Poor	0,5	
	Moderate or Good	0	
		Sum of Weighting Values	V_{WS}

Figure 3-Parameters for selection of M Lighting Class

The controlling criteria for the lighting of roads for motorized traffic are the luminance level and uniformity of the carriageway, the illuminance level of the surrounds of the road, the limitation of disability and discomfort glare, and the requirements for direct visual guidance. Direct visual guidance is considered in 7.2. For the other criteria recommended values are given in Table 2 for the lighting classes M1 to M6, reflecting various traffic situations. The lighting criteria used are the maintained average road surface luminance (Lav), the overall (Uo) and longitudinal (Ul) uniformity of the luminance, the surround ratio (Rs), and the threshold increment (fTI). These values apply to roads, which are sufficiently long so that the luminance concept can be used, outside conflict areas and/or outside areas with measures of traffic calming. The surround ratio is considered for roads with adjacent footpath/cycle path only when no specific requirements are given (see P lighting classes.

Table 2. Lighting classes for motorized traffic, based on road surface luminance.

Lighting class	Road surface				Threshold increment	Surround ratio
	Dry			Wet *		
	L_{av} in $cd \cdot m^{-2}$	U_o	U_l	U_o	f_{TI} in %	R_s
M1	2,0	0,40	0,70	0,15	10	0,5
M2	1,5	0,40	0,70	0,15	10	0,5
M3	1,0	0,40	0,60	0,15	15	0,5
M4	0,75	0,40	0,60	0,15	15	0,5
M5	0,50	0,35	0,40	0,15	15	0,5
M6	0,30	0,35	0,40	0,15	20	0,5

*Applicable in addition to dry condition, where road surfaces are wet for a substantial part of the hours of darkness and appropriate road surface reflectance data are available.

Figure 4-Lighting Classes for Motorised Traffic

3.3.2 Class C: Conflict Areas

Conflict areas occur whenever vehicle streams intersect each other or run into areas frequented by pedestrians, cyclists, or other road users, or when there is a change in road geometry, such as a reduced number of lanes or a reduced lane or carriageway width. Their existence results in an increased potential for collisions between vehicles, between vehicles and pedestrians, cyclists, or other road users, or between vehicles and fixed objects. Parking areas and toll-stations are also regarded as conflict areas. General circulation areas at outdoor working places are covered by CIE S 015/E:2005.

NOTE 1: Pedestrian crossings may require special consideration; they are not subject of this report. In some countries, national standards exist which give further guidance relative to national practices. Pedestrian crossings minimum requirements should be in accordance with CIE 136-2000. The lighting should reveal the existence of the conflict area, the position of the kerbs and road markings, the directions of the roads, the presence of pedestrians, other road users, and obstructions, and the movement of vehicles in the vicinity of the conflict area. Where no lighting is otherwise provided on a road leading to or leaving the conflict area, the selected lighting class should be installed for a stretch long enough to provide about 5 seconds of driving distance at the expected traffic speed. The lighting classes C0 to C5 are defined by the lighting criteria given for each class in Table 5.

Table 3. Parameters for the selection of C lighting class.

Parameter	Options	Weighting Value V_w	V_w Selected
Speed	Very High	3	
	High	2	
	Moderate	1	
	Low	0	
Traffic volume	Very high	1	
	High	0,5	
	Moderate	0	
	Low	-0,5	
	Very low	-1	
Traffic composition	Mixed with high percentage of non-motorized	2	
	Mixed	1	
	Motorized only	0	
Separation of carriageways	No	1	
	Yes	0	
Ambient luminance	High	1	
	Moderate	0	
	Low	-1	
Visual guidance / traffic control	Poor	0,5	
	Moderate or good	0	
		Sum of Weighting Values	V_{WS}

Figure 5-Parameters for selection of C Lighting Class

Table 2 — C lighting classes based on road surface illuminance

Class	Horizontal illuminance	
	$\bar{E}$ [minimum maintained] lx	U_o [minimum]
C0	50	0,40
C1	30	0,40
C2	20,0	0,40
C3	15,0	0,40
C4	10,0	0,40
C5	7,50	0,40

Figure 2-Lux levels and uniformity for Lighting Class C

Crime and Lighting Studies Most of the studies of crime and lighting have been conducted by measuring the crime rates before and after upgrading the lighting, or by interviewing local residents to record their opinion about the effectiveness of the upgrading. These studies have been recorded in the USA (Tien, 1979), UK (Painter, 1988, 1989), Japan (Kansai, Report No 4, 1989), and France (Marinier, 1983). Not all of them provide data that are soundly based but taken as a whole; they suggest the improvement of the lighting performance can directly reduce the number of acts of crime and harassment. Newly installed or upgraded lighting can displace crime to an adjoining area. A UK study (Lloyd and Wilson, 1989) found such displacement, but a study by Schreuder (Lux Europa, 1993) showed an overall reduction without displacement.

These studies also indicate that fear of crime, which can be as harmful as crime itself, is reduced by good lighting. This fear has an adverse effect on morale in a neighbourhood and deters residents from coming out of their houses at night. Not only does this increase the sense of isolation of the residents but it provides greater opportunities for criminals, because there are fewer people to observe or restrain them.

Thus, the lighting contributes also to indirect effects through the self-confidence and the pride it generates. It creates also a social control that can be either formal (real supervision) or informal (climate of supervision). It is not known precisely which luminous characteristics, for which cultural and social context, with which mechanism, the lighting (or its improvement) can have an impact on urban security. The debate, on methodological, theoretical, and prescriptive aspects continues (CERTU, 2006). Where the fear of crime is an aspect to be considered, facial recognition should be considered. Additional requirements in this case are given in Tables 6 and 7.

3.3.3 Lighting Class P: Pedestrian and Low Speed Traffic Areas

Lighting Levels for Pedestrian and Low Speed Traffic Areas The parameters relevant for the selection of an appropriate P lighting class for a given pedestrian or low speed traffic area are summarized in Table 6. The lighting classes P1 to P6 are defined by the lighting criteria given for each class in Table 7. They are intended for pedestrians and pedal cyclists on footways, cycleways, and other road areas lying separately or along the carriageway of a traffic route, and for residential roads, pedestrian streets, parking places, etc.

CIE 115:2010

Table 6. Parameters for the selection of P lighting class.

Parameter	**Options**	**Weighting Value V_w**	**V_w Selected**
Speed	Low	1	
	Very low (walking speed)	0	
Traffic volume	Very high	1	
	High	0,5	
	Moderate	0	
	Low	-0,5	
	Very low	-1	
Traffic composition	Pedestrians, cyclists and motorized traffic	2	
	Pedestrians and motorized traffic	1	
	Pedestrians and cyclists only	1	
	Pedestrians only	0	
	Cyclists only	0	
Parked vehicles	Present	0,5	
	Not present	0	
Ambient luminance	High	1	
	Moderate	0	
	Low	-1	
Facial recognition	Necessary	Additional requirements	
	Not necessary	No additional requirements	
		Sum of **W**eighting **V**alues	V_{WS}

Figure 3-Parameters for eth selection of P Lighting Class

The P classes in Table 3 or the HS classes in Table 4 are intended for pedestrians and pedal cyclists on footways, cycleways, emergency lanes and other road areas lying separately or along the carriageway of a traffic route, and for residential roads, pedestrian streets, parking places, schoolyards, etc.

Table 3 — P lighting classes

Class	**Horizontal illuminance**		**Additional requirement if facial recognition is necessary**	
	$\bar{E}$[a] [minimum maintained] lx	E_{min} [maintained] lx	$E_{v,min}$ [maintained] lx	$E_{sc,min}$ [maintained] lx
P1	15,0	3,00	5,0	5,0
P2	10,0	2,00	3,0	2,0
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 $\bar{E}$ value indicated for the class.

Figure 4 - Lux levels and uniformity for Lighting Class P

Table A.6 **Lighting classes for subsidiary roads with mainly slow-moving vehicles, cyclists and pedestrians**

Traffic flow	**Lighting class**	
	Ambient luminance: very low (E1) or low (E2)	**Ambient luminance: moderate (E3) or high (E4)**
Busy A)	S4 or P4	S4 or P4
Normal B)	S5 or P5	S5 or P5
Quiet C)	S6 or P6	S6 or P6

NOTE 1 If facial recognition is important then an ES lighting class from BS EN 13201-2:2003, Table 5, or an E_{SC} lighting class from CIE 115:2010 [N1], Table 7, can be selected as an additional criterion. Good colour rendering contributes to a better facial recognition. (The ES lighting class in BS EN 13201-2:2003 is expected to be replaced by SC upon publication of the revised edition.)

NOTE 2 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 3 It is recommended that the actual overall uniformity of illuminance U_o be as high as reasonably practicable.

NOTE 4 Grey highlighting indicates situations that would not usually occur in the UK.

NOTE 5 The ambient luminance descriptions E1 to E4 refer to the environmental zone as defined in ILP GN01 [N5].

A) Busy traffic flow refers to areas where the traffic usage is high and can be associated with local amenities such as clubs, shopping facilities, public houses, etc.

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

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

Figure 5 - Lighting Class P

4 Bat Protection

For Bat protection we have reviewed Flynn Furney Environmental Consultants Ecological Impack Assessment Report and the following mitigation measures have been imposed.

Lighting has only been installed where necessary for public safety. These lights have been designed and selected with specific shutters and filters to minimise any potential for back spills into the sensitive locations while still providing the primary function of safely lighting to the circulation routes.

4.1 Reflectance's

Downward lighting can be reflected from bright surfaces. To minimize bat disturbance, the design avoids the use of bright surfaces and incorporates darker colour lamp heads and poles to reduce reflectance (RAL Anthracite grey).

4.2 Shielding of Luminaires & Light

To minimize bat disturbance, the design avoids the use of upward lighting by shielding or by downward directional focus.

4.3 Type of Light

To minimize bat disturbance, the design avoids the use of strong UV lighting. The lighting design is based on the use of LED lighting which has minimal or no UV output of significance and use of monochromatic sources and a warm-white (2700K) LED with low blue content.

5 Proposed Lighting Scheme

The proposed luminaires are selected to meet all the aforementioned design criteria (minimum lux levels, glare, colour rendering etc.).

Roadway lanterns and pole top lighting is the primary lighting type proposed throughout. The proposed luminaires are selected and utilized to meet all the aforementioned design criteria (minimum lux levels, glare, colour rendering etc.).

See Section 7.0 Lighting Schedule below for specification of all selected fittings.

6 Proposed Lighting Scheme Calculation Results:

The figures below detail the light calculation result generated by Dialux.

Location	Average lux level	Uniformity
Upper Parking	13.1 Lux	0.37
Main Entrance Parking	19.9 Lux	0.48
Car Ramp	21.9 Lux	0.28
Upper lift access	20.9 Lux	0.39
Car entrance, and disability parking	20.50 Lux	0.25
Main Entrance Parking	19.9 Lux	0.48
Access by St. Davnet's Row	23.2 Lux	0.42
Pedestrian Steps	109 lux	0.69
Pedestrian Pathways		

Figure 6 Lighting Scheme Calculation Results

On review of the lighting results, light levels achieved are in line with standards and little or no light pollution on adjacent properties exist.

The ULR has been estimated at 1.0% which is less than the design criteria maximum of 15% for an E3 environment.

Upper Parking – Average lux level: 13.1 Lux at 0.37 uniformity

Properties	$\bar{E}$	E_{min}	E_{max}	g_1	g_2	Index
Parking 2 Perpendicular illuminance (adaptive) Height: 17.150 m	13.1 lx	4.89 lx	35.0 lx	0.37	0.14	RS1

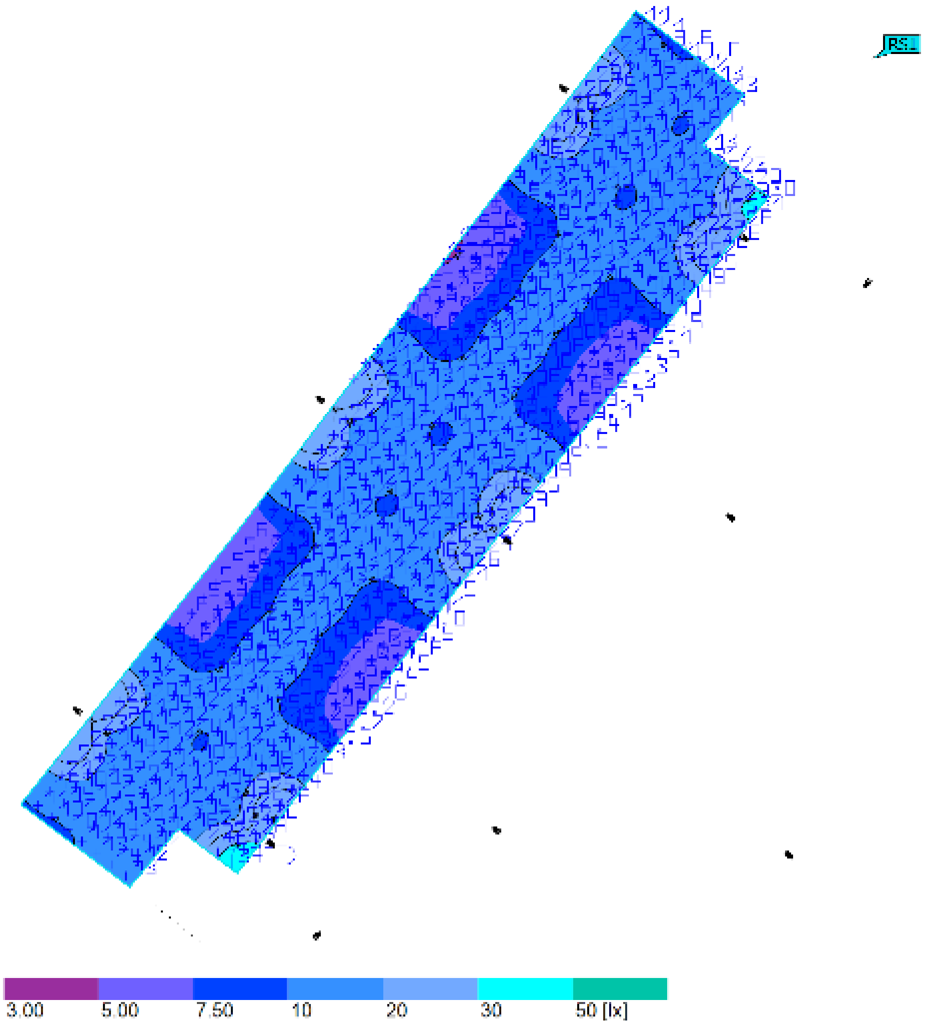


Figure 7 ***Upper Parking***

Main Entrance Parking – Average lux level: 19.9 Lux at 0.48 uniformity

Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
car ramp 1 Perpendicular illuminance (adaptive) Height: 14.159 m	19.9 lx	9.63 lx	30.9 lx	0.48	0.31	RS4

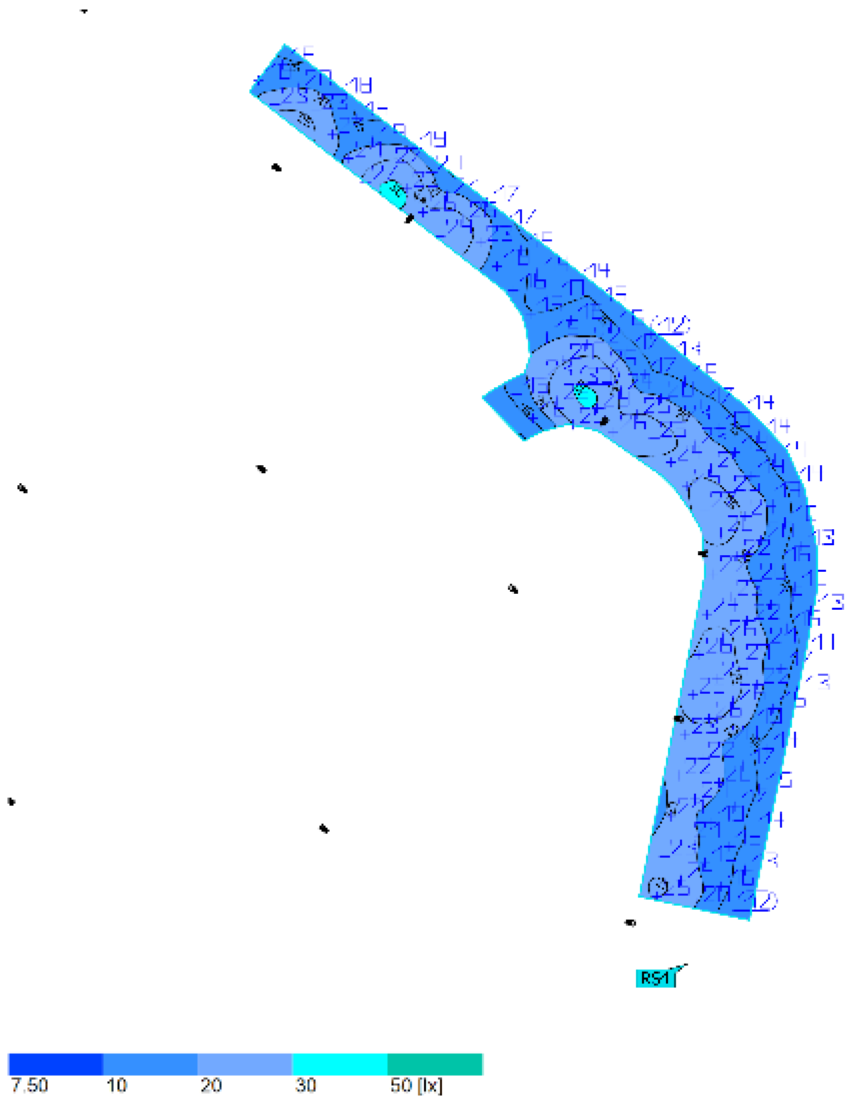


Figure 8- Main Entrance Parking

Car Ramp – Average lux level: 21.9 Lux at 0.28 uniformity

Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
car ramp 3 Perpendicular illuminance (adaptive) Height: 16.476 m	21.9 lx	6.12 lx	37.5 lx	0.28	0.16	RS3

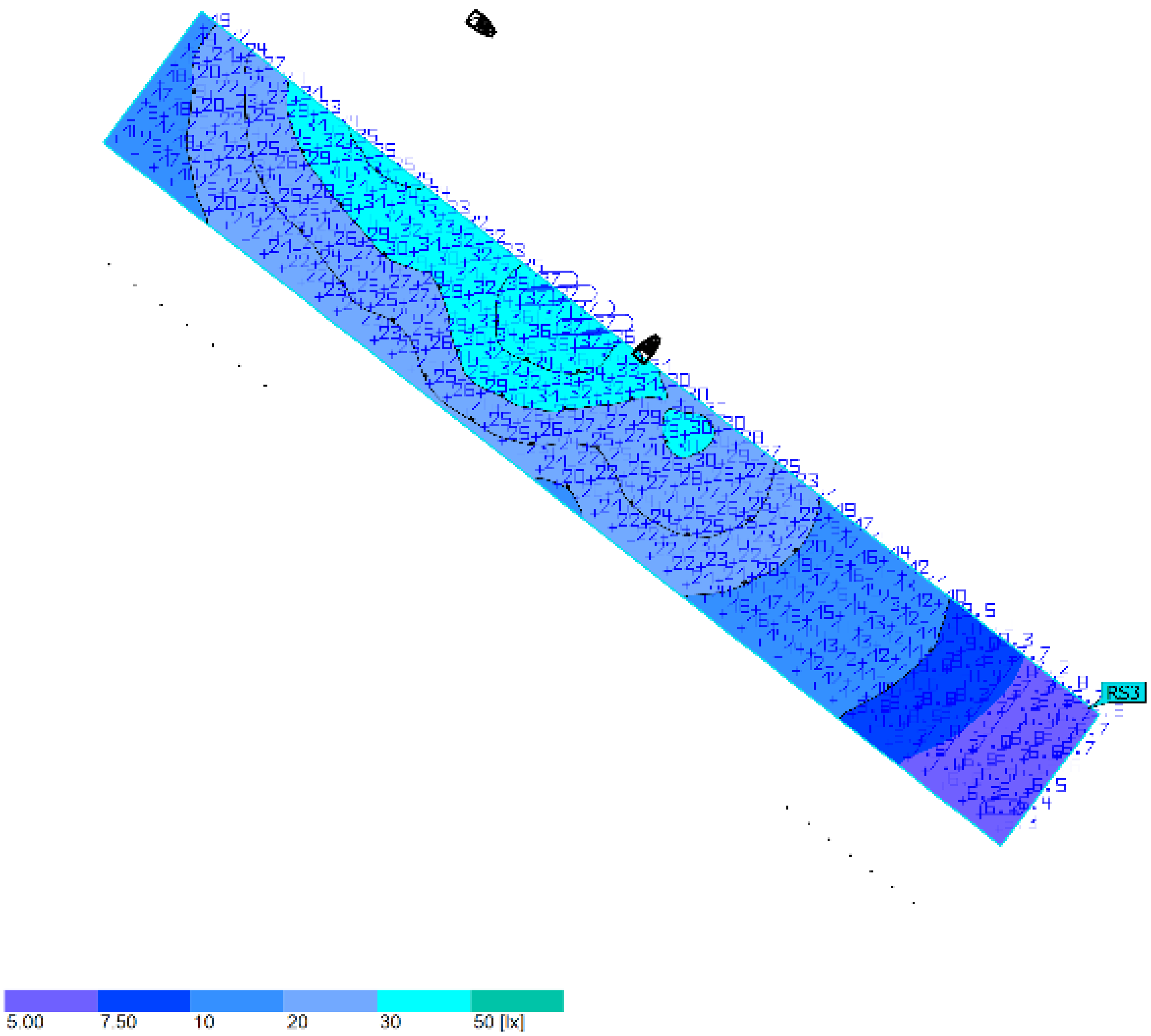


Figure 9-Parking Ramp

Upper lift access – Average lux level: 20.9 Lux at 0.39 uniformity

Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
lift access Perpendicular illuminance (adaptive) Height: 10.000 m	20.9 lx	8.12 lx	91.3 lx	0.39	0.089	RS5

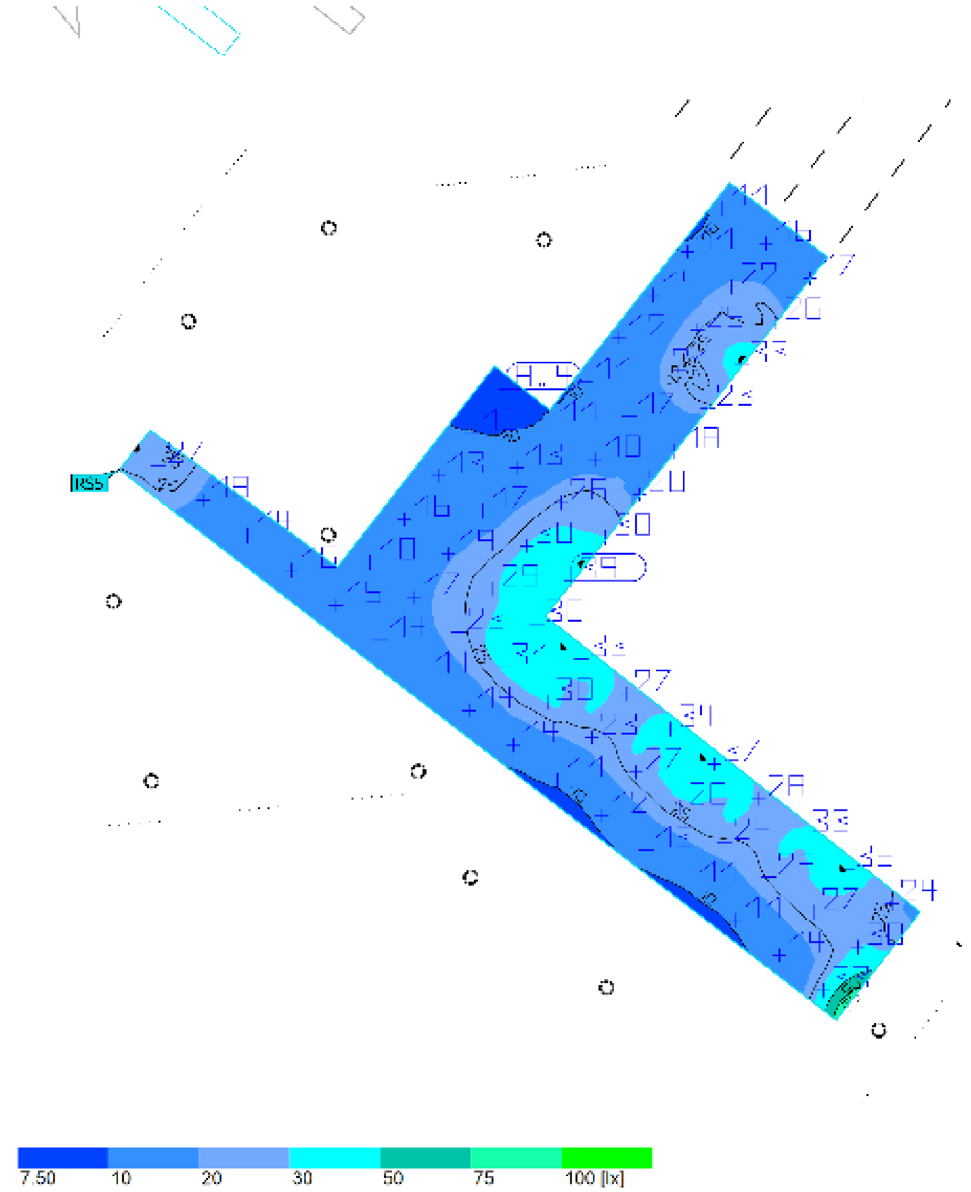


Figure 10- Upper lift access)

Car entrance, and disability parking – Average lux level: 20.5 Lux at 0.25 uniformity

Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
Surface result object 50 (Furniture) Perpendicular illuminance (adaptive) Height: 9.953 m	20.5 lx	5.14 lx	52.8 lx	0.25	0.097	RS36

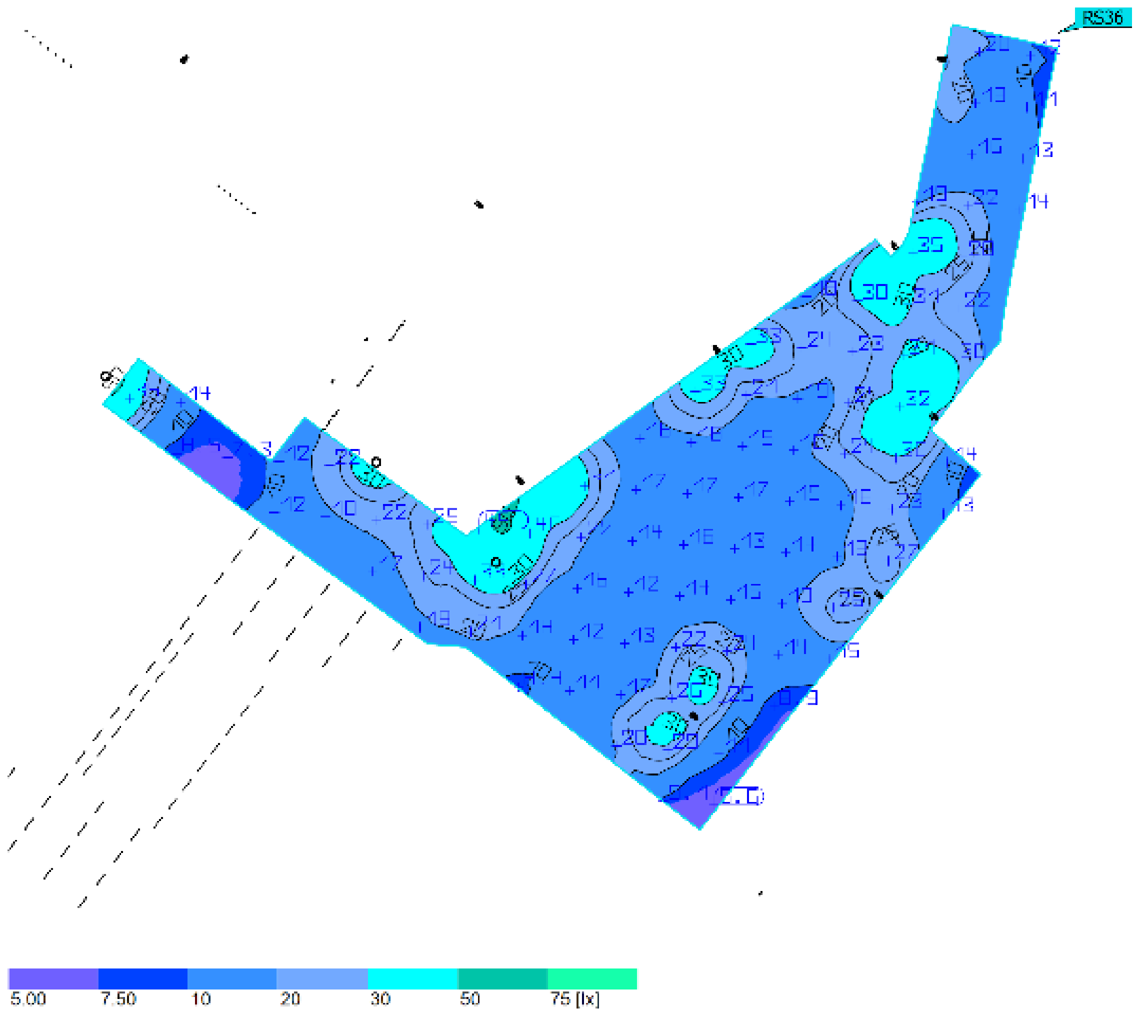


Figure 11- Car entrance, and disability parking

Access by St. Davnet’s Row - Average lux level: 23.2Lux at 0.42 uniformity

Properties	Ē (Target)	E_{min}	E_{max}	g_1 (Target)	g_2	Index
access st davnets row Perpendicular illuminance (adaptive) Height: 0.000 m, Wall zone: 0.000 m	23.2 lx (≥ 50.0 lx) ✗	9.84 lx	54.7 lx	0.42 (≥ 0.40) ✓	0.18	WP1

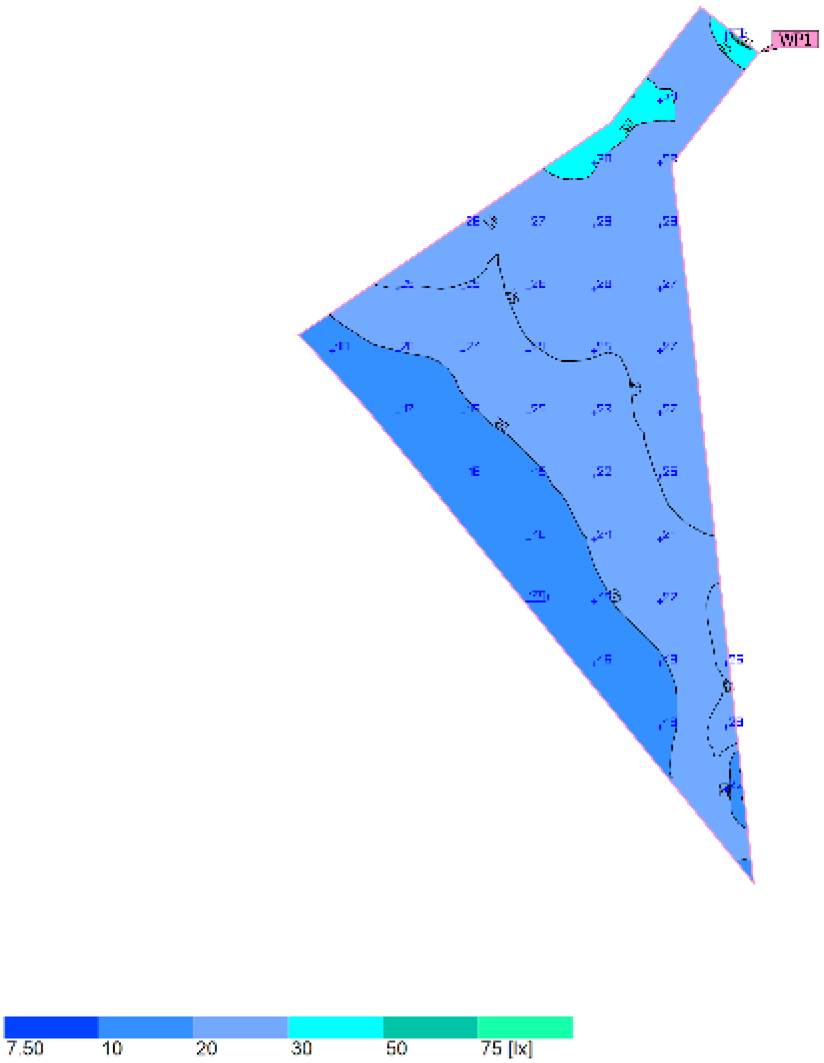


Figure 12- Access by St. Davnet’s Row

Steps- 109 Lux at 0.69 uniformity

Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
stairs Perpendicular illuminance (adaptive) Height: 1.690 m	109 lx	74.8 lx	127 lx	0.69	0.59	RS7

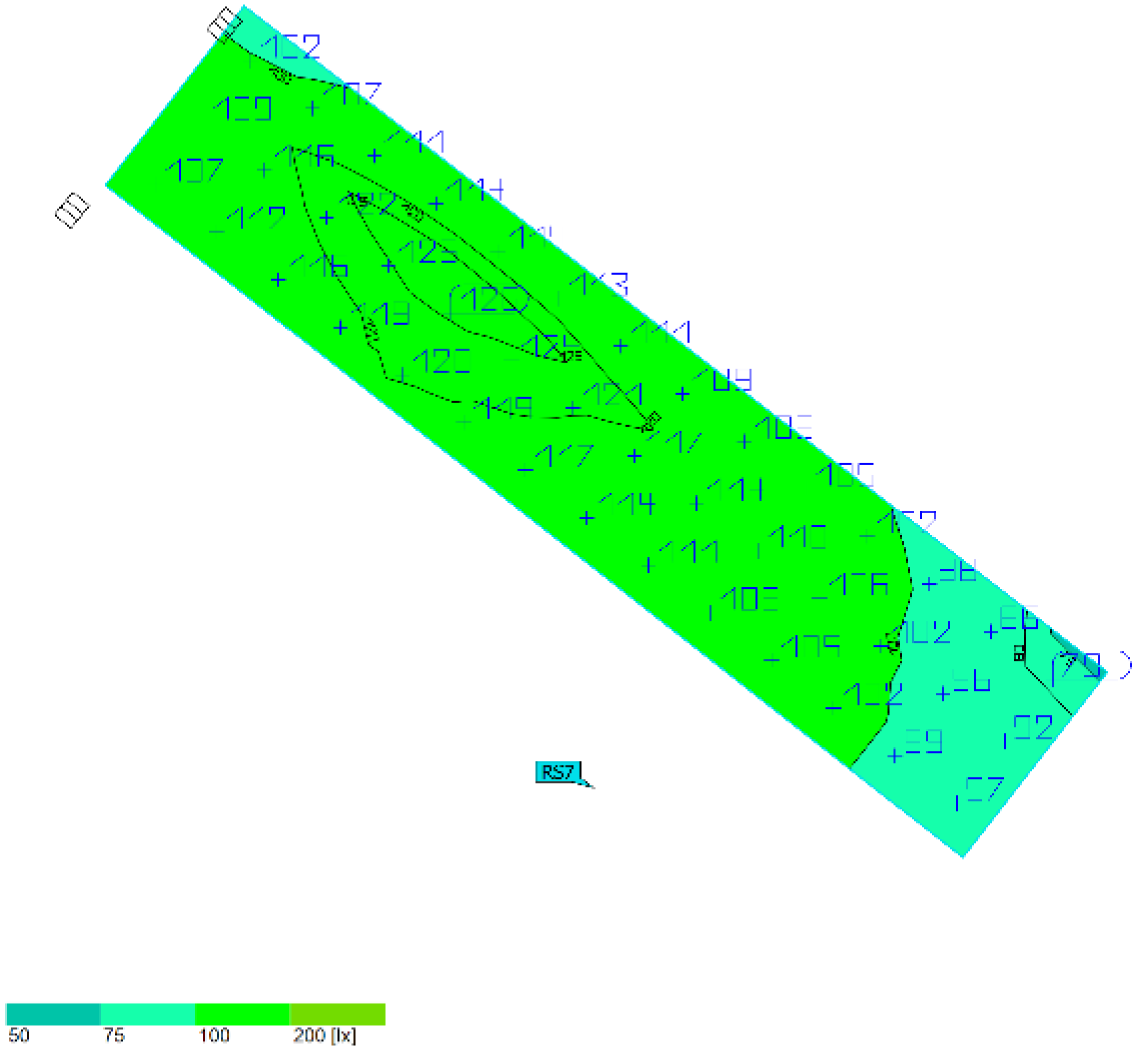


Figure 13- Steps

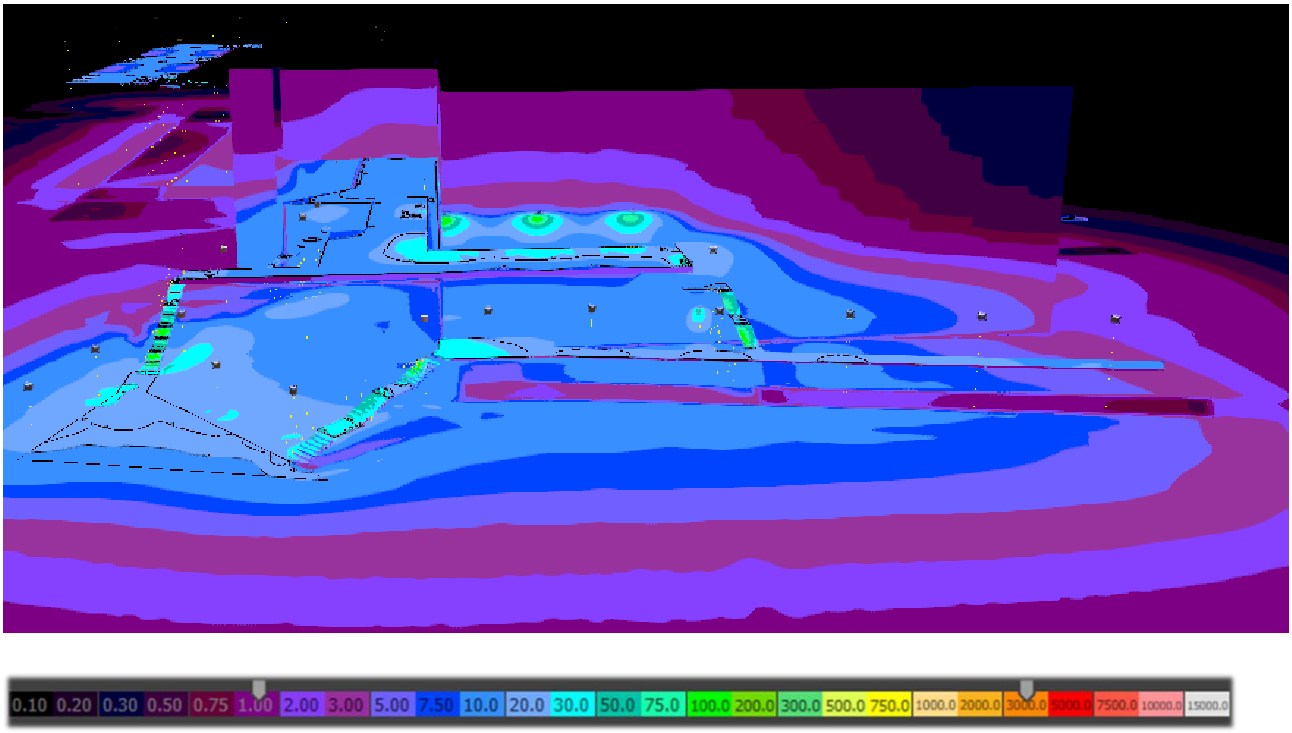


Figure 14: 3D Model false color rendering visualization from front

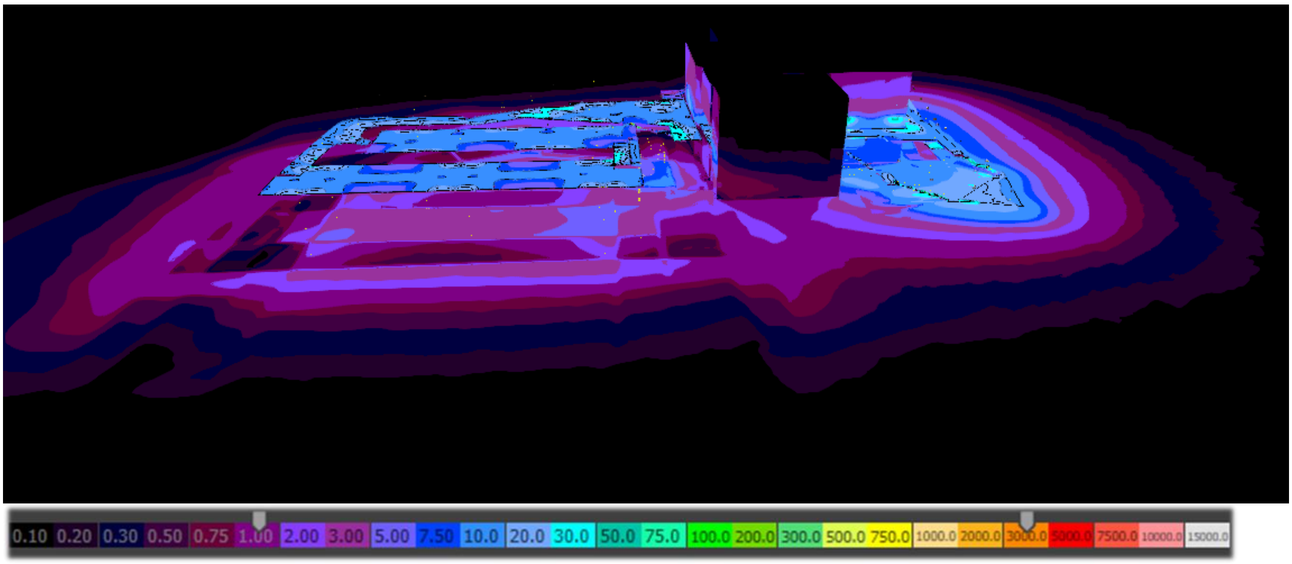


Figure 15: 3D Model lighting visualization –View from right side

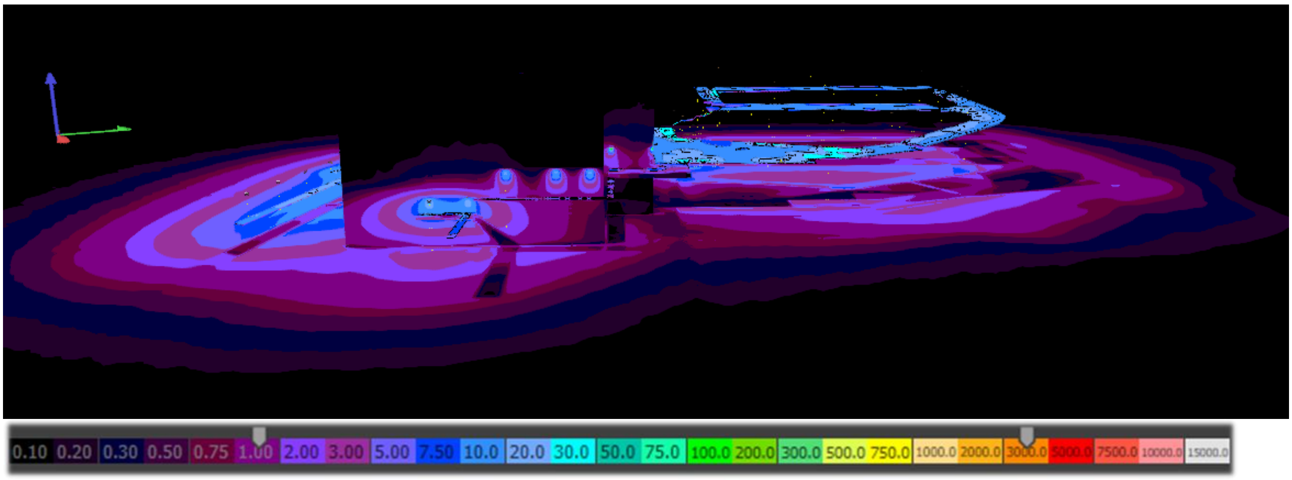


Figure 16: 3D Model lighting visualization. View from left side

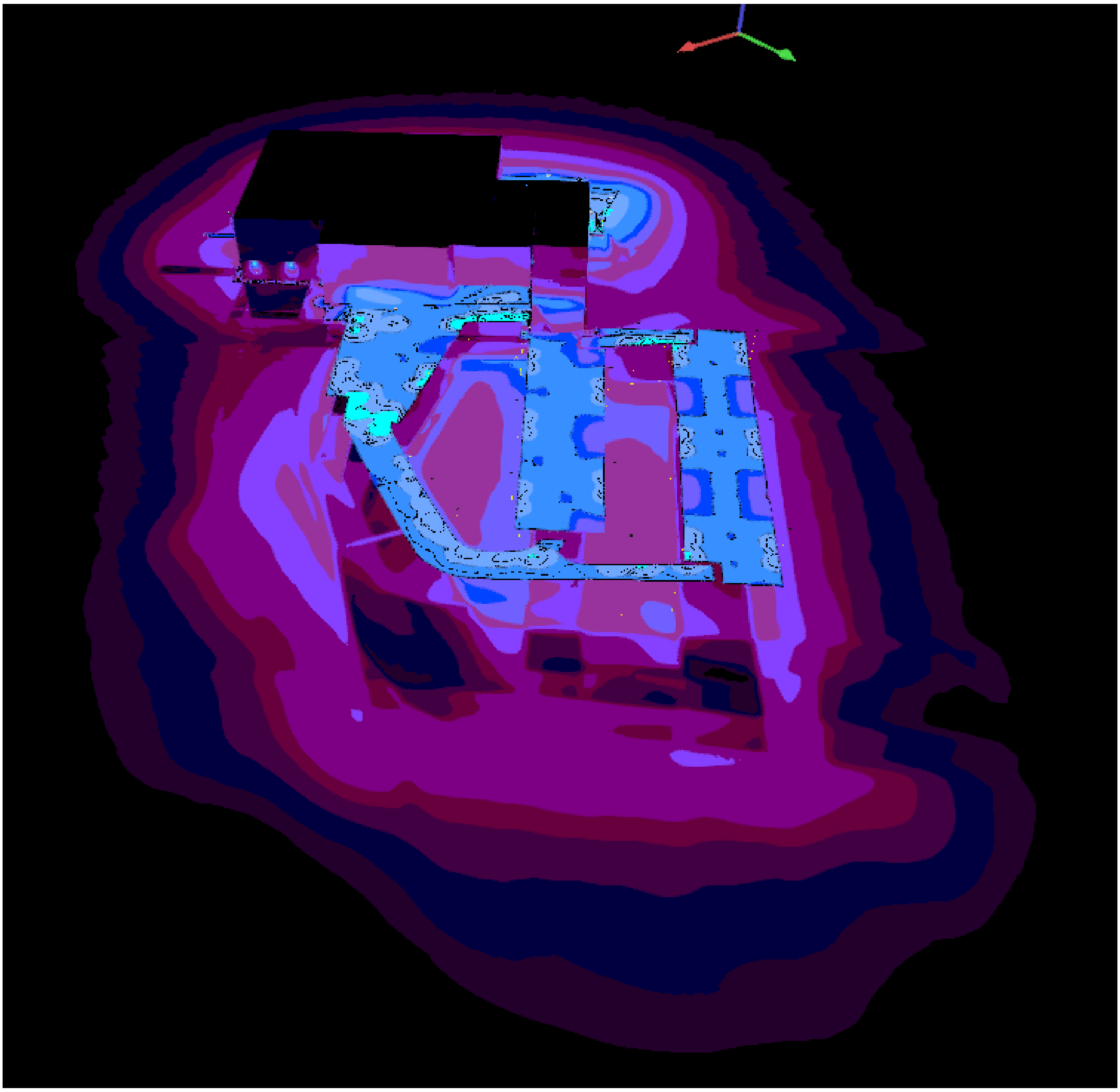
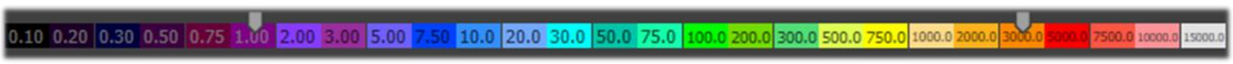


Figure 17: 3D Model lighting visualization from back



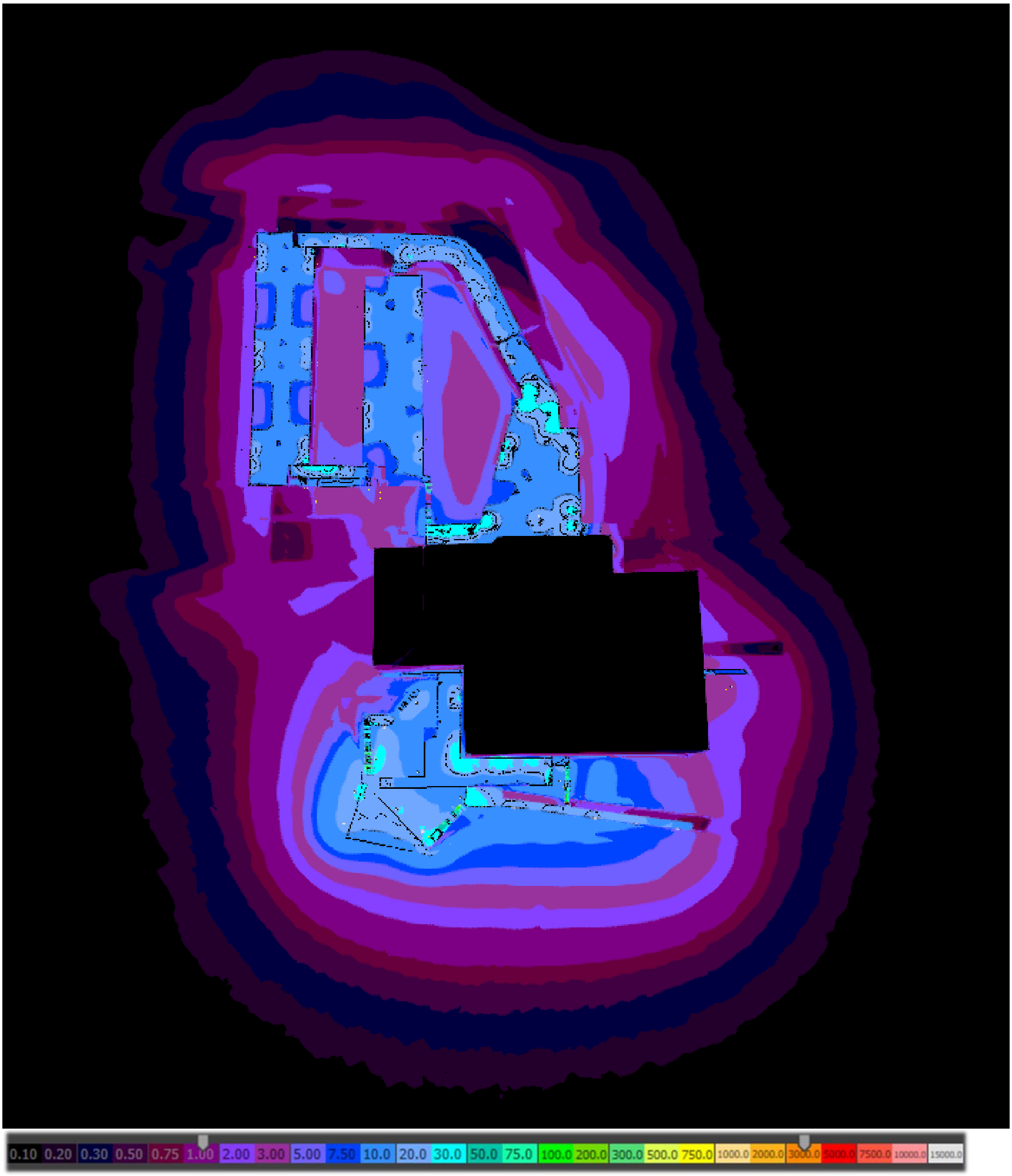


Figure 18: 3D Model lighting visualization –Birds eye view

7 Luminaire Schedule:

Figure 19 Luminaire XL1

Luminaire XL1 –
14.4W LED recessed linear continuous strip light with 15mm toughened transparent glass diffuser in aluminium housing, 3000K, IP65, IK10, 1000mm L 90mm W x 90mm D.
SIMES S.P.A. Ref: S.7009.13

Figure 20-Luminaire XL2

Luminaire XL2 –
38W LED roadway lighting lantern 3000K, IP66, IK08 all mounted on a 6M pole, 655mm L x 362mm W x 155mm D.
THORN Ref: R2L2 96268439.

Figure 21 Luminaire XL3

Luminaire XL3 –
40W LED post top lantern 3000K, IP66, IK08 all mounted on a 4M pole, 700mm dia, 720mm W x 500mm H.
THORN Ref: Avenue F2, 96260065 AVF 18L70 740 RS CL BS 3550 CL2 N4M.

Figure 22 Luminaire XL4

Luminaire XL4 –
8W LED surface wall mounted light fitting 3000K, IP65, IK06, 265mm L x 110mm H x 100mm D.
THORN Ref: Cesar Rectangular 96268564 CESAR RECT 3L70 1WD 832

Figure 23 Luminaire XL5

Luminaire XL5 –
25W LED surface wall mounted light fitting 3000K, IP65, IK10 381mm L x 305mm H x 196mm D.
THORN Ref: Piazza II LED 96666264 PIAZZA II LED 2700-840 HF P ANT

Figure 24 Luminaire XL6

Luminaire XL6 –
6.5W LED continuous handrail strip light, 3000K, IP67, IK10, 341mm L x 48.3mm dia.
SCHREDER Ref: ALINEA HANDRAIL 6.5W

Figure 25 Luminaire XL7

Luminaire XL7 –
10.5W LED ground mounted recessed circular uplighter, 3000K, IP66, IK09, 260mm dia, 100mm D x 325mm Base.
SIMES S.P.A. Ref: MEGAPLANO S.5468N

Figure 26 Luminaire XL8

Luminaire XL8 –
12W LED surface wall mounted linear continuous strip light with opal diffuser in aluminium GREY housing, 3000K, IP65, IK10, 1018mm L 22mm W x 23mm D.

SIMES S.P.A. Ref: CONTINUOUS ROD MINIMAL SURFACE NEW S.2310T.14

8 Conclusion

The calculation results generated by Dialux Evo confirm that the design as presented complies with the design criteria of an E3 environment.

The design includes for mitigation to bat foraging which are light sensitive 3000k lighting is being used throughout.

Generally light fittings used have no upward light output throughout to minimise light spill.

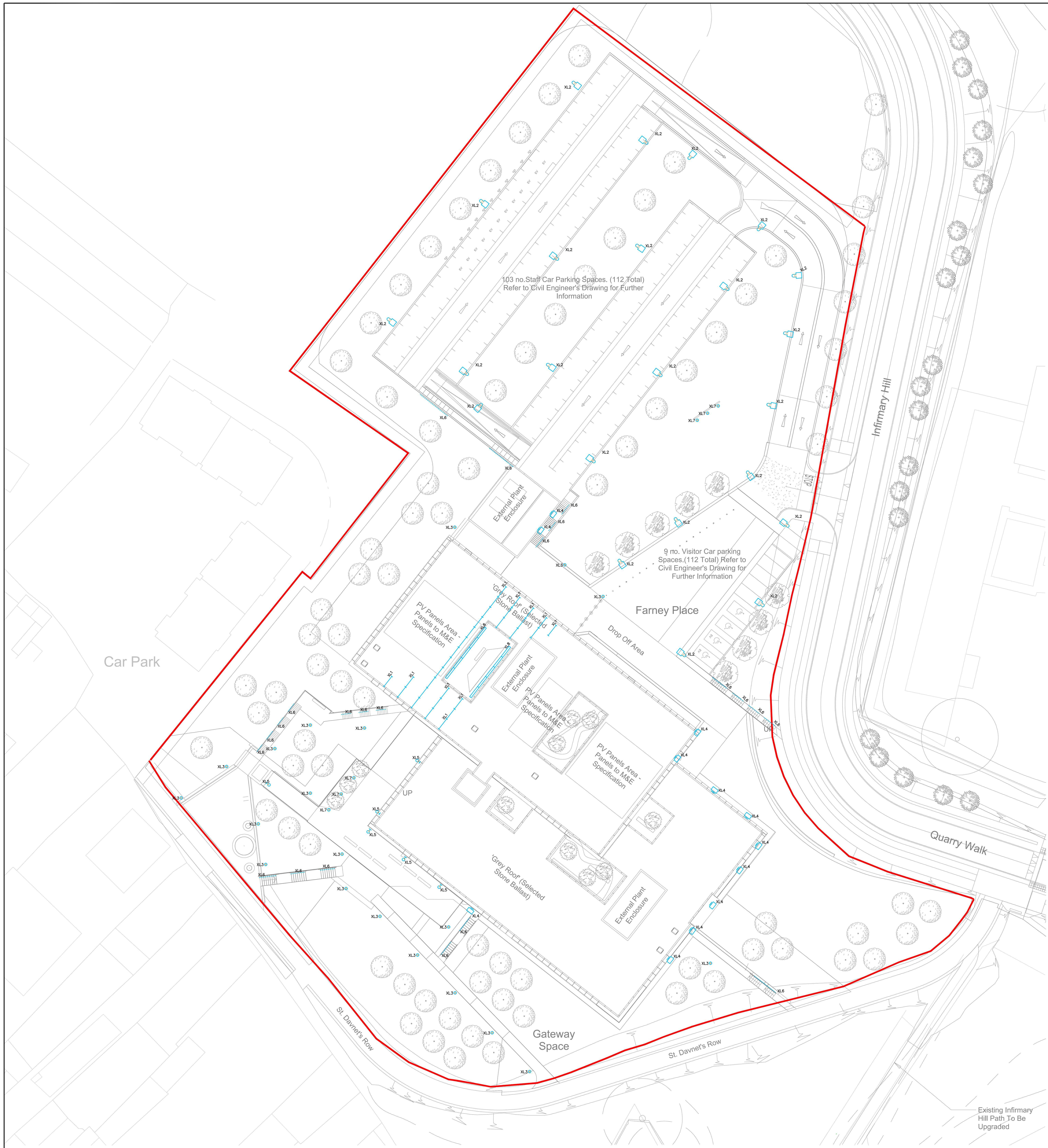
Good optical control will be used with an upward light ratio of 0% for fittings.

The proposed layout offers a design aesthetically pleasing for occupants and for the site as a whole.

Homan O' Brien believe the proposed layout will blend seamlessly into the surrounding environment.

Appendix 1: Drawings

2221-P-E1000 Rev 'P-01'- Site Plan - Site Lighting Layout.
2221-P-E1004 Rev 'P-01'- Site Plan – Site Lighting Isolines Layout.



Notes:

1. The installation shall comply fully with IS1010 Regulations.
2. Refer to Lighting Impact Assessment for specification for all light fittings.

Symbols Reference:

XL1	14.4 W LED Continuous Recessed 3000K, IP65, IK10.
XL2	38 W LED, Roadway Lighting Lantern, 3000K, IP65, IK08, All mounted on A 6m Pole.
XL3	40 W LED, Post Top Lantern Light Fitting, 3000K,IP65, IK08, All mounted on A 4m Pole.
XL4	8 W LED, Surface Wall Mounted Light Fitting, 3000K, IP65, IK06.
XL5	25 W LED, Surface Wall Mounted Light Fitting, 3000K, IP65, IK06.
XL6	6.5 W LED Continuous Handrail Strip Light 3000K, IP65, IK10.
XL7	10.5 W LED Ground Mounted Recessed Circular Uplighter, 3000K, IP65, IK09.
XL8	14.4 W LED Continuous Surface 3000K, IP65, IK10.

ISSUED FOR PLANNING

0 6 12 18 24 30
METRES

Revision	Issue: P–Preliminary T–Tender CN–Construction A–Approval I–Information	Date	Checked

Revision	Issue: P–Preliminary T–Tender CN–Construction A–Approval I–Information	Date	Checked

Revision	Issue: P–Preliminary T–Tender CN–Construction A–Approval I–Information	Date	Checked
P01	Issued for Planning.	23–11–2023	S.S.

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Monaghan Co. Council,
New Civic Offices
Dublin Street North,
Monaghan, Co. Monaghan.

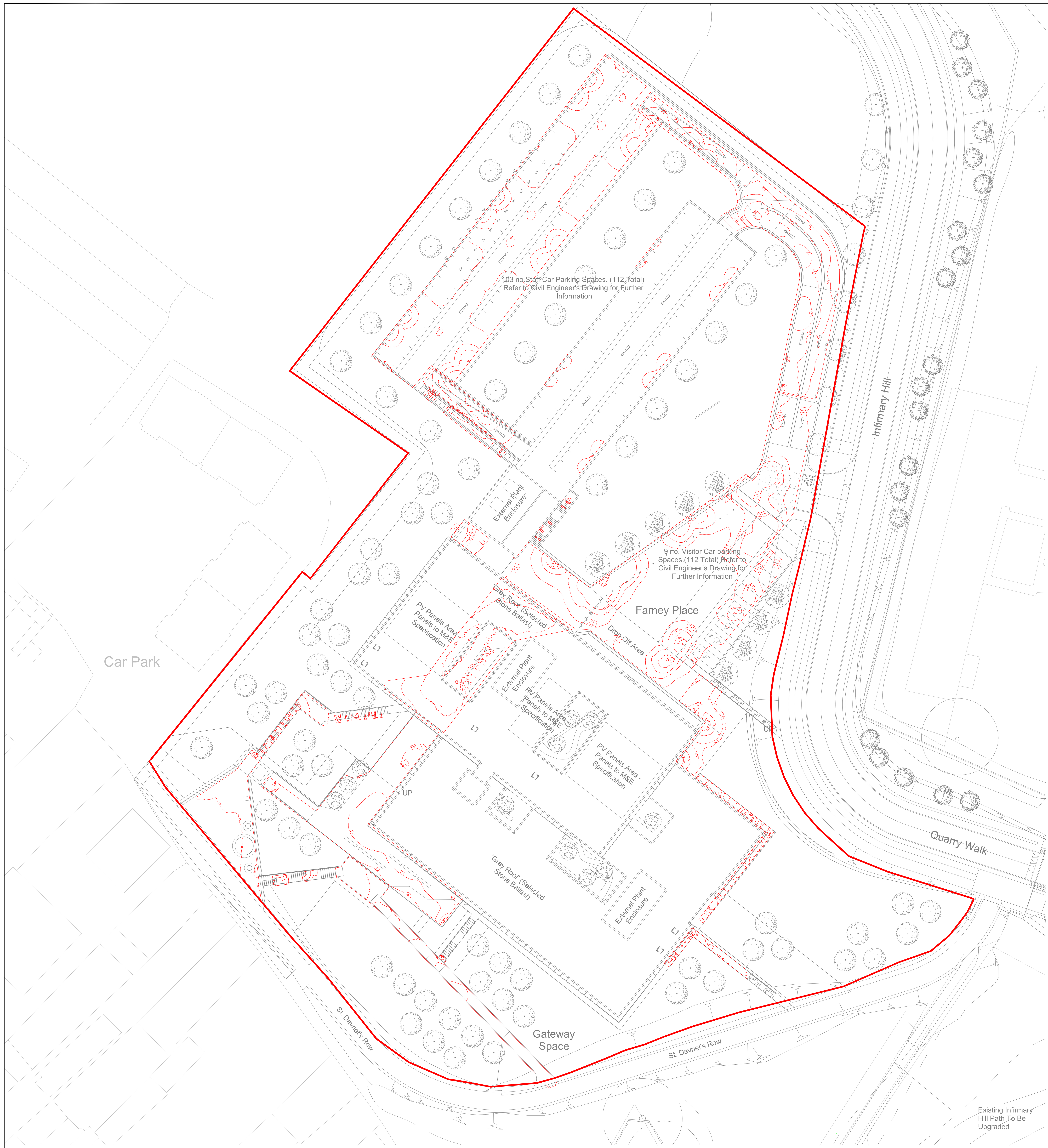
Monaghan Co. Council,
The Glen,
Glen Road, Killygowan,
Monaghan, Co. Monaghan.

Electrical Services Installation

Site Plan
Site Lighting Layout

Henry J Lyons Architect's.
51–54 Pearse Street,
Dublin, Ireland.
D02 KA66

Drawing Number	Date	Scale	Drawn	Checked	Issue
2221–E1000	30–01–2023	Refer to Scalebar	J.S.	B.H.	P01



ISSUED FOR PLANNING

0 6 12 18 24 30
METRES

Revision	Issue: P-Preliminary T-Tender CN-Construction A-Approval I-Information	Date	Checked	Revision	Issue: P-Preliminary T-Tender CN-Construction A-Approval I-Information	Date	Checked	Revision	Issue: P-Preliminary T-Tender CN-Construction A-Approval I-Information	Date	Checked
									Issued for Planning.	23-11-2023	P01 S.S.

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Monaghan Co. Council, New Civic Offices Dublin Street North, Monaghan, Co. Monaghan.	Monaghan Co. Council, The Glen, Glen Road, Killygowan, Monaghan, Co. Monaghan.
Electrical Services Installation Site Plan Site Lighting Isolines Layout	Henry J Lyons Architect's. 51-54 Pearse Street, Dublin, Ireland. D02 KA66

Drawing Number	Date	Scale	Drawn	Checked	Issue
2221-E1003	30-01-2023	Refer to Scalebar	J.S.	B.H.	P01

HOMAN O'BRIEN
Engineering Excellence.

Appendix 2: Monaghan Active Travel – Public Lighting Calculation Report

SES 08623 Rev A Monaghan Active Travel - Public lighting Calculation Report - DBFL

DATE:	**18 August 2023**
DESIGNER:	**Alex Naper**
PROJECT No:	**SES 08623 Rev A**
PROJECT NAME:	**Monaghan Active Travel - DBFL**

Sabre ELECTRICAL SERVICES LTD.

Carriageway designed in accordance with EN13201-2:2015 Category M6
Combned foot & cycle path designed in accordance with EN13201-2:2015 Category P4.

Road section back of path to back of path meets recommendations of EN13201-2:2015 Category P3.

Rev A: Updated Site layout

Outdoor Lighting Report

PREPARED BY: Sabre Electrical Services Ltd.
Unit 11,
Bellview Industrial Estate,
Tolka Valley Road,
Dublin 11
Phone Number: 01 8110875
Contact: Graham Sheehan
eMail: graham@sabrelighting.ie

Layout Report

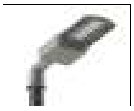
General Data

Dimensions in Metres Angles in Degrees

Calculation Grids

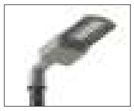
ID	Grid Name	X	Y	X' Length	Y' Length	X' Spacing	Y' Spacing
1	Grid 1	667561.31	833598.37	186.00	78.00	1.50	1.50
2	Grid 2	667649.87	833704.12	47.97	54.00	1.50	1.50
3	Grid 3	667526.38	833668.91	186.00	335.00	1.50	1.50
4	Grid 4	667348.93	833658.80	193.15	166.00	1.50	1.50

Luminaires



Luminaire A Data

Supplier	C U Phosco
Type	E951-64-R2-G-727-W5-0500-45W
Lamp(s)	727SS
Lamp Flux (klm)	6.48
File Name	E951-64-R2-G-727-W5-0500-45W.ies
Maintenance Factor	0.87
Imax70,80,90(cd/klm)	346.8, 69.5, 0.0
No. in Project	5



Luminaire B Data

Supplier	C U Phosco
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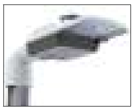
Lamp(s)	727SS
Lamp Flux (klm)	6.41
File Name	E951-64-H1-G-727-W5-0500-45W.ies
Maintenance Factor	0.87
Imax70,80,90(cd/klm)	376.6, 84.9, 0.0
No. in Project	12



Luminaire C Data

Supplier	C U Phosco
Type	E950-28-P4A-727-C600-16W
Lamp(s)	727N
Lamp Flux (klm)	2.19
File Name	E950-28-P4A-727-C0600-16W.ies
Maintenance Factor	0.83
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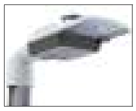
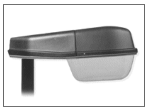
No. in Project	3



Luminaire E Data

Supplier	C U Phosco
Type	E950-28-R3A-727-C250-8W
Lamp(s)	727N
Lamp Flux (klm)	0.98
File Name	E950-28-R3A-727-C0250-8W.ies
Maintenance Factor	0.83
Imax70,80,90(cd/klm)	716.7, 30.5, 0.3
No. in Project	16



Luminaire F Data

Supplier	_Historic Lanterns
Type	ZX3/Clear_P/1289/120/-41x/922305*
Lamp(s)	100W-SONT+
Lamp Flux (klm)	10.70
File Name	ZX3_Clear Poly._1289_SON-T+_100_120#-41x_922305TW.ldt
Maintenance Factor	0.75
Imax70,80,90(cd/klm)	542.7, 67.2, 49.8
No. in Project	1

Layout

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
1	A	667587.77	833653.22	8.00	292.00	5.00	0.00	1.00			
2	F	667556.00	833637.75	8.00	292.00	5.00	0.00	1.00			
3	A	667617.55	833670.80	8.00	292.00	5.00	0.00	1.00			
4	A	667645.95	833690.79	8.00	302.00	5.00	0.00	1.00			
5	A	667663.72	833708.69	8.00	32.00	5.00	0.00	1.00			
6	A	667643.88	833733.22	8.00	49.00	5.00	0.00	1.00			
7	C	667662.89	833749.63	6.00	130.00	5.00	0.00	0.40			
8	E	667684.33	833717.95	5.00	321.00	5.00	0.00	0.40			
9	B	667625.43	833751.22	8.00	56.00	5.00	0.00	1.00			
10	B	667595.14	833765.94	8.00	74.00	5.00	0.00	1.00			
11	B	667562.75	833776.56	8.00	71.00	5.00	0.00	1.00			
12	B	667530.18	833787.36	8.00	75.00	5.00	0.00	1.00			
14	B	667498.96	833801.72	8.00	42.00	5.00	0.00	1.00			
15	B	667492.22	833838.73	8.00	348.00	5.00	0.00	1.00			
16	B	667499.71	833871.99	8.00	348.00	5.00	0.00	1.00			
18	B	667506.85	833905.77	8.00	348.00	5.00	0.00	1.00			
19	B	667512.07	833938.34	8.00	13.00	5.00	0.00	1.00			
20	B	667496.75	833966.20	8.00	55.00	5.00	0.00	1.00			
21	B	667472.20	833989.36	8.00	46.00	5.00	0.00	1.00			
22	B	667456.35	834001.38	8.00	129.00	5.00	0.00	1.00			
23	C	667481.11	834008.15	6.00	134.00	5.00	0.00	1.00			
22	E	667519.48	833769.41	5.00	110.00	0.00	0.00	0.40			
23	E	667493.37	833760.98	5.00	107.00	0.00	0.00	0.40			
24	E	667467.17	833752.55	5.00	107.00	0.00	0.00	0.40			
25	E	667443.29	833745.29	5.00	100.00	0.00	0.00	0.40			
26	E	667416.83	833749.74	5.00	65.00	0.00	0.00	0.40			
27	E	667398.87	833768.31	5.00	45.00	0.00	0.00	0.40			
28	E	667383.15	833787.34	5.00	39.00	0.00	0.00	0.40			
29	E	667366.87	833806.86	5.00	41.00	0.00	0.00	0.40			
30	E	667510.99	833745.43	5.00	151.00	0.00	0.00	0.40			
31	E	667523.52	833765.58	5.00	151.00	0.00	0.00	0.40			
32	E	667500.63	833728.76	5.00	141.00	0.00	0.00	0.40			
33	E	667491.08	833705.83	5.00	154.00	0.00	0.00	0.40			
34	E	667494.48	833688.77	5.00	188.00	0.00	0.00	0.40			
35	E	667474.60	833667.16	5.00	112.00	0.00	0.00	0.40			
36	E	667489.29	833674.79	5.00	125.00	0.00	0.00	0.40			

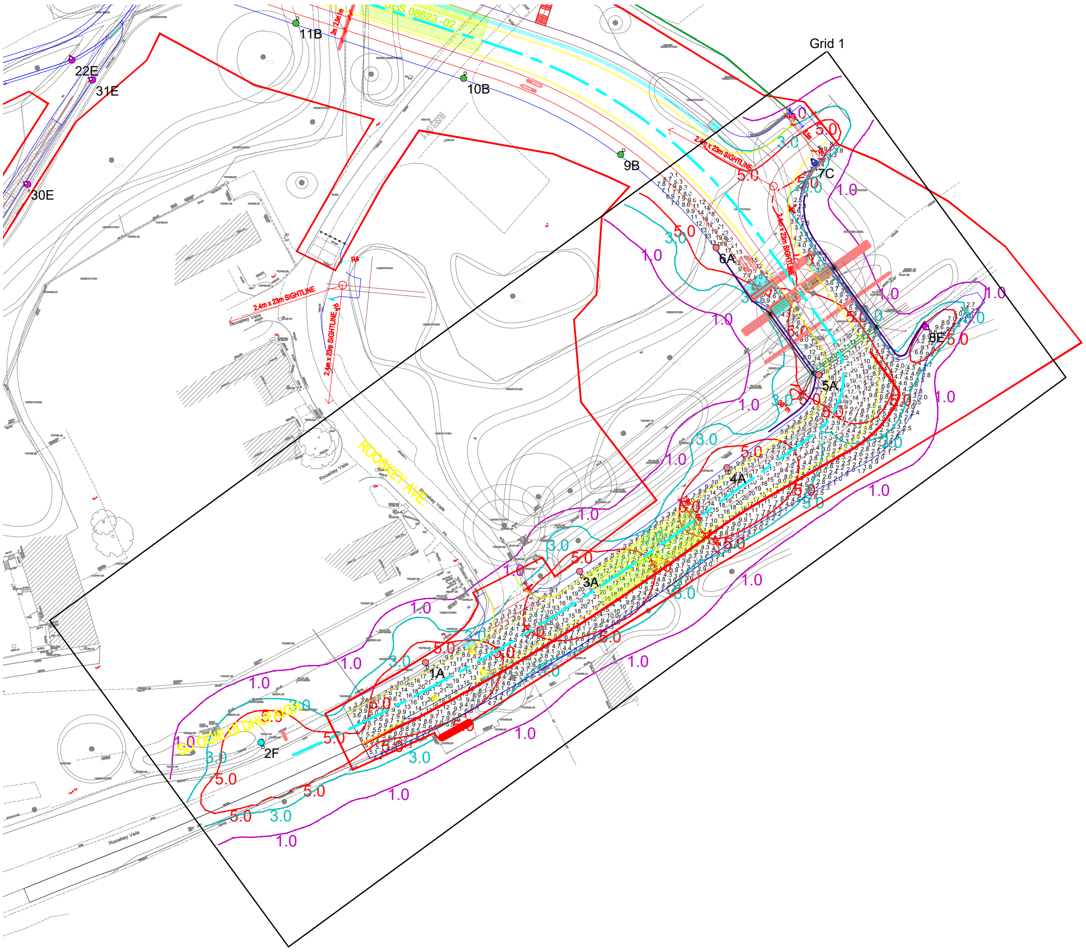
8514621427

Layout Continued

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
39	C	667677.09	833811.58	6.00	225.00	5.00	0.00	0.40			

Horizontal Illuminance (lux)

Grid 1



Results

Eav	8.13
Emin	1.74
Emax	22.11
Emin/Emax	0.08
Emin/Eav	0.21

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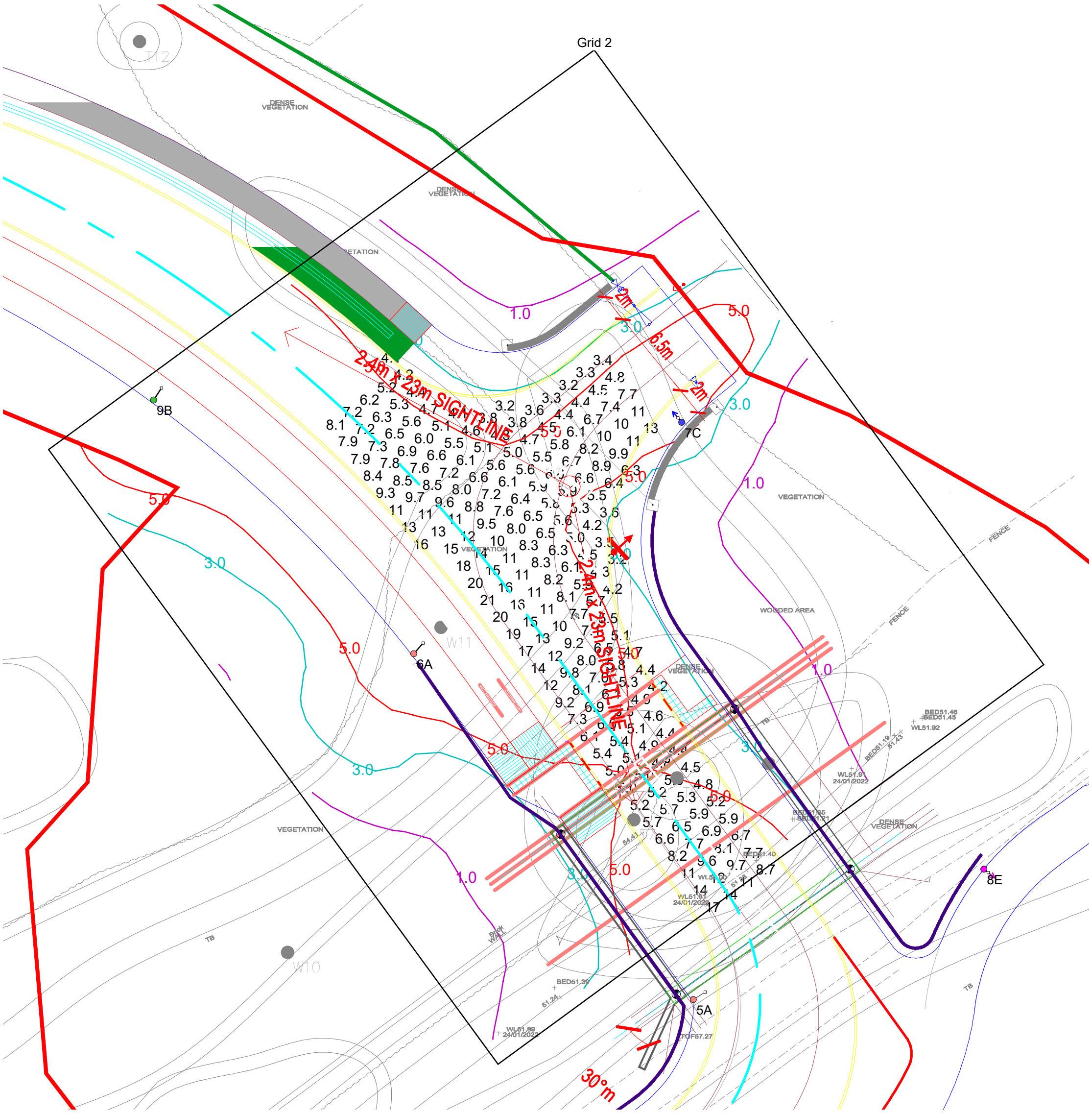
Horizontal Illuminance (lux)

Grid 2



Results

Eav	7.66
Emin	3.19
Emax	20.86
Emin/Emax	0.15
Emin/Eav	0.42

Horizontal Illuminance (lux)

Grid 3

Results

Eav	8.30
Emin	1.96
Emax	19.15
Emin/Emax	0.10
Emin/Eav	0.24

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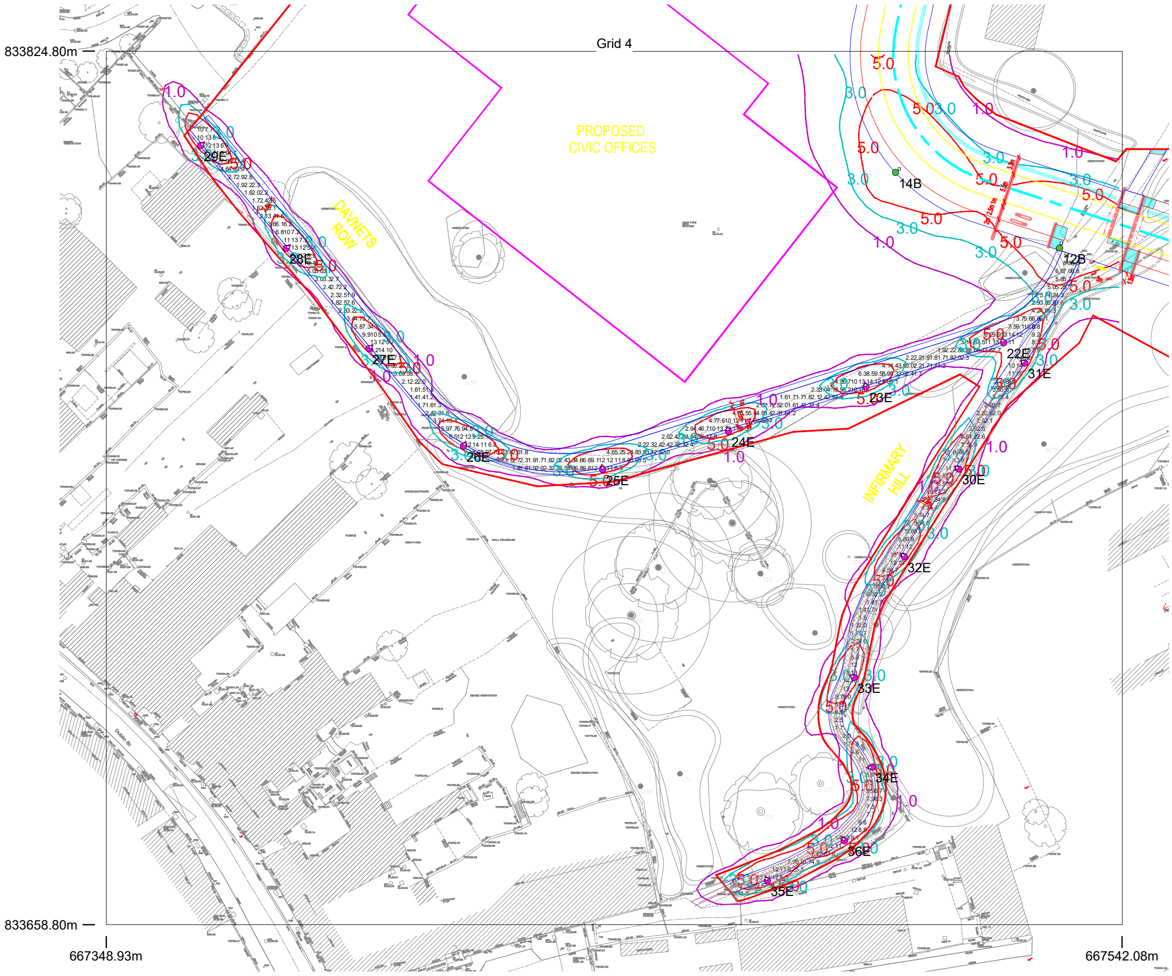
Horizontal Illuminance (lux)

Grid 4



Results

Eav	6.01
Emin	1.17
Emax	14.45
Emin/Emax	0.08
Emin/Eav	0.19

8514621427

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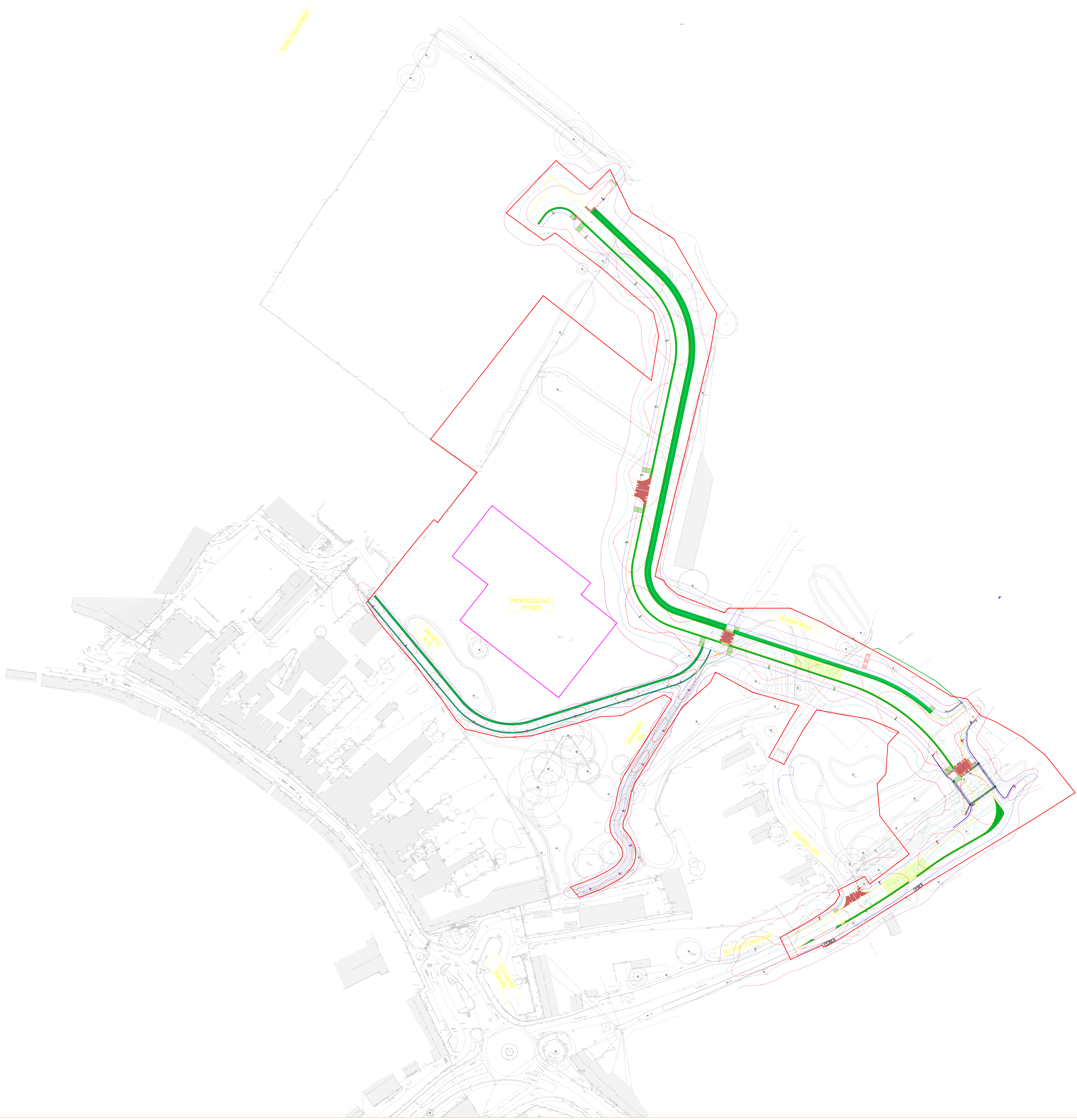
Engineering Excellence.

Appendix 3: Monaghan Active Travel – Public Lighting layout

SES 08623 Rev A Monaghan Active Travel - Public lighting Layout - DBFL



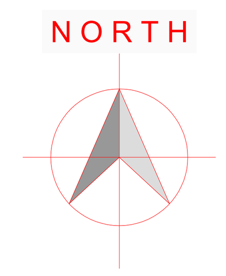
1.0 lux
3.0 lux
5.0 lux

Notes:
All LED lanterns must have Constant Light Output (CLO).
Automatically dimmed to 75% each night from 12 midnight to 6am.
(U14 Profile)
All lanterns to have 7pin NEMA sockets fitted.

Electronic Photocells switched at 35/18lux
All columns, luminaires, cable and pillars, shall comply with Local Authority General Specification for Public Lighting.

No trees to be located within falling distance of P/L columns.
Minimum set-back of columns is 800mm from face of kerb.

PL-Cable-Chamber — Public lighting cable chamber as per Local Authority P/L Dept. specification.



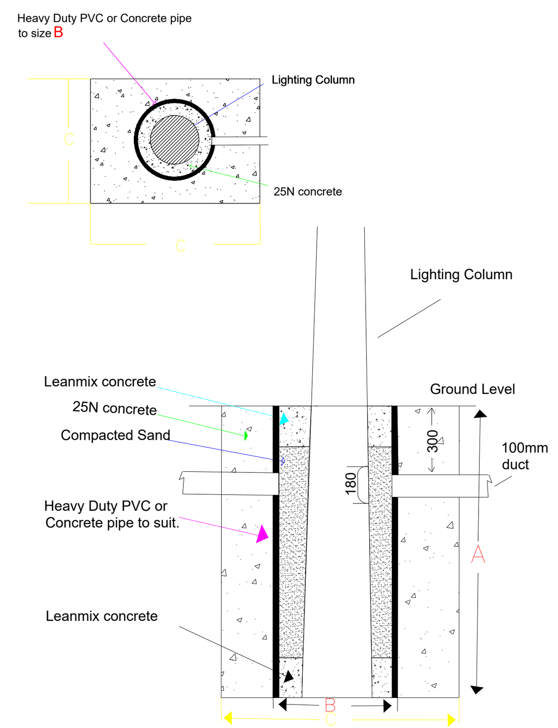
- Luminaire A E951-64-R2-G-727-W5-0500-45W
  8m Column, 0.5m outreach bracket. Qty 5
- Luminaire B E951-64-H1-G-727-W5-0500-45W
  8m Column, 0.5m outreach bracket. Qty 12
- Luminaire C E950-28-P4A-727-C600-16W
  6m Column, post top mounted. Qty 3
- Luminaire E E950-28-R3A-727-C250-8W
  5m Raise & Lower Column, post top mounted. Qty 16
- Luminaire F ZX3/Clear_P/1289/120/-41x/922305*
  Existing HID luminaire estimated as 100 Watt HPS.

PL — 2X6sq NYCY cable laid in ducting to I.S.10101:2020.
Single wall ducting, colour red to be used manufactured from high density polyethylene (H.D.P.E.), 107mm external diameter, having a wall thickness of 5mm.
This ducting to have the words "Street Lighting" stamped on, letter size 9mm at 1m intervals. The lettering to face uppermost in the trench. All works to Local Authority specification.
This is a circuit layout and not indicative of where ducts are to be laid.

PL Midi Pillar — Public Lighting Pillar (located at least 2m from ESB pillar)

Typical Base detail, to be checked by site engineers.

COLUMN MOUNTING HEIGHT		12m	10m	8m	6m
COLUMN ROOT DEPTH	A	1.9m	1.7m	1.5m	1.0m
CABLE ENTRY DEPTH		0.3m	0.3m	0.3m	0.3m
ROOTING CONCRETE DEPTH					
COLUMN DOOR HEIGHT		1.5m	1.5m	1.5m	1.5m
COLUMN SLEEVE SIZE(mm) internal	B	450	400	400	300
EXCAVATION (width x length)	C	1000	800	600	400



NOTES

NO ACCOUNT IS TAKEN FOR THE BLOCKING EFFECT CAUSED BY BUILDINGS, TREES ETC. THE CALCULATION SHOWN BY THIS DRAWING ASSUMES THAT THE WHOLE AREA BEING CONSIDERED IS IN THE SAME PLANE, I.E. THERE ARE NO CHANGES IN GRADIENT OR ELEVATION.

This drawing layout is based on calculated lighting levels, produced by Sabre Electrical Services Ltd., using Lighting Reality software. Any alterations to the layout or luminaire type used for the lighting design calculations, will require a revised lighting design to be carried-out. A redesign may require approval from the Local Authority Public Lighting Dept. prior to any alterations/modifications being implemented on site.

ELECTRICAL SERVICES LTD.
Specialist Contractors
PUBLIC LIGHTING - FLOOD LIGHTING - SPORTS LIGHTING

UNIT 11,
BELLVUE INDUSTRIAL ESTATE,
FINGLAS,
DUBLIN 11.
E - MAIL: graham@sabrelighting.ie PH: 01-811 0875

REV	DESCRIPTION	INITS	CHK'D	DATE
-	?	GS	CHK	---------
-	?	GS	CHK	---------
-	?	GS	CHK	---------
-	?	GS	CHK	---------
-	?	GS	CHK	---------
-	?	GS	CHK	---------
A	Updated site layout.	AN	CHK	18-08-23

CLIENT/CUSTOMER
DBFL

PROJECT
Monaghan Active Travel

TITLE
Public Lighting Layout

DRAWN	SCALE	DATE
A.N	1:1000@A1	24-07-23
DRAWING NUMBER		ISSUE
SES 08623		2

BASE DRAWING NUMBER

DRAWING ORIGIN

DO NOT SCALE FROM THIS DRAWING

Appendix 4: Monaghan Active Travel – Spacing Calculation

SES 08623-02 Monaghan Active Travel - Spacing Calculation - DBFL

Monaghan Active Travel

Standard	EN 13201 : 2015
Designer	Alex Naper
Project #	SES 08623
Study #	01
Date	24/07/2023
Application	Ulysse 3.5.2
Description	Carriageway designed in accordance with EN13201-2:2015 Category M5
	Foot/ cycle path designed in accordance with EN13201-2:2015 Category P4.

Table of contents

1. Fixtures

1.1. E951 64 LED R1 lens glass 500mA E951-64-R1-G-727-W5-0500-45W

Type E951 64 LED R1 lens glass 500mA

Source 727SS

Source flux 1.000 klm

G* 4

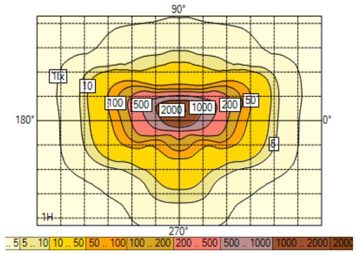
Luminaire wattage 45.0 W

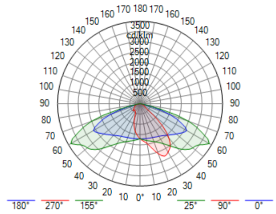
MF 0.87

Matrix E951-64-R1-G-727-W5-0500-45W

Luminaire flux 6.518 klm

Efficacy 145 lm/W

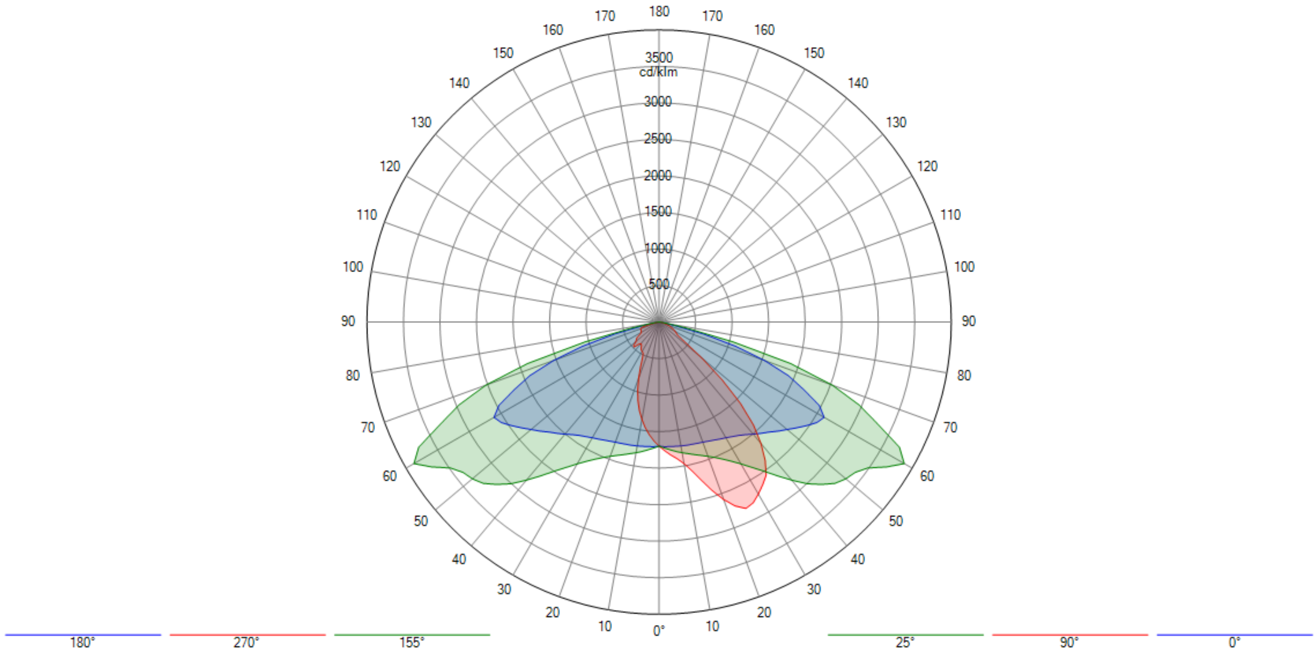




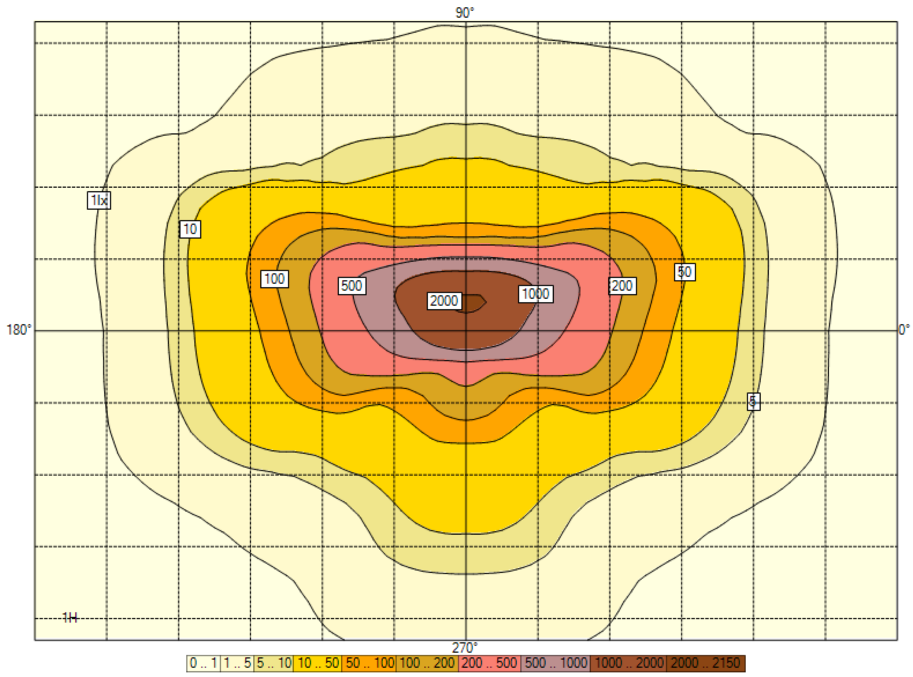
2. Photometric documents

2.1. E951 64 LED R1 lens glass 500mA E951-64-R1-G-727-W5-0500-45W

Polar/Cartesian diagram



Isolux



3. Results

3.1. Grid summary

Single lane with level (IL)

P4 (IL : Min = 1.00 lux Ave = 5.00 lux)

1. Z positive illuminance	Ave (A) (lx)	Min/Ave (%)	Min/Max (%)	Min (lx)	Max (lx)
Dynamic cross section	11.2	42	21	4.7	22.1

Single lane with level (IL) (1)

P4 (IL : Min = 1.00 lux Ave = 5.00 lux)

1. Z positive illuminance	Ave (A) (lx)	Min/Ave (%)	Min/Max (%)	Min (lx)	Max (lx)
Dynamic cross section	13.2	42	22	5.5	24.8

Multi-lanes (LU)

M5 (LU : Ave = 0.50 cd/m² Uo = 35 % Ul = 40 % UoW = 15 % TI : 15 % EIR : 0.30)

1.1 Luminance - RTable - C2007	Ave (A) (cd/m²)	Min/Ave (%)	Min/Max (%)	Min (cd/m²)	Max (cd/m²)	UL (%)
Dynamic cross section - Observer 1 (-60.00; -6.88; 1.50)	0.50	46	23	0.23	0.99	55 %
Dynamic cross section - Observer 2 (-60.00; -9.63; 1.50)	0.52	45	23	0.23	1.00	81 %

1.2 Luminance - RTable - C2007	Ave (A) (cd/m²)	Min/Ave (%)	Min/Max (%)	Min (cd/m²)	Max (cd/m²)	UL (%)
Dynamic cross section - Observer 1 (-60.00; -6.88; 1.50)	0.50	46	23	0.23	0.99	55 %
Dynamic cross section - Observer 2 (-60.00; -9.63; 1.50)	0.52	45	23	0.23	1.00	81 %

3.2. Observer summary

Multi-lanes (TI 1)

M5 (LU : Ave = 0.50 cd/m² Uo = 35 % Ul = 40 % UoW = 15 % TI : 15 % EIR : 0.30)

	TI
Dynamic cross section - Direction (0.0)	9

Multi-lanes (TI 2)

M5 (LU : Ave = 0.50 cd/m² Uo = 35 % Ul = 40 % UoW = 15 % TI : 15 % EIR : 0.30)

	TI
Dynamic cross section - Direction (0.0)	5

3.3. Values summary

EIR road

M5 (LU : Ave = 0.50 cd/m² Uo = 35 % Ul = 40 % UoW = 15 % TI : 15 % EIR : 0.30)

	EIR road
Dynamic cross section - Multi-lanes (EIR)	0.41

4. Power consumption

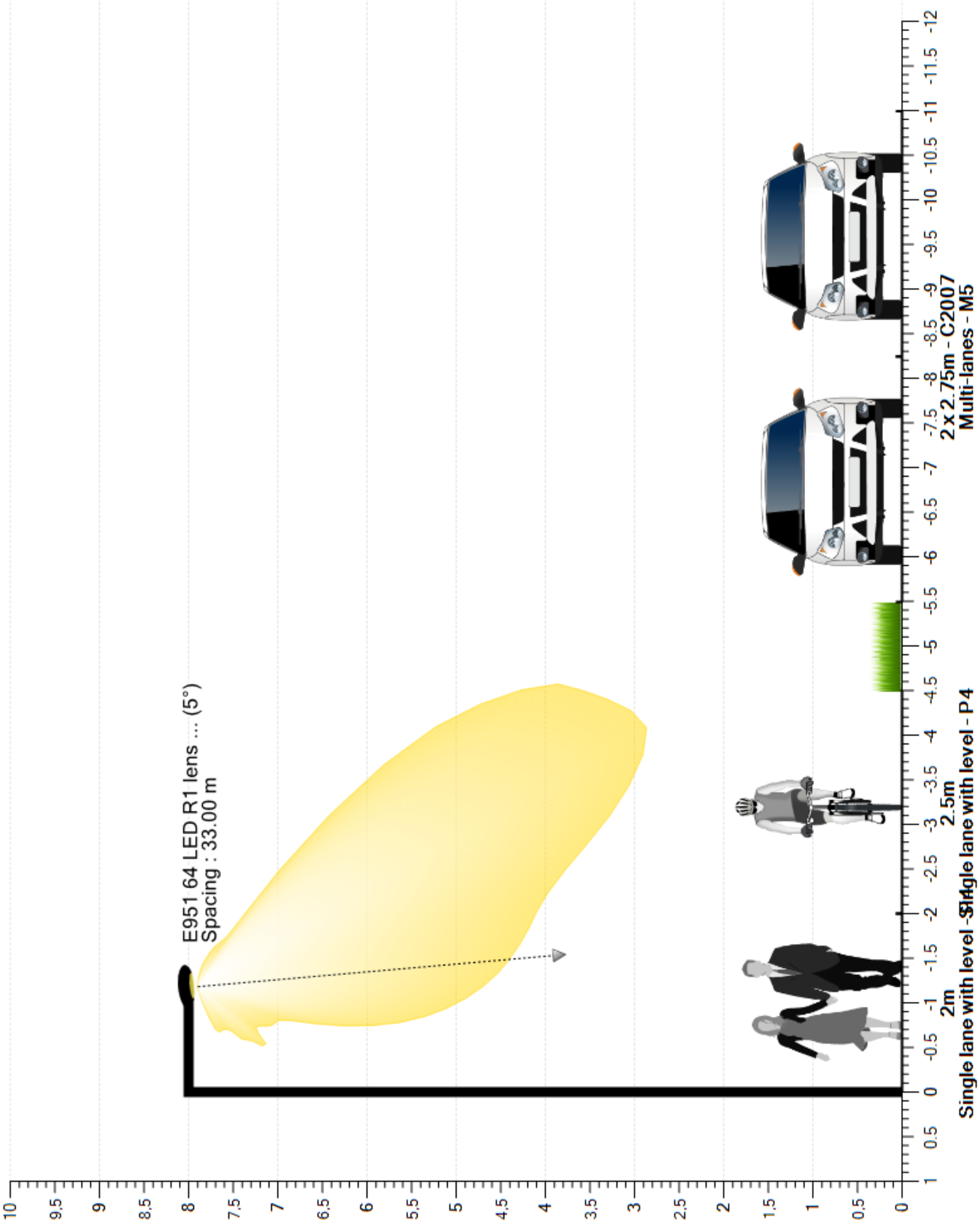
4.1. Dynamic cross section

Fixture	Current [mA]	Qty	Dimming	Power / Fixture	Total

E951 64 LED R1 lens glass 500mA E951-64-R1-G-727-W5-0500-45W	0	30	100 %	45 W	1364 W

5. Cross section

5.1. 2D View



6. Dynamic cross section

6.1. Matrix description

Ph. color	Description	Current [mA]	Source flux [klm]	Luminaire flux [klm]	Power [W]	Efficacy [lm/W]	MF	Height [m]	Fixture
	E951 64 LED R1 lens glass 500mA E951-64-R1-G-727-W5-0500-45W		1.000	6.518	45.0	145	0.870	5 x 8.00	

6.2. Luminaire positions

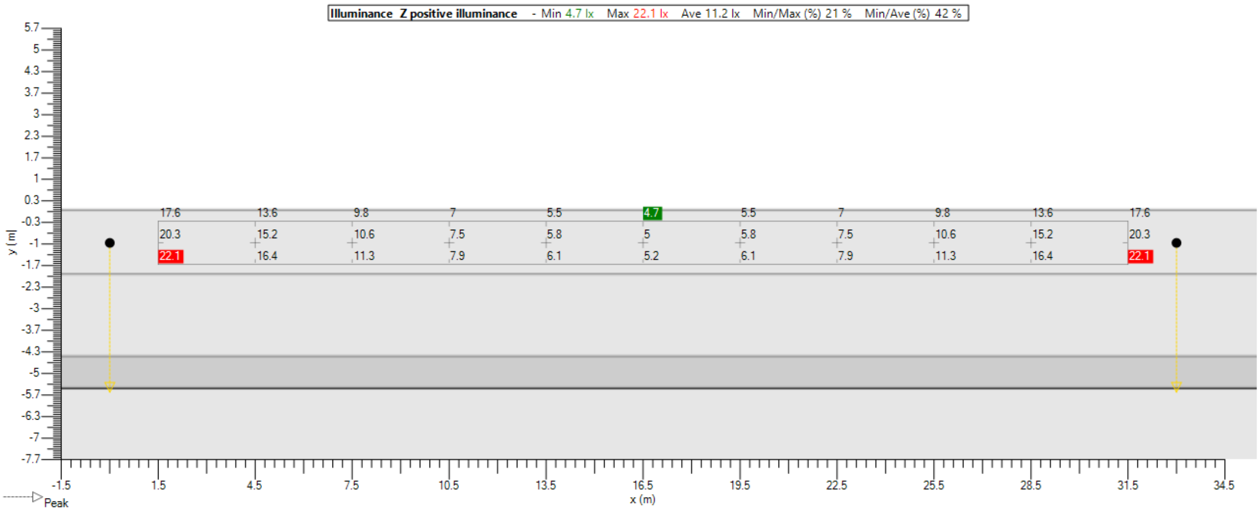
	Color	N°	Position			Luminaire							Target		
			X [m]	Y [m]	Z [m]	Name	Current [mA]	Az [°]	Incl [°]	Rot [°]	Flux [klm]	MF	X [m]	Y [m]	Z [m]
☑		1	-33.00	-1.00	8.00	E951 64 LED R1 lens glass 500mA E951-64-R1-G-727-W5-0500-45W	-	180.0	5.0	0.0	1.000	0.870	-33.00	-1.70	0.00
☑		2	0.00	-1.00	8.00	E951 64 LED R1 lens glass 500mA E951-64-R1-G-727-W5-0500-45W	-	180.0	5.0	0.0	1.000	0.870	0.00	-1.70	0.00
☑		3	33.00	-1.00	8.00	E951 64 LED R1 lens glass 500mA E951-64-R1-G-727-W5-0500-45W	-	180.0	5.0	0.0	1.000	0.870	33.00	-1.70	0.00
☑		4	66.00	-1.00	8.00	E951 64 LED R1 lens glass 500mA E951-64-R1-G-727-W5-0500-45W	-	180.0	5.0	0.0	1.000	0.870	66.00	-1.70	0.00
☑		5	99.00	-1.00	8.00	E951 64 LED R1 lens glass 500mA E951-64-R1-G-727-W5-0500-45W	-	180.0	5.0	0.0	1.000	0.870	99.00	-1.70	0.00

6.3. Luminaire groups

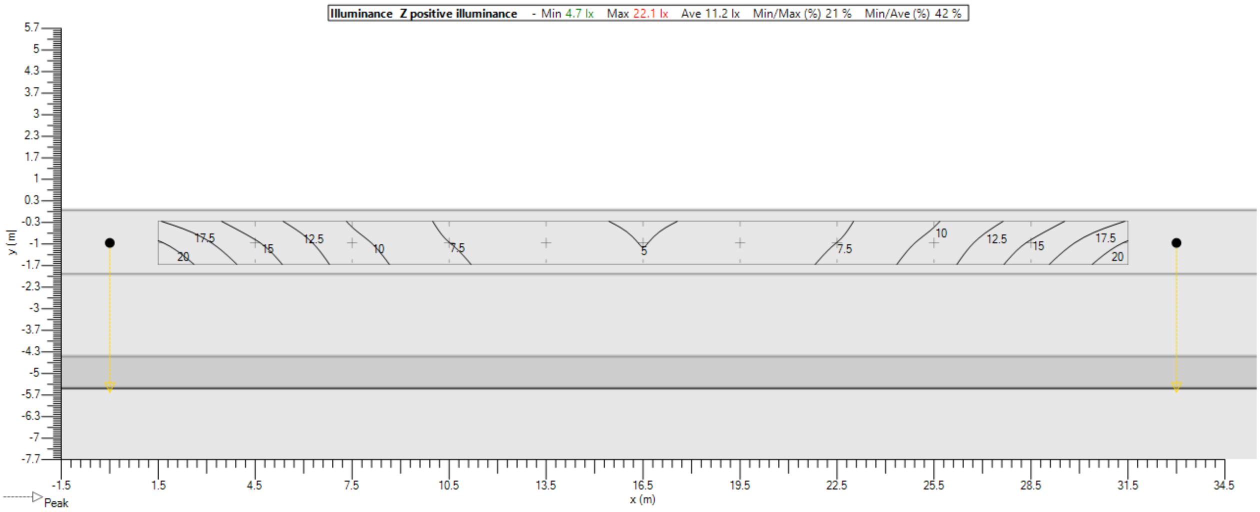
Linear																
	Color	N°	Position			Luminaire					Dimension			Rotation		
			X [m]	Y [m]	Z [m]	Name	Az [°]	Incl [°]	Rot [°]	Dim [%]	Count	Spacing [m]	Size [m]	X [°]	Y [°]	Z [°]
☑		1	-33.00	-1.00	8.00	Fixture left	180.0	5.0	0.0	100	5	33.00	132.00	0.0	0.0	0.0

6.4. Single lane with level (IL) - Z positive

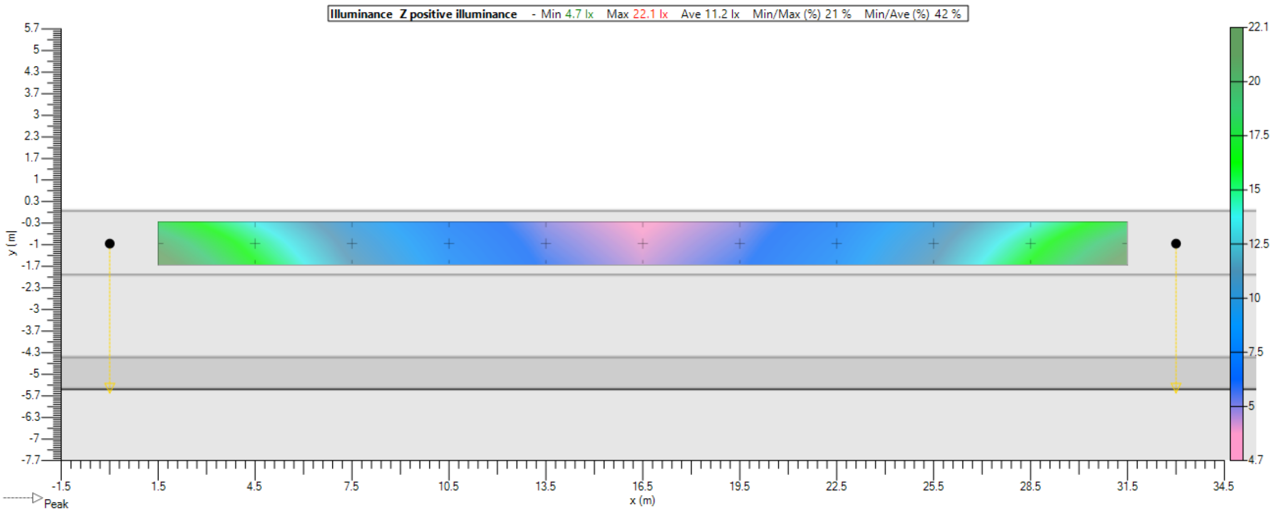
Values



Isolevel

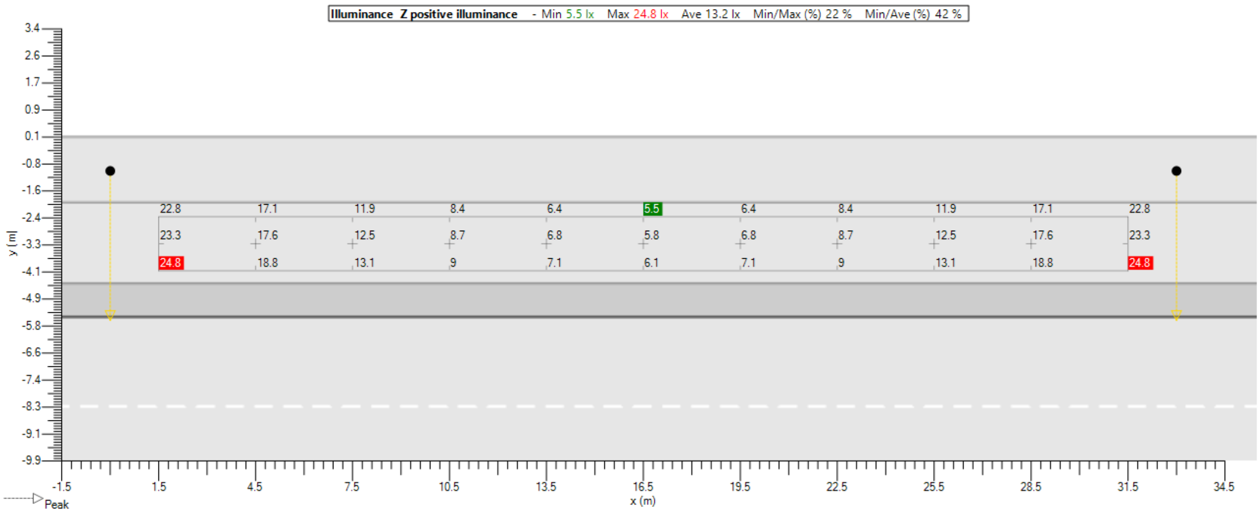


Shading

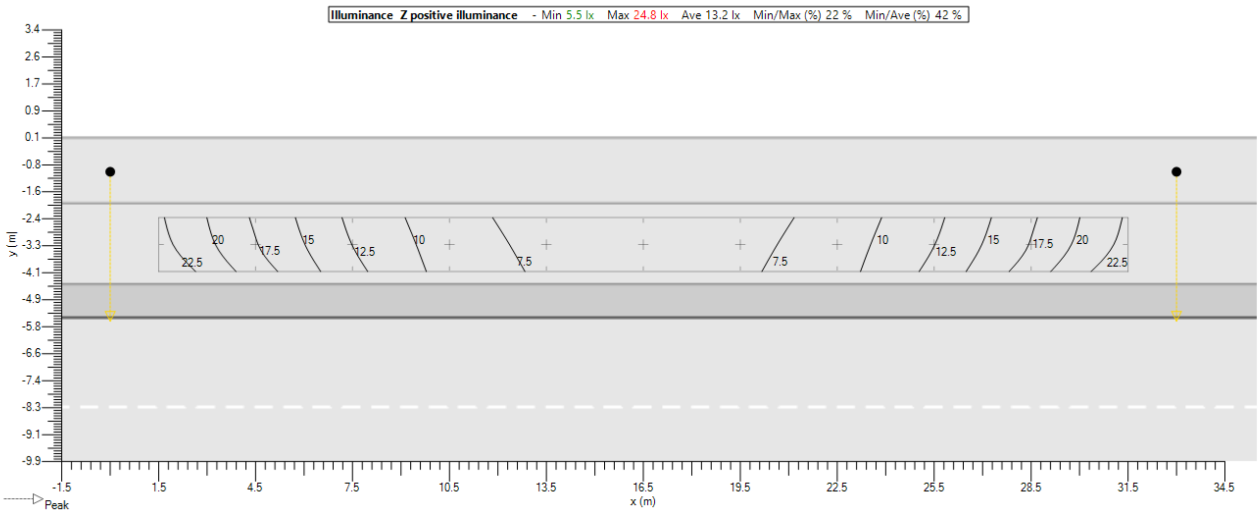


6.5. Single lane with level (IL) (1) - Z positive

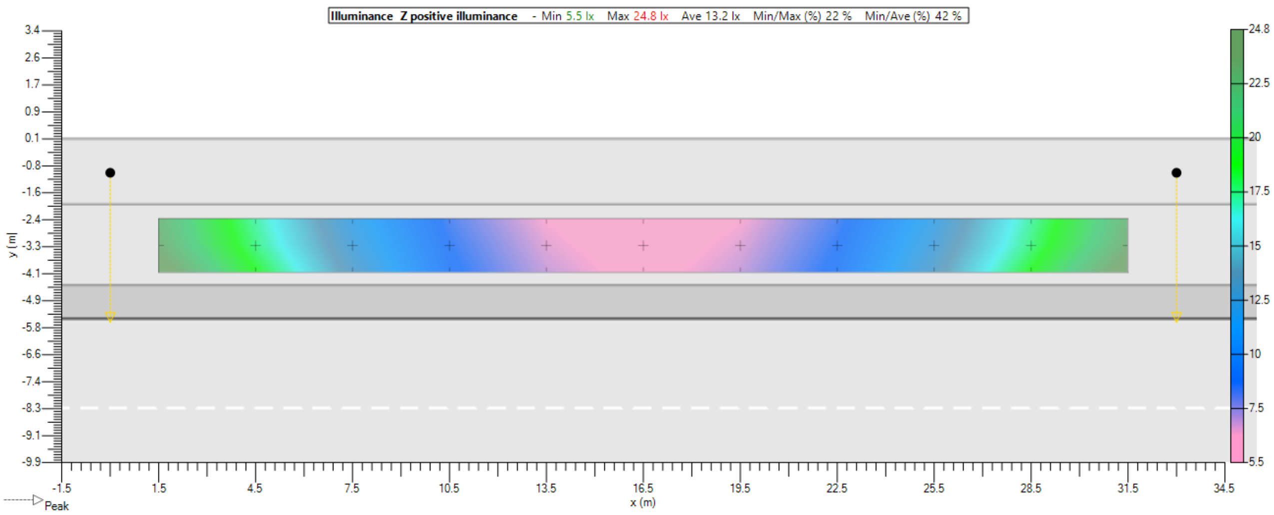
Values



Isolevel

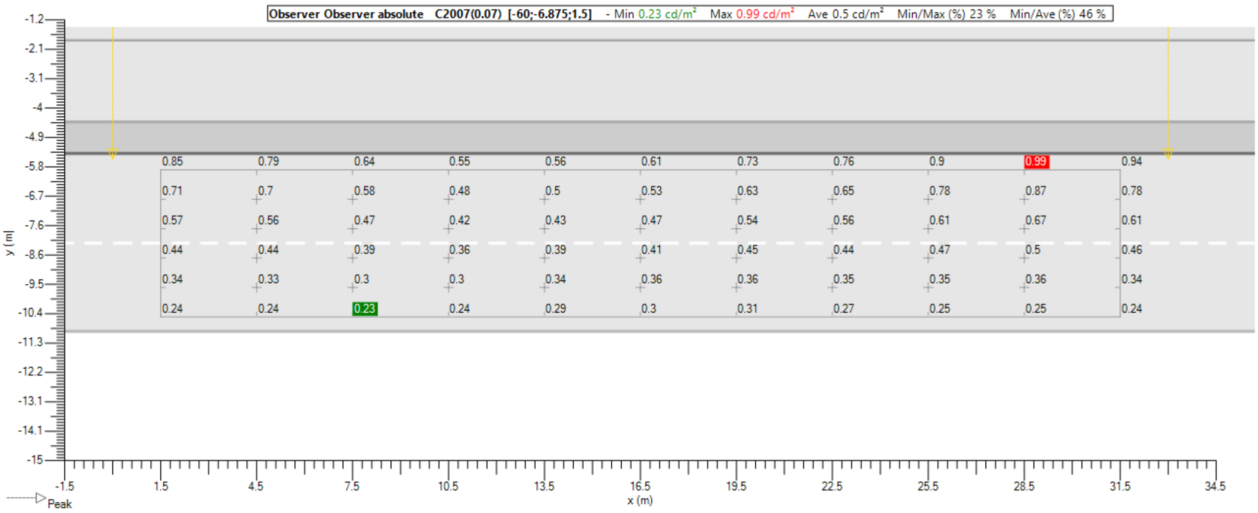


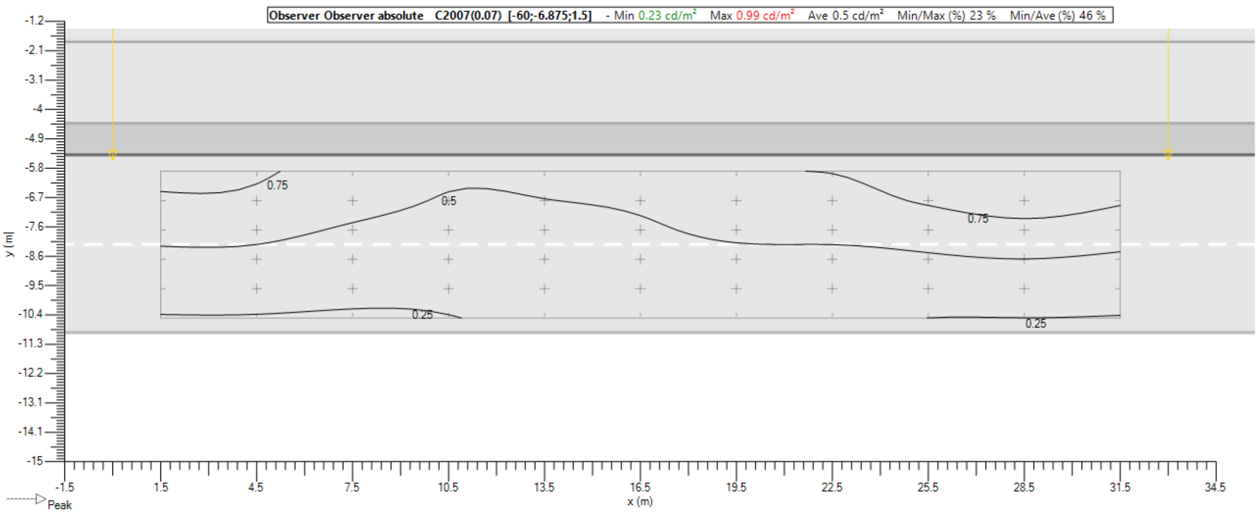
Shading

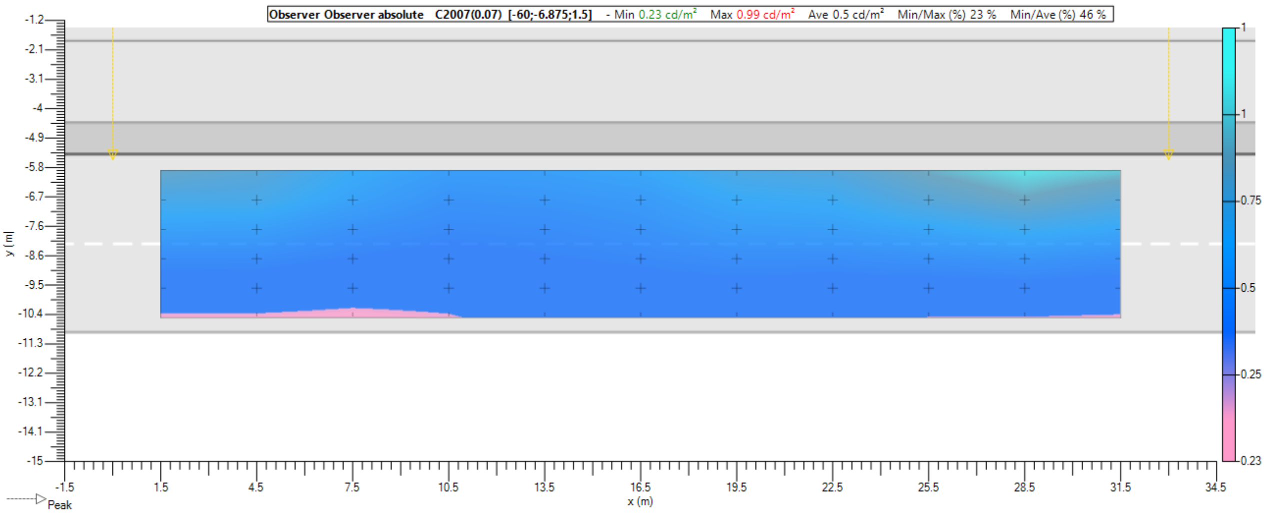


6.6. Luminance - Multi-lanes (LU) - C2007

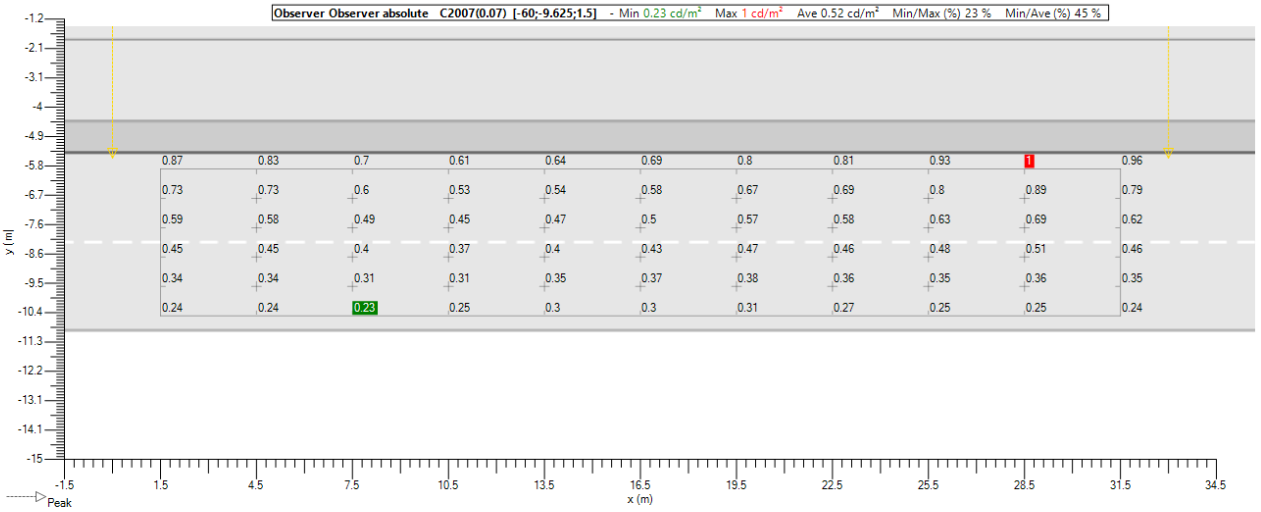
Multi-lanes (LU) - Absolute 1

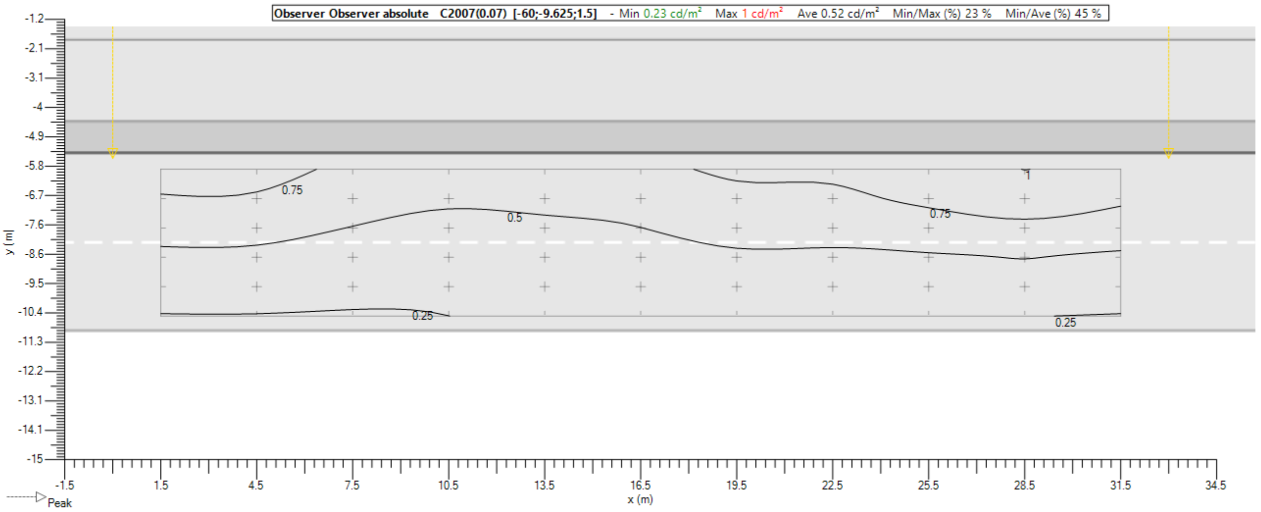


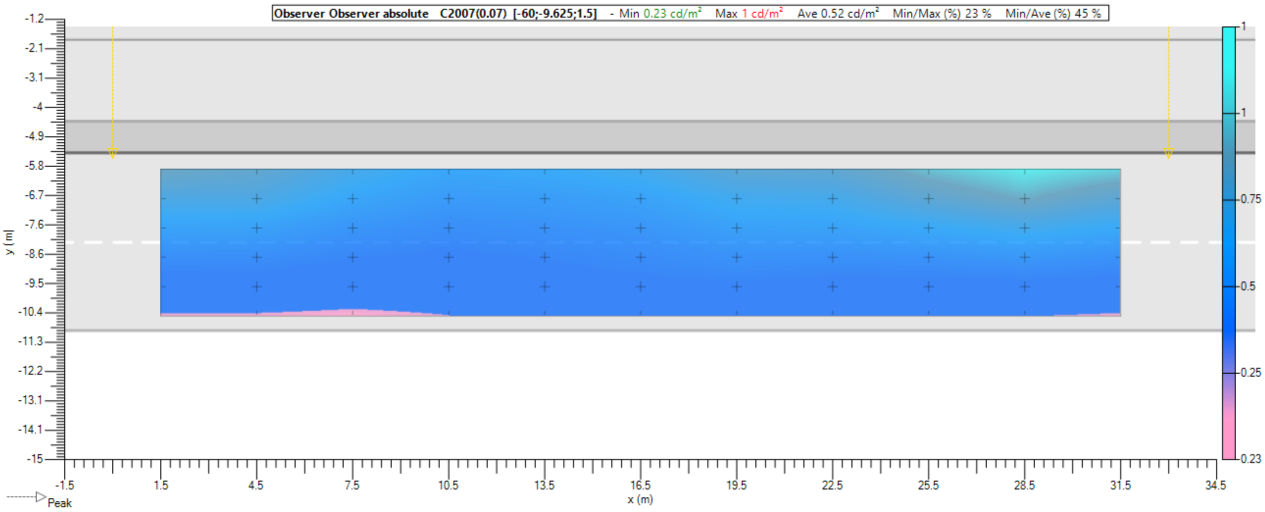




Multi-lanes (LU) - Absolute 2

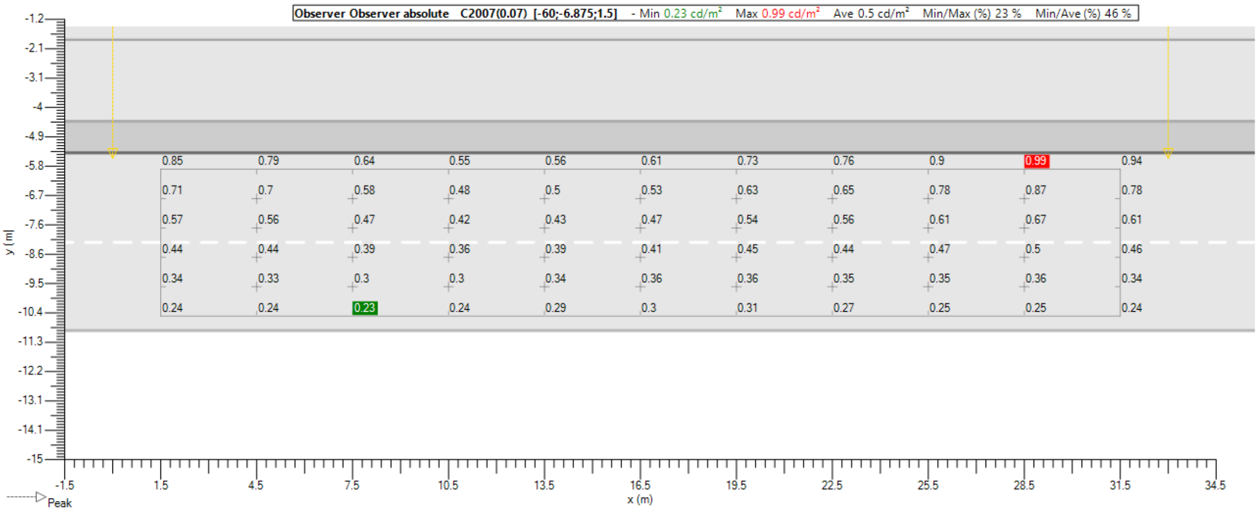


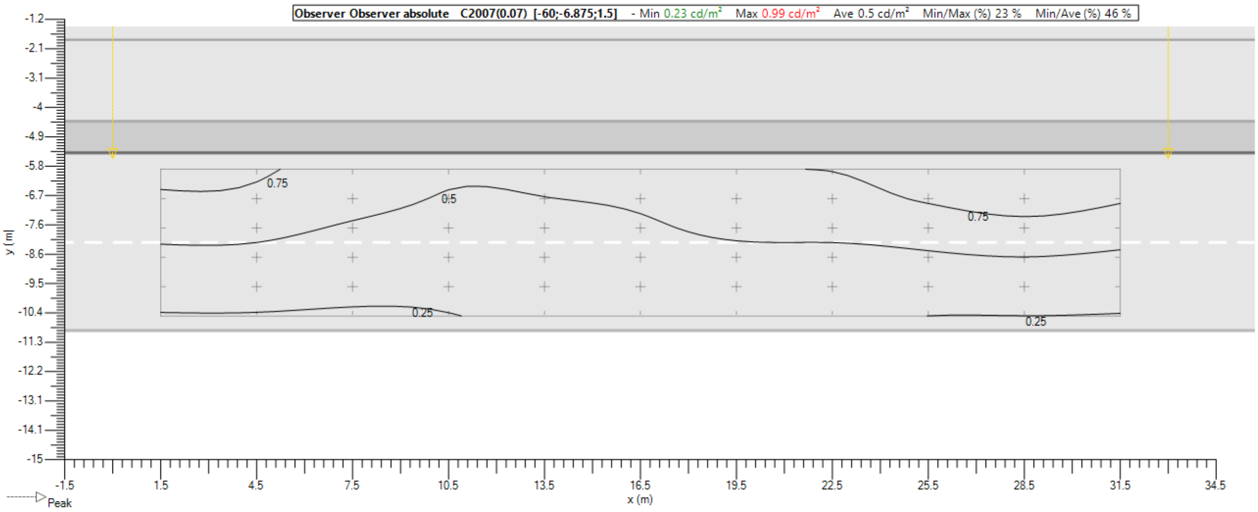


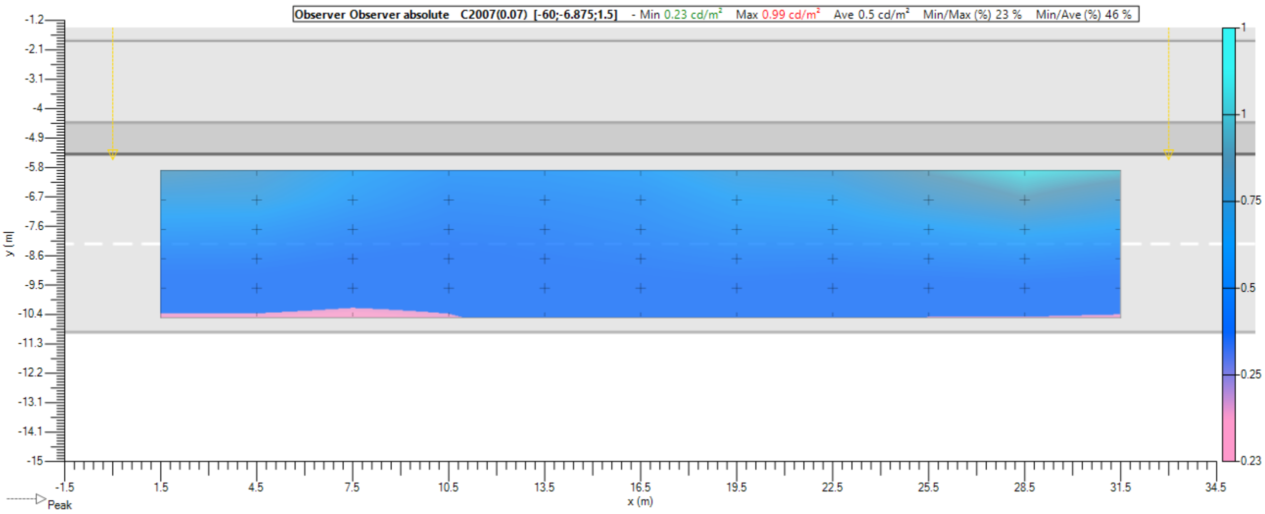


6.7. Luminance - Multi-lanes (LU) - C2007

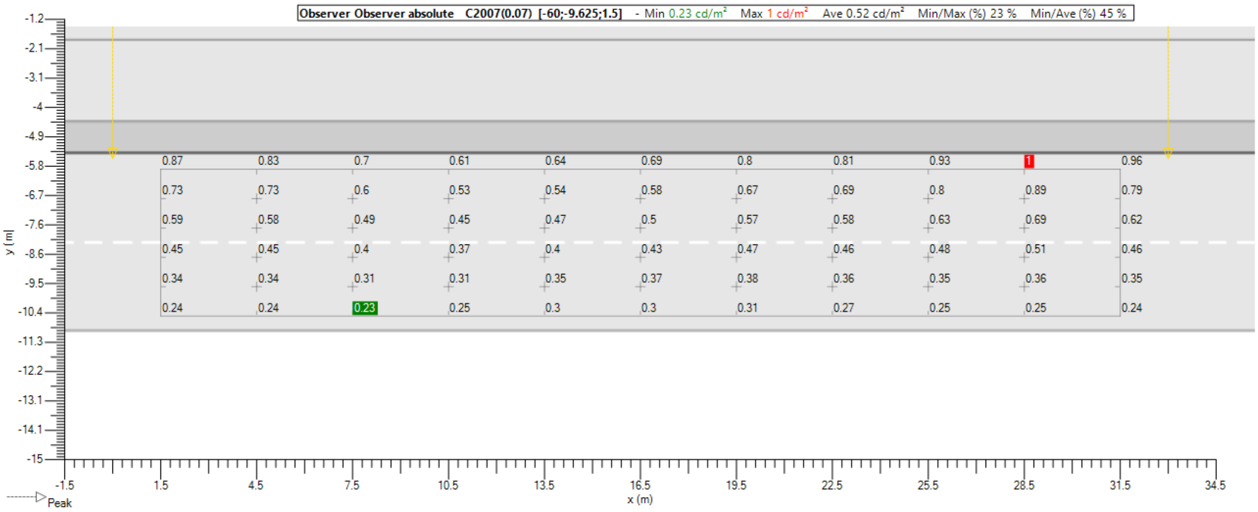
Multi-lanes (LU) - Optional - Absolute 1

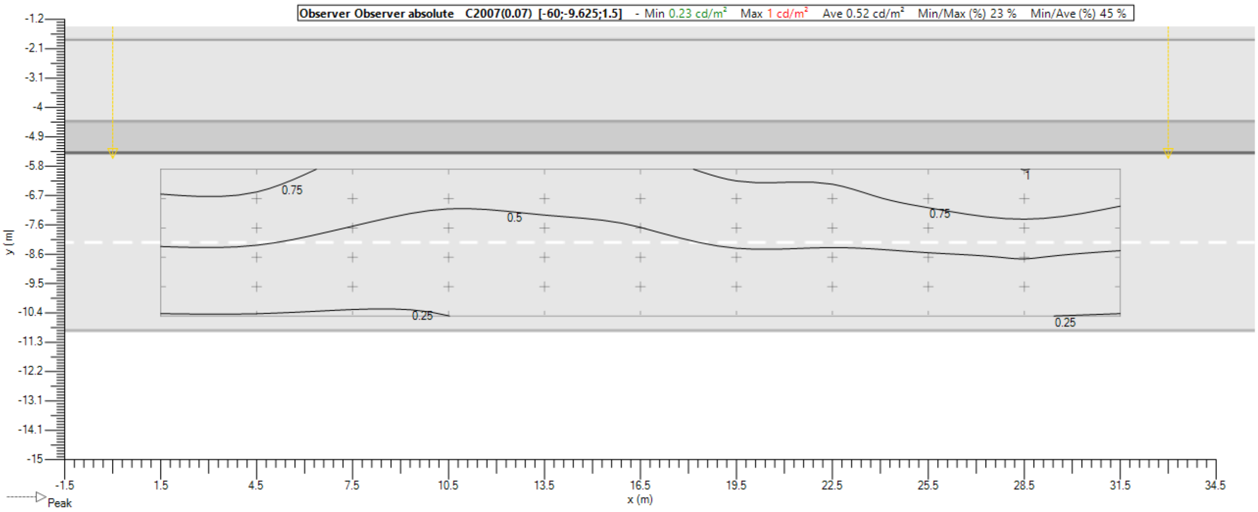


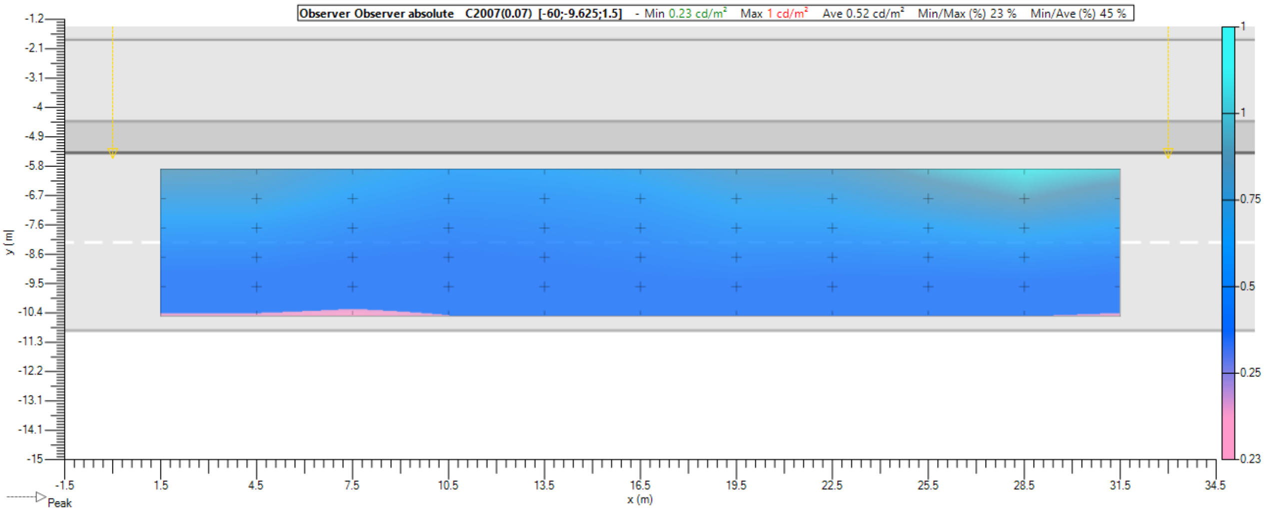




Multi-lanes (LU) - Optional - Absolute 2

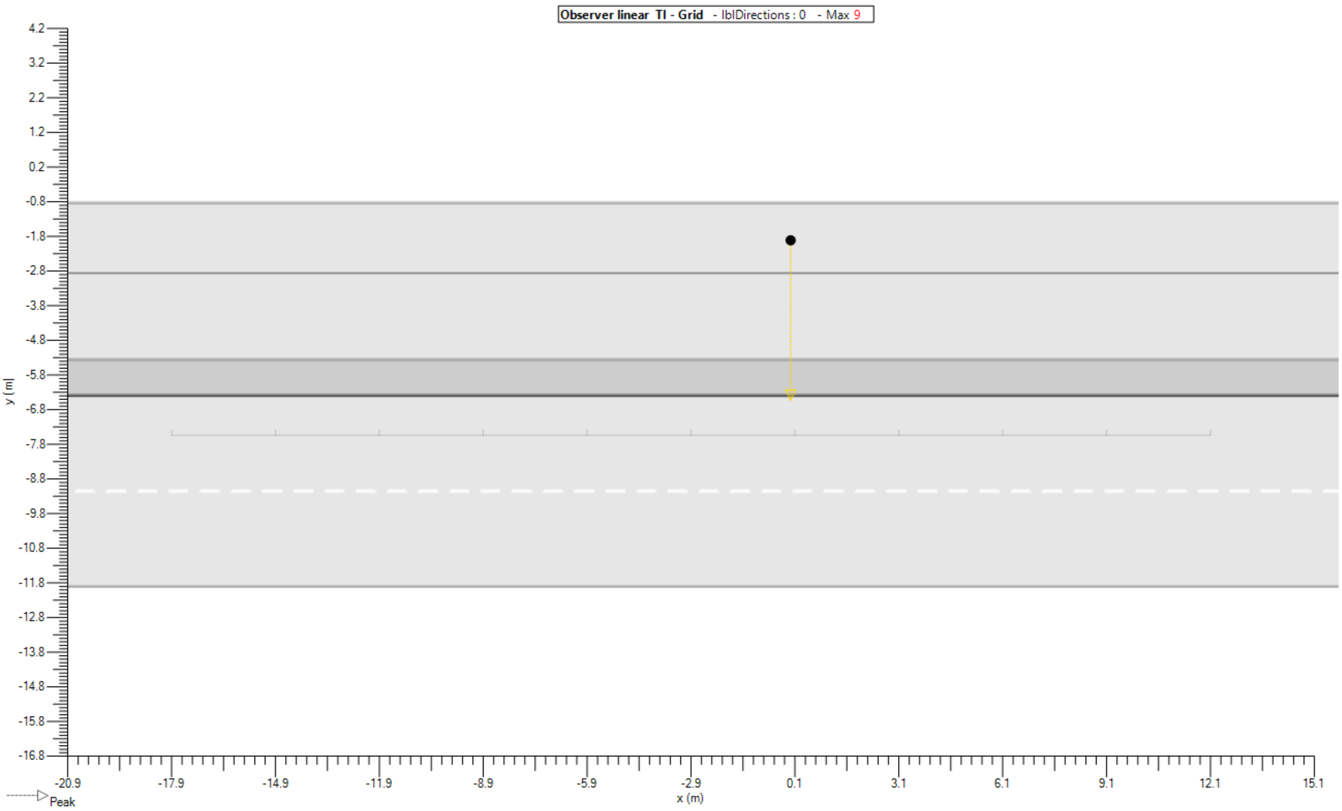




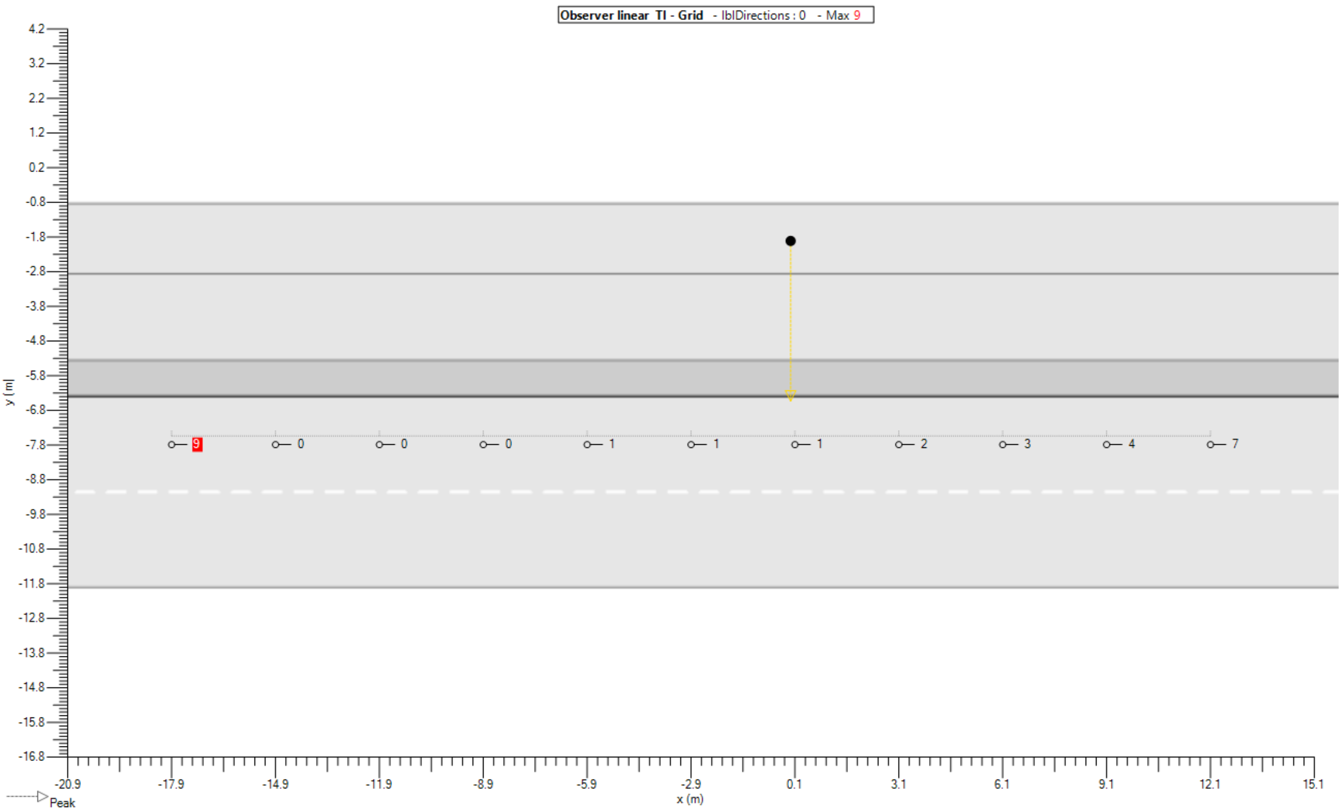


6.8. Multi-lanes (TI 1) - TI - Grid

Implantation

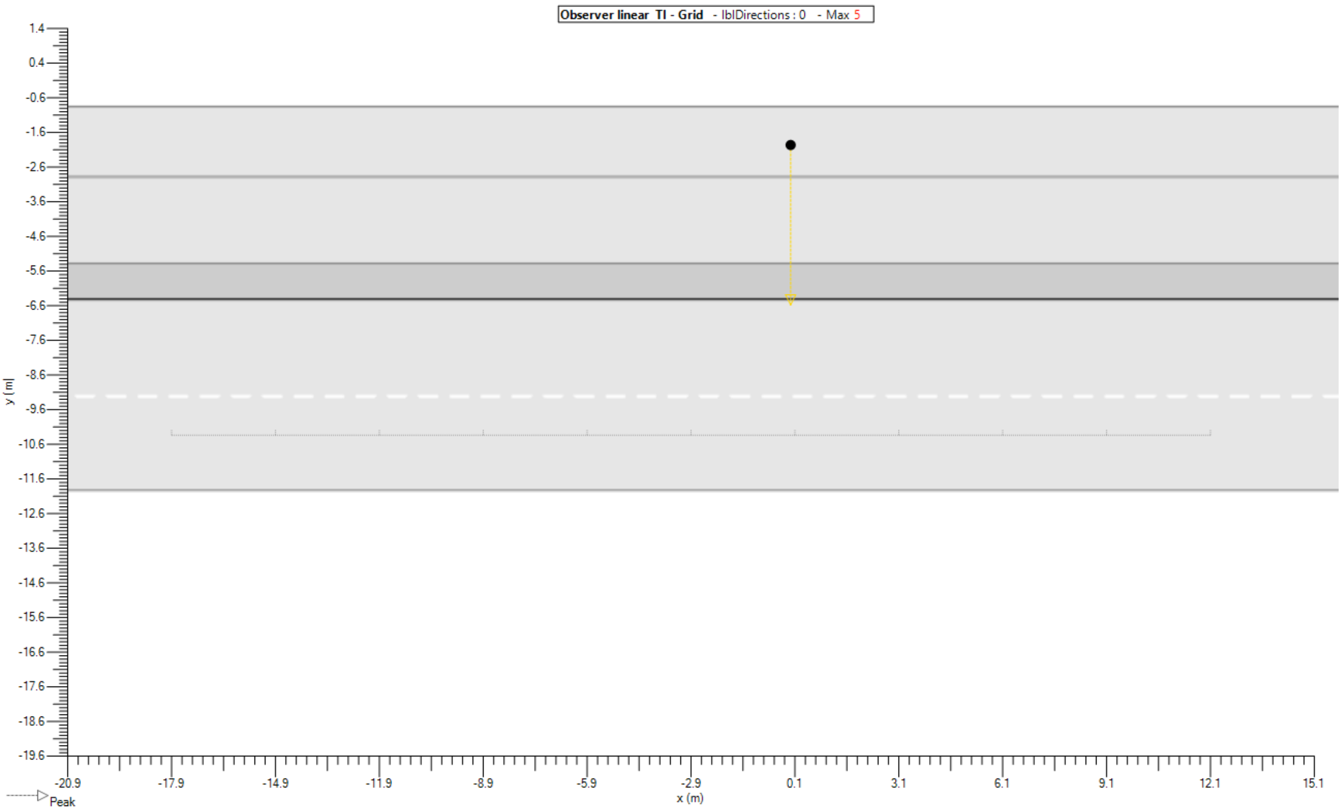


Values

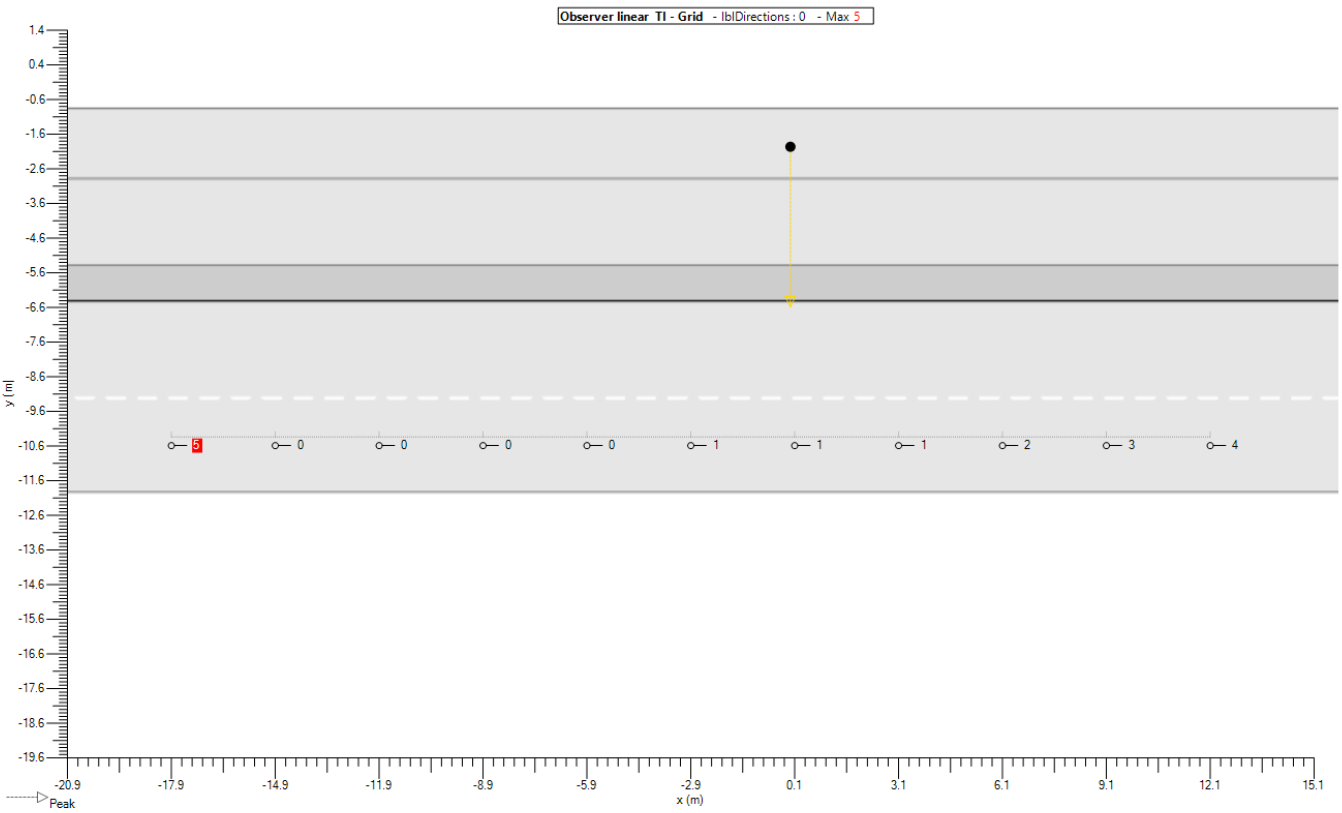


6.9. Multi-lanes (TI 2) - TI - Grid

Implantation



Values



7. Grids

7.1. Single lane with level (IL)

General	
Type	Grid rectangular XY
Enabled	☑
Colour	■

Geometry						
Origin	**X**	1.50 m	**Y**	-1.67 m	**Z**	0.00 m
Rotation	**X**	0.0 °	**Y**	0.0 °	**Z**	0.0 °
Dimension	**Count X**	11	**Count Y**	3		
	Spacing X	3.00 m	**Spacing Y**	0.67 m		
	Size X	30.00 m	**Size Y**	1.33 m		

7.2. Single lane with level (IL) (1)

General	
Type	Grid rectangular XY
Enabled	☑
Colour	■

Geometry						
Origin	**X**	1.50 m	**Y**	-4.08 m	**Z**	0.00 m
Rotation	**X**	0.0 °	**Y**	0.0 °	**Z**	0.0 °
Dimension	**Count X**	11	**Count Y**	3		
	Spacing X	3.00 m	**Spacing Y**	0.83 m		
	Size X	30.00 m	**Size Y**	1.67 m		

7.3. Multi-lanes (LU)

General	
Type	Grid rectangular XY
Enabled	☑
Colour	■

Geometry						
Origin	**X**	1.50 m	**Y**	-10.54 m	**Z**	0.00 m
Rotation	**X**	0.0 °	**Y**	0.0 °	**Z**	0.0 °
Dimension	**Count X**	11	**Count Y**	6		
	Spacing X	3.00 m	**Spacing Y**	0.92 m		
	Size X	30.00 m	**Size Y**	4.58 m		

8. Observer

8.1. Multi-lanes (TI 1)

General	
Type	Observer linear
En	☑
Color	■
Directions	0.0
Calculation	TI - Grid
Grid	Multi-lanes (LU)

Geometry						
Origin	**X**	-17.88 m	**Y**	-6.88 m	**Z**	1.50 m
Rotation	**X**	0.0 °	**Y**	0.0 °	**Z**	0.0 °
Dimension	**Count**	11	**Spacing**	3.00 m	**Size**	30.00 m

8.2. Multi-lanes (TI 2)

General	
Type	Observer linear
En	☑
Color	■
Directions	0.0
Calculation	TI - Grid
Grid	Multi-lanes (LU)

Geometry						
Origin	**X**	-17.88 m	**Y**	-9.63 m	**Z**	1.50 m
Rotation	**X**	0.0 °	**Y**	0.0 °	**Z**	0.0 °
Dimension	**Count**	11	**Spacing**	3.00 m	**Size**	30.00 m