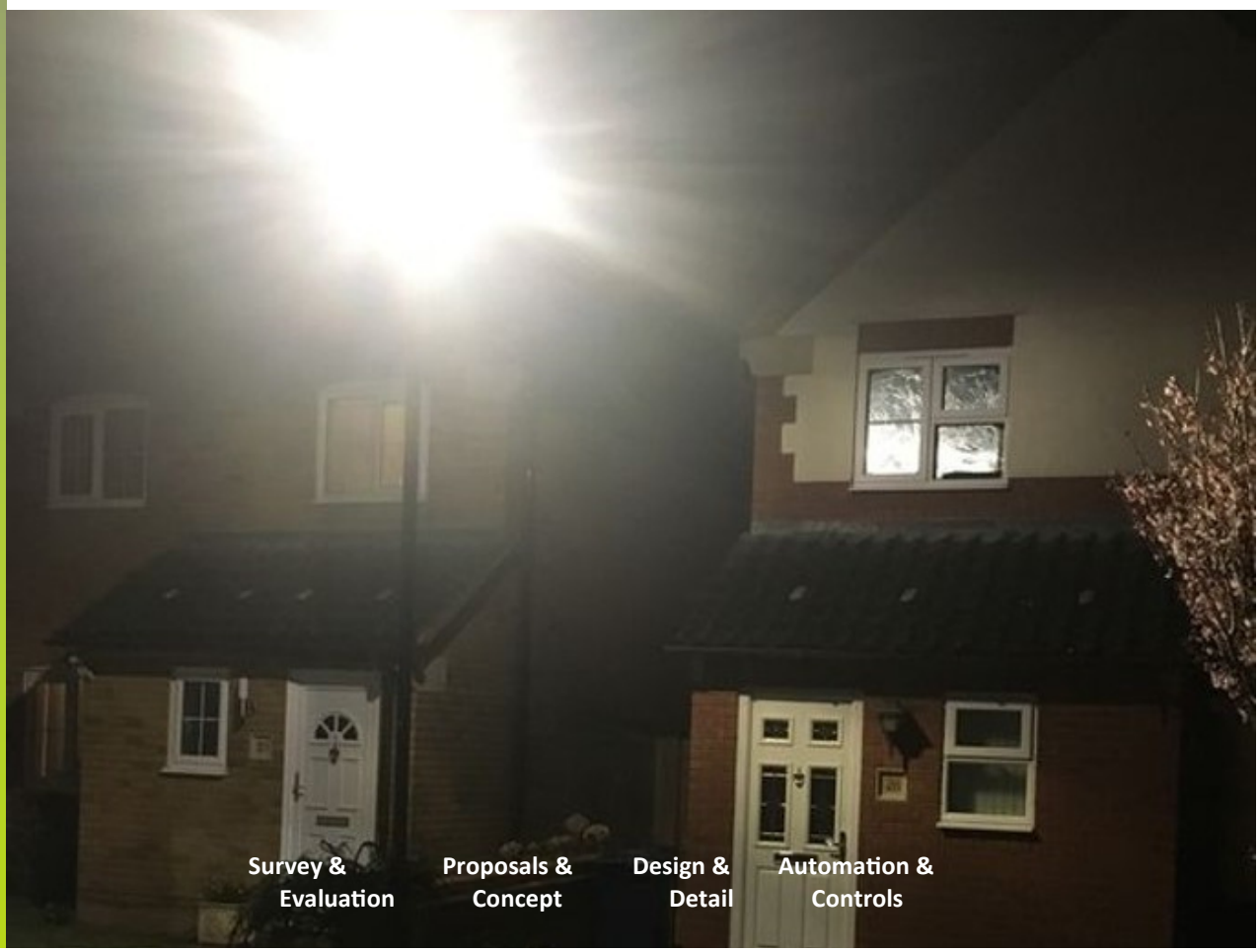
BIANCHI LIGHTING LIMITED

GUIDE
FOR THE REDUCTION OF OBTRUSIVE LIGHT

Lighting Principals for limitation of Spill Light into properties and the environment



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Introduction

The issue of obtrusive, or Intrusive light has been mentioned in some previous publications. The most recent version is now based on the technical reports issued in 2017 and 2020.

The technical report from the International Commission on Illumination (CIE) represents the most recent technical study and sets maximum limits on the performance of light that may have detrimental implications on health. This has lead to a Public Guidance note (GN01) form the industry trade bodies related to lighting that include:

The institute of Lighting Professionals (ILP)

The Society of Light and Lighting (SLL)
A division of the Chartered institute of Building services Engineers (CIBSE).

These trade bodies have supported and legitimised the content of the technical report into guidance which can be used in law.

This has lead to adoption of the technical limits into Government within the National Planning Policy Framework (NPPF) and therefore devolved into Local Planning Policy Frameworks adopted in each local Authority.

This document seeks to simply explain what individuals and organisations can do, based on the CIE and GN01 publications

Ministry of Housing, Communities & Local Government

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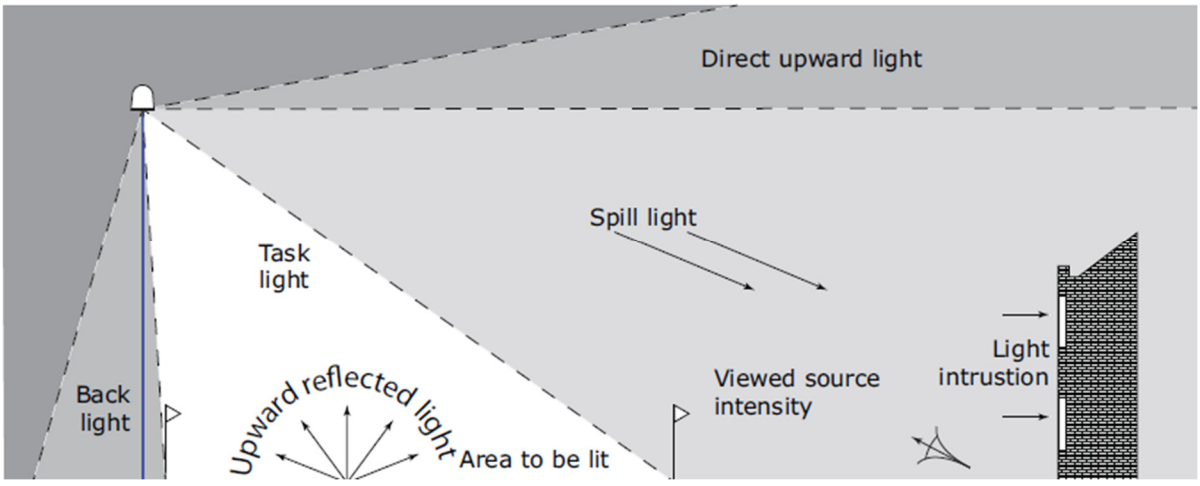


1. Methods of Measurement

Methods for the measurement of Obtrusive Light are generally required to follow the process and limitations stated in international guidance CIE 150.

Generally this requires the measurement of:

- Illuminance (Lux) Light Falling on a surface area, and
- Luminance (cd/m²) Measurement from a notional observer, in a specific location

The current methods of demonstrating those limitations fall into one, or both, of the following categories.

◊ Direct Measurement of obtrusive light

This requires the use of expensive measuring equipment, plural. Specific measuring tools are required to measure each element of the lighting guidance.

These tools are calibrated using a tungsten source, and equipped with filtration to more accurately mimic human eye attributes. For a single floodlight, this is fine, but in multiple arrays (e.g. sports) this may not be specific enough to identify which light may be causing the issue, or percentages of contribution of light is applied from such arrays determine specific performance characteristics of one light, due to background environment illumination.

◊ Alternatively, Measurement can be conducted using specific lighting software to more accurately analyse the lighting effects and direction, omitting any background element that could affect the results.

This method uses Lighting 3D software tools and background CAD drawings to place lighting grids and locations for the calculations above, together with measured manufacturers photometry for full analysis. This tends to be more flexible and accurate.

2. Guidance for Individuals

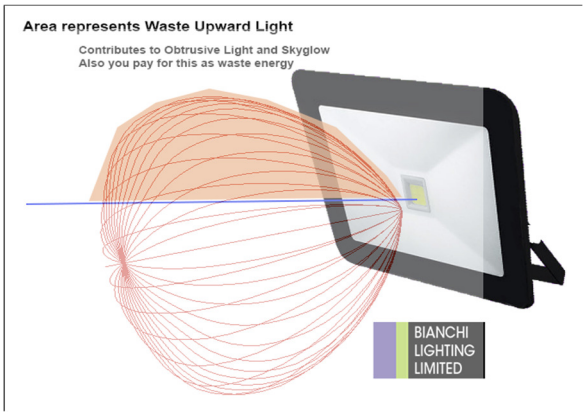
In this section, this advice is generally for those who believe they are subject to obtrusive Light from other individuals or small organisations.

Typically security Lights are uncontrolled optically, with a wide spread beam pattern and if buying from warehouse sheds, or electrical wholesalers, mostly low cost.
These are generally poorly designed, and misplaced in many occasions.

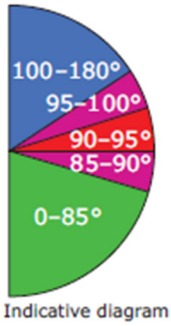
Where individuals are dealing with such security lights from neighbours, it is better to have a sensitive conversation and come to an agreement. There is public guidance documents for the application of domestic and security lighting, which can help in forming an understanding in discussions in the form of a document GN09.

This document confirms the effects of light beyond a boundary can affect not only vision impairment of other people, but also flora and fauna, due to circadian Rhythm. Skyglow at shallow angles is also to the detriment of those who look at stars in the night sky.

Commonly, misplaced and misaligned luminaires are harmful and waste a significant amount of energy. It should be noted that artificial light emitted from premises which affects someone's enjoyment of their own premises can be considered as a legal nuisance.



The angle of the emitted light, is dependant on the optical direction and quality of the luminaire housing and any reflector. To give guidance on this, the following table shows the potential effects that may be found in mis-aligned luminaires.



Indicative diagram

Table 1: The effect on the ability to view the night sky at various angles

Angle of light emitted (degrees)	Sky glow effect	Glare effect
100 – 180	Local	Little
95 – 100	Significant	Some
90 – 95	High	High
85 – 90	Significant	High
0 – 85	Minimal	Some

2. Guidance for Individuals (Cont.)

For Obtrusive light analysis, there a significant cost to conducting Obtrusive light analysis, there is also a specialism required, which not all lighting designers have. The guidance requires the analysis of light intrusion into windows from an exterior installation for indoor and outdoor recreational spaces, where such light may prevented owner / occupiers from the enjoyment and tranquillity such spaces offer.

Interior design methods to mitigate such spill such as blackout blinds or similar mitigating methods paid by inhabitants of such buildings should not be relied upon to evidence the limitation of spill. This is defined in the Clean Neighbourhood and Environment Act 2005.

In addition waste light emitted from building windows in combination with exterior architectural and security lighting could be detrimental to the surrounding environment. Lighting could project into the environment, where such spill effects could affect flora and fauna and animals such as bats that are a protected species.

Bats are used as a primary indicator of the health and biodiversity of habitats, hence their presence is promoted, even where there may be little or no existing presence.
Supporting such habitats has led to zonal limiting guidance combined with landscaping to provide some protection from the effects of light spill. These are given below.

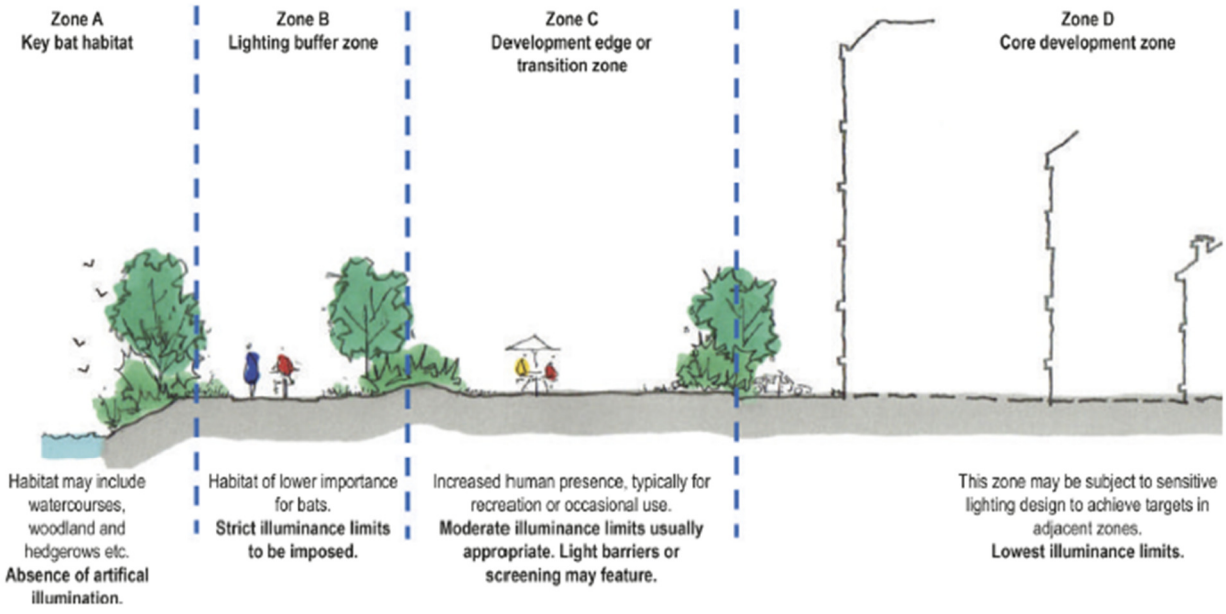


Figure 4. Example of illuminance limit zonation.

It may be expected that Planning conditions may be applied to some building projects where analysis or evidence of the presence of spill at the intersection of each zone may be required

2. Guidance for Individuals (Cont.)

In all cases, reference should be made to the local Planning Policy Framework (LPPF) of the local authority.
Where there are a number of individuals suffering from obtrusive light, from the same site, it is recommended that these persons with common interest should form a group and, as a group of persons approach the business or institution collectively, and with respect to seek a common acceptable resolution. Where all efforts fail, share costs as obligations fall on the Local Authority's Environmental Health office. In summary, gather the evidence using measurement, or design, then approach Environmental Health , to take the action necessary.

Currently, it is very common, that these Environmental Health Officers, are not lighting experts with, very little knowledge, on the subject, and commonly, no access internally to highway engineers, who have some knowledge but commonly, no experience of resolving such issues.

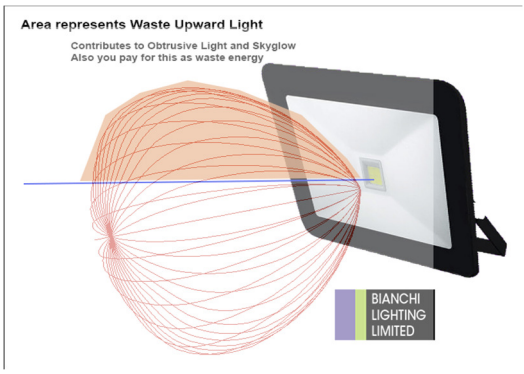
Summary For those with Spill light Complaints

It may be better to rely on councils to apply regulatory requirements, rather than define them. If there are multiple persons then group together and allow combined funds to allow for full analysis to take place. Otherwise seek to negotiate using such documents provided as evidence, and gentle persuasion may win through.

3. Guidance for Companies, Public housing seeking to mitigate Obtrusive Light

Developments, existing or proposed haver a duty under the Construction Design and Maintenance Regulations (CDM) to assess all risks and mitigate against those risks identified. CDM risk assessments form the basis of any job in hand and are available to be used in law should risks be identified but not mitigated, or, even if risks are not identified that should reasonably have been and which represent a hazard.

It therefore falls on the risk assessment to identify the possibility of obtrusive light to the detriment of others, also described as 'sensitive receptors'.



In all cases, reference should be made to the local Planning Policy Framework (LPPF) of the local authority.
Legislation under the Clean Neighbourhood and Environment Act: 2005 and tightening of the guidance around Obtrusive light and Skyglow in 2017 has prompted action in the government NPPF (Framework) which is now devolving into the Local planning framework (LPPF).

Planners are therefore now placing requirements as conditions within development submissions to mitigate against the effects of Obtrusive light and Skyglow, which places additional cost and design time against the project.

Rather than retro analysis of obtrusive light in a built environment, it is more cost effective to make judgements and assessments at the design stage using specialist lighting analysis software. This avoids many instances of change of material and/or locations post construction.
This is still a specialist field and not all are able to undertake such work. The output reports are dependant on the Luminaire optics, and locations used in the design.

Summary: Allow some funding and get the right advice.

4. Guidance to Planners and Environmental Health

Chartered Institute of Environmental Health

tcpa

Developments, existing or proposed have a duty under the Construction Design and Maintenance Regulations (CDM) to assess all risks and mitigate against those risks identified. CDM risk assessments form the basis of any job in hand and are available to be used in law should risks be identified but not mitigated, or, even if risks are not identified that should reasonably have been and which represent a hazard.

It therefore falls on the client risk assessment to identify the possibility of obtrusive light to the detriment of others, also described as 'sensitive receptors'.

Managing risks

As an ongoing part of a risk management plan, there must be a system in place that monitors risks – keeping track of identified risks, determining what risks are no longer a threat, monitoring risks that are still viable, and recognising any new risks that might have presented themselves.

For either developments or complaint from existing developments, the first port should be to determine if the risk was identified in the first place.

Following the NPPF guidance, and the local NPPF application of it, planners may then have the option to put in place conditions to meet their NPPF requirements, which may require an obtrusive lighting impact report. This can also be applied retrospectively, where the complaint may be derived via the Environmental Health (CIEH) route.

The question is, what should the report contain?.

The report should contain and make reference to the CIE Technical Report 150, version current at the time of the study. Typically, this should show:

- ◊ Stated Limitations from the technical report (and GN01 Guidance)
- ◊ Locations of the sensitive receptors and results achieved for Illuminance calcs (Lux)
- ◊ Locations of the sensitive receptors and results achieved for Luminance calcs (cd/m²)
- ◊ Results for an E_V (horizontal) calculation grid to determine the reduction of light with distance.
- ◊ A results page from software

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4. Guidance to Planners and Environmental Health

Chartered Institute of Environmental Health

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Technical Results from Software

The following shows a report that has been designed to fail in areas for illustrative purposes.

Obtrusive Light - Compliance Report

CIE 150:2017, E3-Medium District Brightness, Pre-Curfew

CIE 150:2017, — This defines the calculation method and its validity

Filename: Example Calculation Exterior

Date : Time:

Illuminance

Maximum Allowable Value: 10 Lux

E3-Medium District Brightness, — This states the Environmental Zone Applied and thereby it's limits

Calculations Tested (29):

Calculation Label	Test Results	Max. Illum.
ObtrusiveLight_6_3_Ill_Seg1	PASS	0.0
ObtrusiveLight_5_2_Ill_Seg1	PASS	0.0
ObtrusiveLight_2_4_Ill_Seg1	PASS	2.0
ObtrusiveLight_2_7_Ill_Seg1	PASS	0.6
ObtrusiveLight_6_4_Ill_Seg1	PASS	0.0
ObtrusiveLight_3_5_Ill_Seg1	PASS	0.0
ObtrusiveLight_8_2_Ill_Seg1	PASS	0.3
ObtrusiveLight_8_1_Ill_Seg1	PASS	0.3
ObtrusiveLight_7_1_Ill_Seg1	PASS	0.5
ObtrusiveLight_6_1_Ill_Seg1	PASS	0.3
ObtrusiveLight_6_2_Ill_Seg1	PASS	0.2
ObtrusiveLight_1_2_Ill_Seg1	PASS	0.0
ObtrusiveLight_2_1_Ill_Seg1	PASS	0.3
ObtrusiveLight_2_2_Ill_Seg1	PASS	0.0
ObtrusiveLight_2_3_Ill_Seg1	PASS	2.6
ObtrusiveLight_2_5_Ill_Seg1	PASS	0.0
ObtrusiveLight_5_1_Ill_Seg1	PASS	0.1
ObtrusiveLight_2_6_Ill_Seg1	PASS	0.5
ObtrusiveLight_2_8_Ill_Seg1	PASS	0.0
ObtrusiveLight_3_1_Ill_Seg1	PASS	0.0
ObtrusiveLight_3_2_Ill_Seg1	PASS	0.0
ObtrusiveLight_3_3_Ill_Seg1	PASS	0.0
ObtrusiveLight_3_4_Ill_Seg1	PASS	0.2
ObtrusiveLight_3_6_Ill_Seg1	PASS	0.0
ObtrusiveLight_3_7_Ill_Seg1	PASS	0.0
ObtrusiveLight_4_2_Ill_Seg1	PASS	0.0
ObtrusiveLight_4_1_Ill_Seg1	PASS	0.0
ObtrusiveLight_1_3_Ill_Seg1	PASS	0.4
ObtrusiveLight_1_1_Ill_Seg1	PASS	2.0

Pre-Curfew — This states the Point in Time i.e. Early, or Late evening

Luminous Intensity (Cd) At Vertical Planes

Maximum Allowable Value calculated from CIE 150:2017 (varies by Projected Area sq.m. and Distance Factor)
For E3-Medium District Brightness, Projected Area and Distance Factors:
(0.002, 0.86) (0.01, 1.9) (0.03, 3.8) (0.13, 7.5) (0.5, 15)
Projected Area (sq.m) = Approx. projected emitting area of luminaire in direction of observer
Distance (m) = Distance from luminaire to observer
Max Cd Allowed = Projected Area Factor * Distance

Calculations Tested (29):

Calculation Label	Test Results
ObtrusiveLight_6_3_Cd_Seg1	PASS
ObtrusiveLight_5_2_Cd_Seg1	PASS
ObtrusiveLight_2_4_Cd_Seg1	FAIL
ObtrusiveLight_2_7_Cd_Seg1	FAIL
ObtrusiveLight_6_4_Cd_Seg1	FAIL
ObtrusiveLight_3_5_Cd_Seg1	PASS
ObtrusiveLight_8_2_Cd_Seg1	PASS
ObtrusiveLight_8_1_Cd_Seg1	PASS
ObtrusiveLight_7_1_Cd_Seg1	FAIL
ObtrusiveLight_6_1_Cd_Seg1	FAIL
ObtrusiveLight_6_2_Cd_Seg1	FAIL
ObtrusiveLight_1_2_Cd_Seg1	PASS
ObtrusiveLight_2_1_Cd_Seg1	PASS
ObtrusiveLight_2_2_Cd_Seg1	PASS
ObtrusiveLight_2_3_Cd_Seg1	FAIL
ObtrusiveLight_2_5_Cd_Seg1	PASS
ObtrusiveLight_5_1_Cd_Seg1	PASS
ObtrusiveLight_2_6_Cd_Seg1	FAIL
ObtrusiveLight_2_8_Cd_Seg1	PASS
ObtrusiveLight_3_1_Cd_Seg1	PASS
ObtrusiveLight_3_2_Cd_Seg1	PASS
ObtrusiveLight_3_3_Cd_Seg1	PASS
ObtrusiveLight_3_4_Cd_Seg1	FAIL
ObtrusiveLight_3_6_Cd_Seg1	PASS
ObtrusiveLight_3_7_Cd_Seg1	PASS
ObtrusiveLight_4_2_Cd_Seg1	PASS
ObtrusiveLight_4_1_Cd_Seg1	PASS
ObtrusiveLight_1_3_Cd_Seg1	FAIL
ObtrusiveLight_1_1_Cd_Seg1	FAIL

Failed Meter Locations (77):

Offending Lum. No.	Label Meter Coords	Proj. Area	Distance	Cd	Max Cd Allowed
38	LL-C+ BS 203.498, 132.886, 0.425	0.008	38.4	194	73
38	LL-C+ BS 204.186, 133.184, 0.425	0.008	38.8	209	74
38	LL-C+ BS 203.498, 132.886, 1.175	0.007	38.3	77	73
38	LL-C+ BS 204.186, 133.184, 1.175	0.007	38.7	88	74
47	LL-C+ 266.455, 52.287, 2.475	0.009	40.2	147	76
47	LL-C+ 266.734, 51.591, 2.475	0.009	40.9	146	78
47	LL-C+ 266.455, 52.287, 3.225	0.008	40.2	95	76
47	LL-C+ 266.734, 51.591, 3.225	0.008	40.9	94	78
47	LL-C+ 267.845, 67.073, 4.375	0.007	32.4	66	62
47	LL-C+ 267.148, 66.797, 4.375	0.007	31.9	67	61
47	LL-C+ 266.45, 66.522, 4.375	0.007	31.4	65	60
47	LL-C+ 261.943, 63.558, 1.725	0.012	29.5	302	112
47	LL-C+ 262.21, 62.857, 1.725	0.012	30.1	295	114
47	LL-C+ 262.478, 62.157, 1.725	0.012	30.8	286	117
47	LL-C+ 262.746, 61.456, 1.725	0.012	31.4	285	119
47	LL-C+ 263.013, 60.756, 1.725	0.012	32	295	122
47	LL-C+ 263.281, 60.055, 1.725	0.012	32.7	301	124
47	LL-C+ 261.943, 63.558, 2.475	0.011	29.4	209	112
47	LL-C+ 262.21, 62.857, 2.475	0.011	30	199	114
47	LL-C+ 262.478, 62.157, 2.475	0.011	30.7	188	117
47	LL-C+ 262.746, 61.456, 2.475	0.011	31.3	179	119
47	LL-C+ 263.013, 60.756, 2.475	0.011	32	175	121
47	LL-C+ 263.281, 60.055, 2.475	0.01	32.6	174	124
47	LL-C+ 261.943, 63.558, 3.225	0.01	29.3	136	56

Light Unit Number

Upward Waste Light Ratio (UWLR)

Maximum Allowable Value: 5.0 %

Calculated UWLR: 1.2 %
Test Results: PASS

Upward Flux Ratio (UFR)

Maximum Allowable Value:	12.0
Reference Area(s):	CalcPts_Building Perimeter_1 CalcPts_Car Park Disabled_2 CalcPts_Car Park Surface
Average Reflectance - Reference Area(s):	0.07
Average Reflectance - Surround:	0.20
Initial Average Illuminance - Reference Area(s):	24.65 Lux
Average Maintained Illuminance Required:	15.00 Lux
Total Area - Reference Area(s):	3557 Sq.m.
Total Luminaire Flux (All Locations) :	184200
Downward Light Ratio (DLO):	0.988
Upward Light Ratio (ULO):	0.012
Utilization Factor (UF):	0.476

Calculated UFR: 7.28
Test Results: PASS

In this example report, the software produces a PASS / FAIL Result.

This makes determining the validity of any written report fairly easy, and gives confidence that such reports are easy to interpret and apply.