

The Christie Foundation Trust
**Paterson Redevelopment
Project**
External Lighting Impact Report

PRP-ARUP-ZZ-ZZ-RP-N-1002

For Information | 03 February 2022

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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Guidance Notes for the Reduction of Obtrusive Lighting – Institute of Lighting Engineers (ILE) 2011

Appendix B

Luminaire Layout

1 Introduction

This report has been compiled to detail the findings of a light pollution study for the external lighting installation of the Paterson Redevelopment Project.

The report will assess the impact of the proposed lighting scheme for the development on the surrounding areas, in particular adjacent buildings such as Wilmslow and Oak Road Residences. It will assess the impact of light overspill from the external lighting scheme of the main building and the external compound. In the absence of detailed planning constraints or legislative requirements the report compares the proposed installation against typical industry standard guidelines.

2 Design Criteria

2.1 Introduction

To assess the impact of the proposed external lighting scheme the following documents have been consulted and used as a basis of guidance for comparison:

- Guidance Notes for the Reduction of Obtrusive Lighting – Institute of Lighting Engineers (ILE) 2011

For the guidance parameters of calculations the design criteria laid out within the ILE Guidance Notes for the Reduction of Obtrusive light has been followed.

2.2 Guidelines

The ILE Guidance note defines the environmental zones in which any building under assessments sits in as shown in Figure 1.

Table 1 – Environmental Zones			
Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	UNESCO Starlight Reserves, IDA Dark Sky Parks
E1	Natural	Intrinsically dark	National Parks, Areas of Outstanding Natural Beauty etc
E2	Rural	Low district brightness	Village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Small town centres or suburban locations
E4	Urban	High district brightness	Town/city centres with high levels of night-time activity

Figure 1- ILE Environmental Zone Classifications ©2011 ILE

The recommended for the limitations of light spillage from external installations for each classified zone is as stated in Figure 2.

Table 2 – Obtrusive Light Limitations for Exterior Lighting Installations – General Observers						
Environment al Zone	Sky Glow ULR [Max %]⁽¹⁾	Light Intrusion (into Windows) E_v [lux]⁽²⁾		Luminaire Intensity I [candelas]⁽³⁾		Building Luminance Pre-curfew⁽⁴⁾
		Pre- curfew	Post- curfew	Pre- curfew	Post- curfew	Average, L [cd/m²]
E0	0	0	0	0	0	0
E1	0	2	0 (1*)	2,500	0	0
E2	2.5	5	1	7,500	500	5
E3	5.0	10	2	10,000	1,000	10
E4	15	25	5	25,000	2,500	25

ULR = **Upward Light Ratio of the Installation** is the maximum permitted percentage of luminaire flux that goes directly into the sky.

E_v = **Vertical Illuminance in Lux** - measured flat on the glazing at the centre of the window.

I = **Light Intensity in Candelas (cd)**

L = **Luminance in Candelas per Square Metre (cd/m²)**

Curfew = **the time after which stricter requirements (for the control of obtrusive light) will apply**; often a condition of use of lighting applied by the local planning authority. If not otherwise stated - 23.00hrs is suggested.

***** = **Permitted only from** Public road lighting installations

Figure 2- ILE Limitation of Light Spillage Recommendations©2011 ILE

Appendix A has further information regarding the Institute of Lighting Engineers (ILE) Guidance Notes.

2.3 Calculations

The Paterson Redevelopment Project falls under the environment zone E3 described as a suburban area.

The following calculations have been completed based on the proposed lighting scheme for comparison with the recommendations of the ILE guidance document:

- Light trespass into windows vertically measured in lux at critical locations to surrounding building

Critical locations around the site have been identified as shown in Figure 3.



Figure 3- Critical Locations of Surrounding Buildings

Vertical light trespass has been calculated at the site boundary for each of these locations identified as follows:

1. Residential area Wilmslow Road adjacent to main building
2. Residential area Wilmslow Road adjacent to external compound
3. Residential area Oak Road adjacent to external compound

2.4 Assumptions

For the purposes of carrying out the analysis of the proposed external lighting scheme the following assumptions were made:

- The differing road and landscaping levels across the site have been considered negligible and the surrounding area has been modelled as flat.
- All existing surrounding highway, junction and miscellaneous lighting not associated with the Paterson Redevelopment Project has not been considered as these are existing conditions whose impact cannot be changed.
- It has been assumed that the Environmental Zone applicable to the scheme will be E3 (Medium district brightness areas, appropriate for suburban locations).

- The calculation for the light trespass into windows has assumed full height coverage of the surface, assessed at a range of 0-20m high to allow for the worst case scenario in the absence of detailed information on surrounding buildings.
- All landscaping details such as trees, shrubbery and hedgerows has been omitted from the calculation in the absence of detailed information. This assumes worst case conditions.
- All building ridges and recesses have not been modelled due to the complex nature of the building façade a simplified geometry exported from google sketch up has been utilised

3 Proposed Scheme

3.1 General

The proposed external lighting schemes covers main external areas of the building including:

- Level 07 terraces
- Building perimeter
- Service yard

The overhang of the building is utilised to illuminate the external pedestrian walkway below. Downlights are recessed into the underside of the soffit of the overhang as shown below.

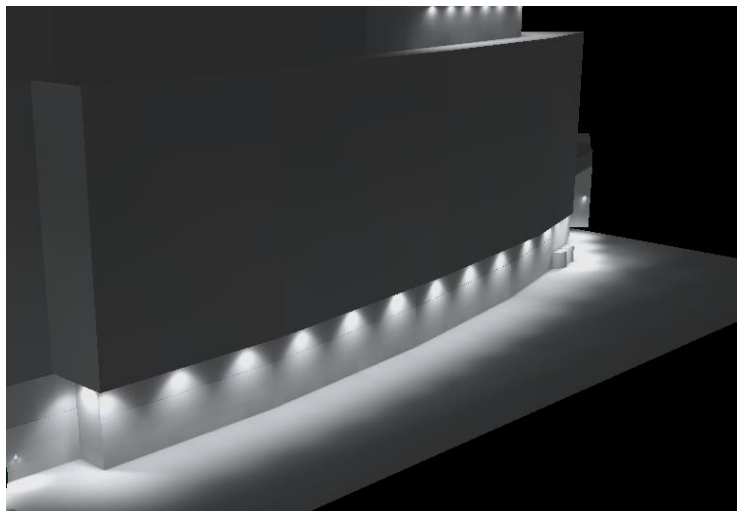


Figure 4 – Pedestrian Pathway Lighting

The landscaped area in front of the FM compound is lit using low level bench mounted LED strips. This casts a low-level light onto the landscape.

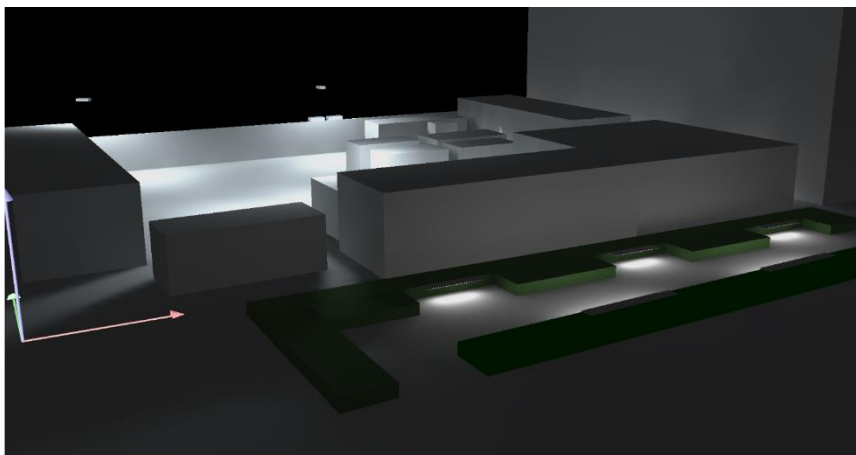


Figure 5 – Service Yard Lighting

3.2 Modelling

The proposed external scheme was modelled in Dialux® 4.13 Simulation Software. The Paterson Redevelopment Project and the surrounding area were modelled.

Three calculation surfaces were defined at the critical locations on the boundary of the site noted within the Design Criteria section of this report.

4 Results

4.1 Introduction

All calculation results have been assessed against the more rigorous post curfew conditions.

4.2 Vertical Light Trespass

The vertical light trespass calculated at each of the critical locations identified in the design criteria can be surmised as shown in the following table.

	Description	E _{aver} (lux)
1	Residential area Wilmslow Road adjacent to main building	1.21
2	Residential area Wilmslow Road adjacent to external compound	0.71
3	Residential area Oak Road adjacent to external compound	0.52

The guidance of an E3 environmental zone are that post curfew vertical light trespass into adjacent building windows must not exceed 2 lux. The table above illustrates that all average lux levels across all calculation surfaces are below the 2 lux threshold therefore satisfying the criteria. In addition to this these calculations do not take into account hedgerow or other lighting barriers within the natural site environment and are based on the site boundary not the windows of any neighbouring properties. The actual incident light at any adjacent property would be further reduced from these values.

5 Conclusion

The maximum vertical illuminance level at the surrounding areas, particularly at the critical areas identified will be compliant with the Institution of Lighting Engineers Guidance Notes for vertical light trespass in an E3 environmental zone in pre & post-curfew conditions.

All of the luminaires specified are downward facing and have a negligible effect on upward light spillage.

The scheme will also utilise a time switching and photocell arrangement for night time hours (provisionally 23.00hrs to 07.00hrs) to reduce the impact on neighbouring buildings in post curfew conditions and to reduce the energy consumption of the site.

Appendix A

Guidance Notes for the Reduction of Obtrusive Lighting – Institute of Lighting Engineers (ILE) 2011

GUIDANCE NOTES FOR THE REDUCTION OF OBTRUSIVE LIGHT

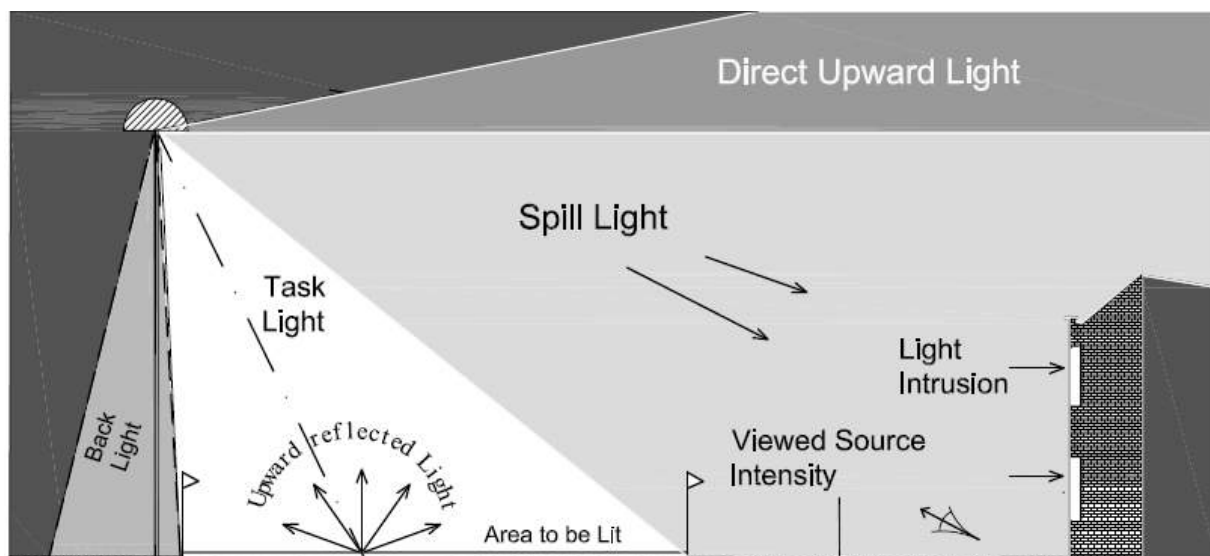
“Think before you light - The right amount of light, where wanted, when wanted.”

Man's invention of artificial light has done much to safeguard and enhance our night-time environment but, if not properly controlled, **obtrusive light** (sometimes referred to as light pollution) can present serious physiological and ecological problems.

Obtrusive Light, whether it keeps you awake through a bedroom window or impedes your view of the night sky, is a form of pollution, which may also be a nuisance in law and which can be substantially reduced without detriment to the lighting task.

Sky glow, the brightening of the night sky, **Glare** the uncomfortable brightness of a light source when viewed against a darker background, and **Light Intrusion (“Trespass”)**, the spilling of light beyond the boundary of the property or area being lit, are all forms of obtrusive light which may cause nuisance to others and waste money and energy. Think before you light. Is it necessary? What effect will it have on others? Will it cause a nuisance? How can you minimise the problem?

Figure 1 – Types of obtrusive light



Do not "over" light. This is a major cause of obtrusive light and is a waste of energy. There are published standards for most lighting tasks, adherence to which will help minimise upward reflected light. Organisations from which full details of these standards can be obtained are given on the last page of this leaflet.

Dim or switch off lights when the task is finished. Generally a lower level of lighting will suffice to enhance the night time scene than that required for safety and security.

“Good Design equals Good Lighting”

Any lighting scheme will consist of three basic elements: a light source, a luminaire and a method of installation.

Light sources (Lamps)

Remember that the light source output in LUMENS is not the same as the wattage and that it is the former that is important in combating the problems of obtrusive light.

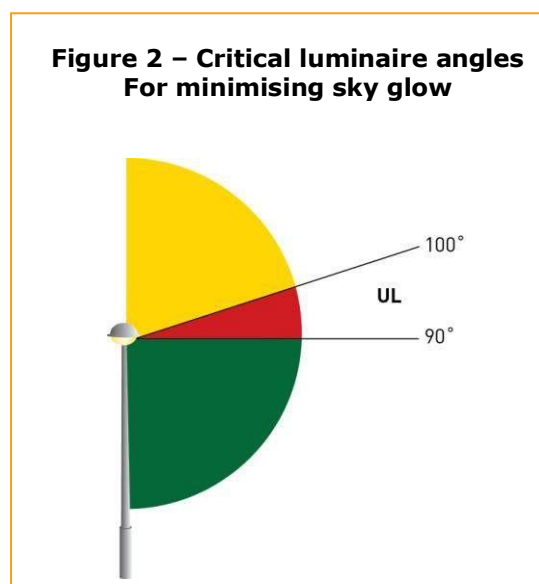
Most nighttime visual tasks are only dependant on light radiated within the visual spectrum. It is therefore NOT necessary for light sources to emit either ultra-violet or infra-red radiation unless specifically designed to do so. It is also understood that light from the shorter wavelengths of the spectrum has important effects on both flora and fauna that should be considered.

Research indicates that light from the blue end of the spectrum has important non-visual effects on the health of the human body, in particular in our sleep/wake patterns. It is therefore important to appreciate that while in obtrusive light terms the use of blue light should be minimised, there are many night-time tasks such as driving and sports where to be fully awake is an important aid to safety.

Luminaires

Care should always be taken when selecting luminaires to ensure that appropriate products are chosen and that their location will reduce spill light and glare to a minimum.

Use specifically designed lighting equipment that minimises the upward spread of light near to and above the horizontal. The most sensitive/critical zones for minimising sky glow are those between 90° and 100° as shown in Figure 2 and referred to as the lower, upward light output zone (UL).



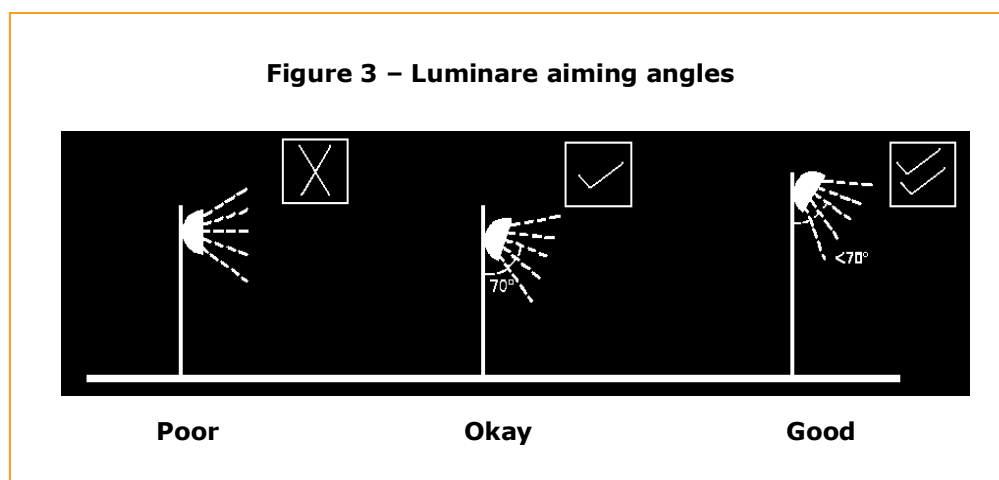
For most sports and area lighting installations the use of luminaires with double-asymmetric beams designed so that the front glazing is kept at or near parallel to the surface being lit should, if correctly aimed, ensures minimum obtrusive light.

Appendices 1 and 2 to these notes gives more details of how to choose and if necessary modify luminaires.

Installation

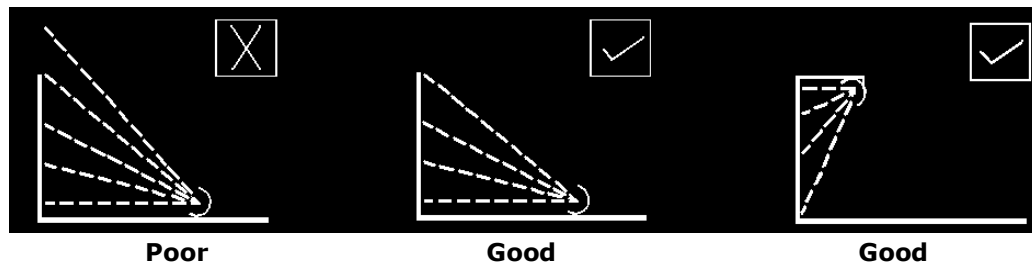
In most cases it will be beneficial to use as high a mounting height as possible, giving due regard to the daytime appearance of the installation. The requirements to control glare for the safety of road users are given in Table 3.

Keep glare to a minimum by ensuring that the main beam angle of all lights directed towards any potential observer is not more than 70°. Higher mounting heights allow lower main beam angles, which can assist in reducing glare. In areas with low ambient lighting levels, glare can be very obtrusive and extra care should be taken when positioning and aiming lighting equipment. With regard to domestic security lighting the ILP produces an information leaflet GN02:2009 that is freely available from its website.



When lighting vertical structures such as advertising signs, direct light downwards wherever possible. If there is no alternative to up-lighting, as with much decorative lighting of buildings, then the use of shields, baffles and louvres will help reduce spill light around and over the structure to a minimum.

For road and amenity lighting installations, (see also design standards listed on Page 5) light near to and above the horizontal should normally be minimised to reduce glare and sky glow (Note ULR's in Table 2). In rural areas the use of full horizontal cut off luminaires installed at 0° uplift will, in addition to reducing sky glow, also help to minimise visual intrusion within the open landscape. However in some urban locations, luminaires fitted with a more decorative bowl and good optical control of light should be acceptable and may be more appropriate.

Figure 4 – Façade Illumination

Since 2006 “Artificial Light” has been added to the list of possible Statutory Nuisances in England, Wales and Scotland. The monitoring of such nuisances will be the responsibility of Environmental Health Officers (EHOs) for which separate guidance is being produced.

With regard to the planning aspect, many Local Planning Authorities (LPAs) have already produced, or are producing, policies that within the planning system will become part of their local development framework. For new developments there is an opportunity for LPAs to impose planning conditions related to external lighting, including curfew hours.

The Scottish Executive has published a design methodology document (March 2007) entitled [“Controlling Light Pollution and Reducing Energy Consumption”](#) to further assist in mitigating obtrusive light elements at the design stage.

ENVIRONMENTAL ZONES

It is recommended that Local Planning Authorities specify the following environmental zones for exterior lighting control within their Development Plans.

Table 1 – Environmental Zones

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

Where an area to be lit lies on the boundary of two zones the obtrusive light limitation values used should be those applicable to the most rigorous zone.

NB: Zone E0 must always be surrounded by an E1 Zone.

DESIGN GUIDANCE

The following limitations may be supplemented or replaced by a LPA's own planning guidance for exterior lighting installations. As lighting design is not as simple as it may seem, you are advised to consult and/or work with a professional lighting designer before installing any exterior lighting.

Table 2 – Obtrusive Light Limitations for Exterior Lighting Installations – General Observers

Environmental Zone	Sky Glow ULR [Max %] ⁽¹⁾	Light Intrusion (into Windows) E_v [lux] ⁽²⁾		Luminaire Intensity I [candelas] ⁽³⁾		Building Luminance Pre-curfew ⁽⁴⁾
		Pre-curfew	Post-curfew	Pre-curfew	Post-curfew	Average, L [cd/m ²]
E0	0	0	0	0	0	0
E1	0	2	0 (1*)	2,500	0	0
E2	2.5	5	1	7,500	500	5
E3	5.0	10	2	10,000	1,000	10
E4	15	25	5	25,000	2,500	25

ULR = **Upward Light Ratio of the Installation** is the maximum permitted percentage of luminaire flux that goes directly into the sky.

E_v = **Vertical Illuminance in Lux** - measured flat on the glazing at the centre of the window.

I = **Light Intensity in Candelas (cd)**

L = **Luminance in Candelas per Square Metre (cd/m²)**

Curfew = **the time after which stricter requirements (for the control of obtrusive light) will apply**; often a condition of use of lighting applied by the local planning authority. If not otherwise stated - 23.00hrs is suggested.

***** = **Permitted only from** Public road lighting installations

(1) Upward Light Ratio – Some lighting schemes will require the deliberate and careful use of upward light, e.g. ground recessed luminaires, ground mounted floodlights, festive lighting, to which these limits cannot apply. However, care should always be taken to minimise any upward waste light by the proper application of suitably directional luminaires and light controlling attachments.

- (2) Light Intrusion (into Windows)** – These values are suggested maxima and need to take account of existing light intrusion at the point of measurement. In the case of road lighting on public highways where building facades are adjacent to the lit highway, these levels may not be obtainable. In such cases where a specific complaint has been received, the Highway Authority should endeavour to reduce the light intrusion into the window down to the post curfew value by fitting a shield, replacing the luminaire, or by varying the lighting level.
- (3) Luminaire Intensity** – This applies to each luminaire in the potentially obtrusive direction, outside of the area being lit. The figures given are for general guidance only and for some sports lighting applications with limited mounting heights, maybe difficult to achieve.
- (4) Building Luminance** – This should be limited to avoid over lighting, and related to the general district brightness. In this reference building luminance is applicable to buildings directly illuminated as a night-time feature as against the illumination of a building caused by spill light from adjacent luminaires or luminaires fixed to the building but used to light an adjacent area.

Table 3 – Obtrusive Light Limitations for Exterior Lighting Installations – Road Users		
Road Classification ⁽¹⁾	Threshold Increment (TI)	Veiling Luminance (Lv)
No road lighting	15% based on adaptation luminance of 0.1cd/m ²	0.04
ME6/ ME5	15% based on adaptation luminance of 1cd/m ²	0.25
ME4/ ME3	15% based on adaptation luminance of 2cd/m	0.40
ME2 / ME1	15% based on adaptation luminance of 5cd/m ²	0.84

TI = Threshold Increment is a measure of the loss of visibility caused by the disability glare from the obtrusive light installation

Lv = Veiling Luminance is a measure of the adaptation luminance caused by the disability glare from the obtrusive light installation

(1) = Road Classifications as given in BS EN 13201 - 2: 2003 Road lighting Performance requirements. Limits apply where users of transport systems are subject to a reduction in the ability to see essential information. Values given are for relevant positions and for viewing directions in path of travel. For a more detailed description and methods for determining, calculating and measuring the above parameters see CIE Publication 150:2003.

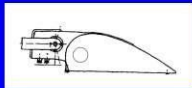
RELEVANT PUBLICATIONS AND STANDARDS:

British Standards: www.bsi.org.uk	BS 5489-1: 2003	Code of practice for the design of road lighting – Part 1: Lighting of roads and public amenity areas
	BS EN 13201-2:2003	Road lighting – Part 2: Performance requirements
	BS EN 13201-3:2003	Road lighting – Part 3: Calculation of performance
	BS EN 13201-4:2003	Road lighting – Part 4: Methods of measuring lighting performance.
	BS EN 12193: 1999	Light and lighting – Sports lighting
	BS EN 12464-2: 2007	Lighting of work places – Outdoor work places
Countryside Commission/ DOE	Lighting in the Countryside: Towards good practice (1997) (<i>Out of Print but available on www.communities.gov.uk/index.asp?id=1144823</i>)	
UK Government / Defra www.defra.gov.uk	Statutory Nuisance from Insects and Artificial Light – Guidance on Sections 101 to 103 of the Clean Neighbourhoods and Environment Act 2005	
	Road Lighting and the Environment (1993) (Out of Print)	
CIBSE/SLL Publications: www.cibse.org	CoL	Code for Lighting (2002)
	LG1	The Industrial Environment (1989)
	LG4	Sports (1990+Addendum 2000)
	LG6	The Exterior Environment (1992)
	FF7	Environmental Considerations for Exterior Lighting (2003)
CIE Publications: www.cie.co.at	01	Guidelines for minimizing Urban Sky Glow near Astronomical Observatories (1980)
	83	Guide for the lighting of sports events for colour television and film systems (1989)
	92	Guide for floodlighting (1992)
	115	Recommendations for the lighting of roads for motor and pedestrian traffic – Second Edition (2010)
	126	Guidelines for minimizing Sky glow (1997)
	129	Guide for lighting exterior work areas (1998)
	136	Guide to the lighting of urban areas (2000)
	150	Guide on the limitations of the effect of obtrusive light from outdoor lighting installations (2003)
	154	The Maintenance of outdoor lighting systems (2003)
ILP Publications: www.theilp.org.uk	TR 5	Brightness of Illuminated Advertisements (2001)
	TR24	A Practical Guide to the Development of a Public Lighting Policy for Local Authorities (1999)
	GN02	Domestic Security Lighting, Friend or Foe
ILP/CIBSE Joint Publications	Lighting the Environment - A guide to good urban lighting (1995)	
ILP/CSS Publications	Joint Code of Practice for the installation, maintenance and removal of seasonal decorations. (2005)	
ILP/CfDS Joint Publication www.dark-skies.org	Towards Understanding Sky glow. 2007	
IESNA www.iesna.org	TM-15-07 (R) Luminaire Classification System for Outdoor luminaires	

NB: These notes are intended as guidance only and the application of the values given in Tables 2 & 3 should be given due consideration along with all other factors in the lighting design. Lighting is a complex subject with both objective and subjective criteria to be considered. The notes are therefore no substitute for professionally assessed and designed lighting, where the various and maybe conflicting visual requirements need to be balanced.

APPENDIX 1 - PROPOSED OUTDOOR LUMINAIRE CLASSIFICATION SYSTEM

Variable Aim Luminaires – General Classifications:

➤ Type A	Symmetrical	
➤ Type B	Asymmetrical	
➤ Type C	Double-Asymmetrical	

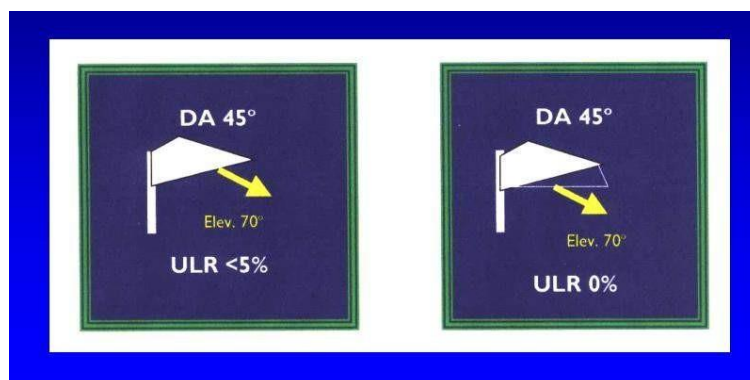
Proposed labelling System:

Fixed Position luminaires



Variable Aim Luminaires

(Shown here for a 45° Double-Asymmetric luminaire aimed at 70° – with and without a cowl).



APPENDIX 2 - ILLUSTRATIONS OF LUMINAIRE ACCESSORIES FOR LIMITING OBTRUSIVE LIGHT (images provided by Philips and Thorn)

Cowl (or Hood)



External Louvre



SHIELD



SHEILD "Barn Doors"



Double Asymmetric Luminaire



Simple Hood



Circular Louvre



Cowl & Louvre



Internal Louvre (horizontal)

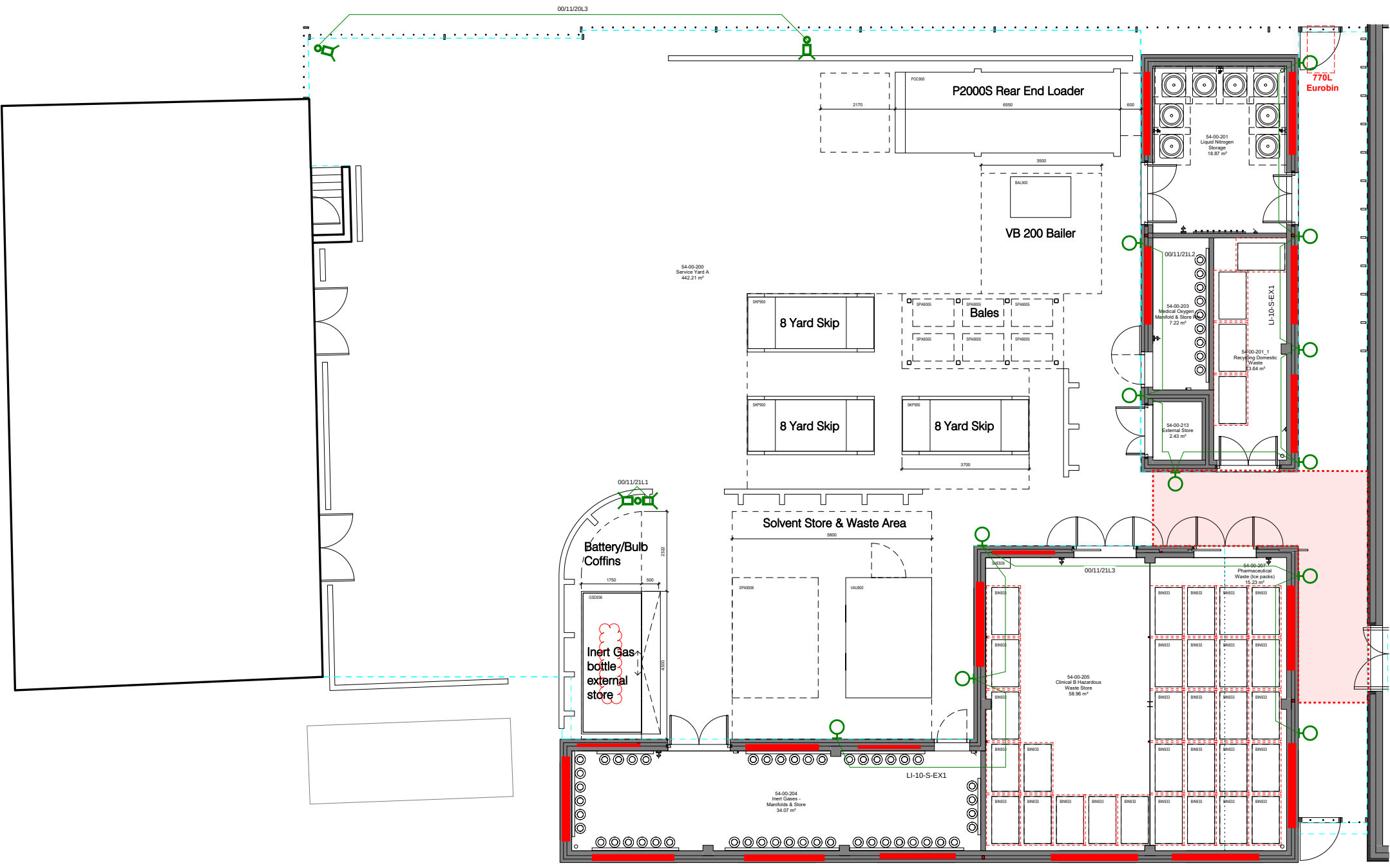


Internal Louvre (vertical)



Appendix B

Luminaire Layout



Legend

 Whitecroft Kolo IP65 Hood 14.2W External Light [Mounting Height: 1600mm AFFL]

 Whitecroft Sirocco Flood 150W Luminaire [Mounting Height: 4000mm on column]

Lighting Control
External lighting to FM compound controlled by external photocell and BMS timesclock. Periods of illumination to be confirmed by Client.

Compliance with ILP Guidance 2011
The external lighting indicated has been designed to minimise obtrusive light, in accordance with the guidance outlined in ILP Guidance Note 01-2011 - 'Guidance notes for the reduction of obtrusive light'.

Reference	Description	Lamp/Lumen Package
Q	Whitecroft Kolo IP65 400mm	1008lm 14W
R	Whitecroft Sirocco Flood 1200mm	14840lm 150W

Main Building External Lighting
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LEGEND



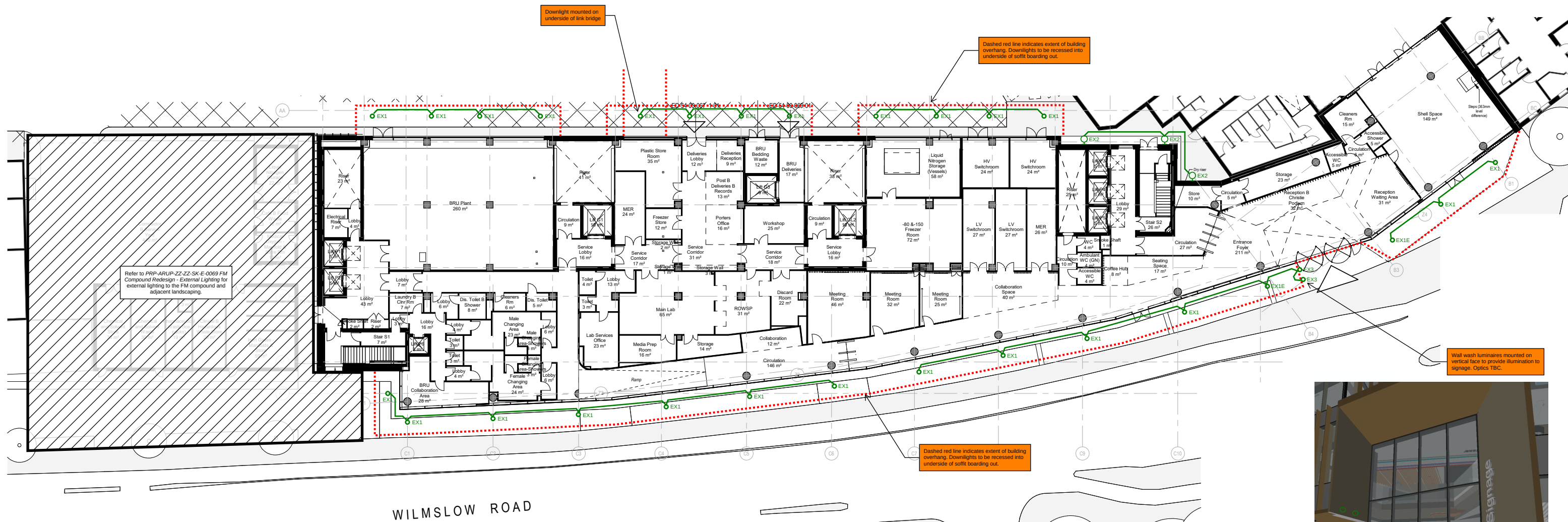
EX1
Whitcroft Mirage LED IP65
4000k
2500lm
DALI driver
'E' suffix denotes integral emergency



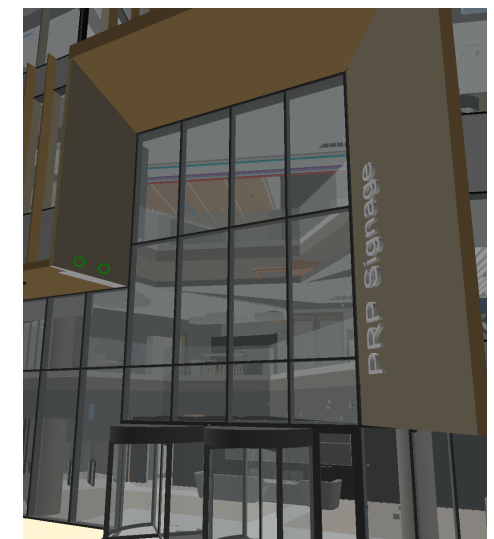
EX2
Whitcroft Kolo Hood IP65
4000k
1008lm
DALI driver

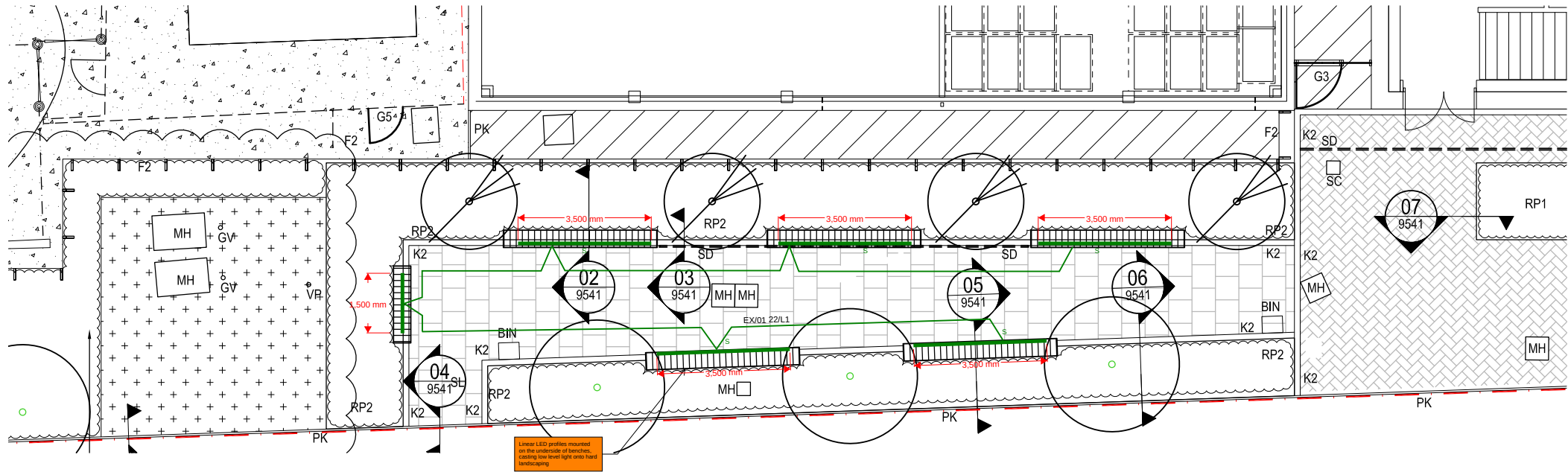


EX3
Thorn Contrast Medium
4000k
3887lm
Optics TBC
DALI driver

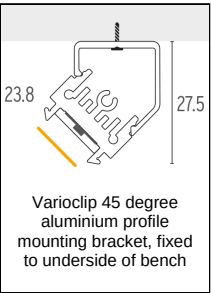


Wall wash luminaires mounted on vertical face to provide illumination to signage. Optics TBC.





Legend



Reference	Description	Lamp/Lumen Package
S	LED Linear VarioLED IP67 3800k 280lm/m with 45 degree mounting bracket	1100lm 27.2W