Intended for
Stadium Capital Holdings

Project no.
61030030/SOENV/02

Date
11 June 2013

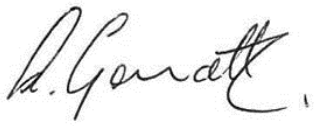
MIDLAND CRESCENT STUDENT HOUSING

OBTRUSIVE LIGHT LIGHTING REPORT

MIDLAND CRESCENT STUDENT HOUSING
OBTRUSIVE LIGHT LIGHTING REPORT

Revision History

Revision	Date	Purpose / Status	Document Ref.	Comments
C	11.06.13	Third Issue	61030030/SOENV/02	
B	15.04.13	Second Issue	61030030/SOENV/02	Building Profile Amended
A	12.10.12	First Issue	61030030/SOENV/02	

Prepared By	Reviewed By	Approved By
		
L Socker	**A Garratt**	**A Bell**
Principal Engineer	Associate	Director

Ramboll
Carlton House
Ringwood Road
Woodlands
Southampton SO40 7HT
United Kingdom

tel +44 (0)23 8081 7500
fax +44 (0)23 8081 7600
southampton@ramboll.co.uk

CONTENTS

APPENDICES

1. EXECUTIVE SUMMARY

1.1. Lighting, Criteria, Methodology and Impacts

1.1.1. The aim of this report is to provide an evaluation of the lighting from the proposed Midland Crescent Student Housing on the Finchley Road London NW3.

1.1.2. Lighting from exterior areas which include footways access stairs and security lighting has the potential to impact on the adjacent railway in that it may affect track visibility for railway operatives or colours in lighting may conflict or cause confusion with colours used for signalling. The scheme lighting has been evaluated against this criteria and obtrusive light planning guidance.

1.1.3. The report is based on data obtained from the developer and plans provided at the time of light modelling and addresses the effects of light in terms of recognised planning policy requirements. These are based on the document 'Lighting in the countryside towards good practice – Department of the Environment and Countryside Commission' noted in Camden Council guidance documentation and recognises the sensitivity and public awareness of lighting with the impact upon surroundings. The need for lighting is discussed for security, safety and to reduce crime.

1.1.4. Guidance on acceptable levels of light have been taken from the Institution of Lighting Professionals Guidance Notes for The Reduction of Obtrusive Light. This sets out limits on Luminaire Intensity (Brightness of Light Fitting and Light Source) for a particular environment. The environment which is being accessed is classed as an Environmental Zone E3 which comes under the description 'Suburban' and would be of medium district brightness.

1.1.5. The lighting analysis used to evaluate the impact of lighting has been based on a speculative trapezoidal building comparable to the development and with comparable glazing areas. The main façade examined is the southern aspect which has the largest area of glass and extends to the lower levels close to the railway. This is viewed as the most onerous aspect and has been modelled for external fittings and light out of window using Philips Calculux software.

1.1.6. Analysis shows that, without providing fencing, the effects of glare from viewing the lighting will not be problematical as the glare rating calculated is GR10 which is classed as unnoticeable. The average light level in lux would be 12 lux with maximum of 37 lux equivalent to a well-lit roundabout. Regarding the allowable luminaire intensity pre-curfew it is 10,000 candelas (cd) and 1,000 cd post curfew. From calculations the maximum intensity is 794 cd which is within acceptable limits for the defined environmental zone. Furthermore there would be no upward light output from the exterior fittings modelled.

1.1.7. Since calculations were undertaken, a boundary fence is being provided which will reduce the impact of light on to the railway

2. INTRODUCTION

2.1. Report and Site Description

2.1.1. This report provides an analysis of the lighting from the proposed development.

2.1.2. The report is based on data obtained from the developer and plans provided at the time of light modelling and addresses the effects of light in terms of recognised planning policy requirements based on the document 'Lighting in the countryside towards good practice – Department of the Environment and Countryside Commission' noted in Camden Council guidance documentation and recognising the sensitivity and public awareness of lighting with the impact upon surroundings. The need for lighting is discussed for security, safety and to reduce crime. The standards applied are noted together with design levels that have been used. In summary the report discusses:-

- Information provided.
- Need for lighting.
- Lighting levels applied and standards followed.
- Equipment used.
- Renderings and colour treatments.
- Effects on the surrounds (character of landscape and environment) and observers.
- Effect on railway and distraction.
- Mitigation (including screening to contain lighting effects controls and hours of use).

2.1.3. The main concerns to be addressed are that lighting from the site may impact on the railway in that it may be glary or extremely bright and interfere with the train drivers' vision and comprehension of signals. There is also the issue of general light nuisance, trespass and pollution.

2.1.4. Factors that have been taken into account in determining the lighting provided and the analysis of impact are as follows:-

- Control of upward waste light.
- Appropriate light levels for tasks.
- Site boundaries and adjoining properties.
- Control of the effects of glare and light trespass and spillage on adjoining land.
- Applicable standards and limits placed on lighting levels and obtrusive light.
- Measures to mitigate unavoidable impacts.

2.1.5. Lighting is being provided for the safety, comfort and personal security of the building users. For external lighting in particular the user must be able to see the layout of the footpaths/ premises and any obstructions with certainty and in time to respond. Internally the user should be able to carry out the required tasks and navigate the premises which must appear inviting.

3. SITE DESCRIPTION

3.1. Site Location

3.1.1. The site is located in Hampstead north London. The site is approximately 0.16Ha, located adjacent to Finchley Rd, NW3 6LT (approximate National Grid Reference is 526130, 184880). A site location plan is shown in Appendix 1.

3.2. Site Boundary and Surroundings

3.2.1. The site is vacant land located between National Rail lines, and is currently overgrown with shrub-like vegetation and grasses. It is located in a mixed-use area of Hampstead.

- To the east of the site is Finchley Road, which is fronted predominantly by commercial spaces (mainly shops) at ground level and residential apartments above. There is also a Holiday Inn.
- The northern, southern and western boundaries are immediately adjacent to National Rail lines.
- Further to the north is Rosemont Road, which is predominantly residential with a small number of commercial spaces.
- Further to the south is Blackburn Road, the O2 shopping centre and associated outdoor car park. Within the centre is a cinema, gym, restaurants and shops including a supermarket.

3.3. Proposed Development

3.3.1. The development is a mixed residential and student housing scheme of approximately 92 beds (approximately 10% disabled and 10% studio units) with some commercial space on the ground floor and both lower ground floors. 11 residential units are proposed with a separate access from Finchely Road, located on the east side of the building. The development is likely to consist of seven storeys with two of these being below Finchely Road level . There will be no parking on site but cycle stores are provided within the lower ground level.

4. LIGHTING REQUIREMENTS

4.0.1. The Midland Crescent Student Housing site will have minimal external lighting that would impinge or affect the surrounding environment. There are however two sources of lighting which are:-

i. For security purposes to aid evacuation in an emergency there will be lighting to the footways with an average maintained illuminance of 5 lux. This will be provided by directional bollards directing light away from the railway so there will be no back light or light source visible from the railway.

ii. Interior functions

iii. There will be no architectural lighting provided for wall washing and grazing

4.1. Methodology

4.1.1. The lighting analysis used to evaluate the impact of lighting has been based on a speculative trapezoidal building comparable to the development and with comparable glazing areas. The main façade examined is the southern aspect which has the largest area of glass and extends to the lower levels close to the railway. This is viewed as the most onerous aspect.

4.1.2. The programme used to model the light out of window is Philips Calculux

4.1.3. The fittings likely to be used in the accommodation are either a fluorescent or LED fitting which would be surface mounted. The light source (lamp/LED fitting which is behind a diffuser) would therefore not be directly visible to persons inside or outside the building.

4.1.4. The lighting evaluation has been undertaken based on a speculative lighting layout for the student accommodation. Assumed lighting consists of Philips Core Line surface LED fittings for interior lighting, and Phillips Verona bollards for the exterior fittings.

4.1.5. The site has been modelled with the railway track taken as 9m below the street ground level of the site. No account has been taken of retaining walls at the side of the track which could obstruct the view of some windows.

4.1.6. Evaluation has also taken into account light spill and upward light together with the brightness of the building structure relative to the environment and railway signalling.

4.1.7. The amount of light spill will also be assessed however we note that some light spill can produce a benefit in terms of security or in helping people navigate around the boundary. Light can also have an effect on ecology which will be briefly discussed.

4.1.8. The aims of lighting, the principles of night vision and requirements of night use are noted in this report and follow the quality criteria for pedestrian use as listed below:-

- Average illuminance/luminance;
- Illiuminance/Luminance uniformity;
- Limitation of glare;
- Lighting of the surrounds;
- Optical Guidance; and
- Limiting and controlling obtrusive light.

4.2. Potential Impacts

4.2.1. Lighting from the site may impact on the railway in that it may be glary or extremely bright and interfere with train drivers vision and comprehension of signals.

4.2.2. Lighting may also impact on any neighbouring buildings and the viewed intensity of light sources from neighbouring buildings may require analysis together with any light from the development that falls outside the site.

4.2.3. Light can also have an effect on ecology which will be briefly discussed.

4.3. List of Lighting Standards

4.3.1. This report and the review of lighting from the development has been examined with the relevant British and European Standards and Industry Codes of Practice. A non-exhaustive list of these standards is bulleted below.

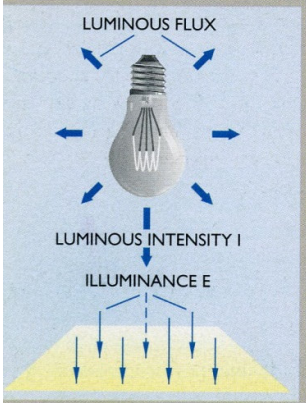
- BS 5489:2003 – Code of practice for road lighting
- BSEN 13201:2003 – Road lighting - performance criteria/calculation /measurement
- BSEN 12464-1:2011 Light and lighting – Lighting of work places Part 1 indoor work places.
- BSEN 12464-2:2007 Light and lighting - Lighting of work places Part2 outdoor work places.
- ILE Technical Report TR28 Measurement of road lighting performance on site
- ILP Guidance notes for the reduction of obtrusive light
- CIE 112: 1994 Glare Evaluation System for Use within Outdoor Sports and Area Lighting
- CIE 150-2003 (ISBN 3 901 906 19 3) Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations.
- Lighting in the countryside towards good practice – Department of the Environment and Countryside Commission.
- CIBSE/SLL Lighting Guide 6 1992 The Outdoor Environment

5. LIGHTING MEASUREMENTS

5.1. Luminance and Luminance Uniformity

5.1.1. The brightness of a light source or object is termed as its luminance. The variables used to describe lighting are noted in the table below;-

Variables and units in lighting technology



Variable	Symbol	Unit	Definition
Luminous flux	Φ	Lumen (lm)	The light output of a light source
Luminous intensity	I	Candela (cd)	Intensity of the light output in a specific direction (luminous flux/solid angle)
Illuminance	E	Lux (lx)	Luminous flux incident on a surface area divided by the size of the surface area
Luminance	L	cd/m^2 cd/cm^2	Luminous intensity of a light emitting surface divided by the size of the perceived surface or: the brightness of a diffuse reflecting surface, determined by multiplying illuminance with reflectance divided by p

5.1.2. When using luminance as a control measure for design one should be aware that the apparent brightness of the subject will be vary depending on where the object is being viewed from (i.e. angle of observation and distance influence luminance). The amount of light falling on the subject can also be misleading when judging brightness as the surface properties of the subject (colour, texture etc.) will influence the amount of reflectance light. Other factors (i.e. atmospherics etc.) also affect how light is perceived.

5.1.3. All these factors have to be appreciated in evaluating lighting. The observation point and angle of perception may influence how the installation is perceived and whether there would be a problem for the train driver in recognising signalling.

5.1.4. When measuring the amount of light falling upon a surface, the units are lux and the term used to describe this is illuminance.

5.2. Glare

5.2.1. Glare is frequently caused by light sources that are much brighter than their surroundings, and that are directly seen along the line of sight at normal viewing angles.

5.2.2. Glare can occur as a result of excessive contrast when one part of the field of view is much brighter than another. The most common source of excessive brightness in an exterior environment is the sun, or at night, road luminaires. Viewing a bright source against a dark background can cause glare.

5.2.3. Glare caused is caused by the presence of a bright light source (luminaires) in the field of view of the observer. Glare can be experienced in the form of :-

- *Discomfort Glare* - This can be the unpleasant sensation of the presence of bright spots in the field of vision, which may not necessarily impair vision. Discomfort glare is therefore subjective.

- *Disability Glare* – This is the effect of impaired vision due to the presence of light sources in the field of view. These sources cause stray light in the eye, which is superimposed to the image on the retina. The result is a reduction in contrast of the image so that the ability to see low contrasts and/or small objects is reduced. Therefore disability glare is directly related to road safety. Disability glare is an objective measurable quality and is measured by Threshold increment.

5.2.4. To appraise glare and place a numerical rating the CIE glare rating system has been applied. The lower the value of Glare Rating (GR) the better the glare restriction. The nine point scale is tabled below. Glare ratings have been calculated for all areas of adjacent track and critical viewing surrounds.

5.2.5. Glare Rating

Glare Rating (GR)	Assessment
(1)	(2)
Unbearable	90
	80
Disturbing	70
	60
Just Admissible	50
	40
Noticeable	30
	20
Unnoticeable	10
From CIE Report 112:1994 Glare Evaluation System for use Within Outdoor Sports and Area Lighting	
Nine Point Glare Assessment Scale	

5.2.6. How this can be applied to circulation routes and working tasks is illustrated in the table below:-

Type of Application	Risk	GR max
(1)	(2)	(3)
Safety and Security	Low Risk	55
	Medium Risk	50
	High Risk	45
Movement and Safety	Pedestrians only	55
	Slow Moving Traffic	50
	Normal Traffic	45
Work (For viewing tasks of decisive importance on working areas it may be advisable to use maximum glare rating values of GR_{max} 5 units lower than those specified)	Very Rough	55
	Rough – Medium	50
	Fine	45
Sports	Training	55
	Competition, TV , CCTV	50
From CIE Report 112:1994 Glare Evaluation System for use Within Outdoor Sports and Area Lighting		

6. LIGHTING PLANNING REQUIREMENTS

6.1. Requirements

6.1.1. In considering the appropriate level of light on to buildings and upward light ratio (ULR) the environmental zone in which the building lies should be established using the Institution of Lighting Professionals Guidance Notes for the Reduction of Obtrusive Light which is used by local planning authorities. The Student accommodation in this area can be classified as a zone of medium district brightness and environmental zone E3. The metrics for environmental zones E3 are noted in the table below together with the other environmental zones.

6.2. Planning Policy Guidance

6.2.1. General Planning Policy Guidance notes (PPG) set out design policies and considerations for design. With regard to lighting these consider the impact and if lighting will have a significant impact on the character or quality of the environment (PPG1-1997). There is also PPG23 (Planning and Pollution Control) that permits authorities to take account of the polluting impact of lighting in preparing local plans. These are generally summarised as:-

- Impact on the environment
- Measures to minimise impact

6.3. Environmental Zone Description

E0 – Protected Dark – UNESCO Starlight Reserves, IDA Dark Sky Parks
E1 – Natural Intrinsically dark – national parks areas of outstanding natural beauty etc.
E2 - Low district brightness areas typically rural, small village or relatively dark urban location.
E3 - Medium district brightness typically suburban, small town centre or urban location
E4- Urban High district brightness, town or city centres with high levels of night time activity.

Table 6.3.1- Obtrusive Light Limitations for Exterior Lighting Installations

Obtrusive Light Limitations for Exterior Lighting Installations						
Environmental Zone	Sky Glow ULR Max (%)	Light trespass into windows Ev (lux)		Source Intensity I (kcd)		Building Luminance pre curfew
		Pre curfew	Post Curfew	Pre curfew	Post Curfew	Average L (cd/m^2)
E0	0	0	0	0	0	0
E1	0	0	0 (1*)	0	0	0
E2	2.5	5	1	7.5	0.5	5
E3	5	10	2	10	1	10
E4	15	25	5	25,000	2,500	25
Note: Taken from The Institution of Lighting Professionals Guidance Notes for the Reduction of Obtrusive Light * Permitted only from public road installations.						
Light into windows – These are suggested maximums and need to take account of existing light trespass at the point of measurement. * Acceptable for public road lighting installations ONLY.						
Source Intensity - This applies to each source in the potentially obtrusive direction, outside of the area being lit. The figures are given for general guidance only and for some large sports lighting applications with limited mounting heights, may be difficult to achieve.						
Building Luminance – This should be limited to avoid over lighting, and relate 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 floodlights or floodlights fixed to the building but used to light an adjacent area.						
Values also noted in BSEN12464-2:2007 table 2						

6.3.1. It is important to consider the **source intensity** of the luminaire in any potentially obtrusive direction especially when located close to buildings and viewed from domestic windows. Figures in the table above give limitations on these parameters.

6.3.2. A typical viewed source intensity of 0.8 kcd can be experienced from the light fittings in the building which are within recommended post curfew limits for this environmental area. It should be noted that the intensity of the light source when viewed is dependent on the observer position in relation to the light source that is visible from that location. From a train driver's perspective, this is not likely to be problematical as the viewing position is opposite the window and the driver is not likely to be looking in to the windows but at the track ahead.

6.3.3. Light pollution is a generic term that encompasses many different aspects of improper lighting, some of which are discussed below.

6.4. Light Trespass

6.4.1. Some light spill can often produce a benefit in terms of security, or in helping people navigate around the boundary or defined area, but unless this is meeting a part of the defined requirement, then spillage of this sort should be avoided.

6.4.2. Light trespass and glare are subjective in nature and difficult to eliminate, but they can be minimised through good design practices. The fact that light trespass is a concern is a given, however overly rigid regulations are just as undesirable as light trespass itself. Codes must allow for design flexibility through a reasonable review process.

6.5. Obtrusive Light

6.5.1. Reducing light spill and obtrusive light decreases the nuisance caused to others, be it keeping people awake due to light coming through a bedroom window or impeding views due to glare. Lighting beyond the task area also wastes electricity resulting in unnecessary emissions of greenhouse gases and increasing the carbon footprint.

6.6. Atmospheric Light Scatter

6.6.1. Light scatter is another factor relevant to light pollution. Tiny particles of dust and moisture in the atmosphere will interrupt a path of light, and disperse some of the light in all directions. Some will inevitably go upwards. In industrial areas and in damp climates the amount of scatter will be more. A similar effect will be produced if lighting equipment is not cleaned regularly. Dust and dirt on the optical surfaces will both reduce their efficiency, and introduce scatter. Halo effects around optics is often evidence of light scatter.

6.6.2. This is has been addressed in the submission by restricting he upward light being delivered from exterior lighting within the development.

6.7. Ecology

6.7.1. In modern society people need light which can prolong the working day and allow access to leisure facilities during darker winter months and to create a safe and secure environment.

6.7.2. The proliferation of external lighting has however caused concern for the environment. The cumulative glow of artificial light can cause views of moonlight and star studied night skies to be obliterated. In addition excessive lighting increases urbanisation on rural areas, disturbing their tranquillity and views for future generations.

6.7.3. Anyone who has observed moths and other insects flying frantically around lights cannot doubt that artificial illumination has allure to some creatures. Many have witnessed bats honing in on lighted areas to feast on the fauna they attract. How other wildlife is affected is less well known, but some research indicates that light could have a detrimental effect of some wildlife. The use of artificial light to modify our environment to suit man's needs has taken the use of artificial light to astonishing extremes without realisation of all of the consequences.

6.7.4. Within this urban setting ecological effects have not been commented upon within this report for this small development.

6.8. Effects on Flora and Fauna

6.8.1. With respect to flora, lighting may cause the premature flowering or failure to flower of certain plants.

6.8.2. With regard to fauna, light can affect the feeding patterns of night hunting animals like foxes and badgers, which may be attracted to the light.

6.8.3. With this in mind, it is in environmental interests to keep the lighting footprint as small as possible to reduce the effect on nature.

7. ANALYSIS OF PROPOSALS

7.1. Proposed Installation

7.1.1. The performance requirements of the lighting will be to provide sufficient lighting internally to allow students to study providing an average of 500 lux to task areas following guidance from BSEN 12464-1:2011 Light and lighting – Lighting of work places indoor work places. For external lighting the perimeter pathway will have an average maintained illuminance of 5 lux and overall uniformity of 30%. Based on these criteria the isolux footprint from the speculative development is pictured here in paragraph 7.7 below.

7.1.2. Department of the Environment and Countryside Commission' guidance documents noted in Camden Council documentation recognises the sensitivity and public awareness of lighting and impact upon surroundings. The need for lighting is discussed for security, safety and to reduce crime. The key factors discussed are:-

- Information provided.
- Need for lighting.
- Lighting levels applied and standards followed.
- Equipment used.
- Renderings and colour treatments.
- Effects on the surrounds (character of landscape and environment) and observers.
- Effect on railway and distraction.
- Mitigation (including screening to contain lighting effects controls and hours of use).

7.2. Information provided.

7.2.1. At the time of initial analysis details were available of the southern façade with the north and south facades still being developed. Plans initially provided and reviewed were 1666-00-DR-0114 to 0110 D01; and elevation 1666-00-DR-0602 D01 for ground and lower ground glazing from which calculations were developed. Plans 1928-00-DR-108 to 116 P01 with Sections 1928-00-DR- 401 to 405 rev P01 and Elevations 1928-00-DR-601 and 605 rev P01 have been considered for the amended design.

7.2.2. External lighting for functional footway illumination will be provided by low level bollards directed away from the railway.

7.3. Need for lighting.

7.3.1. The development will have minimal external lighting that would impinge and/or affect the surrounding environment. There are however two sources of exterior lighting which are:-

- For security purposes to aid evacuation in an emergency there will be lighting to the footways with an average maintained illuminance of 5 lux. This will be provided by directional bollards directing light away from the railway so there will be minimal back light or light source visible from the railway.

- Internal lighting is required to enable occupants to see what they are doing and work effectively at night and in areas where there is insufficient daylight.
- No architectural lighting provided for wall washing and grazing.

7.4. Lighting levels applied and standards followed.

7.4.1. The performance requirements of the internal lighting are based on a speculative layout to provide sufficient lighting internally to allow students to study providing an average of 500 lux to task areas (BSEN12464). Lighting levels could be reduced when task areas within the room are analysed and lower background ambient lighting is designed reducing building lighting and power requirements.

7.4.2. External lighting is proposed to follow British Standard guidance from BSEN 12464 and CIBSE/SLL lighting guide 6 'The Outdoor Environment with a minimum maintained average of 5 lux.

7.5. Equipment used.

7.5.1. The equipment used to model interior lighting levels are Philips Core line luminaire reference RC160V W60L60 1xLED34/840 and Philips Verona bollard reference EGP+GGP145 1xSON-I-70W-CO

	
Phillips Core Line Luminare	Philips Verona Bollard

7.6. Renderings and colour treatments.

7.6.1. As it is not intended to light the exterior of the building no renderings or colour treatments have been modelled.

7.7. Effects on the surrounds (character of landscape and environment) and observers

7.7.1. In appraising the impact of lighting, calculations show that concerns regarding glare and impairment due to bright light sources can be disregarded as the glare ratings are low. The glare ratings calculated along the railway (Figure 2) show the glare rating category un-noticeable with a maximum glare rating of GR10. For traffic conditions a glare rating of 45 is acceptable (see paragraph 5.25), therefore the lighting should not impede railway operatives.

7.7.2. The maximum luminous intensity from the functional building lighting is 794 cd which is acceptable for the environment after curfew. It is extremely unlikely that the lights will be directly viewed by anyone outside the building so light intensities are not perceived as being a problem. To view this intensity one would have to be alongside the building looking up at the higher floor luminaires. This would obviously not be possible for train drivers and it has been assessed that the maximum view intensities will be approximately 160cd.

7.7.3. Examining the isolux footprint it is predicted that an average illuminance of 28 lux would be experienced on the adjacent railway. At the west end of the site where the building is further away the illuminance would be between 12 and 30 lux while on the east between 11 and maximum peak of 70 lux. The 1 lux contour would extend about 15m from the southern face of the building taking lux levels at existing ground level.

7.7.4. It also noted that Network Rail perceive the accommodation block building backgrounds could cause a distraction to the viewing signals. At track level this will be mitigated by a fence discussed in paragraph. 7.8.7

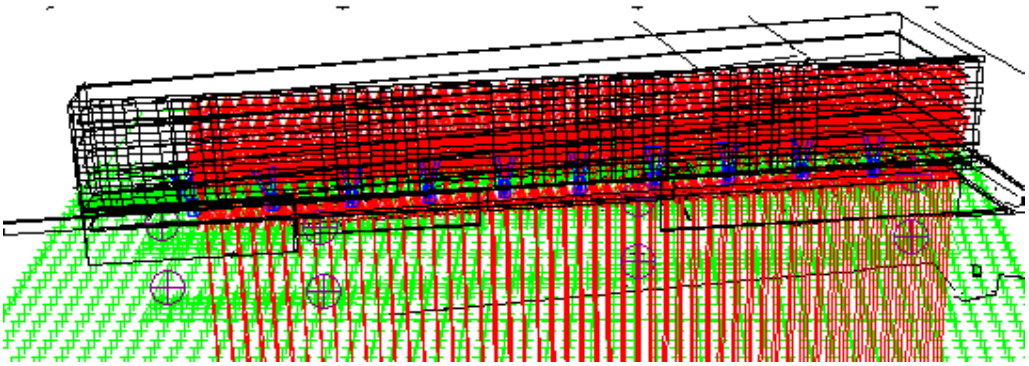


Figure 1 - Elevation on Modelling (Depicting Reduced Glazing and Lighting).

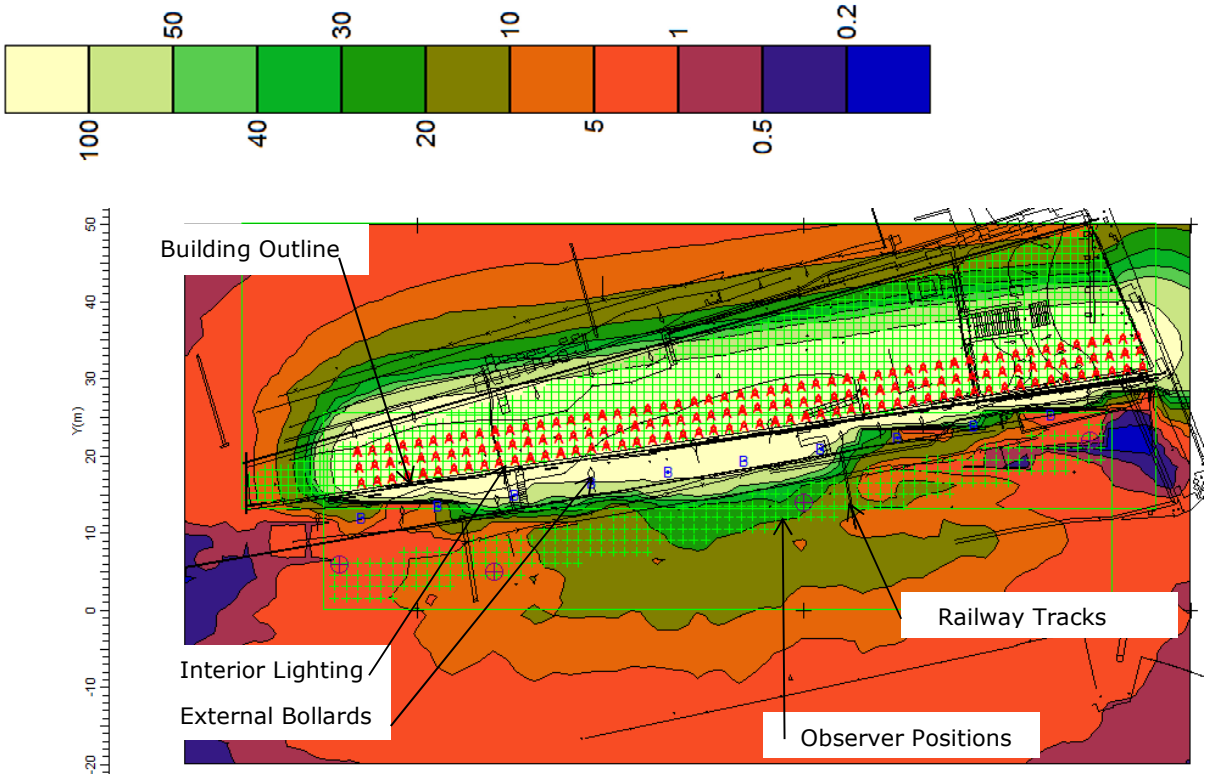


Figure 2 - Isolux Plot showing light spill (below) with lighting levels calculated at ground floor level.

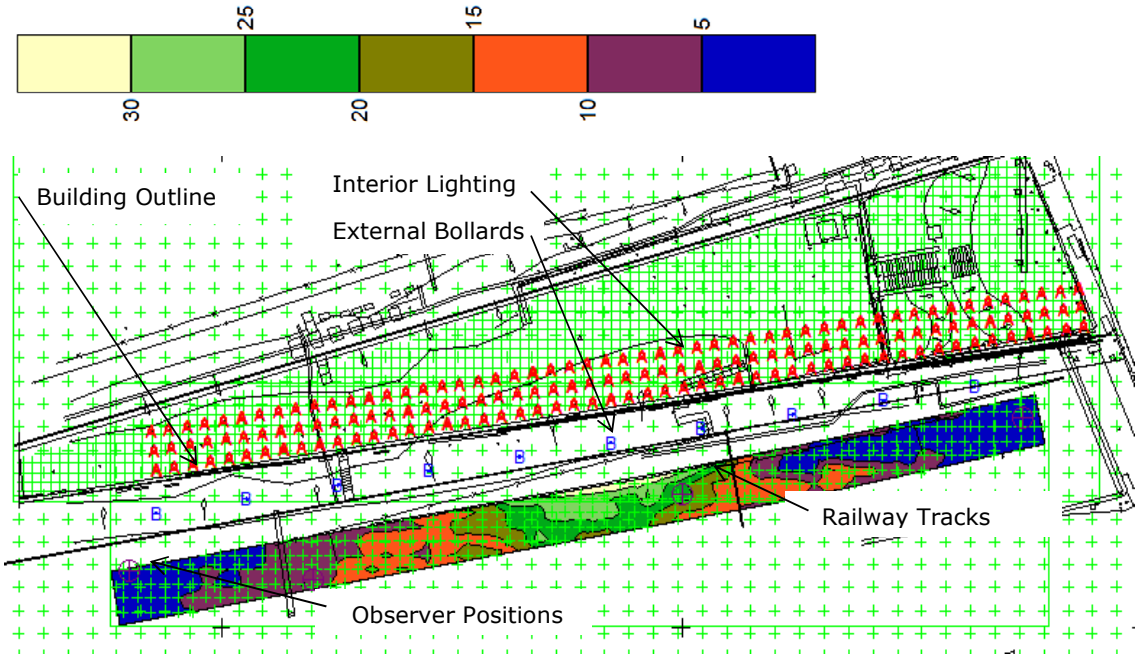


Figure 3 - Isolux Plot showing light spill (below) with lighting levels calculated at track level.

7.8. Visual Impact

7.8.1. The existing street lighting columns along the Finchley Road are by day are visually obtrusive. Properties along the road are two and three story with windows on the upper levels so comparatively similar lighting level will be generated from these properties and the light impact from this building will be no worse than neighbouring properties which includes the O2 centre with café and eating places and mostly glass façade as shown below.

7.8.2. The east façade faces the Finchley Road which is a lit main road with lighting columns and lanterns. The building façade is similar to the O2 centre neighbouring the development to the south with similar floor to ceiling lighting. However the building being considered has a smaller proportional area of glazing frontage in comparison to the O2 centre. The upper 4 storeys have a similar area of glazing to adjacent residential properties. As glazing is similar, the impact of lighting from this element of the development is viewed as not being problematical in a lit highway environment with lit shop frontages.

Neighbouring O2 Centre

Finchley Road

7.8.3. Lighting provided for the development will not have a negative impact on the visual character of this urban environment as surrounding buildings are lit. The environment is not particular sensitive as it is urban and not an area of outstanding natural beauty (AONB) retaining dark sky status nor site of special scientific interest (SSSI).

7.8.4. It is not predicted that security lighting or the lit facades will have a detrimental significant impact on the environment with adjacent buildings being of similar character and similarly lit to architectural advantage. Leaving the building without light would make it dark and uninteresting or uninviting at night. Lighting of the exterior footways and stairs is required for safety and security enabling the wayfinding for users. The architectural significance of the structure is commented elsewhere in the planning application.

7.8.5. Mitigation (including screening to contain lighting effects controls and hours of use).

7.8.6. Given the low level of lighting impacts predicted by the current modelling, mitigation measures are not directly required in order to reduce light levels to within acceptable limits.

7.8.7. Should mitigation still be considered, options include:

- A boundary fence is to arc over the top of the external amenity area in a louvered /brie soleil design serving the purpose of shading the southern windows, screening light spillage from the commercial units at track level and providing the protection Network Rail require for protection against objects thrown on to the tracks. This can be installed to reduce light spill onto the railway. The effect of this fence will be a slight reduction in glare to an observer on the railway tracks and illuminance on the tracks.

- Further mitigation measures that can be provided include fins or louvers to the building that would shade the view of the lights to the railway and view of the windows from approaching trains.

8. SUMMARY

8.1. Summary Options and Preference

8.1.1. An important criterion for the required luminance level is the brightness of the surroundings. This is because the light from the surroundings interferes with the normal adaptation state of the eye; that is to say the adaptation state as determined by the average luminance of the surroundings. Bright surroundings lower the contrast sensitivity of the eye, and to compensate for this loss the average road-surface luminance should be increased. In the reverse situation, i.e. dark surroundings and a bright road surface, the driver's eyes become adapted to the road surface luminance level thus reducing perception in the darker regions of the surroundings against which objects cannot therefore be seen.

8.1.2. Guidance on acceptable levels of light is available from the Institution of Lighting Professionals Guidance Notes for The Reduction of Obtrusive Light. This document sets limits on Luminaire Intensity (Brightness of Light Fitting and Light Source) for a particular environment. The environment which is being accessed is classed as an Environmental Zone E3 which comes under the description 'Suburban' and would be of medium district brightness. The allowable luminaire intensity pre-curfew is 10,000 candelas and 1,000 candelas post curfew. From calculations the maximum intensity is 794 cd which is acceptable.

8.1.3. The amount of light falling on to the tracks has been assessed and this is likely to be under 35 lux (maximum) which is equivalent to an indoor parking area or lit building site. The average illuminance is likely to be about 12 lux which is equivalent to a well lit side road. The glare rating which assesses the degree of glare experienced by an observer on the track (i.e. train driver) is minimal. The maximum glare rating is 10 which is unnoticeable on the glare evaluation scale. A glare rating of 45 is deemed acceptable for traffic conditions and a glare rating of 50 is just admissible.

8.1.4. Minimal exterior lighting is being provided which has been designed for the functional task to enable evacuation of the building in an emergency. This will be provided by low level bollards and will have minimal visual impact during the day or night.

8.1.5. A boundary fence will obscure view of glazing from track level and reduce the distraction to train drivers.

8.1.6. It is viewed that lighting for the development will be in keeping with the area and not be detrimental to the lit environment as can been seen in the quality figures below.

Obtrusive Light Limitations for Exterior Lighting Installations						
Environmental Zone	Sky Glow ULR Max (%)	Light trespass into windows Ev (lux)		Source Intensity I (kcd)		Building Luminance pre curfew
		Pre curfew	Post Curfew	Pre curfew	Post Curfew	Average L (cd/m^2)
E3 Requirement	5	10	2	10	1	10
Scheme metrics	0	NA	NA	0.86	0.86	NA
Note: Taken from The Institution of Lighting Professionals Guidance Notes for the Reduction of Obtrusive Light * Permitted only from public road installations.						

APPENDIX 1 – SITE LOCATION PLAN

APPENDIX 2 – DEFINITIONS /TERMINOLOGY

Adaptation – The process by which the state of the visual system is modified by previous and present exposure to stimuli that may have various luminance's, spectral distributions and angular substances.

Colour Appearance – General expression of the colour impression, described in terms of temperature in degrees Kelvin.

Colour Rendering – A general expression for the appearance of surface colours when illuminated by a light from a given source compared with the appearance when lit by some reference source.

Contrast – (i). In the perceptual sense: Assessment of the difference in appearance of two or more parts of a field seen simultaneously or successively (hence: brightness contrast, lightness contrast, colour contrast, simultaneous contrast, successive contrast, etc.).
(ii) In the physical sense: Quantity intended to correlate with the perceived brightness contrast, usually defined by one of a number of formulae which involve the luminances of the stimuli considered, for example: ☐L/L near the luminance threshold, or L1/L2 for much higher luminances.[IEC 50 (845)/CIE 17.4:1987; 845-02-47]

Cut Off – Technique for concealing lamps and surfaces of high luminance from direct view in order to reduce glare.

Cut off Angle – Angle measured from nadir, between the vertical axis and the first line of sight at which the lamps and the surfaces of high luminance are not visible.

Disability glare – Defined as the form of glare in which the ability to see detail is impaired without necessarily causing discomfort. The effect is usually caused by extreme contrast and can be measured in terms of a reduction of visual performance. The presence of a bright light source in the field of view causes the eye to adapt to a higher lighting level, so that the eye becomes less sensitive to the lower luminance parts of the scene which affects the contrast sensitivity. For specification it may be expressed in a number of ways. Using threshold increment (TI) using the following values of TI should be used 5%, 10%, 15%.

Discharge Lamp – Lamps producing light by an electronic discharge in a gas filled transparent tube. Discharge is produced by applying a high voltage across the electrodes which ionizes the gas filling.

Discomfort glare – Disability glare impairs visibility and may or may not be accompanied by discomfort glare. Discomfort glare may or may not impair visual performance. The degree of discomfort is dependent on the visual task or the time it is being performed. For specification if it is expressed using the unified glare rating (UGR) the following values of UGR should be used 10, 13, 16, 19, 21, 25, 28.

Diversity (Ud) – The measure of minimum to maximum luminance (Ud_L) illuminance (Ud_E) over a specified area.

Flashed Area – The area of luminous parts of a luminaire visible from the plane of view.

Glare – Intense or blinding light that causes discomfort or impairment of vision (see disability glare and discomfort glare).

Glare Index – Glare index is typically used for internal room calculations and calculated as a measure of discomfort glare for the least comfortable viewpoint. The glare index of a lighting installation is usually defined by a Building Research Station formula.

Glare Rating – Upper limit of glare calculated by the CIE Glare Rating system based on the veiling luminance produced by the luminaires and the veiling luminance produced by the environment. An

acceptable glare rating for an installation is achieved if the glare rating at any relevant observer position and viewing direction is less than the glare rating in the CIE nine point guidance table.

Illuminance (E) – The amount of light incident on a surface. Measured in (Lux (L)

Incandescence – Defined by the Oxford English Dictionary as 'emitting light on account of being at high temperature', heating an object above 525^{o}C causes incandescence or light emission.

Isolux – For a given value of luminaire line of constant illuminance on the ground or working plane.

Lumens – Unit of luminous flux (Lm).

Luminance (L) – The brightness of an object or surface. Measured in Candela (Cd/m^2).

Luminance Intensity (I) – intensity of light output inn a specific direction. Measured in candela (Cd)

Luminous Flux (**Φ**)- Quantity of light emitted by a light source, form of electromagnetic radiation. Measured in Lumens (Lm)

Metal Halide - A discharge lamp that uses a mix of metal halides added to the discharge gas to create a 'white light'. Have good colour rendering fairly log life. New generation of lamps like Cosmo and CDM Elite have ceramic rather than quartz burners and designed for mini reflectors. Lamps have a good colour rendering of Ra 60 to 70.

Mesopic Vision – Scientific term for a combination between *photopic vision* and *scotopic vision* in low (but not quite dark) lighting situations.

Obtrusive Light – Light which causes annoyance, discomfort, or a reduction in the ability to see essential information, i.e signs signals. Obtrusive light can be the result of quantitative, directional or spectral attributes in a specific situation e.g. a spill light from an installation.

Photopic Vision – Scientific term for human colour vision under normal lighting conditions during the day.

Scotopic Vision – Scientific term for human vision in the dark below 0.034cd/m^2

Threshold Increment – The number indicating the degree to which disability glare is controlled expressed as a percentage.

Upward Light Ratio (ULR) – The sum of the upward light flux contribution of each luminaire in the installation divided by the total upward and downward flux of all luminaires.

Veiling Luminance – Luminance that when added by superposition to the luminance of both the adapting background and the object, makes the luminance threshold or the luminance difference threshold the same under the two following conditions: (1) glare present, but no additional luminance; (2) additional luminance present, but no glare (unit:cd/m^2)

APPENDIX 3 - COMPARATIVE ILLUMINANCE LEVELS

To provide an appreciation of the lighting levels being evaluated and to show the likely night time impact according to measurable illuminance values. These have been set against existing night time levels which have been assessed by desk top study. The levels can be translated into comprehensible light values according to the following table:

Lighting Conditions	Illuminance Value (lux)
(1)	(2)
Tropical sunshine	100,000
English June sunshine	80,000
Overcast day	5,000
Bad light stops play	1,000
Well lit office	500
Well lit domestic room	200
Working area, building site	50
Trunk Road Roundabout	20
Good main road lighting in city	15
Typical side road lighting	5
Minimum design security lighting	1
Minimum design emergency lighting	0.2
Clear moonlight	0.2
Starlight on clear night	0.01
Taken from 'Lighting for industry and security', Stanley Lyons, 1980	

Table 1 - Man-Made and Natural Illuminance Lighting Levels

Lighting Conditions	Illuminance Value (lux)
(1)	(2)
Hypermarket	1,000
Department store	750
Small shop / Office	500
Restaurant	200
(Lighting Pritchard table 8.2 and 8.3 page 190/192)	

Table 2 – Typical Retailing and Office Illuminances

A major qualification, however, should be made about these measurements in that the eye can pick up fine degrees of light impact, which cannot be measured on a, meter.

The maximum horizontal illuminance due to whole sky excluding direct sunlight in the UK is about 35,000 lux. This value occurs in July and for only a relatively short period at noon. A standard

outdoor illuminance of 5,000 lux based on a complete hemisphere of sky is used as a basis of calculations in the UK.

Table 3 - Man-Made and Natural Luminance Lighting Levels

Lighting Conditions	Luminance Value (Cd/M^2)
(1)	(2)
Surface of the sun	2,000,000,000 cd/m^2
Unobstructed sunshine	8,000 cd/m²
Flourescent lamp	5,000 to 15,000 cd/m^2
Surface of the full moon	2,500 cd/m^2
Bright day	2,000 cd/m²
Average overcast day	500 /m²
Dusk	50 d/m²
Motorway (Artificaly Lit Road Surface 30Lux)	2 cd/m²
Dual Carriageway	1.5 cd/m²
Side road	0.5 cd/m²

100,000 lux horizontal daylight corresponds to about approximately 3,000 cd/m² and more than 8,000 cd/m².

APPENDIX 4 – ABBREVIATIONS

CIBSE – Chartered Institution of Building Services Engineers

CIE – International Commission on Illumination

CDM – Ceramic Discharge Metal Halide lamp

CPO – Cosmo Polis lamp

ILP – Institution of Lighting Professionals (Formally Engineers)

LED – Light Emitting Diode

SLL – Society of Light and Lighting