The Leeds City Station (Southern Entrance) Order Environmental Statement

Townscape and Visual Amenity Technical Appendix
Report 296480RPT011

May 2012
Metro & Network Rail

The Leeds Railway Station (Southern Entrance) Order Environmental Statement

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Metro & Network Rail

Metro
Wellington House
40 - 50 Wellington Street
Leeds
LS1 2DE

Network Rail
Hudson House
Station Rise
York
YO1 6HT

Mott MacDonald, 2nd Floor, 2 Brewery Wharf, Kendell Street, Leeds LS10 1JR, United Kingdom
T +44(0) 113 394 6700 F +44(0) 113 394 6701, W www.mottmac.com

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Mott MacDonald, 2nd Floor, 2 Brewery Wharf, Kendell Street, Leeds LS10 1JR, United Kingdom
T +44(0) 113 394 6700 F +44(0) 113 394 6701, W www.mottmac.com

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Abbreviations

BPM	Best Practicable Means
CoPA	Control of Pollution Act 1974
DfT	Department for Transport
EMP	Environmental Management Plan
ES	Environmental Statement
GLVIA	Guidelines for Landscape and Visual Impact Assessment
HUV	Holbeck Urban Village
IEMA	Institute of Environmental Management and Assessment
LI	Landscape Institute
LDF	Local Development Framework
LSSE	Leeds Southern Entrance Station
NPPF	National Planning Policy Framework
PPS	Planning Policy Statement
SA	Strategic Aims
SP	Strategy Principle
TAG	Transport Analysis Guidance
TVIA	Townscape and Visual Impact Assessment
UDP	Unitary Development Plan
UK	United Kingdom
ULR	Upward Light Ratio
VE	Visual Envelope

1. Introduction

1.1 Introduction to Townscape and Visual Impact Assessment

This document describes the effects that the proposed Leeds Station Southern Entrance (LSSE) will have upon the townscape and the visual receptors' views of that townscape.

This document describes:

- the planning policy context;
- details of the methodology and significance criteria used in the assessment;
- the existing baseline conditions;
- the impacts and effects of the proposed development on townscape and visual receptors;
- mitigation measures proposed to reduce impacts; and
- any residual impacts.

The A3 sized figures to accompany this technical appendix are presented in Volume III of this Environmental Statement (ES).

The key findings from Leeds Station Obtrusive Light Analysis (Mott MacDonald 2012) and LSSE Daylight and Sunlight Performance Study (Aecom 2009) are included in this document and both reports are appended in Appendix B and C respectively.

1.2 Scheme Design in Context of Townscape and Visual Impact Assessment

The following is a brief overview of how the proposed development will affect the townscape and visual resources and receptors during construction and operation.

Potential impacts during construction include:

- total or partial loss of existing townscape resource or features, open space and/or street space for temporary landtake (e.g. work sites) during construction;
- impact of temporary features (e.g. construction plant, hoardings) on surrounding townscape character;
- visual effects associated with construction traffic;
- removal of or change to built fabric (buildings, frontages etc); and
- loss of or change to public realm.

Potential impacts during operation include:

- total or partial loss of existing townscape resources or features and structures in the area of permanent landtake;
- impact of permanent new features on surrounding townscape character;
- changes in the overall townscape character and views as a result of the above;
- access to daylight and sunlight for the existing residential properties;
- impacts of the artificial light sources associated with the proposed development on the existing residential properties and open spaces; and
- visual effects associated with additional road traffic.

1.3 Legislation and Policy

This section provides a brief overview of the legislation relevant to the townscape and visual assessment. This is addressed from the perspective firstly of national requirements and Government guidance and policy, then in terms of local policy as set out in the Leeds Local Development Framework (LDF) and saved policies under the Unitary Development Plan (UDP).

1.3.1 National Planning Policy Framework (NPPF)

The NPPF has replaced majority of the Planning Policy Statements and Planning Policy Guidance from the 27th March 2012.

The NPPF encourages good design as part of promoting sustainable development, in particular paragraph 61 is relevant to this proposal which states that although visual appearance and the architecture of individual buildings are very important factors, securing high quality and inclusive design goes beyond aesthetic considerations. Therefore, planning policies and decisions should address the connections between people and places and the integration of new development into the natural, built and historic environment.

1.3.2 Local Planning Policy

1.3.2.1 Leeds Local Development Framework (LDF)

Leeds' Core Strategy (Preferred Option, October – December 2009) sets out the Council's vision for the future development of Leeds over the next 20 years and is the principal document in the LDF. The Core Strategy addresses a wide range of environmental, social and economic considerations in order to address the challenges and opportunities which Leeds faces. It is envisaged that the Core Strategy will be adopted in winter 2012 and therefore the proposed policies are not considered in this assessment.

1.3.2.2 Leeds Unitary Development Plan (UDP) Review 2006

The Leeds UDP Review (2006) forms the Development Plan for Leeds until such time as it is gradually replaced by the emerging LDF. The following strategic policy is considered relevant to the proposed development:

Policy SG2 states that one of the general strategic goals is to maintain and enhance the character of the District of Leeds.

Within the context of the UDP's overall goals, nine key UDP Strategic Aims (SA) have been identified. As priorities, the Leeds UDP seeks to address the following aims:

- Policy SA1 Environment aims to secure the highest possible quality of the environment throughout the District, by protecting existing good environment, conserving and enhancing where there is scope for improvement, including initiating the renewal and restoration of areas of poor environment; and
- Policy SA7 Urban Regeneration aims to promote the physical and economic regeneration of urban land and buildings within the urban areas, taking account of the needs and aspirations of local communities.

The following UDP Strategy Principle (SP) is considered relevant to the proposed development:

- Policy SP8 states that the role of the City Centre will be enhanced by:

- a planned approach to the expansion of Centre uses within a defined City Centre boundary;
- an environmental strategy concerned with improving urban design, and provision and enhancement of linked greenspaces; and
- a broad land use approach involving mixed uses within a "Quarters" philosophy.

The following General Policies are considered relevant to the proposed development:

- Policy N2 'Provision of New Greenspace' states that support will be given to the establishment of a hierarchy of greenspaces accessible to residential areas, serving the following functions and with the associated minimum targets for provision:
  - Local amenity space – for immediate local needs, including formal children's play areas and informal amenity space within or adjacent to housing: 0.2 ha per 50 dwellings; and
  - Local recreational areas – providing for local informal recreational needs of older children and adults: 2.8 ha within 400m;
- Policy N5 'Direct Action to Improve and Provide More Greenspace' states that the city council will seek both itself and in partnership with other agencies to improve the quantity and quality of greenspace provision through a phased programme for the acquisition and laying out of new greenspaces, outdoor recreation facilities and footpaths, and the extension of existing greenspaces;
- Policy N8 'Urban Green Corridors' states that the strategic network of urban green corridors links the main urban area with the countryside. These corridors provide or have the potential to provide for informal recreation and also contribute to visual amenity and nature conservation;
- Policies N9 and N10 'Other Corridor Functions' states that all development proposals should respect and where possible enhance the intrinsic value of land in fulfilling a corridor function in terms of access, recreation, nature conservation and visual amenity. Development will not be permitted which adversely affects a public right of way unless an alternative is provided which maintains the convenience, safety and visual amenity offered by the original right of way;
- Policy N12 'Urban Design' states that proposals for development should respect the following fundamental priorities for urban design:
  - spaces between buildings are of considerable importance. Development should create a series of linked and varied spaces that are defined by buildings and landscape elements;
  - the best buildings of the past should be retained. New buildings should be of good design in their own right as well as good neighbours;
  - new developments should respect the character and scale of buildings and the routes that connect them;
  - movement on foot and on bicycle should be encouraged; and
  - visual interest should be encouraged throughout;
- Policy N13 'Building Design' states that the design of all new buildings should be of high quality and have regard to the character and appearance of their surroundings. Good contemporary design which is sympathetic or complementary to its setting will be welcomed;
- Policy N19 'Building Conservation' states that all new buildings and extensions within or adjacent to conservation areas should preserve or enhance the character or appearance of the area by ensuring that:
  - the siting and scale of the building is in harmony with the adjoining buildings and the area as a whole;
  - detailed design of the buildings, including the roofscape is such that the proportions of the parts relate to each other and to adjoining buildings;
  - the materials used are appropriate to the area and sympathetic to adjoining buildings. Where a local materials policy exists, this should be complied with; and
  - careful attention is given to the design and quality of boundary and landscape treatment;

- Policy N23 'Landscape Design' states that incidental open space around new built development should be designed to provide a visually attractive setting for the development itself and, where appropriate, contribute to informal public recreation and nature conservation. Existing features which make a positive visual contribution should be retained where possible;
- Policy CC3 'Urban Design' states that the identity and distinctive character of the city centre will be maintained by:
  - protecting the building fabric and style which make Leeds a unique and attractive city;
  - encouraging good innovative designs for new buildings and spaces; and
  - upgrading the environment where necessary to complement the needs of activities which are essential to the identity, vitality and function of the city centre;
- Policy CC5 'Urban Design' states that all development within the conservation area or its immediate setting must be designed so as to preserve or enhance the existing character of the area;
- Policy 31A 'Holbeck Urban Village Strategic Housing and Mixed Use Site' states that under this policy land is allocated as a strategic housing and mixed use site, subject to:
  - preparation of a framework which will provide guidance on the sustainable development, mix and location of uses, conservation and urban design issues, the public realm, pedestrian permeability, vehicular access, parking, and methods of implementation; and
  - environmental improvements to the public realm, including open public space, pedestrian routes, the Holbeck Village and the Leeds Liverpool Canal.

1.3.3 Holbeck Urban Village Planning Framework

The Holbeck Urban Village (HUV) Revised Planning Framework was adopted in February 2006 as Supplementary Planning Guidance. It sets out the planning and design framework for the regeneration of this historically important area which includes many buildings in poor condition, underutilised and with many gap sites. The vision for HUV is as follows:

- to preserve the area's unique character, combining the architectural legacy with new high quality and contemporary design; and
- to create a mixed use, sustainable community with a distinctive sense of place, which exemplifies best practice in urban regeneration and sustainable development.

In terms of urban design and public realm, the Framework sets out a number of principles which are as follows:

- retain the best buildings from the past, not just the listed buildings. These buildings all contribute to the special and unique character of HUV;
- extensions and new developments should be of the highest quality design in a contemporary style;
- all planning applications should be accompanied by a character appraisal of any buildings on the site, together with an urban design statement that indicates how the design will contribute to the development of the urban village and continue the public arts strategy into the site and buildings;
- materials should be of a high quality and chosen to complement the prevailing materials within the area which are red brick, sandstone and blue slate (provided that this does not inhibit the development of innovative buildings using new technologies to achieve sustainability). Quality modern materials such as steel and glass would be allowed in conjunction with the use of traditional materials. Materials should be locally sourced where possible and the re-use of reclaimed materials will be encouraged;
- developments should be at a scale, height, massing and alignment complementary to the part of the village they are in. Within the conservation area, heights of new buildings should be within a storey height difference of adjacent buildings;
- retain and reinforce the varied roofline of the area;

- sustainable alternatives to the car will be promoted including improved access to the railway station and encouragement of cycling and walking; and
- key views across and out of the village, for example, of the three towers at Tower Works should be retained.

2. Approach and Methodology

2.1 Introduction

This chapter sets out the proposed methodology for carrying out the Townscape and Visual Impact Assessment (TVIA). The TVIA will determine the likely effects of the LSSE scheme on the townscape resource and visual amenity within the defined study area.

This chapter describes the methods used for determination of the baseline conditions, how the potential for impacts of the proposed development will be derived and how the effects will be assessed. In addition, mitigation measures required to prevent, reduce or offset the effects and the residual effects remaining after mitigation will also be considered. The assessment will also consider the likely effects of other 'granted' developments in the vicinity of the project insofar as they may change the effects of the development proposals.

The key methods for numerical modelling and calculations which have been used for the obtrusive light assessment are outlined in this chapter (for further detail, see Appendix B).

2.2 Scope of Assessment

2.2.1 Overview

For the purpose of the assessment process, a clear distinction is drawn between townscape and visual impacts, as defined below:

- townscape effects relate to the impacts of the development upon the physical characteristics or components of the urban environment, which together form the character of that townscape, e.g. buildings, street types and plots; and
- visual effects relate to the changes arising from the development to individual receptors' views of that townscape e.g. local residents, users of adjacent or open space, or transport users passing through the area.

2.2.2 Spatial Scope

Scope of Townscape and Visual Assessment

The extent of the Visual Envelope (VE) defines the spatial scope of the studies. The VE is defined as the extent of potential visibility to or from a specific area or feature.

The new scheme will be located over the River Aire and attached to the existing railway station. The visual envelope is limited by the railway station to the north, high apartment blocks to the west and east and the buildings adjacent to Victoria Bridge and at the junction of Neville Street and Water Lane to the south.

The site offices will be located to the west of the proposed scheme, adjacent to Office Lock on the Leeds and Liverpool Canal enclosed by a high brick wall.

The barge loading area which will be used during construction works will be located to the east of the proposed scheme, in close proximity to Bridge End and Water Lane, adjacent to a designated listed building.

The visual envelope is illustrated on Figure 17 in Volume III of this ES.

Scope of Obtrusive Light Assessment

The obtrusive light assessment has considered the two buildings adjacent to the proposed new south entrance to Leeds City Station, see figure 1 in Appendix B for visual clarification.

2.2.3 Temporal Scope

The temporal scope of the assessment commenced in 2011 with assessment of the baseline townscape conditions that currently exist. The initial site visit was conducted in September 2011 with trees in full leaf.

Operational effects of the proposed works have been assessed to one year after completion of the works.

2.3 Sensitive Receptors

Sensitive townscape elements and features include:

- listed buildings;
- conservation areas;
- open views towards the Tower Works across the Holbeck Urban Village area; and
- unity of nineteenth centaury industrial buildings in the Holbeck Urban Village.

Sensitive visual receptors include:

- residents in properties with views of the proposed development;
- users of outdoor recreational facilities including public rights of way and public realm whose attention or interest may be focussed on the townscape;
- temporary hotel residents with views of the proposed development;
- travellers on roads, lanes and railway lines within and around the study area; and
- occupiers of business and commercial properties.

2.4 Methodology

2.4.1 Consultation

A summary of the scoping opinion responses in relation to townscape and visual amenity and how they have been addressed are included in Table 2.1 below.

Table 2.1: Summary of scoping responses

Name of Organisation	Scoping Opinion Comment	Response
Natural England	3.1 Landscape and Visual Impacts Natural England expects the methodology of consideration of landscape impacts to reflect the approach set out in the Guidelines for Landscape and Visual Impact Assessment (The Landscape Institute, 2002), the Landscape Character Assessment Guidance for England and Scotland (Scottish Natural Heritage and The Countryside Agency, 2002) and good practice.	See Section 2.5.2.1 of this technical appendix for a consideration of the Guidelines for Landscape and Visual Impact Assessment (The Landscape Institute, 2002) as part of this assessment.

Name of Organisation	Scoping Opinion Comment	Response
Natural England	The assessment should also include the cumulative effect of the development with other relevant existing or proposed developments in the area. In this context Natural England would expect the cumulative impact assessment to include those proposals currently at Scoping stage. Due to the overlapping timescale of their progress through the planning system, cumulative impact of the proposed development with those proposals currently at Scoping stage would be likely to be a material consideration at the time of determination of the planning application.	An assessment of cumulative effects of the proposed scheme has been considered in Section 8.11 of Volume I: Main Statement of this ES.
Natural England	The assessment should refer to the relevant National Character Areas which can be found on our (Natural England's) website. Links for Landscape Character Assessment at a local level are also available on the same page.	This assessment refers to townscape only, the National Character Areas have not been considered as they refer to the broad landscape at national level which have not been considered relevant for the purposes of this assessment.

2.4.2 Desk Study

The following information has been reviewed and consulted during the desk based study:

- Leeds Local Development Framework;
- Leeds LDF Core Strategy (Preferred Option);
- Leeds Core Strategy maps;
- Leeds Unitary Development Plan 2006;
- Leeds UDP proposal maps;
- Holbeck Urban Village Planning Framework; and
- GRIP 4 Report and Appendices.

2.4.3 Site Survey

A site survey was undertaken by a landscape specialist on 22nd September 2011 to verify the findings of the desk study, and involved the following activities:

- assessment of the local townscape character, key elements and features;
- confirmation of listed buildings and conservation areas;
- identification of key visual receptors within the visual envelope and the recording (photographs) of the probable view; and
- verification of the visual envelope on site.

2.5 Assessment Criteria and Methodology

2.5.1 Overview

This section sets out the proposed methodology for carrying out the Townscape and Visual Impact Assessment (TVIA) including the methods used for the determination of the baseline conditions, how the potential for impacts of the proposed development will be derived, how the effects will be assessed and the identification of mitigation measures.

2.5.2 Assessment of Baseline Conditions

2.5.2.1 Sources of information

The assessment methodology is based on guidance set out in:

- 'Guidelines for Landscape and Visual Assessment' produced by the Landscape Institute (LI) and Institute of Environmental Management and Assessment (IEMA) in 2002 (Second Edition);
- 'By Design', Department of the Environment, Transport and the Regions and Commission of Architecture and the Built Environment, 2000;
- Transport Analysis Guidance (TAG) Unit 3.3.8 – The Townscape Sub-Objective;
- The Department for Transport (DfT) Design Manual for Road and Bridges Volume 11; and
- 'Guidance Notes for the Reduction of Obtrusive Light GN01:2011', Institution of Lighting Professionals, 2011.

2.5.2.2 Baseline surveys

Existing baseline conditions have been identified by both desktop and field study, including townscape character, planning designations, approved developments, the visual envelope, key visual receptors and townscape features in the vicinity of the proposed development.

The assessment will seek to identify the significance of changes to the character of the existing townscape and visual amenity which is predicted to arise from the LSSE scheme.

2.5.3 Evaluation of Baseline Conditions

2.2.3.1 Townscape

The local townscape character areas within the study area have been identified as broadly homogeneous units of distinct features and elements. The existing conditions of the character areas have been described by studying the characteristic and locally distinctive features forming the townscape of the area. The features contributing to townscape character that have been used for the assessment include:

- urban layout;
- land uses;
- density and scale;
- appearance and culture;
- activities;
- legibility;
- accessibility;
- public open spaces/squares; and
- 'soft' landscape features.

The character areas have been assessed in terms of their quality, condition and capacity to accommodate the proposed development without significant detriment and have been summarised in character area descriptions. However, it should be noted that townscape character invariably forms a part of continuum and that the character area boundaries were quite generalised in many instances as a result.

The assessment of the sensitivity of the townscape character areas has been based on the criteria in Table 2.2.

Table 2.2: Criteria for Sensitivity of Townscape Character Areas

Sensitivity	Description
High	A townscape of high or moderate quality, it may be designated, in good condition and largely intact, with a strong sense of place. It may be a scarce or fragile townscape, with historic or ecological interest which contributes to townscape quality. A townscape which is highly susceptible to change.
Medium	A townscape of moderate or low quality and condition, with some intactness, a moderate sense of place and mainly common features. It may have some historical or ecological interest which contributes to townscape quality. A townscape which is reasonably tolerant of changes.
Low	A townscape of low quality and condition with disparate elements. It demonstrates a high degree of change and has limited historic or ecological interest. A townscape which is potentially tolerant of substantial changes with little overall effect.

Based on GLVIA, IEMA and LI, 2002

2.5.3.1 Visual Amenity

The sensitivity of different visual receptors will vary according to the interest in their visual environment, viewing opportunity and duration. The visual receptors were categorised into groups reflecting proximity to the site and viewers expectations as set out below:

- "High sensitivity" - viewers with proprietary interest and/or prolonged viewing opportunities, such as residents, tourists, visitors and recreational users of public open space and public rights of way;
- "Moderate sensitivity" - viewers with moderate interest in their environment and/or transitory viewing opportunities, such as office and other workers and cyclists and pedestrians in the streets; and
- "Low sensitivity" - viewers with low interest in their everyday surroundings and/or fleeting viewing opportunities, such as commuters, train passengers, car drivers and commercial users.

2.5.4 Identification of Potential Impacts and effects

This section provides a description of the proposed construction works and completed LSSE scheme. This has been followed by an assessment of the likely effect of the scheme on baseline conditions. The predicted impacts on the townscape and visual receptors, together with the significance of the effects, have been assessed using the methodology described below.

2.5.4.1 Magnitude of impact

Magnitude of impact is a means of predicting the degree to which the townscape character and elements or existing visual amenity would be changed by the proposed development. For visual amenity receptors magnitude would generally tend to rise with increasing proximity to the scheme.

Effects have been evaluated by combining the assessment of both magnitude and sensitivity to predict the significance of effect. These effects can be beneficial or adverse, temporary or permanent depending on the nature of the development, the mitigation and any enhancement measures proposed.

The magnitude of impact will be assessed on a five point scale from 'no change' to 'major' (which could be either positive or negative), as shown in Table 2.3.

Table 2.3: Magnitude of Impact for Townscape Resource and Visual Amenity

Magnitude	Descriptor
Major	Fundamental change in key townscape elements and character and/or existing visual amenity resulting in temporary and/or permanent change.

Magnitude	Descriptor
Moderate	Detectable change in townscape elements and character and/or existing visual amenity resulting in non-fundamental temporary or permanent change.
Minor	Detectable but minor change in townscape elements and character and/or existing visual amenity.
Negligible	Insignificant change to townscape elements and character and/or visual amenity.
No change	No noticeable change to townscape elements and character and/or existing visual amenity.

Based on GLVIA, IEMA and LI, 2002

2.5.5 Assessment of Significance

In order to ascertain the effect of the proposed development within the townscape context, it is necessary to evaluate the proposals in relation to the receptors that may be affected by the development. The significance of the impact of a development will be in part dependent on the sensitivity of the receptor to the proposed change. Sensitivity refers to the ability of a townscape character area (or individual townscape element or feature) to accommodate change associated with the proposed development without significant detriment.

The assessment of the significance of the effect on townscape character will depend on the degree to which the proposal and mitigation measures:

- complement, respect and fit into the existing scale, pattern and cultural aspects of the townscape;
- maintain existing townscape character and enable a sense of place to be retained through beneficial and sensitive design;
- blend in with surrounding townscape features and elements; and
- avoid conflict with national and local policy towards protection/enhancement of townscape areas.

Both townscape and visual amenity effects have been evaluated, using professional judgement and by combining the assessment of both magnitude of the impact and sensitivity of the receptor to predict the significance of effect, as outlined in Table 2.4. Reasoned, professional judgement will define the significance of the predicted effects. These effects can be beneficial or adverse, temporary or permanent depending on the nature of the development and the mitigation and any enhancement measures proposed.

The assessment of the significance of the visual amenity effect will depend on the degree to which the proposal and mitigation measures:

- cause an improvement or deterioration to a view; and
- affect strategic and important views to landmarks in addition to the visual context of receptors.

Significance is accorded to Very large, Large and Moderate effects.

Table 2.4: Significance of Effects on Townscape Resource and Visual Amenity

Magnitude of Impact	Townscape and Viewer Sensitivity		
	High	Medium/ Moderate	Low
Major	Large/ Very Large	Moderate/Large	Slight/Moderate
Moderate	Moderate/Large	Moderate	Slight
Minor	Slight/Moderate	Slight	Negligible/Slight
Negligible	Slight	Negligible/Slight	Negligible/Slight
No change	Neutral	Neutral	Neutral

Based on GLVIA, IEMA and LI, 2002

2.5.6 Mitigation Measures

The identification and assessment of potential townscape and visual effects is an important part of the iterative design process because it can help avoid or minimise potential adverse effects of the works and, where appropriate, will also help to identify opportunities for townscape enhancement. This includes recommendations for mitigation measures and design considerations to offset or reduce or compensate for identified effects. The effects are then reassessed on the basis of mitigation measures being in place, to enable determination of any remaining significant residual effects.

2.5.7 Residual Effects

The residual effects following implementation of the mitigation measures are assessed using the same criteria as in Section 2.5 above.

2.5.8 Obtrusive Light Assessment Methodology

The obtrusive light assessment was undertaken in four key stages:

- The first stage assigns an appropriate classification in terms of the environmental zone that the development is to be constructed within;
- The second stage involves gathering relevant design and model information and construction of an appropriate 3D model incorporating all pertinent information. During this stage any assumptions made, existing drawing/s or models utilised are recorded to ensure a transparent approach to the obtrusive light assessment;
- In the third stage, results are calculated according to the Institution of Lighting Professionals (ILP) specified criteria, Sky Glow (Upright Light Ration – ULR) / Light Intrusion / Luminaire Intensity / Building luminance, as indicated within Table 2.5; and
- The fourth stage includes interpretation of the results and comparison with the given ILP thresholds indicating possible mitigation measures, should they be required.

Numerical modelling and calculations were carried out using the Lighting Analyst software AGI32, version 2. Three-dimensional geometric models of the proposed station structures and the adjacent buildings were provided by an external company. These were imported into the AGI32 analysis software, with surfaces, glazing and any other appropriate surface parameters assigned.

The recommended maximum obtrusive light characteristics which were used during the third stage of the assessment, as defined in the ILP guidance notes, are given below:

Table 2.5: Obtrusive Light Limitations

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

Source: Institution of Lighting Professionals, Guidance Notes for the Reduction of Obtrusive Light GN01:2011

The ILP guidance refers to 'pre-curfew' and 'post-curfew' criteria. The guidance states that this is often specified by the local planning authority, and that in the absence of any specific requirements 23:00hrs is suggested as a guideline. Whilst this item of the ILP guidance is useful for initial assessment, it is also a recommendation of this report that the project stakeholders, if possible, determine mutually acceptable curfew hours in agreement with the local building owners.

The results of numerical modelling and calculations were compared against the Institute of Lighting Professionals (ILP) guidance note 'Guidance Notes for the Reduction of Obtrusive Light' [GN01:2011].

2.6 Assumptions and Limitations

2.6.1 Assumptions concerning the baseline

Where appropriate, visual receptors have been grouped rather than identified individually for the purposes of the assessment.

The assessment has focussed on the public domain.

Due to the availability of high quality promotional material including visual representations of the scheme, photomontages have not been produced for the purposes of this ES.

2.6.2 Assumptions concerning the prediction of effects

The description of the significance of the visual effect will relate to groups of receptors rather than individual receptors. In quantifying effects, the assessment process aims to be as objective as possible. However, whilst in some instances changes to a view can be factually defined, or direct loss of features quantified, the evaluation of townscape character and visual effect frequently requires qualitative judgements to be made. This is generally considered acceptable if based on 'professional expertise', supported by clear evidence, reasoned argument and informed opinion. The conclusions of this assessment therefore combine objective measurement with informed professional interpretation.

The assumptions made during the numerical modelling process for the obtrusive light assessment are listed in Chapter 7 of Appendix B.

3. Baseline

3.1 Introduction

This chapter describes the key elements and features present in the study area from a townscape and visual amenity perspective.

3.2 Baseline Conditions

3.2.1 Townscape Conditions

Leeds City Station is located to the south-west of Leeds city centre over Neville Street (as shown on Figure 1 in Volume III of this ES) immediately to the south of the Central Business District and the south west of the main shopping areas of the Trinity and Burton Arcades, the Headrow Shopping Centre and Leeds Shopping Plaza. Pedestrian, cyclists, taxis and buses access the main station entrance via New Station Street. Additional entrances are located on Wellington Street for pedestrians only and off Princes Square adjacent to the station car parking and drop off areas. The Holbeck Urban Village commercial district is to the south of the station area. The station is connected to the trunk road network to the south via Neville Street which leads to the A653, Great Wilson Street and onto the M621 and to the west along Wellington Street onto the A58(M).

Leeds City Station and associated railway tracks are positioned on a major brick railway viaduct which straddles the River Aire at the station's location and separates the City Centre from Holbeck Urban Village. The River Aire runs parallel to western end of the station before turning to cross at a perpendicular angle beneath the station and emerging at Granary Wharf. The Leeds and Liverpool Canal joins the River Aire via a listed lock structure to the south of the station. At this point, the waterway becomes the Aire and Calder Navigation and flows in an easterly direction.

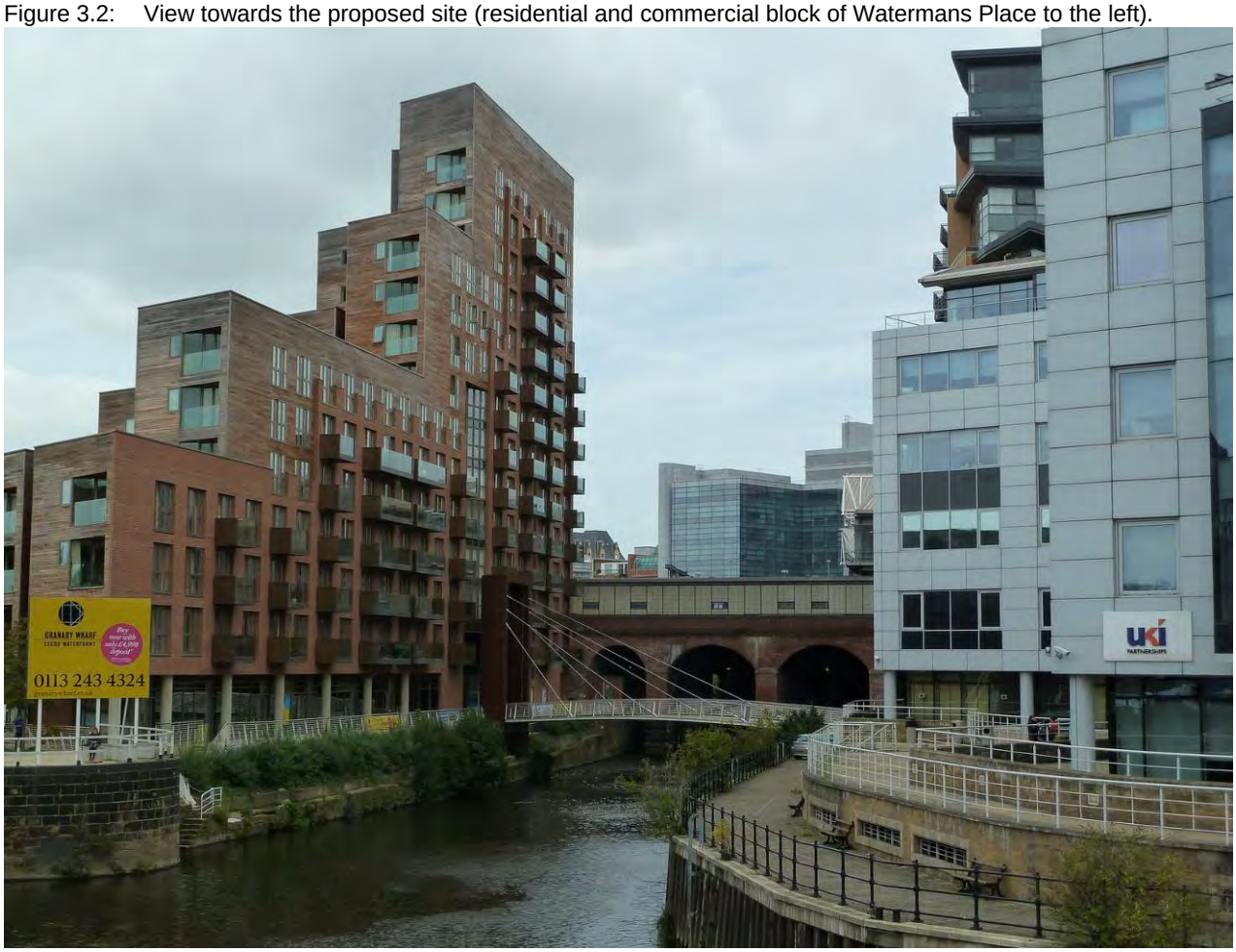
There are two recent developments either side of the River Aire, the Blue Apartments and Watermans Place on Granary Wharf. Blue Apartments are a 16 storey high residential block with ground floor retail use that has recently been fitted out as a golf shop, including a private deck which cantilevers over the eastern river wall. There is no public footpath on the eastern bank in the immediate vicinity of the proposed station entrance.

Figure 3.1: View towards the proposed site (Blue Apartments & Watermans Place at Granary Wharf on the east and west banks of the River Aire respectively).

Source: Mott MacDonald

On the west bank a residential and commercial block, Watermans Place, is a mixed use scheme standing up to 15 storeys high. Along the western bank there is a floodwall of 1.6m in height alongside the ground floor retail unit but between the Little Neville Street Footbridge and the viaduct, this is mainly a route for service access to plant rooms and refuse stores.

Figure 3.2: View towards the proposed site (residential and commercial block of Watermans Place to the left).



Source: Mott MacDonald

3.2.2 Townscape Character Areas

The study area can be divided into two main character areas shown on Figure 18 in Volume III of this ES. In order to enable an assessment of the townscape character and quality of the urban area, the study has defined areas of a largely comparable townscape character and quality.

The characteristics of both townscape character areas are described below. It should be noted that these are broad character descriptions.

3.2.2.1 Leeds Station Transport Hub Character Area

Urban Layout

Leeds City Station is located in the centre of Leeds city. It is situated on a large brick viaduct, which is orientated in an east-west direction. To the north, this character area extends to Princess Square and New Station Street. To the south it is contained by the Granary Wharf development and the commercial and residential buildings located along Neville Street. The area is centred on the railway station building,

railway infrastructure and the car park to the north of the station. Distinct changes in level and the dominance of the infrastructure characterise the area.

Land Uses

The station area consists of relatively unified land uses, dominated by the railway transport corridor. There are a small number of commercial buildings located to the east and north.

Density and Scale

This character area is characterised by the coarse grain, large scale development of the railway station and associated infrastructure.

Appearance and Culture

The dominating features of this character area are the elements related to the railway station and its infrastructure. The station infrastructure, largely along the southern façade, has a relatively low architectural merit being utilitarian in appearance and the use of a number of different types of materials, colours and several signs create an incoherent pattern. However, within the north station concourse there is a grade II listed building.

Activity

The area is dominated by transport activity, mainly connected with the railway but also car parking facilities. Large commercial buildings are located to the north of this character area.

Accessibility

The complex system of roads and paths reduces the legibility of the area and dictates circulation and movement in the vicinity of the site. Due to the location of the station above the viaduct, the network of footpaths and roads is disorientating and lacks legibility. The principal pedestrian movement corridors through the area are unattractive and channelled by the large existing roads.

Public Open Spaces/Squares

In the immediate vicinity of the site, open space is infrequent and is limited to the streetscape and occasional spaces between buildings; these are relatively quiet spaces.

'Soft' Landscape Features

The 'soft' landscape features are limited to occasional street trees located between the buildings.

The overall sensitivity of the Leeds station Transport Hub Character Area is medium. There is a good sense of place and cultural identity but the features present are degraded by mixed use of materials and poor permeability and legibility.

3.2.2.2 Canal-side Mixed Development – Commercial and Residential

Urban Layout

This character area is limited to the north by the elevated Leeds City Station and it extends to the south encompassing the 19th century arrangement of industrial development concentrated along the River Aire/ Aire and Calder Navigation and the Leeds and Liverpool Canal. It is slightly disordered, with an irregular pattern of streets and buildings interwoven between the waterways.

The Canal Wharf and Holbeck Conservation Areas extend from Neville Street westwards. There are several listed buildings in this area, mainly from the 19th century industrial era.

Land Uses

The area is characterised by various land uses including commercial and multi-storey residential buildings and transport corridors including the dominant junction of Neville Street and Water Lane. There are public open spaces located along the River Aire/Aire & Calder Navigation and the Leeds and Liverpool Canal; however these lack vibrancy and activity creating a relatively unwelcoming environment.

Density and Scale

This character area is characterised by a coarse grain, large scale multi storey developments such as Granary Wharf, Bridgewater Place and offices to the east of the site. Some smaller buildings can be found in between them which are the remnants of the 19th century industrial development.

The building footprints along the waterways are slightly set back accommodating long and narrow public spaces. These are characterised by boardwalks and brick paved footpaths with very little vegetation.

There are a number of car parks including a multi-storey car park on Meadow Lane which tend to detract from the overall character of the area.

Appearance and Culture

The character area is dominated by contrasting developments and different building types and materials interwoven by the smaller scale features associated with the 19th century canal infrastructure which lend some sense of place.

Activities

The area has a variety of commercial and some residential uses. Activity levels tend to be generated through car use with limited active frontages and dedicated pedestrian access.

Accessibility

The complex system of roads reduces the legibility of the area and heavily dictates circulation and movement in the vicinity of the site. The character area has low permeability due to the presence of large buildings and the limited bridge crossings. The principal pedestrian movement through the surrounding area to the site is uninviting, channelled by the large busy road network.

Public Open Spaces / Squares

Throughout the character area, open spaces are infrequent and largely limited to dedicated car parking facilities with occasional spaces between buildings. However, there are public footpaths and small open spaces located in between the commercial development, mainly alongside the surrounding waterways.

The largest open space in the vicinity of the site is the area in between Doubletree Hotel and Watermans Place. It is a vibrant space with the cafes, restaurants and retail units located under the railway viaduct and small amount of vegetation which softens the views.

'Soft' Landscape Features

The area is scattered with a small amount of mainly riparian vegetation which is self-seeded along the river banks. There are a small number of mature trees including willows in a close proximity to Bridge End. Some shrubs and trees are located near the Victoria Bridge, next to the car park and along Neville Street and Great Wilson Street. There are also pockets of semi mature trees in-between the offices.

The overall sensitivity of the Canal Side Mixed Development Character Area is considered to be medium. There is a good sense of place and cultural identity with the presence of the canal features but the recent built elements are an eclectic mix of scale, styles and materials. The area is dominated by the busy road network creating poor pedestrian permeability.

3.2.3 Townscape Related Designations within the study area

There are no known World Heritage Sites, Scheduled Monuments or Registered Parks and Gardens within the study area.

The southern tip of the development site and the proposed location for the site offices are located within the Canal Wharf Conservation Area, whilst the proposed barge loading area on Water Lane is located on the western periphery of the Leeds City Centre Conservation Area. The Conservation Areas are illustrated on Figure 16 in Volume III of this ES. There are no supporting Conservation Area appraisals in place from LCC at present. Following consultation with LCC, conservation area consent will not be required for the construction and operation of the new station entrance, however a conservation area consent is required for the works at Water Lane.

There are 18 listed buildings within the study area, of which two listed buildings border the red line boundary, namely the river lock and retaining walls to the River Aire and Leeds and Liverpool canal and the Victoria Bridge. The warehouse on Water Lane next to the proposed barge loading area is also listed. It is understood that the heritage officer at Leeds City Council has indicated that listed building consent will not be required as the listed structures will not be affected by the development.

Further information relating to listed structures and conservation areas is provided in the Historic Environment Technical Appendix in Volume II of this ES.

3.2.4 Obtrusive Light

Leeds is major urban area with a total population of approximately 800,000. The city centre, in which the proposed new entrance is situated, is a dense area comprising a mix of residential and commercial land use.

The 'environmental zone' has been classified as 'E4' (urban area) in accordance with the ILP 'Guidance Notes for the Reduction of Obtrusive Light' – which also corresponds to the European guidance provided in the International Commission on Illumination (CIE) suite of documents.

3.2.5 Visual Amenity

3.2.5.1 Visual Envelope

The visual envelope is illustrated on Figure 17 in Volume III of this ES and is defined as the extent of potential visibility to or from a specific area or feature.

The development will be split into two distinct areas during the construction phase. These include:

- the location of the new station entrance and a temporary self-erecting crane located on the west bank between the Watermans Place and the Dark Arches or a tower crane on the east bank behind the Blue Apartments building erected permanently for the duration of the works. In addition, a site office compound will be located off Wharf Approach adjacent to the Leeds and Liverpool Canal; and
- a barge loading and unloading area on Water Lane, off Meadow Lane.

The proposed station entrance will be located over the River Aire, linking pedestrian access into the existing railway station. The visual envelope is limited by the elevated railway station to the north, high tower blocks to the west and east and the buildings along the junction of Neville Street and Water Lane to the south. The site offices will be located to the west of the proposed southern entrance, adjacent to Office Lock on the Leeds and Liverpool Canal. The visual envelope is limited by the elevated railway station to the north and the high brick wall to the south.

The barge loading area will be located to the east of the proposed station entrance, in close proximity to Bridge End and Water Lane. The visual envelope will be limited by the presence of existing buildings along the river. The adjacent listed building is presently residential properties; buildings on the opposite side of the river from the barge loading area are both commercial and residential and are not listed.

3.2.5.2 Visual Receptors

The visual receptors were categorised by their sensitivity to change depending on the type of visual receptor affected and the location and context of the views in question. A summary of key visual receptors is set out in the Table 3.1. The locations of visual receptors are shown on Figure 17 in Volume III of this ES.

Approximate distances shown in Table 3.1 are as follows:

- close – up to 100m from the proposed development site;
- mid-distance – between 100m and 250m from the proposed development site; and
- distant – More than 250m from the proposed development site.

Table 3.1: Visual Receptors

No.	Visual Receptor	Description	Distance	Sensitivity
1	Residents of Candle House	Residents of Candle House, mainly those from the northern parts of the building, may have some elevated views towards the station entrance area; however, these are mainly screened by the Doubletree Hotel and Watermans Place buildings.	Mid-distance	High

No.	Visual Receptor	Description	Distance	Sensitivity
		Elevated views of where the site offices, the main compound and the walking route to the site are proposed are possible from the northern, eastern and western part of the building.		
2	Users of Princes Exchange	Some elevated and direct views towards the station building, mainly from the upper floors of the Princes Exchange building.	Mid-distance	Moderate
3	Users of Leeds City Station	Views of the station entrance are possible from the internal footbridge to the west of the station and from the platforms. Direct views from platforms 15, 16 and 17, otherwise no views	Close	Low
4	Workers of Leeds City Station	Views of the station entrance are possible from the internal footbridge to the west of the station and from the platforms. Direct views from platforms 15, 16 and 17, otherwise no views	Close	Low
5	Workers of the Doubletree Hotel	Some oblique views of the station entrance are possible from the northern parts of the building. These are mainly screened by the Watermans Place building.	Close	Low
6	Residents of the Doubletree Hotel	Some oblique views of the station entrance are possible from the northern parts of the building. These are mainly screened by the Watermans Place building.	Close	Moderate
7	Users of Leeds and Liverpool Canal and River Aire	Direct views of the station entrance from the River Aire and the Leeds and Liverpool Canal are possible for the users of these waterways. Going further away towards east and west, views are obscured by the Watermans Place and offices located on the northern riverbank. Views of the proposed barge loading area are possible from the River Aire, close to the Bridge End bridge.	Close to Mid-distance	High
8	Residents of Watermans Place	Direct, close and elevated views towards the site are possible from the Watermans Place building.	Close	High
9	Users of commercial spaces at Watermans Place	Direct and close views towards the site are possible from the Watermans Place building.	Close	Moderate
10	Users of the footbridge and public open space between the Doubletree Hotel and Watermans Place	Direct and close views are possible from the public areas located in a close vicinity to the proposed station entrance. Views from the public open space are largely screened by adjacent buildings.	Close	High
11	Workers at the offices around the site (New Centaur House and UKI Partnership)	Some close and direct views are possible from the offices located close to the station entrance. They are slightly obscured by the existing footbridge in front of the proposed site.	Close	Moderate
12	Users of City House	Views of the station and the proposed station entrance are possible from the upper floors of the City House building.	Mid-distance	Low
13	Residents of Blue Apartments	Direct, close and elevated views towards the proposed station entrance are possible.	Close	High
14	Users of commercial spaces at Blue Building	Direct and close views towards the proposed station entrance are possible from the Blue Building.	Close	Moderate
15	Residents of Bridgewater Place	Direct and elevated views proposed station entrance are possible from this location.	Mid-distance	High
16	Workers at the Bridge Water Place	Direct and elevated views proposed station entrance are possible from this location.	Mid-distance	Moderate

No.	Visual Receptor	Description	Distance	Sensitivity
17	Users of Victoria Bridge, Neville Street and Water Lane	Some views of the proposed station entrance are possible from the junction of Neville Street and Water Lane. They are slightly obscured by the existing footbridge in front of the proposed site.	Mid-distance	Low
18	Users of the building on the corner of Great Wilson Street and Victoria Road	Some views of the proposed station entrance are possible from this location. However, they are limited by the traffic at the junction of Neville Street and Water Lane and by the existing footbridge in front of the proposed site.	Distant	Low
19	Users of offices west of Bridge End, north of Water Lane	Direct views of the barge loading area are possible from this location. It is not possible to see the proposed station entrance from this location.	Close to Distant	Moderate
20	Users of public spaces near Bridge End on both sides of the River Aire	Direct views of the barge loading area are possible from this location.	Close to Distant	High
21	Residents of flats on Water Lane	Oblique views of the barge loading area are possible from this location.	Close to Distant	High
22	Workers at Asda offices	Oblique views of the barge loading area are possible from this location. Some oblique views of the site may be possible from the western parts of the building.	Close to Distant	Moderate

4. Works Affecting Townscape and Visual Amenity

4.1 Construction Phase

The following is a high level description of the key construction activities which will affect the TVIA:

- piling activities causing a nuisance to adjacent residential and commercial properties;
- temporary presence of a crane close to residential and commercial properties, next to the main construction site and at the barge loading site;
- temporary presence of construction lighting in close proximity to residential properties;
- distribution and storage of construction materials along the Leeds and Liverpool canal and River Aire/Aire & Calder Navigation;
- impact of temporary features (e.g. construction plant, hoardings) on surrounding townscape character;
- presence of construction activities in two Conservation Areas (Canal Wharf and City Centre);
- increase in water traffic along the Aire and Calder Navigation for delivery of construction materials;
- increased traffic along Wharf Approach to access the construction compound/site offices and to Water Lane to access the barge loading area; and
- partial loss of existing townscape resource or features, open space and/or street space for temporary landtake (e.g. work sites) during construction.

There are two crane options under consideration in the Constructability Review (Carillion, January 2012) (refer to Section 3.4.2 of the Main Statement in Volume I of this ES for a more general description of the two options):

- a tower crane located behind the Blue Apartments building on the east bank, which would be erected permanently for the duration of the construction works; and
- a self-erecting crane located on the west bank, between the Watermans Place and Dark Arches. This option is the preferred option in terms of townscape and visual amenity, as the crane would be of smaller size and would be dismantled every night, which would be less visible within the surrounding landscape.

From the townscape and visual amenity perspective, the tower crane located behind the Blue Apartments building is considered to be the worst case scenario, as this option utilises a taller and larger crane size, which would be visible from distant viewpoints around Leeds during the construction period. The worst case scenario has been taken into consideration in the assessment section below.

4.2 Operational Phase

The following is a high level description of the key operational phase activities that will affect the TVIA:

- presence of new built element on the border of the Canal Wharf Conservation Area;
- new and upgraded pedestrian linkages across the River Aire;
- upgraded pedestrian linkages along Dark Neville Street
- improvement of the public realm around Little Neville Street;
- presence of lighting associated with the operational scheme;
- partial loss of existing townscape resources or features and structures in the area of permanent landtake;
- impact of permanent new features on surrounding townscape character;
- changes in the overall townscape character as a result of the above; and

- visual effects of new structure.

5. Mitigation & Prediction of Effects

5.1 Introduction

This chapter outlines the effects on townscape and visual amenity which are predicted to occur during both construction and operation of the LSSE scheme following implementation of incorporated mitigation. Incorporated mitigation is considered to be mitigation which is inherent to the scheme design and that Metro and Network Rail are committed to undertaking as part of the development.

5.2 Construction Phase

5.2.1 Incorporated Mitigation

Light pollution will be managed during construction through the adoption of the guidance set out in the Institution of Lighting Professionals, 'Guidance Notes for the Reduction of Obtrusive Light', GN01:2011. This will be set out in the Control of Pollution Act 1974 (CoPA) which will also address potential control methods.

A traffic management plan will be prepared to address potential conflicts between construction traffic and other highway users.

Footpaths and cycleways will remain open throughout the construction period where possible, although localised diversions may be required. Access to Dark Neville Street, including parking access to the undercroft and access to businesses will be maintained during the construction works. The work site will be surrounded by solid hoarding to prevent unauthorised access, screen construction compounds and control dust and litter. Where it is safe to do so, Heras type hoarding will be used following feedback from the consultation exercises. The exact alignment and layout of the hoarding will have to be agreed locally with commercial units such as the Golf Bar to provide the most aesthetically pleasing but safe solution. Incorporation of vision panels into the hoarding will also be considered.

An Environmental Management Plan (EMP) will be prepared for the proposed scheme by the construction contractor in line with Networks Rail's Contract Requirements – Environment documentation (for reference this has been included as a supporting document to this ES in Volume IV). Under the EMP, the contractor will be required to prepare a Noise and Vibration Management Plan and seek local authority consent for construction works under Section 61 of the CoPA. These consents will specify the method of working, the hours of work and noise controls to be applied in accordance with 'Best Practicable Means' (BPM) (as defined in Section 72 of CoPA). Further details relating to noise and vibration mitigation can be found in the Noise and Vibration Technical Appendix in Volume II of this ES.

There will generally be no night-time working other than where night-time railway possessions are necessary to construct the works.

Sensitive reinstatement of working areas at the barge loading and unloading site on Water Lane will be implemented. This is described in more detail in the Historic Environment Technical Appendix in Volume II of this ES.

5.2.2 Predicted Effects

5.2.2.1 Townscape – Construction Phase

Leeds Station Transport Hub Character Area

Construction activity associated with the proposed southern station entrance will be concentrated to the south of this character area, along the southern façade and Dark Arches. If a tower crane is used during construction this will over-sail the station structure and be visible above the station roof.

The magnitude of the predicted impact is low given that the proposed works are concentrated in the southern boundary of the existing station building. The overall significance of effect is Negligible.

Canal-side Mixed Development – Commercial and Residential

The canal-side character area encompasses all three areas of construction activity, the proposed station entrance, the site offices and the barge loading area. Although construction activities associated with the station entrance and the site offices will increase traffic volumes, the main route for delivery of materials will be via Little Neville Street with minor changes to traffic flows along Wharf Approach. Additional traffic movements during working hours will not change the levels of tranquillity and enjoyment of open spaces. Pedestrian access will be permitted between Wharf Approach and the proposed station entrance site. The crane will be a prominent element in the townscape, over-sailing the station structure and the Blue Apartments.

The works would not directly affect the structure of the brick arched viaduct but would partially screen these from view through the erecting of hoardings and other construction activities. The extent of hoarding and protective fencing defining the working areas are shown in Figures 13 and 14 in Volume III of this ES, address the requirement for access to the active frontages associated with the public open space between the Doubletree Hotel and Watermans Place as well as the Blue Apartments and Hilton Hotel.

Construction activity will be restricted to normal working hours which will be Monday to Friday from 0730hrs until 1900hrs and 0800hrs until 1800hrs on a Saturday. Construction will not normally take place overnight, on Sundays, Bank Holidays, Christmas Day or Good Friday; unless it is necessary to do so for reasons of safety to personnel or in order to satisfy the operational requirements of Leeds City Station. .

It is envisaged that pedestrian access will be maintained for the River Aire footbridge for the majority of the construction period; however, the ISIS footbridge is likely to be closed at pertinent intervals for a few hours in duration when materials are being lifted using the tower crane (adjacent to Blue Apartments) from trucks in Little Neville Street. The lift will be steered by the tower crane around the east end of the footbridge and the south end of the Blue Apartments rather than over the building. No access will be available to the Dark Arches or Dark Neville Street at this location. Access along the canal will be maintained for the majority of the towpath adjacent to the proposed area for the site offices. The listed canal walls and lock will be unaffected by the works and the proposed activity is compatible with current land-use patterns.

The barge loading area off Water Lane will be located immediately adjacent to the listed warehouse, developed as residential properties. Basic welfare facilities will be provided at the site compound on Water Lane. The removal of the stone arch and low level wall/footings at Water Lane will improve the use of the space available, and will be subject to a Conservation Area Consent as part of the TWAO application. This will enable the crane to be positioned in the most advantageous location adjacent to the river; and it will

permit the delivery wagons to manoeuvre around the location in a safe manner. Increased traffic movements for deliveries are likely along Water Lane, though this is not expected to change the existing character significantly due to the presence of busy Meadow Lane and the multi-storey car park.

The existing scrub vegetation would be lost during construction. Although not of great quality, trees/scrub are rare features along the river. The movement of materials along the river would be in keeping with historical context of the character area.

The proposed works will not directly affect any of the listed structures such as the canal walls and lock. Construction activities will, however, partially reduce the view of the brick viaduct due to the presence of hoarding but will not change the dominance of the overall structure within the townscape setting. Given the modern, eclectic style of development in the area, the construction works will not significantly affect the setting and context of the conservation area. Setting and long views to the Tower Works will not be affected. The barge loading area will be close to a further listed building; however, the setting has been compromised by recent development and the proposed temporary activities will not interfere with the relationship of the former warehouses to the river.

The magnitude of the predicted impact is minor. Pedestrian access to the public realm between the Doubletree Hotel and Watermans Place will be largely unaffected. Other elements of the construction works will result in a minor change in townscape character as the activities can be accommodated in the existing activity levels in the area. Although the crane will be a large element, the adjacent built elements are of sufficient scale to partially screen and counterbalance the crane height. The overall significance of effect is **slight adverse.**

5.2.2.2 Visual amenity – Construction phase

As discussed in the baseline, the visual envelope generated by the construction activities will be relatively limited due to the density of the urban fabric. The visual receptors are shown on Figure 17 in Volume III of this ES. The effects are described in Table 5.1 below.

Table 5.1: Effects on visual amenity – construction phase

No.	Visual Receptor	Receptor Description	Sensitivity	Magnitude of impact	Effect
1	Residents of Candle House	Some elevated views towards the proposed station entrance area; however, these are mainly screened by the Doubletree Hotel and Watermans Place buildings. The crane would be visible but compatible with the wider industrial and commercial townscape. Elevated views of the site offices area would be possible. The change in the existing view would not be significantly different as the site offices would form part of a wider view over the industrial and commercial townscape.	High	Minor	**Slight adverse**
2	Users of Princes Exchange	Some elevated and direct views over the station building towards the proposed station entrance area and the crane, from the upper floors of the Princes Exchange building. The change in the existing view would not be significantly different as the site offices would form part of a wider view over the industrial and commercial townscape.	Moderate	Negligible	**Negligible**
3	Users of Leeds City	Views of the proposed station entrance would be possible from the internal footbridge to the west of	Low	Minor	**Slight adverse**

No.	Visual Receptor	Receptor Description	Sensitivity	Magnitude of impact	Effect
	Station	the station and from the platforms. No significant change in the quality of the view.			
4	Workers of Leeds City Station	Views of the site are possible from the internal footbridge to the west of the station and from the platforms.	Low	Minor	**Slight adverse**
5	Workers of the Doubletree Hotel	Some oblique views of the proposed station entrance and the crane would be possible from the northern parts of the building. Views are mainly screened by the Watermans Place building, however, some views of construction plant would be possible at the open space between Doubletree Hotel and Watermans Place.	Low	Minor	**Negligible**
6	Residents of the Doubletree Hotel	Some oblique views of the proposed station entrance and the crane would be possible from the northern parts of the building. Views are mainly screened by the Watermans Place building, however, some views of construction plant would be possible at the open space between Doubletree Hotel and Watermans Place.	Moderate	Minor	**Slight adverse**
7	Users of Leeds and Liverpool Canal and River Aire	Direct views of the proposed station entrance and barge loading sites from the River Aire and the start of the Leeds and Liverpool Canal would be possible. Going further away towards east and west, views are obscured by the Watermans Place and offices located on the northern riverbank. The construction activities would partly screen the viaduct arch formations but users of the waterways would be moving through the townscape so that the overall effect would be limited. The barge loading activities would be consistent with the historical working purpose of the river and canal in this area.	High	Minor	**Slight adverse**
8	Residents of Watermans Place	Direct, close and elevated views towards the proposed station entrance and the crane would be possible from the Watermans Place building. The construction works would be a prominent element of the views from the east side of the building. Night-time lighting will be required during the course of works, however, it will be minimised to reduce nuisance where possible.	High	Moderate	**Moderate adverse**
9	Users of commercial spaces at Watermans Place	Direct, close and elevated views towards the proposed station entrance and the crane would be possible from the Watermans Place building. The treatment of the boundary to the construction areas, particularly in relation to the public space to the west of the building, would be important to the visual amenity of the ground floor users of the building. The proposed 2m high timber hoardings located along the river bank would screen some views of the construction activities, especially those located in the lower areas and on the river. Views of the cranes and works at height would be noticeable from the commercial spaces.	Moderate	Moderate	**Moderate adverse**
10	Users of the footbridge and public open space between the Doubletree Hotel and Watermans	Direct and close views of the proposed station entrance are possible from the footbridge; the construction activity will screen the framed view of the viaduct structure. The proposed 2m high timber hoardings located along the river bank would screen some views of the construction activities, especially those located in the lower areas and on the river. Views of the cranes and works at height	High	Minor	**Slight adverse**

No.	Visual Receptor	Receptor Description	Sensitivity	Magnitude of impact	Effect
	Place	would be noticeable from the foot bridge.			
11	Workers at the offices around the site (New Centaur House and UKI Partnership)	Some close and direct views are possible from the offices and associated external spaces located close to the site. Views towards the proposed station entrance would be slightly obscured by the existing footbridge. The barges would also be noticeable but transient elements of the view.	Moderate	Minor	**Slight adverse**
12	Users of City House	Views of the proposed station entrance works and the crane would be possible from the upper floors of the City House building but would be a small part of the overall view.	Low	Negligible	**Negligible**
13	Residents of Blue Apartments	Direct, close and elevated views of the proposed station entrance and the construction crane will be possible. The construction works would be a prominent element of the views from the west side of the building. Night-time lighting will be required during the course of works, however, it will be minimised to reduce nuisance, where possible.	High	Moderate	**Moderate adverse**
14	Users of commercial spaces at Blue Apartments	Direct and close views towards the proposed station entrance and the crane are possible from the Blue Building. The treatment of the boundary to the construction areas would be important to the visual amenity of the ground floor users of the building. The proposed 2m high timber hoardings located along the river bank would screen some views of the construction activities, especially those located in the lower areas and on the river. Views of the cranes and works at height would be noticeable from the commercial spaces.	Moderate	Moderate	**Moderate Adverse**
15	Residents of Bridgewater Place	Direct and elevated views of the proposed station entrance and partial views of the crane would be possible from this location. However, the works would be a small part of the wider views.	High	Minor	**Slight Adverse**
16	Workers at the Bridge Water Place	Direct and elevated views of the proposed station entrance and partial views of the crane would be possible from this location. However, the works would be a small part of the wider views.	Moderate	Minor	**Slight Adverse**
17	Users of Victoria Bridge, Neville Street and Water Lane	Some views of the proposed station entrance and partial views of the crane would be possible. Views would be slightly obscured by the existing footbridge and viewers tend to be moving through the townscape affording transient views.	Low	Negligible	**Negligible**
18	Users of the building on the corner of Great Wilson Street and Victoria Road	Some views of the proposed station entrance and partial views of the crane would be possible. Views would be slightly obscured by the existing footbridge and the traffic at the junction of Neville Street and Water Lane.	Low	Negligible	**Negligible**
19	Users of offices west of Bridge End, north of Water Lane	Direct views of the barge loading area are possible from the offices. It is not possible to see proposed station entrance. Loss of the scrub and trees on the site area would be a minor issue. Increased traffic movements for deliveries are likely along Water Lane, though this is not expected to change views significantly due to the presence of busy Meadow Lane and the multi-storey car park.	Moderate	Minor	**Slight Adverse**
20	Users of	Direct views of the barge loading area are possible	High	Minor	**Slight**

No.	Visual Receptor	Receptor Description	Sensitivity	Magnitude of impact	Effect
	public spaces near Bridge End on both sides of the River Aire	from the public realm. It is not possible to see proposed station entrance. Loss of the scrub and trees on the site area would be a minor issue but noticeable from the river frontage. Increased traffic movements for deliveries are likely along Water Lane, though this is not expected to change views significantly due to the presence of busy Meadow Lane and the multi-storey car park.			**Adverse**
21	Residents of flats on Water Lane	Oblique views of the barge loading area are possible from this location. Night-time lighting will be required during the course of works, however, it will be minimised to reduce nuisance, where possible. Increased traffic movements for deliveries are likely along Water Lane, though this is not expected to change views significantly due to the presence of busy Meadow Lane and the multi-storey Asda car park.	High	Minor	**Slight Adverse**
22	Workers at Asda offices	Oblique views of the barge loading area are possible from this location. Some oblique views of proposed station entrance may be possible from the western parts of the building.	Moderate	Minor	**Slight Adverse**

5.3 Operational Phase

5.3.1 Incorporated Mitigation

5.3.1.1 Townscape and Visual Amenity

The scheme incorporates high quality and contemporary design to the proposed station entrance. The glazed elements will allow views of the existing viaduct structures from the south.

Improvements to the public realm on Little Neville Street will be implemented, this will include the relocation of the existing basalt setts to the edge of the highway.

The bridge decks over the River Aire and station entrance will improve pedestrian accessibility and increase activity levels and vibrancy of the public realm areas. Improvements to the existing treatment of the footpath from Dark Neville Street to Little Neville Street will be incorporated as part of the scheme to promote pedestrian linkages.

5.3.1.2 Lighting

The final lighting design will adopt the guidance set out in the Institution of Lighting Professionals, ‘Guidance Notes for the Reduction of Obtrusive Light’, GN01:2011. The proposed lighting scheme, (refer to the Design & Access Statement for further information) adopts the principle of down lighting where possible, reducing the potential for light trespass.

The following items are suggested incorporated mitigation measures, which are likely to be used in combination with each other, to best resolve the issues identified in the obtrusive light assessment. The exact combination of incorporated mitigation measures will be investigated further at the detailed design stage.

- Switch-off the type 'G' luminaires which provide up-lighting to the south façade structure after an agreed 'curfew' time. This will alleviate some of the light-spill to the surrounding environment and help reduce the light intrusion into the adjacent building windows.
- Careful consideration to the aiming of luminaires. Whilst it is noted that the majority of the lighting scheme consists of local handrail lighting providing focussed lighting for passenger wayfinding, there are a number of high-output luminaires which provide general illumination of the space. Some have been specified with glare baffles, which will be beneficial, however as part of the detailed design and construction process careful consideration should be given to the precise aiming of luminaires to restrict light being spilled away from the surface and zone of intentional illumination.
- Consider reducing the intensity and luminous output of the upward facing luminaires. The design currently shows 150W metal halide luminaires providing up-light to the space. In order to minimise the light flowing through the upper glazing element both the position and the luminous output should be considered.
- Consider using glass of lower transparency. As part of this assessment, a glazing transparency of 80% has been assumed, however if a lower transparency of glazing can be integrated into the design without disrupting the overall building performance and aesthetic, then this should be strongly considered.
- Investigate whether the internal lighting can be reduced after an agreed 'curfew' time. Considering the use of dimming or selective switching will assist with reducing the reflected light spill from the station structure. Whilst it is noted that a number of high-output metal halide luminaires have been used for general illumination to enhance the internal space, it is recommended that consideration be given to the use of alternative dimmable light sources. To achieve an equivalent visible and technical performance it is noted that this may increase the number of total luminaires, which in turn may have financial implications, however this approach would have a positive impact on the overall light spill and the effect on the adjacent buildings.
- Although the visible luminaire intensities have been calculated to be within acceptable limits, it is a recommendation of this report that the type 'G' luminaires, which provide up-lighting to the southern façade structure, are switched-off after an agreed 'curfew' time. In addition to minimising the luminaire intensities visible throughout the night, this measure will also alleviate some of the light-spill to the surrounding environment.
- The building luminance should be limited to avoid overlighting. Since the building is designed to meet the requirements of the station it is assumed that the lighting levels will be reasonable and not excessive, however the ongoing design should consider the effect of any increased internal lighting levels and the effect this would have on the surrounding neighbourhood.
- The building luminance should be related to the general district brightness. Assuming that the surrounding riverside footpath and bridge are well lit, this will have the effect of increasing the general district brightness meaning that the proposed station structure should not appear excessive. It should also be considered that the station entrance will enhance the visual environment, and can provide an attractive component to the nightscape in the local area, as well as creating identity and purpose for the station entrance itself.

5.3.2 Predicted Effects

5.3.2.1 Townscape – Operational Phase

Leeds Station Transport Hub Character Area

The upper extent of the proposed southern station entrance will be visible above the station roof. Pedestrian permeability from the south into the Leeds Station Transport Hub Character Area would be improved. Otherwise the townscape in character area would be largely unaffected by the operational phase of the scheme.

The magnitude of the predicted impact is low given that the proposed works are concentrated in the southern boundary of the existing station building. The overall significance of effect is **Negligible**.

Canal-side Mixed Development – Commercial and Residential

The proposed station entrance structure would not directly affect the brick arched viaduct but this would be partially screened despite the glazed façade. The proposed lighting scheme, (refer to the Design & Access Statement for further information) adopts the principle of down lighting where possible, reducing the potential for light trespass nuisance for adjacent residential properties.

Pedestrian access will be improved through the creation of a new bridge structure across the River Aire. This will create better links with existing pedestrian routes including along Dark Neville Street. The improved pedestrian access will increase activity levels and vibrancy of the public realm areas.

The site offices area will be reinstated following construction, resulting in no change to the existing character.

The barge loading area on Water Lane will also be reinstated.

The proposed scheme will not directly affect any of the listed structures. Given the modern, eclectic style of development in the area, the scheme will not significantly affect the setting and context of the conservation area. Setting and long views to the Tower Works will not be affected.

The magnitude of the predicted impact is minor given the predicted beneficial effects on permeability and access to the public realm. Although the entrance structure will be a large element, the adjacent built elements are of sufficient scale to counterbalance the development. The overall significance of effect is **slight beneficial.**

5.3.2.2 Obtrusive Light – Operational Phase

The results from the modelling and calculations both with and without the implementation of mitigation measures have been compared against the Institute of Lighting Professionals (ILP) guidance note 'Guidance Notes for the Reduction of Obtrusive Light' [GN01:2011]. The results are summarised in Table 5.2 below.

Table 5.2: Obtrusive Light - Summary of Findings

ILP Guidance	Guidance Criteria	Calculated Performance without mitigation measures	Comment	Calculated Performance with mitigation measures in place	Comment
Light Intrusion (into windows) – post-curfew	5 lux	8.8 lux (worst case)	Remedial action recommended	5.0 lux (worst case)	Design considered satisfactory
Luminaire Intensity	2, 500 candela	1009 candela	Design considered satisfactory	1009 candela	Design considered satisfactory
Building Luminance (pre-curfew)	25 cd/m2	40-50 cd/m2	Design considered satisfactory [1]	40-50 cd/m2	Design considered satisfactory [1]
Sky Glow	15%	33%	Remedial action recommended	9.4%	Design considered satisfactory

[1] Although the calculated performance is worse than the guidance criteria, consideration of the wider environment suggests that the design is suitable for the local environment.

Light Intrusion (into windows)

Significant light intrusion into the adjacent building occurs at the lower levels in close proximity to the proposed station structure.

Inter-reflected light from within the building spills out of the south façade and directly onto the adjacent buildings. In addition, some of the spilled light will reflect again off the surface of the River Aire and contribute to the light intrusion of the adjacent buildings.

Calculations without mitigation measures in place have been performed to numerically predict the amount of light which emanates from the proposed building and falls onto the windows of the adjacent buildings. The recommended maximum for an urban area (classified as 'E4') is 5 lux for the 'post-curfew' hours – refer to Table 5.2. A number of windows adjacent to the proposed structure exceed this recommendation and therefore mitigation measures should be considered as part of the detailed design to reduce the effect these works will have on the surrounding neighbourhood.

It is noted that the 'pre-curfew' effect on the adjacent buildings is within ILP recommended limits.

Calculations and modelling based on the prediction that mitigation measures are implemented, have provided results which show that the Light Intrusion (into windows) would not exceed the guidance criteria threshold. It is therefore considered that the light intrusion impacts on the surrounding buildings would not be significant and that a satisfactory design can be achieved..

Luminaire Intensity

Generally the luminaires within the proposed station structure are of sufficient distance away and not aimed towards the adjacent buildings to provide any concern to the occupants.

The only luminaires which cause any significant intensity from the perspective of the adjacent buildings are the in-ground up lights (type 'G' luminaires) which are positioned to illuminate the structure of the southern façade. However, due to the distance and intensity of these light sources, the calculated results indicate that the luminous intensity from the viewpoints considered do not exceed the recommended limits.

Building Luminance (pre-curfew)

It is noted that the ILP guidance is written with reference to buildings directly illuminated as a night-time feature, and that illumination of the internal surfaces which are visible from the outside are not specifically mentioned in the guidance.

The guidance however, does state that a building illuminance "should be limited to avoid over lighting, and related to the general district brightness", and it is this basic principle which shall be considered in the analysis of this building.

Sky Glow

Analysis of the Upward Light Ratio (ULR) suggests that quite a significant proportion of the light spilled from the building passes upwards causing levels of sky glow beyond the limits recommended in ILP guidance.

The upward light emanating from the Southern façade is relatively minimal and within acceptable limits. However, light emanating from the glazing at the top section of the structure contributes a significant portion to the sky glow. This is largely a consequence of the upward facing luminaires located at the upper floor of the proposed structure.

Lighting modelling carried out with the assumption that the mitigation measures are implemented has demonstrated that the Sky Glow guidance criteria would not be exceeded. It is therefore considered that the sky glow would not be increased significantly as a result of the proposed development.

Daylight Performance

The daylight analysis carried out in 2009 and included in Appendix C of this technical appendix indicates the majority of test planes identified on the residential properties to the east of the site are likely to have a major adverse reduction in direct daylight with the proposed development in place as set out in the impact rating scale in Appendix C. Access to direct daylight is inherently limited to these properties due to overshadowing by the Watermans buildings to the west of the site.

The daylight analysis indicates that windows / receptors above the 3rd storey adjacent to Leeds Station and the Dark Arches are likely to have a moderate-minor adverse reduction in direct daylight with the proposed development in place as set out in the impact rating scale in Appendix C. This effect is increased toward the bottom of the building.

Sunlight Performance

The sunlight analysis included in Appendix C indicates the residential properties to the east of the site are likely to experience a minor adverse reduction in direct sunlight with the proposed development in place. Access to direct sunlight is inherently limited to these properties due to overshadowing by the under construction mixed use development to the west of the site

5.3.2.3 Visual amenity – Operational phase

As discussed in the baseline, the visual envelope generated by the operational activities will be relatively limited due to the density of the urban fabric. The visual receptors are shown on Figure 18 in Volume III of

this ES. The justification of the significance of the predicted effects, using professional judgement is addressed under each receptor. Where the predicted experience differs significantly for individual receptors within a single building block, these have been presented separately. This may reduce the overall scale of the predicted effects. These issues are presented in Table 5.3 below.

Table 5.3: Effects on visual amenity – operation phase

No.	Visual Receptor	Receptor Description	Sensitivity	Magnitude of impact	Effect
1	Residents of Candle House	Some elevated views towards the proposed station entrance; however, these are mainly screened by the Doubletree Hotel and Watermans Place buildings. The scheme would form part of a wider view over the industrial and commercial townscape.	High	Negligible	**Slight beneficial**
2	Users of Princes Exchange	Some elevated views towards the proposed station entrance. The scheme would form part of a wider view over the industrial and commercial townscape.	Moderate	Negligible	**Negligible**
3	Users of Leeds City Station	Views of the proposed station entrance would be possible from the internal footbridge to the west of the station and from the platforms. Views south over the river would be possible and there would be an improvement in the ambiance of the area within the station.	Low	Minor	**Slight beneficial**
4	Workers of Leeds City Station	Views of the proposed station entrance would be possible from the internal footbridge to the west of the station and from the platforms. Views south over the river would be possible and there would be an improvement in the ambiance of the area within the station.	Low	Minor	**Slight beneficial**
5	Workers of the Doubletree Hotel	Some oblique views of the proposed station entrance would be possible from the northern parts of the building. Views are mainly screened by the Watermans Place building.	Low	Negligible	**Negligible**
6	Residents of the Doubletree Hotel	Some oblique views of the proposed station entrance and the crane would be possible from the northern parts of the building. Views are mainly screened by the Watermans Place building.	Moderate	Negligible	**Negligible**
7	Users of Leeds and Liverpool Canal and River Aire	Direct views of the proposed station entrance would be possible from some reaches of the river and canal. Views would be obscured by the Watermans Place and offices located on the northern riverbank.	High	Minor	**Slight beneficial**
8	Residents of Watermans Place	Direct, close and elevated views towards the proposed station entrance would be possible. The scheme would introduce a new element into the existing eclectic mix of architectural styles which contrasts with the existing viaduct. Night-time lighting will be designed to reduce nuisance. The visual amenity for the residents at the lower levels and close to the railway station will be adversely affected by the close proximity of the station entrance structure which will block views over the river and shorten views from the properties. There will be views towards the apartments located closest to LSSE entrance from the entrance area of the LSSE structure and in particular from the escalator landing area. These views would adversely affect privacy of the residents. Conversely, residents in the upper levels will view the structure from above over the flowing lines of	High	Moderate to Minor	**Moderate adverse** for the residents closest to the structure. **Slight beneficial** for the residents furthest from the structure

No.	Visual Receptor	Receptor Description	Sensitivity	Magnitude of impact	Effect
		the roof structure which will add an iconic element into the view.			
9	Users of commercial spaces at Watermans Place	Direct, close and elevated views towards the proposed station entrance would be possible. The scheme would introduce a new element into the existing eclectic mix of architectural styles and contrasting with the existing viaduct. Night-time lighting will be designed to reduce nuisance.	Moderate	Minor	**Slight adverse** for the users closest to the structure. **Slight beneficial** for the users furthest from the structure
10	Users of the footbridge and public open space between the Doubletree Hotel and Watermans Place	Direct, close and elevated views towards the proposed station entrance would be possible from the footbridge. The scheme would introduce a new element into the existing eclectic mix of architectural styles and contrasting with the existing viaduct. The entrance would be largely screened from the public open space.	High	Minor	**Slight beneficial**
11	Workers at the offices around the site (New Centaur House and UKI Partnership)	Some close and direct views are possible towards the proposed station entrance from the offices and associated external spaces located close to the site.	Moderate	Minor	**Slight beneficial**
12	Users of City House	Views of the proposed station entrance would be possible from the upper floors of the City House building but would be a small part of the overall view.	Low	Negligible	**Negligible**
13	Residents of Blue Apartments	Direct, close and elevated views towards the proposed station entrance would be possible. The scheme would introduce a new element into the existing eclectic mix of architectural styles and contrasting with the existing viaduct. Night-time lighting will be designed to reduce nuisance. The visual amenity for the residents at the lower levels and close to the railway station will be adversely affected by the close proximity of the station entrance structure which will block views over the river and shorten views from the properties. There will be views towards the apartments located closest to LSSE entrance from the entrance area of the LSSE structure and in particular from the escalator landing area. These views would adversely affect privacy of the residents. Conversely, residents in the upper levels will view the structure from above over the flowing lines of the roof structure which will add an iconic element into the view.	High	Moderate	**Moderate adverse** for the users closest to the structure. **Slight beneficial** for the users furthest from the structure
14	Users of commercial spaces at Blue	Direct, close and elevated views towards the proposed station entrance would be possible. The scheme would introduce a new element into the existing eclectic mix of architectural styles and contrasting with the existing viaduct.	Moderate	Minor	**Slight adverse** for the users closest to the

No.	Visual Receptor	Receptor Description	Sensitivity	Magnitude of impact	Effect
					structure. **Slight beneficial** for the users furthest from the structure l
15	Residents of Bridgewater Place	Direct and elevated views of the proposed station entrance would be possible from this location. However, the works would be a small part of the wider views.	High	Minor	**Slight beneficial**
16	Workers at the Bridge Water Place	Direct and elevated views of the proposed station entrance would be possible from this location. However, the works would be a small part of the wider views.	Moderate	Minor	**Slight beneficial**
17	Users of Victoria Bridge, Neville Street and Water Lane	Some views of the proposed station entrance would be possible. Viewers tend to be moving through the townscape affording transient views.	Low	Negligible	**Negligible**
18	Users of the building on the corner of Great Wilson Street and Victoria Road	Some views of the proposed station entrance would be possible. Views would be slightly obscured by the existing footbridge and the traffic at the junction of Neville Street and Water Lane.	Low	Negligible	**Negligible**
19	Users of offices west of Bridge End, north of Water Lane	No view of the station entrance. Replacement planting and improvements to the public realm would be beneficial.	Moderate	Minor	**Slight beneficial**
20	Users of public spaces near Bridge End on both sides of the River Aire	No view of the station entrance. Replacement planting and improvements to the public realm would be beneficial.	High	Minor	**Slight beneficial**
21	Residents of flats on Water Lane	No view of the station entrance. Replacement planting and improvements to the public realm would be beneficial.	High	Minor	**Slight beneficial**
22	Workers at Asda offices	Some oblique views of proposed station entrance may be possible from the western parts of the building.	Moderate	Negligible	**Negligible**

6. Significant Residual Effects

6.1 Significant Residual Effects

This chapter provides a summary of the residual effects on townscape and visual amenity which remain after implementation of incorporated mitigation and are considered to be significant in terms of the assessment methodology presented in Chapter 2. Significance is accorded to Very Large, Large and Moderate effects and the effects can be either adverse or beneficial.

6.1.1 Construction Phase

6.1.1.1 Townscape character

No significant effects on townscape character are predicted during the construction phase for the transport hub or canal-side character areas. Pedestrian access to the public realm between the Doubletree Hotel and Watermans Place will be largely unaffected. Other elements of the construction works will result in a minor change in townscape character as the activities can be accommodated in the existing activity levels in the area. Although the crane will be a large element, the adjacent built elements are of sufficient scale to partially screen and counterbalance the crane height.

6.1.1.2 Visual amenity

Temporary significant, moderate adverse effects on visual amenity have been predicted for the residents and other users in the properties either side of the River Aire, namely Watermans Place and the Blue Apartments. Direct, close and elevated views towards the proposed station entrance and the crane would be possible and the construction works would be a prominent element of the views from the apartments.

6.1.2 Operational Phase

6.1.2.1 Townscape character

There are no significant effects predicted during the operational phase.

6.1.2.2 Obtrusive Light and Daylight

There are no significant effects of obtrusive light on surrounding buildings predicted during the operational phase of the proposed development.

As set out in the Daylight report in Appendix C the daylight analysis indicates the majority of test planes identified on the residential properties to the east of the site are likely to have a major adverse reduction in direct daylight with the proposed development in place. Access to direct daylight is inherently limited to these properties due to overshadowing by the Waterman's Place buildings to the west of the site.

6.1.2.3 Visual amenity

It should be noted that the visual amenity for a small number of residents in the two high rise properties closest to the proposed development will be adversely affected during operational phase, resulting in

localised significant effects on visual amenity. The northernmost apartments at the lower floor levels in the Blue apartments and Watermans Place will be very close to the proposed station entrance. The residents' view will tend to be foreshortened through the presence of the new structure. The east and west elevations of entrance structure could be viewed as a large, solid structure in close proximity to the balconies and windows of the apartments. Users of apartments further from the station entrance and at higher floor levels are likely to benefit from the presence of the sleek, iconic structure in views over the river.

6.2 Supplementary Mitigation

There are no townscape and visual supplementary mitigation measures proposed for the development.

6.3 Compliance with Planning Policy

The proposed scheme is complaint with the NPPF.

Under the Leeds Unitary Development Plan Review 2006, the scheme would address the following policies:

- Policy SA1 Environment aims to secure the highest possible quality of the environment throughout the District, by protecting existing good environment, conserving and enhancing where there is scope for improvement, including initiating the renewal and restoration of areas of poor environment;
- Policy SA7 Urban Regeneration aims to promote the physical and economic regeneration of urban land and buildings within the urban areas, taking account of the needs and aspirations of local communities;
- Policy N12 'Urban Design' states that proposals for development should respect the following fundamental priorities for urban design:
  - spaces between buildings are of considerable importance. Development should create a series of linked and varied spaces that are defined by buildings and landscape elements;
  - the best buildings of the past should be retained. New buildings should be of good design in their own right as well as good neighbours;
  - new developments should respect the character and scale of buildings and the routes that connect them;
  - movement on foot and on bicycle should be encouraged; and
  - visual interest should be encouraged throughout;
- Policy N19 'Building Conservation' states that all new buildings and extensions within or adjacent to conservation areas should preserve or enhance the character or appearance of the area by ensuring that:
  - the siting and scale of the building is in harmony with the adjoining buildings and the area as a whole;
  - detailed design of the buildings, including the roofscape is such that the proportions of the parts relate to each other and to adjoining buildings;
  - the materials used are appropriate to the area and sympathetic to adjoining buildings. Where a local materials policy exists, this should be complied with; and
  - careful attention is given to the design and quality of boundary and landscape treatment;
- Policy N23 'Landscape Design' states that incidental open space around new built development should be designed to provide a visually attractive setting for the development itself and, where appropriate, contribute to informal public recreation and nature conservation. Existing features which make a positive visual contribution should be retained where possible;
- Policy 31A 'Holbeck Urban Village Strategic Housing and Mixed Use Site'

- Environmental improvements to the public realm, including open public space, pedestrian routes, the Holbeck and the Leeds Liverpool Canal;

Under the Holbeck Urban Village (HUV) Revised Planning Framework, the scheme would be complaint with the following principles:

- extensions and new developments should be of the highest quality design in a contemporary style;
- Materials should be of a high quality and chosen to complement the prevailing materials within the area which are red brick, sandstone and blue slate (provided that this does not inhibit the development of innovative buildings using new technologies to achieve sustainability). Quality modern materials such as steel and glass would be allowed in conjunction with the use of traditional materials. Materials should be locally sourced where possible and the re-use of reclaimed materials will be encouraged;
- developments should be at a scale, height, massing and alignment complementary to the part of the village they are in. Within the conservation area, heights of new buildings should be within a storey height difference of adjacent buildings;
- sustainable alternatives to the car will be promoted including improved access to the railway station and encouragement of cycling and walking; and
- key views across and out of the village, for example, of the three towers at Tower Works should be retained.

7. References

Leeds Local Development Framework:

http://www.yhassembly.gov.uk/Our%20Work/Regional%20Planning/Local%20Development%20Frameworks/Leeds/

http://www.leeds.gov.uk/Environment_and_planning/Planning/Local_development_framework.aspx

Leeds Planning Policy:

http://www.leeds.gov.uk/Environment_and_planning/Planning/Planning_policy.aspx

Leeds LDF Core Strategy:

http://www.leeds.gov.uk/files/Internet2007/2009/43/09-167%20core%20strategy%20main%20lr(1).pdf

http://www.leeds.gov.uk/files/Internet2007/2009/43/core%20strategy%20programme%20timetable.pdf

Core Strategy maps:

http://www.leeds.gov.uk/files/Internet2007/2009/43/09-167%20core%20strategy%20maps%20lr.pdf

Leeds Unitary Development Plan:

http://www.leeds.gov.uk/udpmaps/misc/vol1.pdf

UDP Appendices:

http://www.leeds.gov.uk/files/Internet2007/2007/week49/inter__6EA39B72D3EE295980256E0F003A3EDC_26f7e7ab-08c3-4d47-919d-485351e5a5b3.pdf

UDP proposal maps:

http://www.leeds.gov.uk/udpmaps/index.html

Holbeck Urban Village Planning Framework:

http://www.holbeckurbanvillage.co.uk/2006/02/12/revised-planning-framework/

Appendices

Appendix A. Photographs

Photo A.1: View towards the barge loading area associated with the construction activities. The residential building to the right is designated as listed building.

Source: Mott MacDonald

Photo A.2: View from Bridge End bridge towards the barge loading area.

Source: Mott MacDonald

Photo A.3: Proposed location of the tower crane associated with the construction activities. The site for the proposed scheme is visible in the gap between buildings to the right of the photograph. In the background the Watermans Place and the Candle House are visible.

Source: Mott MacDonald

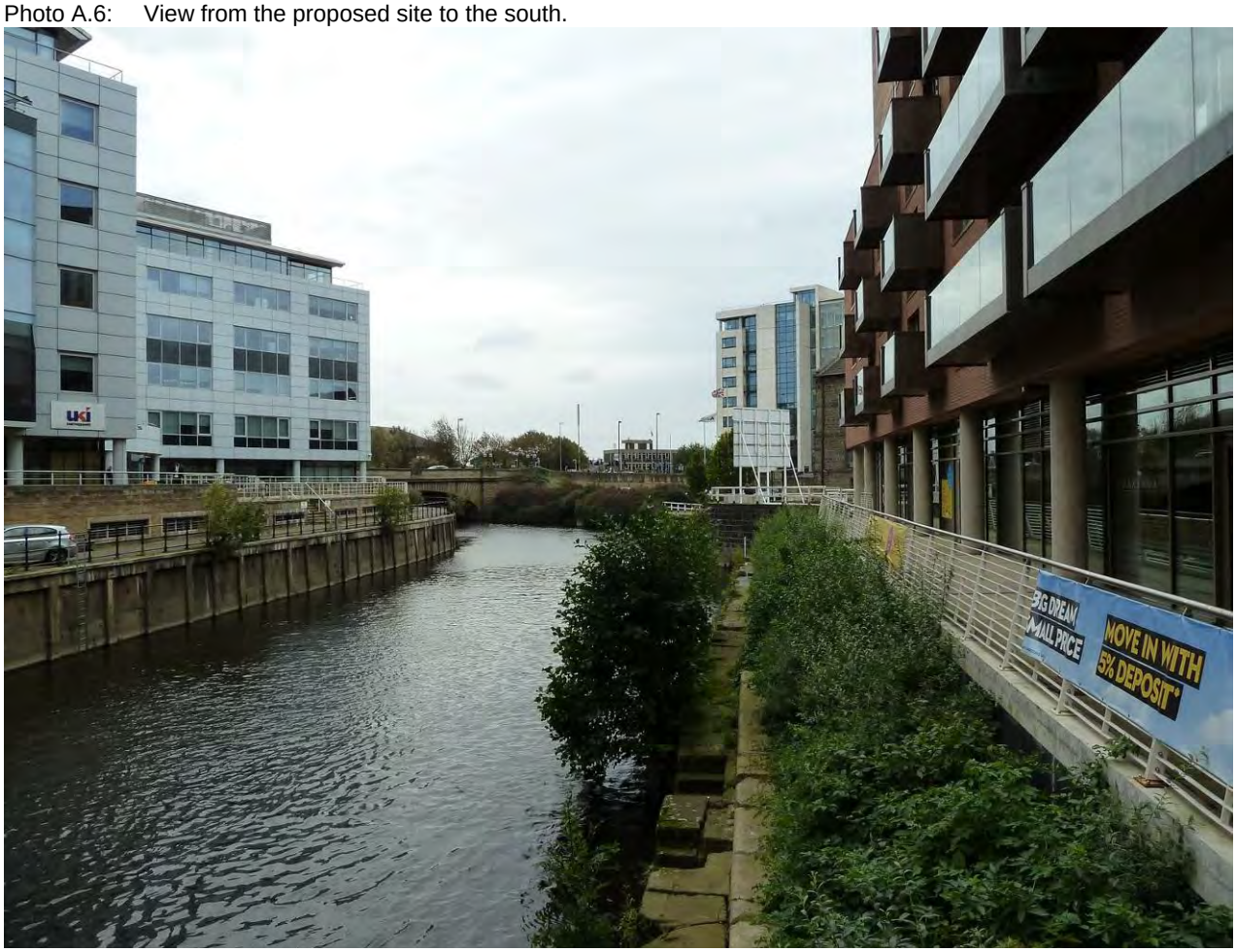
Photo A.4: View of the proposed site location – the existing footbridge at Granary Wharf.

Source: Mott MacDonald

Photo A.5: Public open space between the Doubletree Hotel and Watermans Place building. The proposed site is visible in the gap between the buildings to the left side of the photograph.

Source: Mott MacDonald

Photo A.6: View from the proposed site to the south.



Source: Mott MacDonald

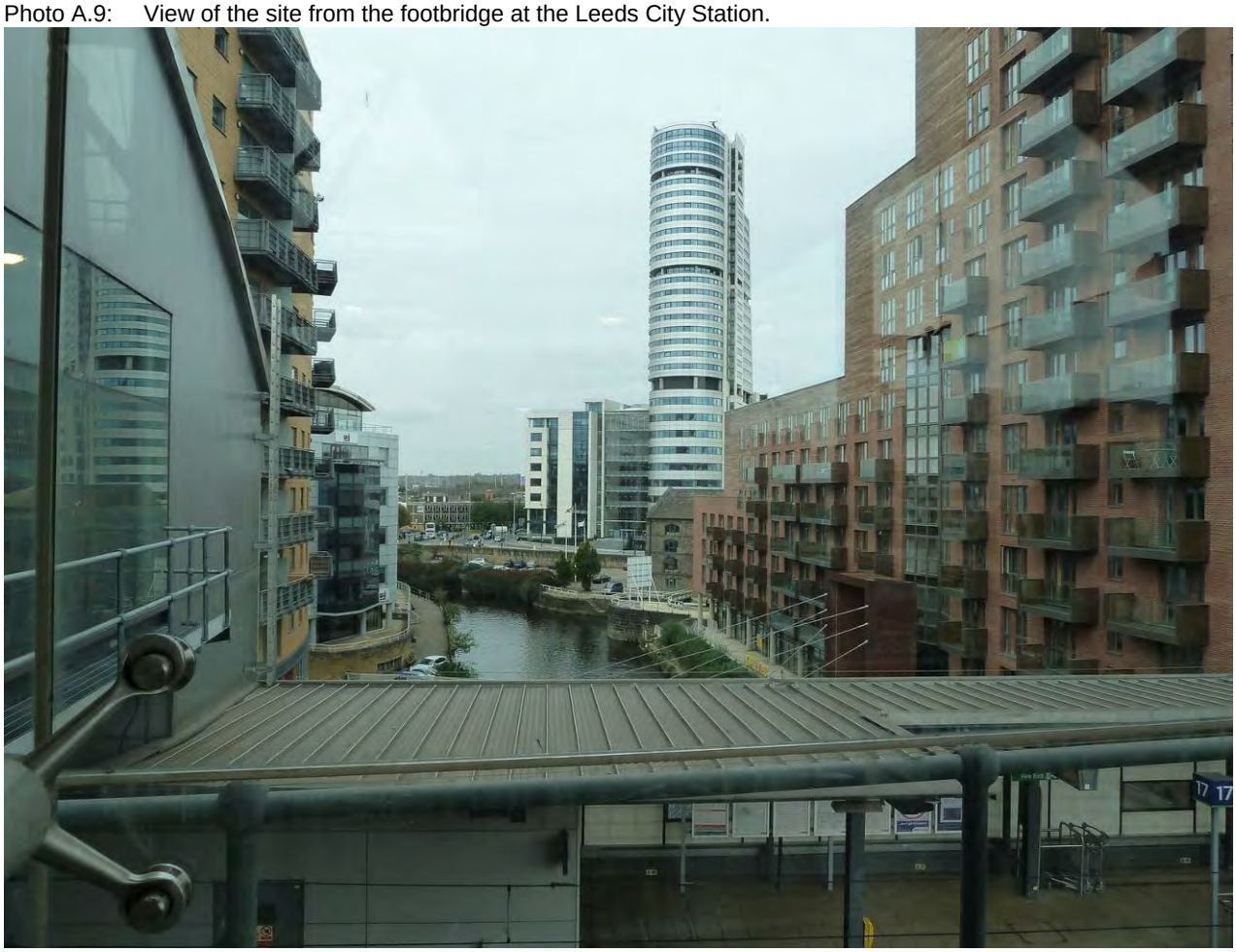
Photo A.7: View of the proposed site from the junction of Water Lane and Neville Street.

Source: Mott MacDonald

Photo A.8: View of the Office Lock – Leeds and Liverpool Canal. The proposed site offices will be located to the right of the photograph, behind the tall brick wall.

Source: Mott MacDonald

Photo A.9: View of the site from the footbridge at the Leeds City Station.



Source: Mott MacDonald

Photo A.10: View of the site from the platform at the Leeds City Station.

Source: Mott MacDonald

Appendix B. LSSE Obtrusive Light Analysis

The Leeds Railway Station (Southern Entrance) Order

Report 296480/RPT32 Obtrusive Light Analysis

May 2012

METRO

Network Rail

Mott MacDonald

The Leeds Railway Station (Southern Entrance) Order

Report 296480/RPT32 Obtrusive Light Analysis

May 2012

Mott MacDonald, 2nd Floor, 2 Brewery Wharf, Kendell Street, Leeds LS10 1JR, United Kingdom
T +44(0) 113 394 6700 F +44(0) 113 394 6701, W www.mottmac.com

Mott MacDonald

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0	11 April 2012	Stuart Hill	Richard Clibborn Jamie McKay	Jason Smith	First Issue
1	4 May 2012	Stuart Hill	Jamie McKay Chaun Lim	Jason Smith	Version for TWAO submission

Mott MacDonald, 2nd Floor, 2 Brewery Wharf, Kendell Street, Leeds LS10 1JR, United Kingdom
T +44(0) 113 394 6700 F +44(0) 113 394 6701, W www.mottmac.com

Content

Executive Summary

This report provides a detailed Obtrusive light assessment of the proposed Leeds Station South Entrance.

The design and associated information for this assessment have primarily been provided by AEDAS architects and AECOM.

Details of the calculation modelling undertaken are described within this report.

The results have been compared against the Institute of Lighting Professionals (ILP) guidance note 'Guidance Notes for the Reduction of Obtrusive Light' [GN01:2011]. The results are summarised here:-

Summary of Findings – Initial Modelling Results (no mitigation)

ILP Guidance	Guidance Criteria	Calculated Performance	Comment
Light Intrusion (into windows) – post-curfew	5 lux	8.8 lux (worst case)	Remedial action recommended
Luminaire Intensity	2, 500 candela	1009 candela	Design considered satisfactory
Building Luminance (pre-curfew)	25 cd/m^2	40-50 cd/m^2	Design considered satisfactory [1]
Sky Glow	15%	33%	Remedial action recommended

[1] Although the calculated performance is worse than the guidance criteria, consideration of the wider environment suggests that the design is suitable for the local environment.

Due to the failure of the original design to meet the given ILP obtrusive light criteria we have modelled some of the suggested mitigation measures to ensure that the impact of these mitigation measures has been successful in reducing both the Light Intrusion and Sky Glow to levels within the given ILP guidance limits. The table below provides the modelling results for the scheme with the mitigation measures proposed incorporated:-

Summary of Findings – Final Modelling Results (incorporating mitigation)

ILP Guidance	Guidance Criteria	Calculated Performance	Comment
Light Intrusion (into windows) – post-curfew	5 lux	5.0 lux (worst case)	Design considered satisfactory
Luminaire Intensity	2, 500 candela	1009 candela	Design considered satisfactory
Building Luminance (pre-curfew)	25 cd/m^2	40-50 cd/m^2	Design considered satisfactory [1]
Sky Glow	15%	9.4%	Design considered satisfactory

As can be seen in the table above, the suggested mitigation measures have been successful in reducing both the Light Intrusion and Sky glow to levels within the ILP guidance criteria and therefore the design is now considered to be satisfactory from an Obtrusive Light perspective.

1. Introduction

The following report has been prepared by Mott MacDonald on behalf of Metro and Network Rail. It provides a detailed summary of Obtrusive Light generated by artificial light sources associated with the proposed Leeds Station Southern Access development. The assessment shall consider the two buildings adjacent to the proposed entrance; refer to section 7.2.1 for a pictorial representation of the scope of this assessment.

The assessment is based on the design guidance provided by the Institute of Lighting Professionals (ILP) guidance notes for the reduction of obtrusive light, 2011.

A number of sensitive receptors have been identified in the area, this reports highlights the impact of the artificial light sources on the sensitive receptors and possible measures to be taken to mitigate impact on the aforementioned sensitive receptors.

2. Environmental Zone Classification

The city of Leeds is major urban area with a total population of approximately 800,000. The city centre, in which the proposed station development is situated, is a dense area comprising of a mix of residential and commercial land use.

The 'environmental zone' is deemed to be 'E4' in accordance with the ILP 'Guidance Notes for the Reduction of Obtrusive Light' – which also corresponds to the European guidance provided in the CIE suite of documents.

The recommended maximum obtrusive light characteristics, as defined in the ILP guidance notes, are given below:-

Obtrusive Light Limitations

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

Source: Institute of Lighting Professionals, Guidance Notes for the Reduction of Obtrusive Light GN01:2011

2.1 Curfew Hours

The ILP guidance refers to 'pre-curfew' and 'post-curfew' criteria. The guidance states that this is often specified by the local planning authority and that in the absence of any specific requirements 23:00hrs is suggested as a guideline. Whilst this item of the ILP guidance is useful for initial assessment, it is also a recommendation of this report that the project stakeholders, if possible, determine mutually acceptable curfew hours in agreement with the local building owners.

3. Light Intrusion into Windows

SUMMARY OF FINDINGS	FURTHER COMMENTS

ILP Guidance – Light intrusion into windows (Ev)

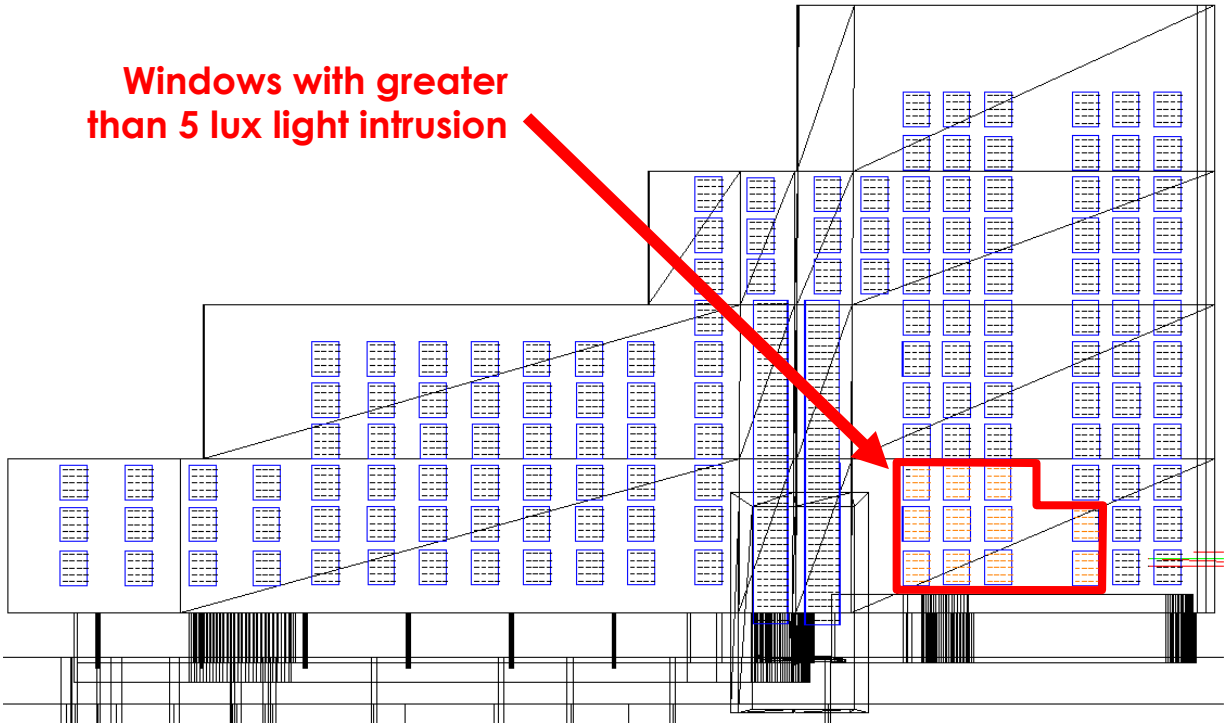
E_V < 5 lux

Adjacent Building - West

Calculated Maximum – Light intrusion into windows ($E_{V(max)}$)

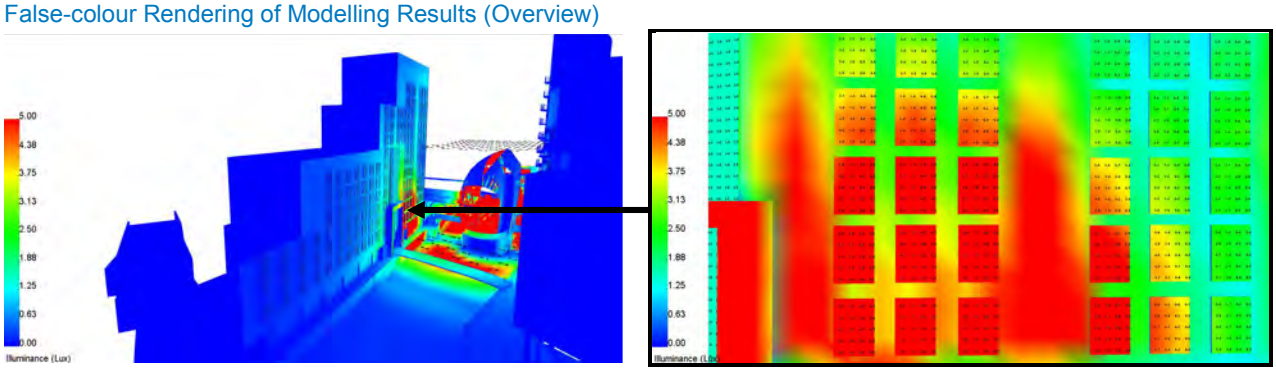
$E_{V(max)}$ = 8.8 lux

Section View of Modelling Results | Adjacent Building – West



Source: Mott MacDonald

False-colour Rendering of Modelling Results (Overview)



Source: Mott MacDonald

SUMMARY OF FINDINGS	FURTHER COMMENTS

ILP Guidance – Light intrusion into windows (Ev)

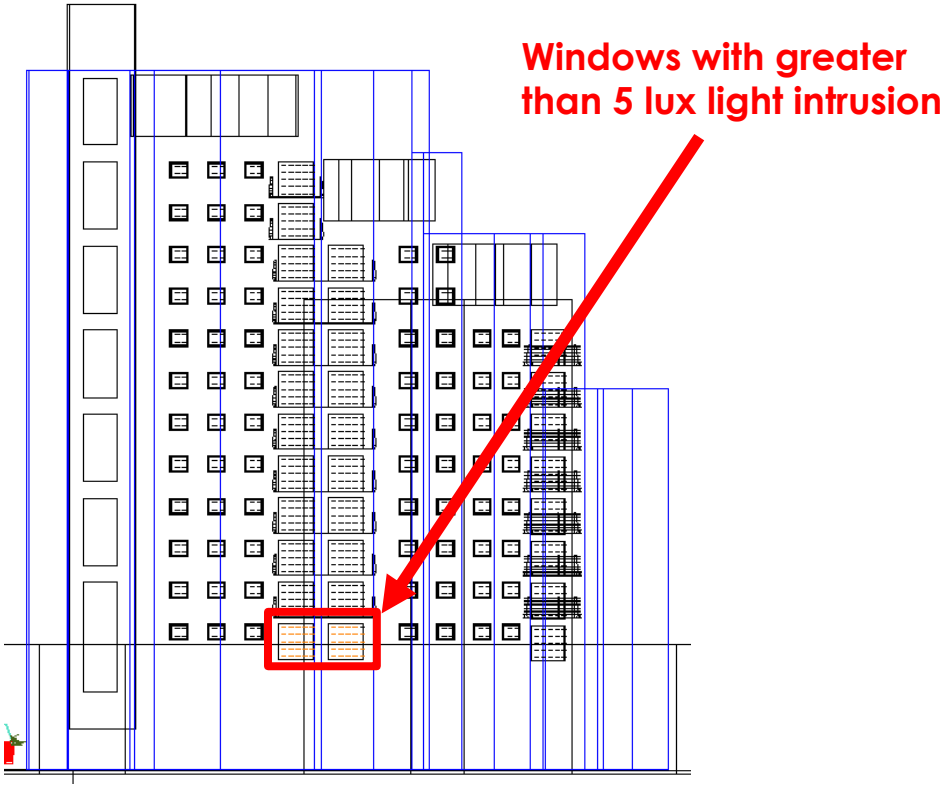
E_V < 5 lux

<u>Adjacent Building – East</u>

Calculated Maximum – Light intrusion into windows ($E_{V(max)}$)

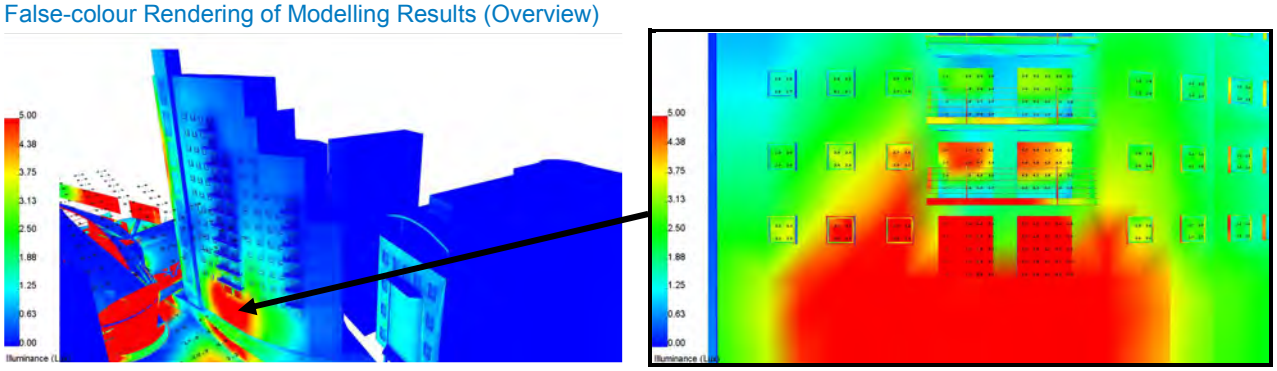
$E_{V(max)}$ = 7.6 lux

Section View of Modelling Results | Adjacent Building – East



Source: Mott MacDonald

False-colour Rendering of Modelling Results (Overview)



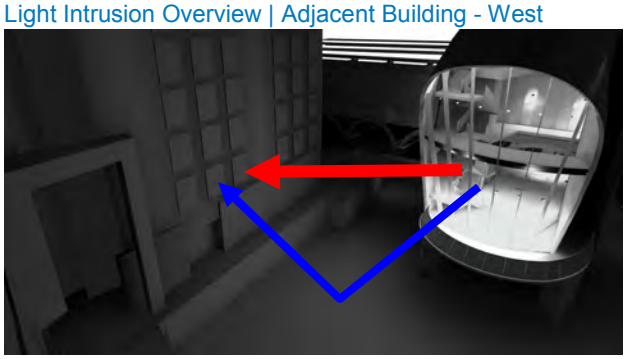
Source: Mott MacDonald

3.1 Interpretation of Results

The previous illustrations identify that the most significant light intrusion into the adjacent building occurs at the lower levels in close proximity to the proposed station structure.

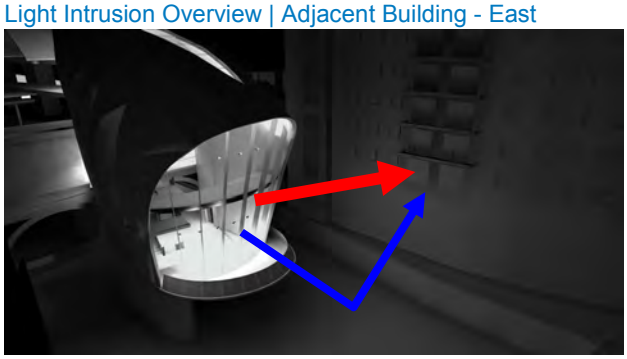
Inter-reflected light from within the building spills out of the south façade and directly onto the adjacent buildings (shown in red below). In addition, some of the spill light will reflect again off the surface of the River Aire and contribute to the light intrusion of the adjacent buildings (shown in blue below).

Light Intrusion Overview | Adjacent Building - West



Source: Mott MacDonald

Light Intrusion Overview | Adjacent Building - East



Source: Mott MacDonald

Calculations have been performed to numerically predict the amount of light which emanates from the proposed building and falls onto the windows of the adjacent buildings. The recommended maximum for an urban area (classified as 'E4') is 5 lux for the 'post-curfew' hours – refer to section 2. A number of windows adjacent to the proposed structure exceed this recommendation and therefore some mitigation measures should be considered as part of the design to reduce the effect these works will have on the surrounding neighbourhood.

It is noted that the 'pre-curfew' effect on the adjacent buildings is within recommended limits.

3.2 Notes and Recommendations

The following recommendations are based on the modelling assessments undertaken as part of this 'obtrusive light' study which has been based on information received from the design team and a number of assumptions – refer to section 7 for details.

It should be noted that the items below may not individually resolve the issues identified, rather a combination of design considerations will be required.

- Switch-off the type 'G' luminaires which provide up-lighting to the south façade structure after an agreed 'curfew' time. This will alleviate some of the light-spill to the surrounding environment and help reduce the light intrusion into the adjacent building windows.

- Careful consideration to the aiming of luminaires. Whilst it is noted that the majority of the lighting scheme consists of local handrail lighting providing focussed lighting for passenger wayfinding, there are a number of high-output luminaires which provide general illumination of the space. Some have been specified with glare baffles, which will be beneficial, however as part of the

detailed design and construction process careful consideration should be given to the precise aiming of luminaires to restrict light being spilled away from the surface and zone of intentional illumination.

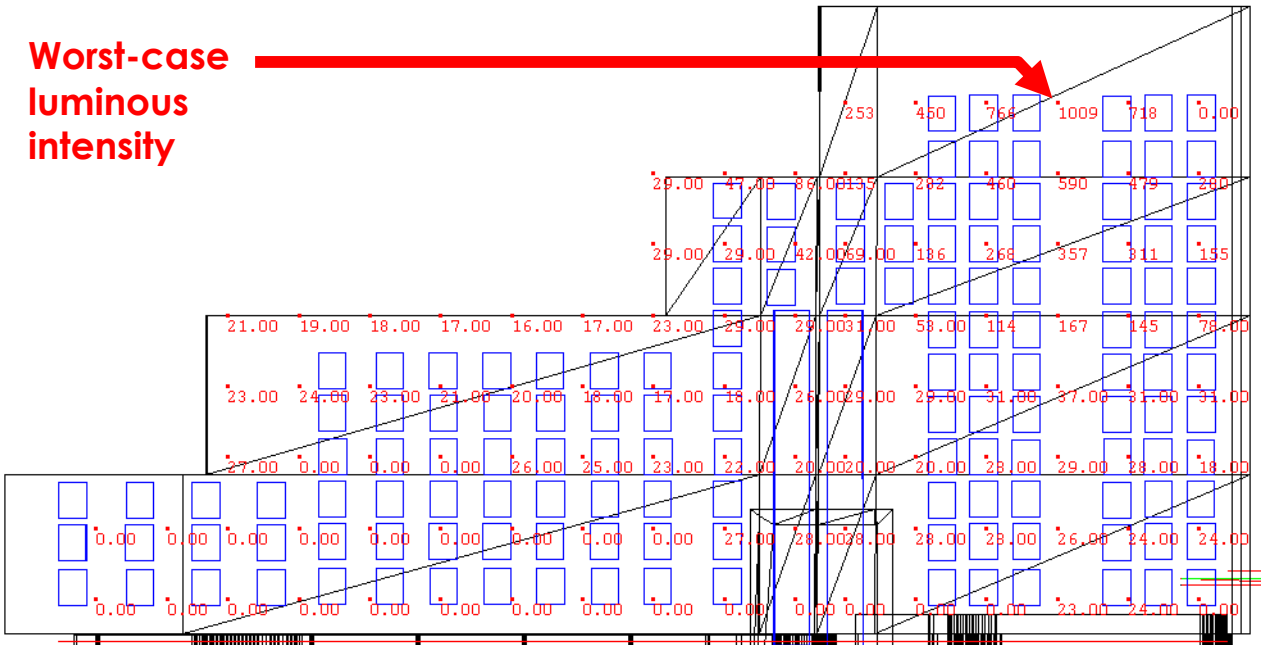
- Consider using glass of lower transparency. As part of this assessment, a glazing transparency of 80% has been assumed, however if a lower transparency of glazing can be integrated into the design without disrupting the overall building performance and aesthetic, then this should be strongly considered.

- Investigate whether the internal lighting can be reduced after an agreed 'curfew' time. Considering the use of dimming or selective switching will assist with reducing the reflected light spill from the station structure. Whilst it is noted that a number of high-output metal halide luminaires have been used for general illumination to enhance the internal space, it is recommended that consideration be given to the use of alternative dimmable light sources. To achieve an equivalent visible and technical performance it is noted that this may increase the number of total luminaires, which in turn may have financial implications, however this approach would have a positive impact on the overall light spill and the effect on the adjacent buildings.

4. Luminaire Intensity

SUMMARY OF FINDINGS	FURTHER COMMENTS
ILP Guidance – Luminaire intensity (I) I < 2500 candela (post-curfew) <u>Adjacent Building – West ($I_{(max)}$)</u> $I_{(max)}$ = 1009 candela	

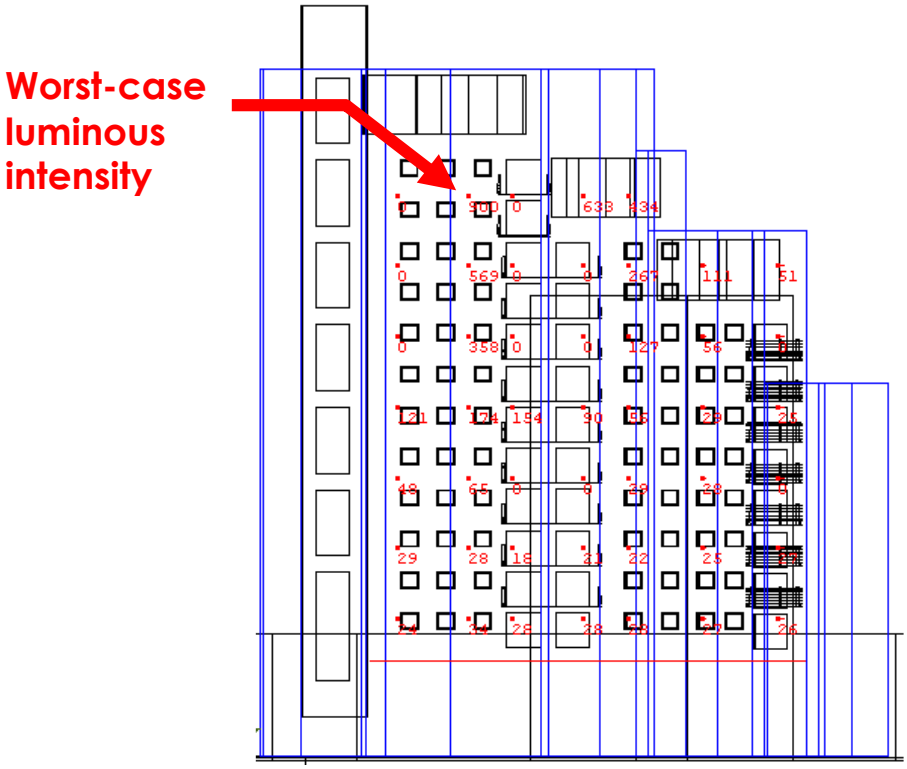
Section View of Modelling Results | Adjacent Building – West



Source: Mott MacDonald

SUMMARY OF FINDINGS	FURTHER COMMENTS
ILP Guidance – Luminaire intensity (I) I < 2500 candela (post-curfew) <u>Adjacent Building – East ($I_{(max)}$)</u> $I_{(max)}$ = 900 candela	

Section View of Modelling Results | Adjacent Building – East



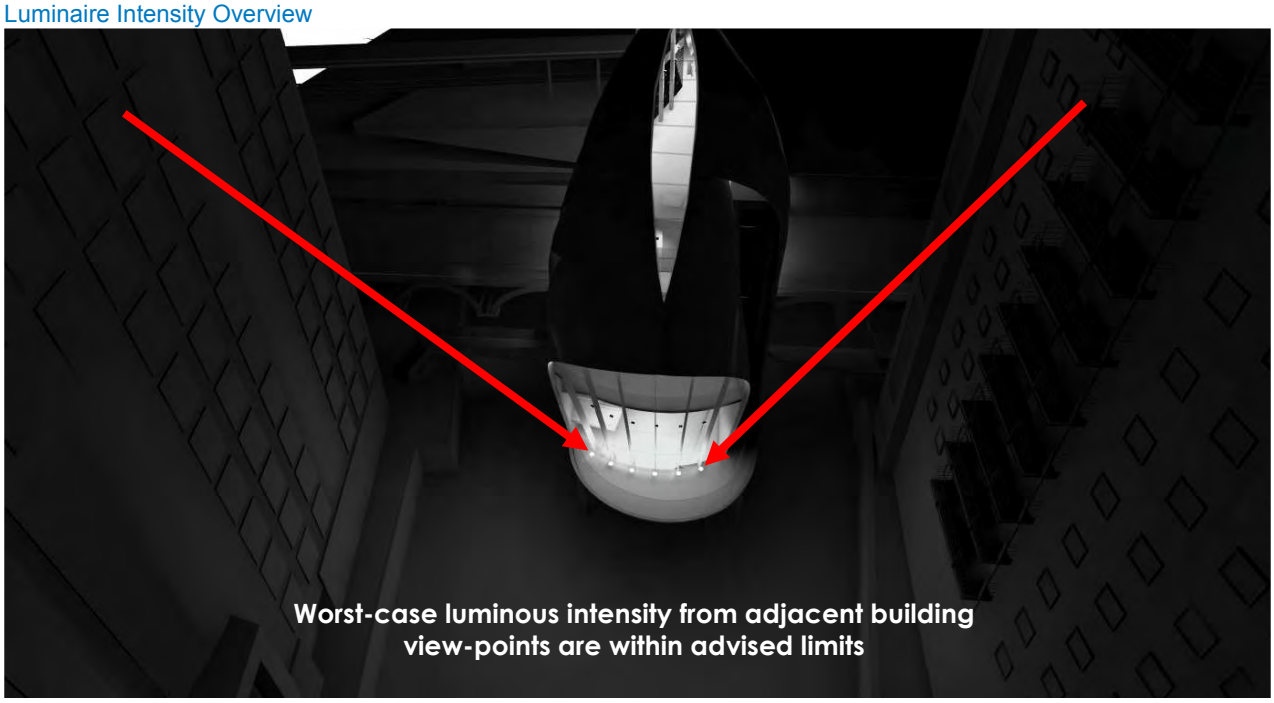
Source: Mott MacDonald

4.1 Interpretation of Results

Generally the luminaires within the proposed station structure are of sufficient distance away and not aimed towards the adjacent buildings to provide any concern to the occupants.

The only luminaires which cause any significant intensity from the perspective of the adjacent buildings are the in-ground up lights (type 'G' luminaires) which are positioned to illuminate the structure of the southern façade. However, due to the distance and intensity of these light sources, the calculated results indicate that the luminous intensity from the viewpoints considered do not exceed the recommended limits.

Luminaire Intensity Overview



Source: Mott MacDonald

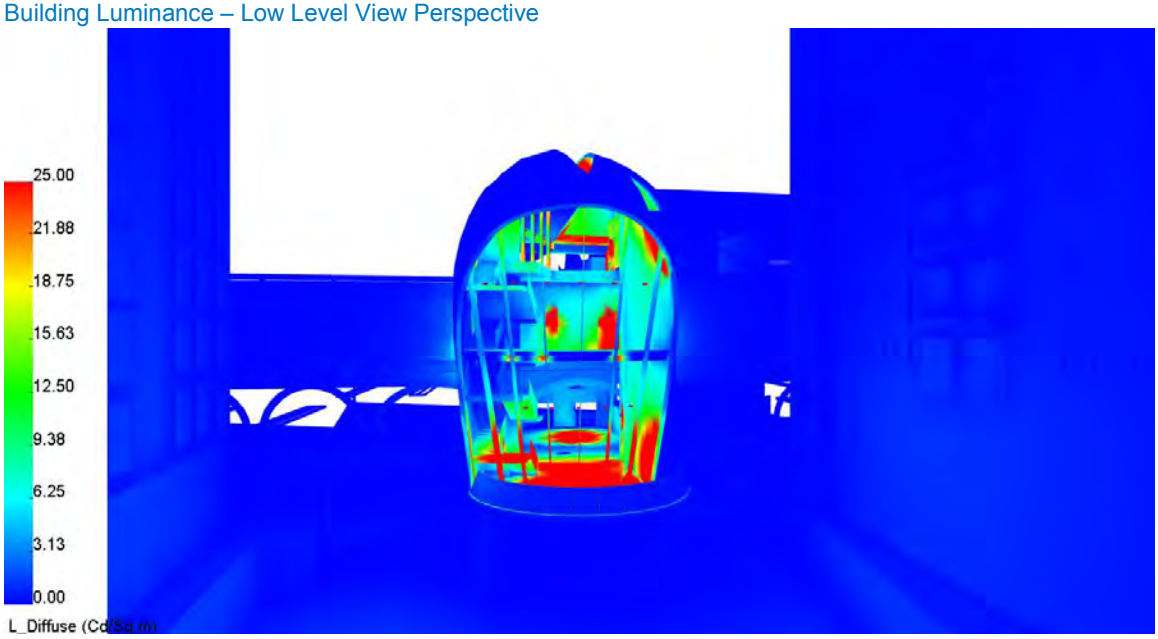
4.2 Notes and Recommendations

Although the visible luminaire intensities have been calculated to be within acceptable limits, it is a recommendation of this report that the type 'G' luminaires, which provide up-lighting to the southern façade structure, are switched-off after an agreed 'curfew' time. In addition to minimising the luminaire intensities visible throughout the night, this measure will also alleviate some of the light-spill to the surrounding environment as discussed in section 3.2.

5. Building Luminance

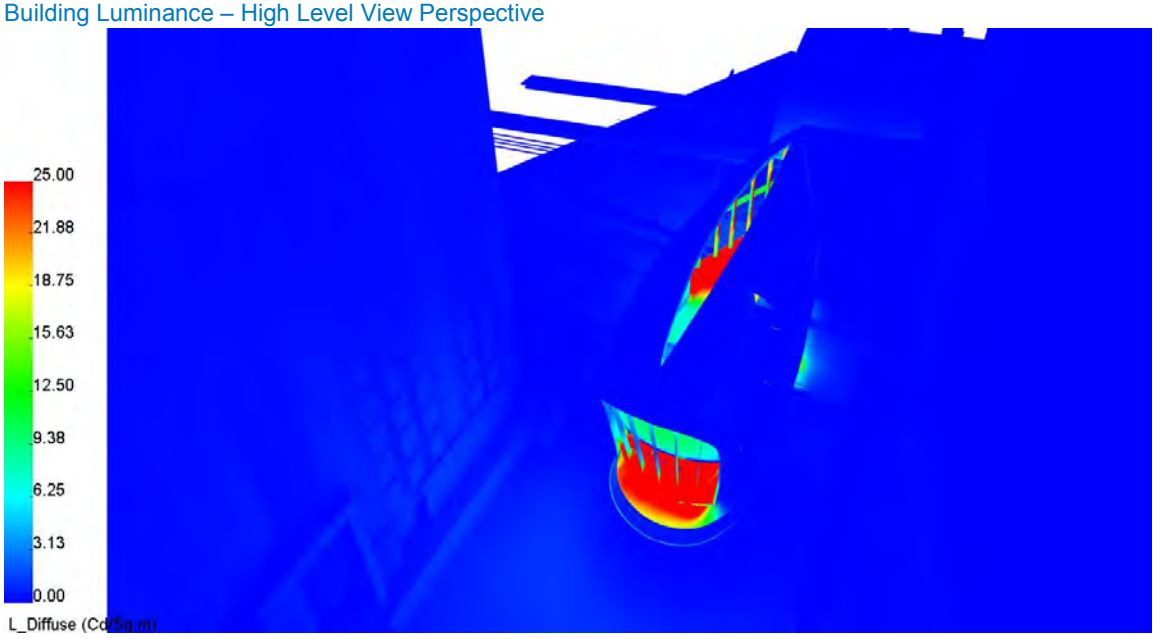
SUMMARY OF FINDINGS	FURTHER COMMENTS
ILP Guidance – Building luminance (L) L < 25 candela/m^2 (pre-curfew) Calculated Maximum – Building luminance ($L_{(max)}$) $L_{(max)}$ = 40-50 candela/m^2	Note; the visible building luminance is largely from the internal floor surfaces, which can be seen through the glazed southern façade.

Building Luminance – Low Level View Perspective



Source: Mott MacDonald

Building Luminance – High Level View Perspective



Source: Mott MacDonald

5.1 Interpretation of the ILP Guidance

It is noted that the ILP guidance is written with reference to buildings directly illuminated as a night-time feature, and that illumination of the internal surfaces which are visible from the outside are not specifically mentioned in the guidance.

The guidance however does state that a building illuminance "*should be limited to avoid over lighting, and related to the general district brightness*", and it is this basic principle which shall be considered in the analysis of this building.

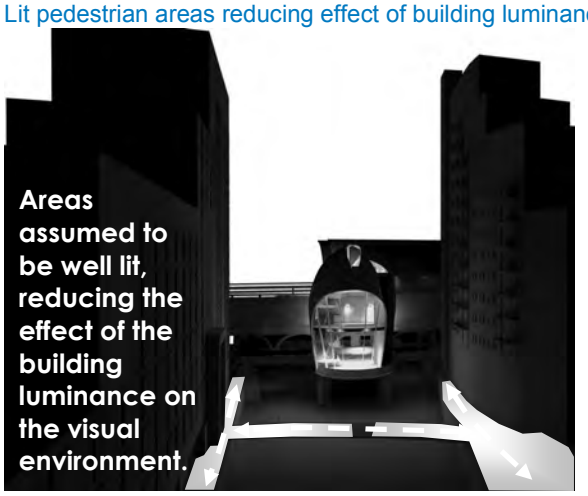
5.2 Interpretation of Results

Since the majority of the visible building's luminance is required for wayfinding and safety of the passengers within, there are no mitigation measures which can be considered without significantly disrupting the overall building design and performance.

As stated above, the key statement in the ILP guidance considers two principles:-

1. **The building luminance should be limited to avoid overlighting.** Since the building is designed to meet the requirements of the station it is assumed that the lighting levels will be reasonable and not excessive, however the ongoing design should consider the effect of any increased internal lighting levels and the effect this would have on the surrounding neighbourhood.
2. **The building luminance should be related to the general district brightness.** Assuming that the surrounding riverside footpath and bridge are well lit, this will have the effect of increasing the general district brightness meaning that the proposed station structure should not appear excessive (as shown in the sketch below). It should also be considered that the station entrance will enhance the visual environment, and can provide an attractive component to the nightscape in the local area, as well as creating identity and purpose for the station entrance itself.

Lit pedestrian areas reducing effect of building luminance



Source: Mott MacDonald (sketch)

Source: AEDAS

5.3 Notes and Recommendations

Further than consideration of the comments above, there are no additional comments or recommendations relating to the building luminance.

6. Sky Glow (Upward Light Ratio – ULR)

SUMMARY OF FINDINGS	FURTHER COMMENTS
ILP Guidance – Sky glow ULR (max %) ULR < 15% <u>Adjacent Building – East</u> Calculated Maximum – Sky glow ULR (max %) ULR_{max} = 33 %	

6.1 Interpretation of the ILP Guidance

The ILP guidance does acknowledge that upward light can enhance the visual environment when applied to structures in an appropriate manner. However, care should be taken to "*minimise any upward waste light*" in order to limit the sky glow effect generated in the environment, refer to reference below.

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.

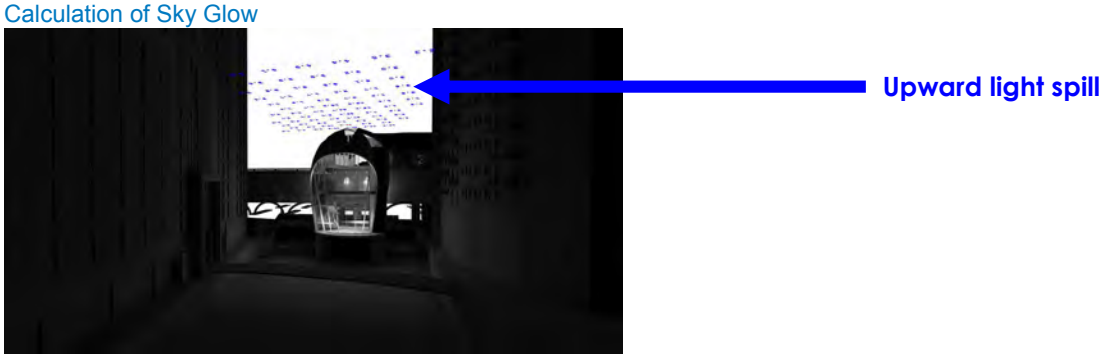
Source: Institute of Lighting Professionals, Guidance Notes for the Reduction of Obtrusive Light GN01:2011

It is noted however that the reflection of internal lighting escaping through large glazed surfaces is not generally considered in the ILP guidance, and that some interpretation is required.

For this analysis the ULR has been determined by comparing the upward light spill onto a plane just above the proposed station structure, with an assumed average internal illuminance of 200lux:-

$$ULR = \frac{Ev_{(MaximumUpwardSpill)}}{Ev_{(AverageInternal)}}$$

Calculation of Sky Glow



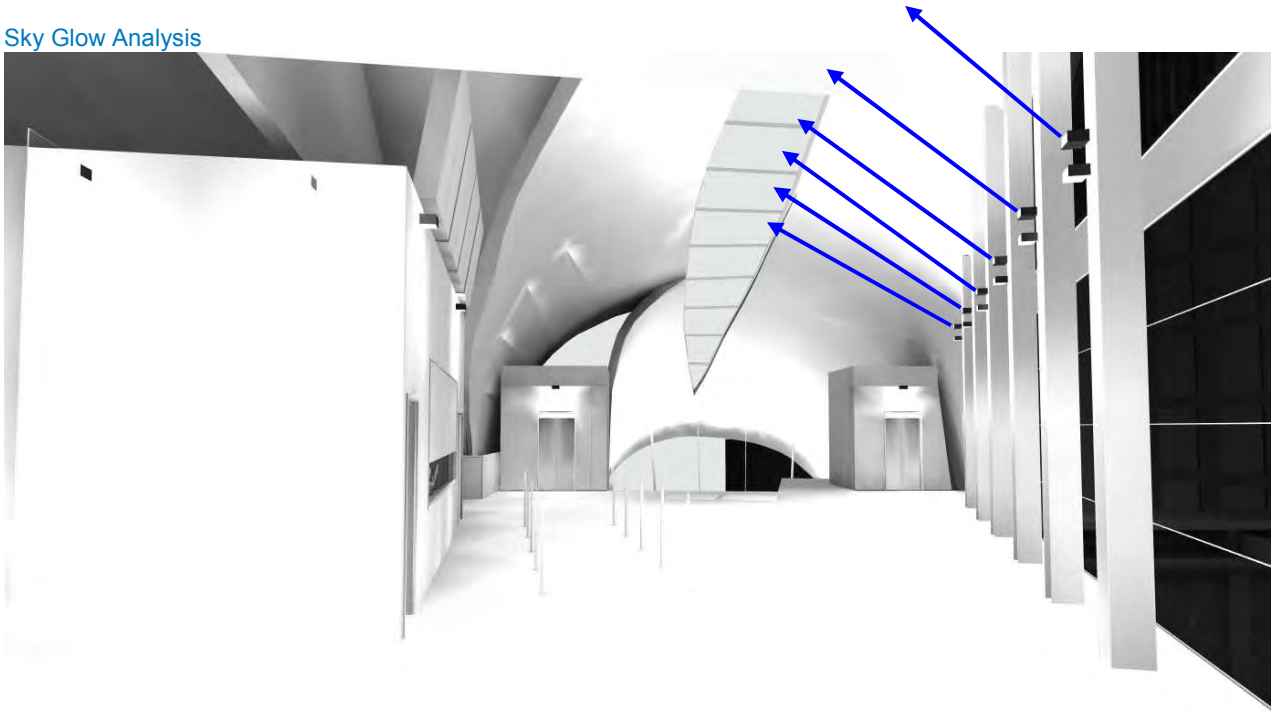
Source: Mott MacDonald

6.2 Interpretation of Results

Analysis of the ULR suggests that quite a significant proportion of the light spill from the building passes upwards causing levels of sky glow beyond the limits recommended in ILP guidance.

The upward light emanating from the Southern façade is relatively minimal and within acceptable limits. However, light emanating from the glazing at the top section of the structure contributes a significant portion to the sky glow. This is largely a consequence of the upward facing luminaires located at the upper floor of the proposed structure.

Sky Glow Analysis



Source: Mott MacDonald

6.3 Notes and Recommendations

The following recommendations are based on the modelling assessments undertaken as part of this 'obtrusive light' study which has been based on information received from the design team and a number of assumptions – refer to section 7 for details.

It should be noted that the items below may not individually resolve the issues identified, rather a combination of design considerations will be required.

- Careful consideration to the aiming of luminaires. Whilst it is noted that the majority of the lighting scheme consists of local handrail lighting providing focussed lighting for passenger wayfinding, there are a number of high-output luminaires which provide general illumination of the space. Some have been specified with glare baffles, which will be beneficial, however as part of the detailed design and construction process careful consideration should be given to the precise

aiming of luminaires to restrict light being spill from the structure, particularly through the glazed top of the roof structure.

- Consider reducing the intensity and luminous output of the upward facing luminaires. The design currently shows 150W metal halide luminaires providing up-light to the space. In order to minimise the light flowing through the upper glazing element both the position (as described above) and the luminous output should be considered here.

- Consider using glass of lower transparency. As part of this assessment, a glazing transparency of 80% has been assumed, however if a lower transparency of glazing can be integrated into the design without disrupting the overall building performance and aesthetic, then this should be strongly considered.

7. Modelling Notes and Assumptions

7.1 Assumptions

The following assumptions have been made during the numerical modelling process:-

3. The lighting proposal, and location of luminaires, is adequately defined within the following AECOM drawings;
   - 60092600/350 revB
   - 60092600/351 revB
   - 60092600/352 revA
   - 60092600/353 revA
4. Obtrusive light shall be considered for the two buildings directly adjacent to the new station entrance only, both part of the 'Granary Wharf' development (refer to section 7.2.1 for further details).
5. The new station structure, existing structure, and surrounding buildings are sufficiently defined within the following 3D AutoCAD files provided by AEDAS:-
   - 'Leeds Station.dwg' [received by Mott MacDonald on 23rd March 2012]
   - 'LS-Surrounding Buildings.dwg' [received by Mott MacDonald on 23rd March 2012]
6. All internal surfaces shall be modelled with 50% reflectance
7. All glazing shall be modelled with 80% transmittance
8. Luminaires for the 'curving light structures' proposed in the 'Leeds Station Southern Entrance: Lighting Concept Report' produced by Faber Maunsell Lighting and dated March 2009, are no longer part of the lighting scheme and shall not be considered within the modelling undertaken
9. Reflectance of the adjacent river is approximately 20%
10. Maintenance factor of 0.7 shall be considered for all luminaires
11. The average internal illuminance of the building is approximately 200lux.
12. Precise luminaire installation details are currently not available, therefore characteristics such as mounting height, installation angle, etc. have been assumed. Where possible, parameters from AECOM drawings (listed in point 3 above) have been used to derive the assumptions.

7.2 Calculation Methodology

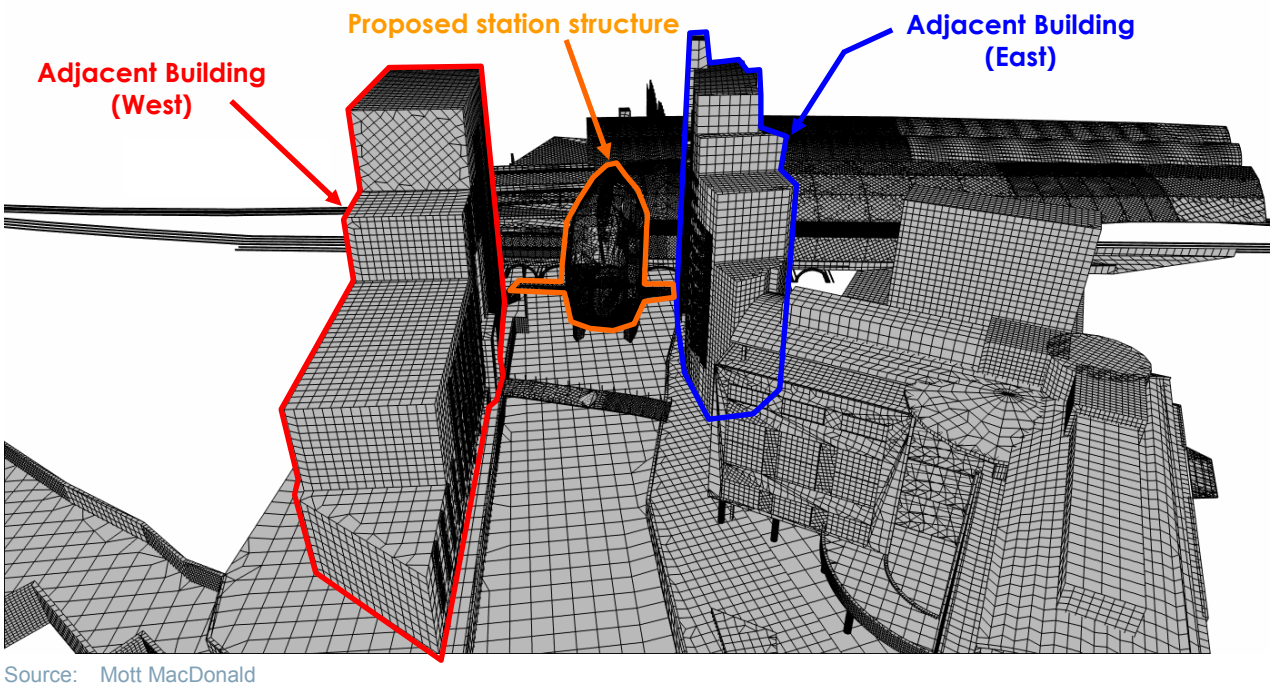
Numerical modelling and calculations have been carried out using the Lighting Analysts' software AGI32 version 2.

3-dimensional geometric models of the proposed station structures, and the adjacent buildings have been provided by AEDAS architects. These have been imported into the AGI32 analysis software, with surfaces, glazing, and any appropriate surface parameters assigned. All assumptions are listed in section 7.1.

7.2.1 Scope of Obtrusive Light Assessment

The obtrusive light assessments shall consider the two buildings adjacent to the proposed new South entrance to Leeds station.

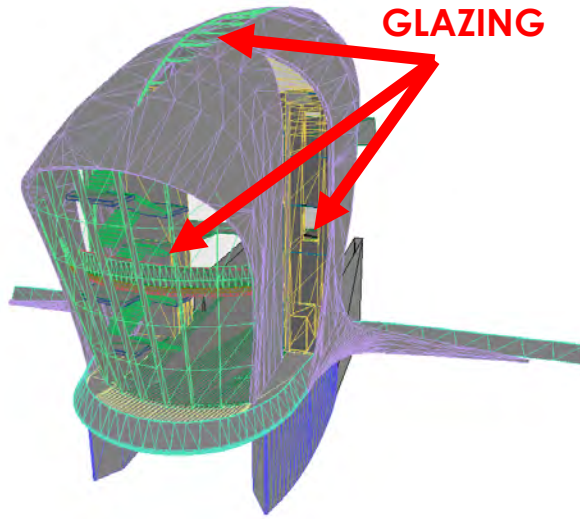
Scope of Obtrusive Light Assessment



Source: Mott MacDonald

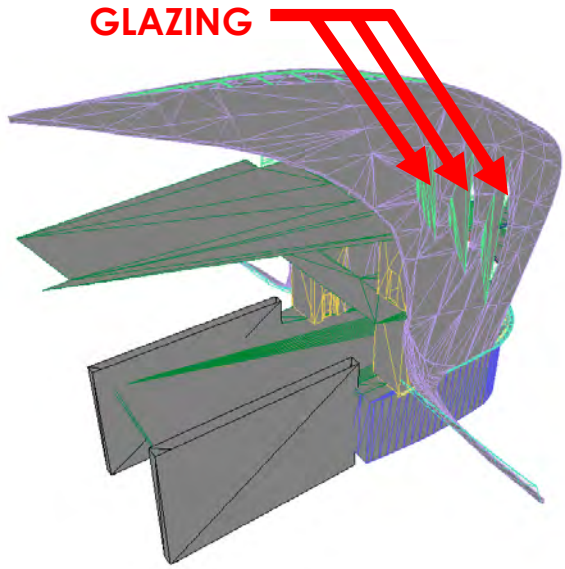
7.2.2 Key External Glazing Elements

Glazing Definition – South Façade and Top



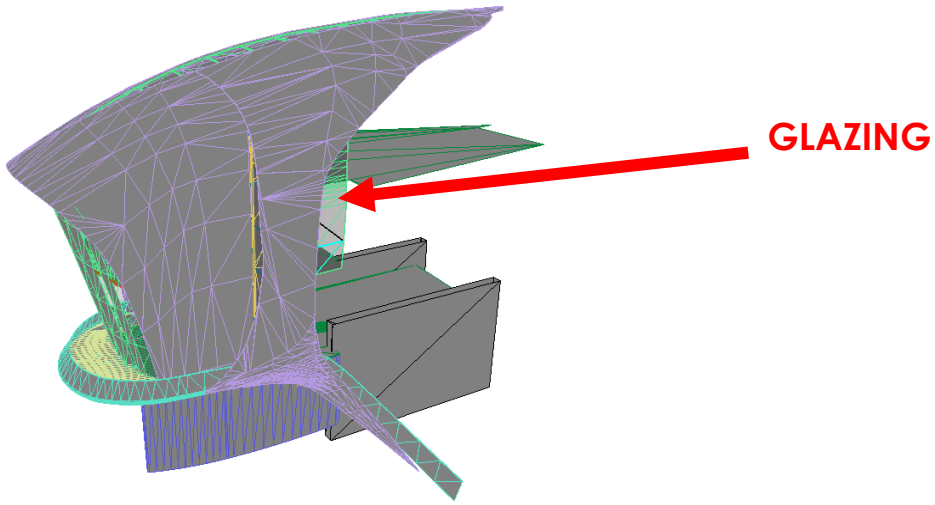
Source: Interpretation of AEDAS 3D model

Glazing Definition – West Façade



Source: Interpretation of AEDAS 3D model

Glazing Identification – East Facade



Source: Interpretation of AEDAS 3D model

7.2.3 Radiosity Stopping Criterion

AGI32 uses a 'radiosity' calculation engine to predict lighting distribution in a 3-dimensional environment. The 'stopping criterion' indicates the amount of unabsorbed light that can remain in the environment before calculations are concluded. The greater the stopping criterion, the more light has been absorbed, however a greater calculation time is required. The complexity of the geometry and number of luminaires within the lighting scheme also increase the calculation time.

For the purpose of this assessment, a stopping criterion of 90% has been used. Since the majority of the lighting is inter-reflected and absorbed within the building, this approach is considered to capture the light spill from the building to a reasonable degree of accuracy.

8. Consideration of Remedial Actions

8.1 Revised Modelling Parameters

To consider and test some of the pertinent remedial actions described in this report, the analysis model has been revised as follows:-

1. External 'Type G' luminaires have been switched-off and are not considered in the analysis – to achieve this the ongoing lighting design will need to implement a suitable time-controlled light switching system to ensure these luminaries will be off after an agreed curfew time.

2. The external glazing elements (identified in section 7.2.2 of this report) have been modified to be a maximum of 62% transparency. This has been based on a typical glazing system (see below) available on the market which has good light attenuation properties.

Glazing Transparencies

UNCOATED LAMINATED GLASS (.030 PVB INTERLAYER) TABLE 1

Product	Transmittance			Reflectance			U-Value		Shading Coefficient	Relative Heat Gain	SHGC*	LSG*	European U-Value
	Visible	Solar	U-V	Vis-Out	Vis-In	Solar	Winter	Summer					
Clear	85%	62%	<1%	7%	7%	6%	.97	.88	.83	178	.72	1.18	5.4
Green	71%	37%	<1%	6%	6%	5%	.97	.88	.64	141	.55	1.29	5.4
Gray	43%	33%	<1%	5%	5%	5%	.97	.88	.62	135	.53	.81	5.4
Bronze	51%	39%	<1%	5%	5%	5%	.97	.88	.66	143	.56	.91	5.4
Blue	53%	36%	<1%	5%	5%	5%	.97	.88	.63	139	.54	.98	5.4
Blue-Green	72%	41%	<1%	6%	6%	5%	.97	.88	.67	146	.58	1.24	5.4
UltraWhite™	88%	77%	<1%	7%	7%	7%	.97	.88	.94	201	.82	1.07	5.4
CrystalGray™	62%	43%	<1%	6%	6%	5%	.97	.88	.69	150	.59	1.05	5.4

*SHGC refers to Solar Heat Gain Coefficient.
*LSG refers to Light to Solar Gain ratio.

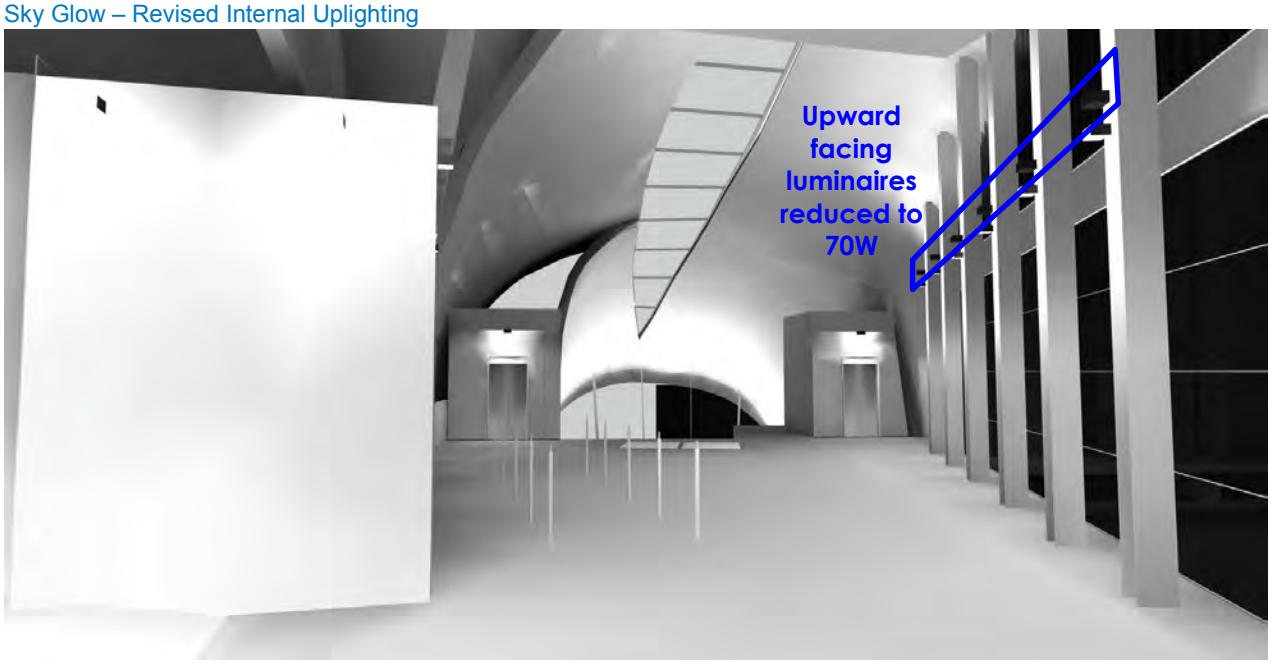
1. The performance data for Table 1 applies to laminated glass constructed with two plies (clear inboard) of 1/4" (6 mm) glass and a .030" (.76 mm) clear pvb interlayer. If UltraWhite™ (15) glass is used, both plies of the laminate are the UltraWhite™ substrate.
2. Increasing the thickness of the pvb interlayer will have an insignificant effect on performance data.
3. If Viracon's reflective coatings are applied to tinted glass, the glass must be heat treated. In this case, a .060" (1.5 mm) pvb interlayer may be required. All coatings are applied to the second (#2) surface.
4. If Viracon's reflective coatings are applied to clear glass, contact our Technical Services Department at 800-533-2080 to determine the possibility of using annealed glass.
5. Our Technical Services Department can also provide performance information on products not listed here.

Source: Viracon

3. The reflectance of the floor surfaces have been reduced to a more conservative estimate of 20% reflectance. It should be noted that the reflectance values of each surface are not currently defined, and the initial assessment of an overall 50% reflectance is still considered reasonable for this analysis; however the floor surfaces are a key component of the structure and a more conservative assessment, in line with common industry practice of 20%, can be applied. Although the results are not included here it is noted from this modelling study that the reduced floor reflectance had a minimal effect on the light instruction (less than 10%) and much less effect on the sky glow.

4. The upward facing luminaires have been changed from 150W (type C) to 70W (type C2) to reduce the upward light. A revised indicative render of the internal space is provided below, and the amended luminaires are highlighted.

Sky Glow – Revised Internal Uplighting



Source: Mott MacDonald

8.2 Revised Summary of Findings

For the purpose of this revised analysis, only the 'light intrusion (into windows)' and the 'sky glow' which were initially identified to be above the guidance criteria are considered. The other criteria have not been changed and are shown for completeness in grey in the table below.

Summary of Findings – Incorporating Remedial Actions Described above

ILP Guidance	Guidance Criteria	Calculated Performance	Comment
Light Intrusion (into windows) – post-curfew	5 lux	5.0 lux (worst case)	Design considered satisfactory
Luminaire Intensity	2, 500 candela	1009 candela	Design considered satisfactory
Building Luminance (pre-curfew)	25 cd/m^2	40-50 cd/m^2	Design considered satisfactory [1]
Sky Glow	15%	9.4%	Design considered satisfactory

[1] Although the calculated performance is worse than the guidance criteria, consideration of the wider environment suggests that the design is suitable for the local environment.

Appendix C. LSSE Daylight and Sunlight Performance Study

FABER MAUNSELL | AECOM

Leeds Station Southern Entrance
Daylight and Sunlight Performance Study

Document No.: 60092600/1020

23 April 2009

LEEDS STATION NEW SOUTH ENTRANCE

FABER MAUNSELL LIGHTING

Prepared by: .....
Patricia Brock
Lighting Consultant

Approved by: .....
Lee Barker-Field
Principal Lighting Consultant

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Telephone: 0113 391 6800 Fax: 0113 391 6899 Website: http://www.fabermaunsell.com

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Non-Technical Executive Summary

Faber Maunsell Lighting has undertaken analysis to assess the likely daytime overshadowing impact of the proposed Leeds Station New South Entrance development on exiting residential properties to the East of the site.

Our analysis indicates the cumulative impact of the proposed development on daylight access to the residential properties to the East of the site is likely to be major adverse.

Our analysis indicates the cumulative impact of the proposed development on sunlight access to the residential properties to the East of the site is likely to be minor adverse.

Access to direct daylight and sunlight is inherently limited to the residential buildings to the East of the site due to existing overshadowing from the mixed used development under construction to the West of the site.

Introduction

This report assesses the daylight and sunlight overshadowing that is likely to be created by the proposed Leeds Station New South Entrance. It includes benchmarking of the assessment findings against BRE good practice guidance.

To facilitate quantification of potential cumulative impacts on daylight and sunlight access around the site, this report assesses base and proposed conditions.

This report considers the base condition to be the access to direct daylight and sunlight that is apparent with the existing buildings on and around the site in place. The proposed condition is considered to be the access to direct daylight and sunlight that is likely to be apparent with the retained existing and the proposed New South Entrance to Leeds Station in place.

The cumulative impact of the proposed development is any net increase in overshadowing created by the proposed condition.

Computational prototyping has been used to generate detailed simulations of direct daylight and sunlight access in the base and proposed conditions which facilitates assessment of the variance between the two conditions.

Figure 1 shows the existing site.

Figure 1: View of the proposed site from the South

Site Conditions Overview

Location

Leeds

Latitude - 53° 48’ N (53.8)

Longitude- 01° 33’ W (-1.55)

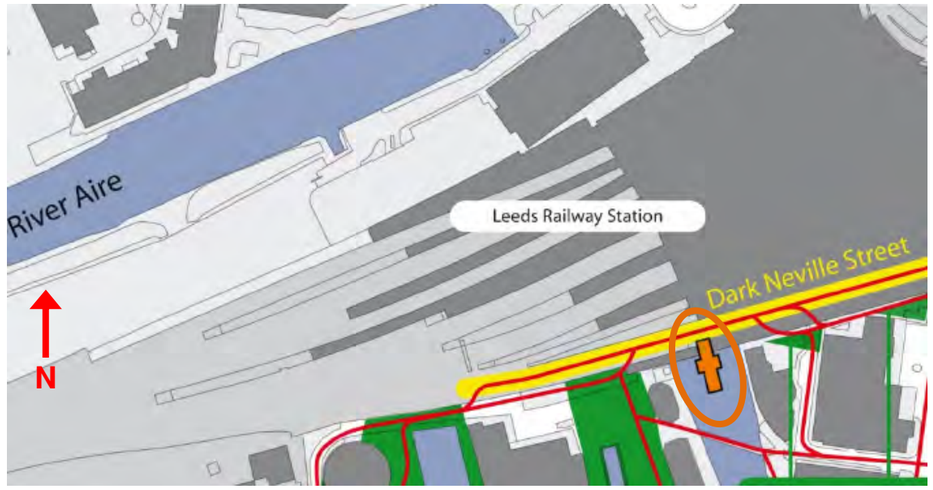
Site Orientation

See Figure 2

Description of the Site Conditions

The proposed Leeds Station New South Entrance site is located South of platforms 16 and 17 of the existing Leeds Station, above the arches of Dark Neville Street and extending onto the River Aire. Adjacent to the site, there are existing residential buildings to the East, Leeds Station to the North and a combination of residential buildings and offices under construction to the West.

Figure 2: Plan view of the site



Proposed New South Entrance

General Observations

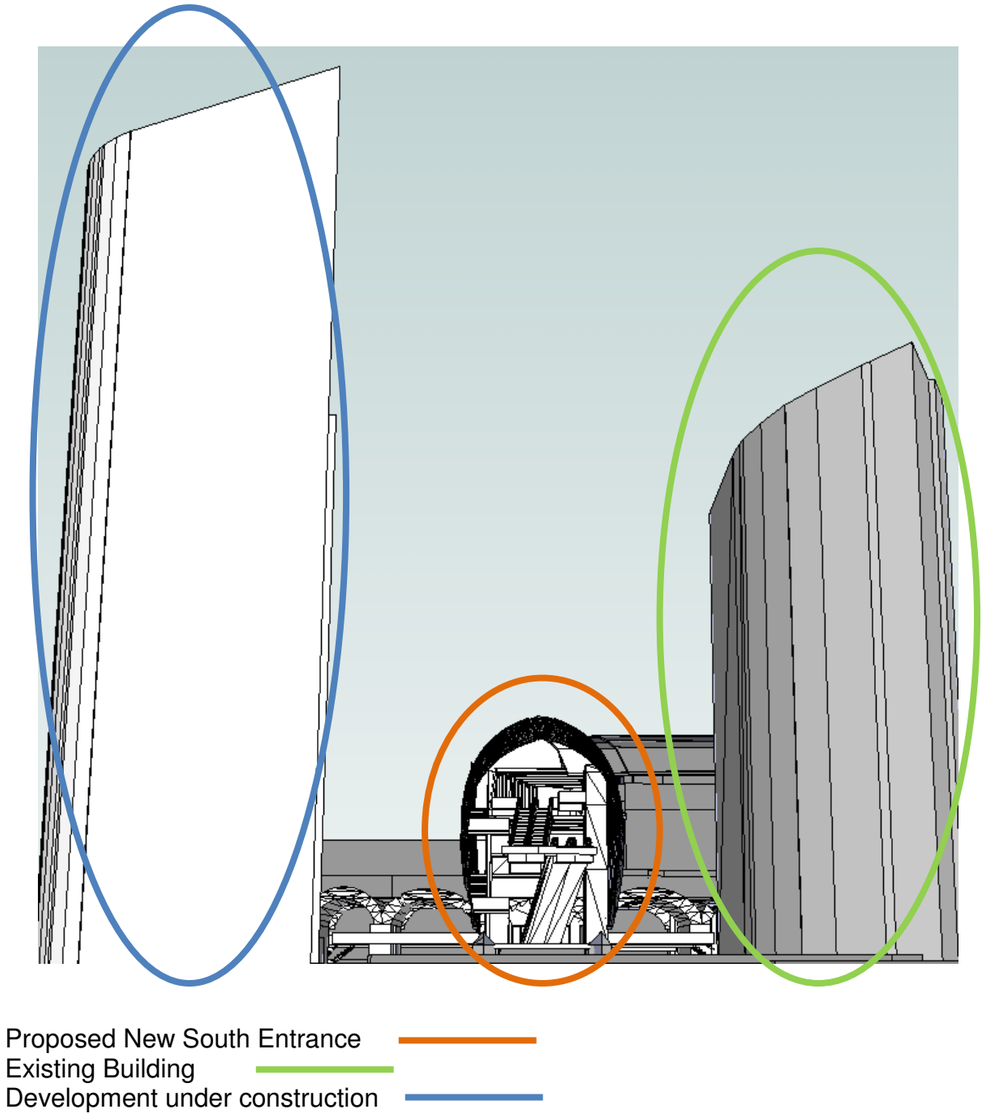
Layout

The proposed site is to the South of the existing station. It is located above the River Aire and sits between a residential development on Little Neville Street to the East and a mixed use development, currently under construction, to the West.

Scale

The proposed development takes the form of a curved, arching façade that is approximately 4 stories high at its the Southern-most point and slopes to meet the height of the existing station building at its northern-most point. Adjacent buildings range in height from 4 to 13 storeys. Figure 3.

Figure 3: Proposed site section with the existing buildings indicated



Assessment Terminology

Daylight - Light that can be considered to be the same as skylight, a widely scattered non-directional light, available irrespective of building orientation.

Diffuse Daylight – Non-directional diffuse light from the sky dome excluding the contribution of direct light from the sun.

Direct Daylight – Daylight that directly reaches a surface or test plane. I.e. excluding the contribution of reflected light.

Sunlight – Directional light from the sun excluding the contribution of daylight. Sunlight direction varies with date and time

Test Planes – Notional planes placed within a model to facilitate calculation of light levels at a point.

Radiosity – A computational modelling technique used to accurately predict light flux transfer in a virtual environment which facilitates the simulation light levels in that environment.

Ray Tracing – A computational modelling technique used to accurately predict directional shadowing in a virtual environment.

Receptor Sensitivity– Consistent descriptive terminology used in a report to express and summarise the likely sensitivity of an impact on a specific receptor, infirmed by receptor type and context factors.

Receptor Sensitivity Scale

The receptor sensitivity scale using this report is listed below. Example receptor types are given for each receptor sensitivity rating.

Minor – windows or doors that served spaces such as circulation space, stairwells, utility rooms and bathrooms.

Moderate – windows that serve spaces such as bedrooms and dual aspect living spaces or kitchens.

Major – windows that serve spaces such as single aspect living spaces and kitchens.

Impact Rating – Consistent descriptive terminology used in a report to express numerically quantified impacts in a non-technical way for reader accessing and interpolation.

Impact Rating Scale

The impact rating scale using this report is listed below. Example impact types are given for each impact rating.

Major Beneficial – Lighting conditions that present a significant positive impact. For example significant improvement on diffuse daylight availability.

Moderate Beneficial – Lighting conditions that present an intermediate positive impact. For example a noticeable improvement in diffuse daylight availability.

Minor Beneficial – Lighting conditions that present a small positive impact. For example a small improvement of diffuse daylight.

Negligible – Lighting conditions that present no significant impact. For example little to no change in access to daylight and sunlight.

Minor Adverse – Lighting conditions that present a negligible negative impact. For example a small diffuse daylight obstruction.

Moderate Adverse – Lighting conditions that present an intermediate negative impact. For example an acceptable, although noticeable, diffuse daylight obstruction.

Major Adverse – Lighting conditions that present a significant negative impact. For example significant diffuse daylight obstruction.

Analysis Methodology

Analysis Methodology

Construct Virtual Model

Construct a 1:1 3D virtual model of the site incorporating existing buildings and notional test planes on and around the site for use in base condition analysis.

Construct a 1:1 3D virtual model of the site incorporating the retained existing buildings, proposed buildings and notional test planes on and around the site for use in proposed condition analysis.

Daylight Analysis

Process two radiosity based computational simulations to analyse base and proposed daylight conditions on surface and test planes around the site. The simulations use a CIE overcast / photometric sky corrected for 12.00 on the summer solstice, 21st of June.

Sunlight Analysis

Process two ray tracing based computational simulations to analyse the base and proposed sunlight access / shadow conditions around the site. The simulations use a CIE clear photometric sky corrected for the spring equinox, 21st of March, the summer solstice, 21st June and winter solstice, 21st December.

Post Processing

Post processing of simulation data to generate numerical and graphical information which describes and presents intuitively the daylight and sunlight conditions calculated.

Assumptions

The placement and geometry of the proposed development and surrounding buildings have been provided to Faber Maunsell lighting in electronic model format by the project architect / design team. The location and size of the test planes were determined from site survey information. In situations where definitive information was not available, standard practice allows for 1m x 2m planes to be placed in typical window locations.

For the daylight simulation, the following material properties have been assumed:

Existing Exterior Facades	20% reflectance
Ground	20% reflectance
Water	50% reflectance
Proposed Facades / Cladding	50% reflectance

For the sunlight simulation, surface reflectances that facilitate a clear depiction of shadow extents are used.

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Daylight Analysis

Identification of Test Planes

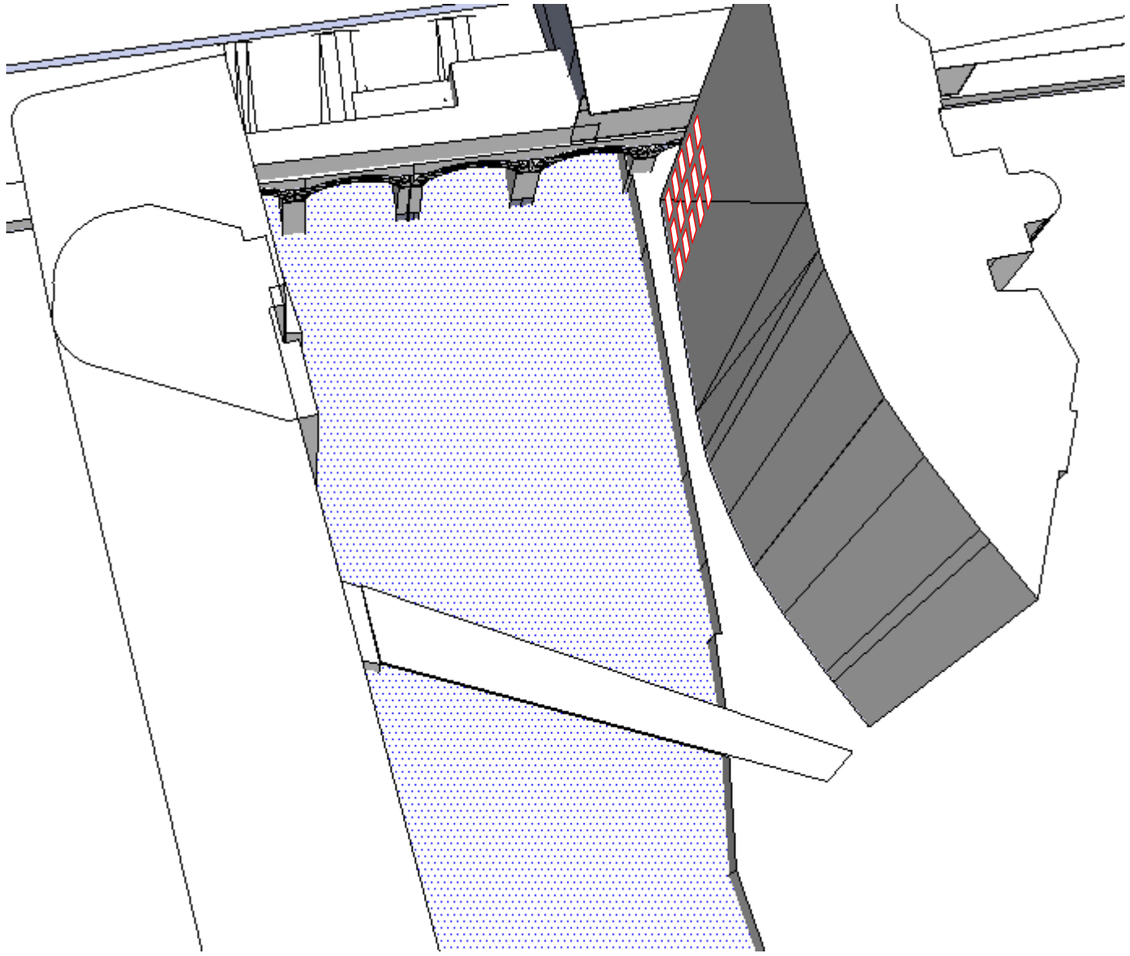
15 test planes have been identified on residential properties to the East of the site. The test planes correspond to window locations.

Figure 4 indicates location of test planes.

Test planes have been referenced as follows:

Top left	ref 1	Bottom left	ref 5
Middle top	ref 6	Middle bottom	ref 10
Top right	ref 11	Bottom right	ref 15

Figure 4: Location of test planes



Key

Test plane

Daylight Simulation Results

Table 1 presents the direct daylight levels our analysis calculated to be on the identified test planes with the base buildings in place and the proposed development in place. Identical lighting conditions were used in both simulations.

Table 1: Simulated Daylight Levels

Facade Ref	Sensitivity of Window Instance	Base Minimum Lux	Base Maximum Lux	Base Light Lux	Proposed Minimum Lux	Proposed Maximum Lux	Proposed Light Lux	% Reduction from Base	Assessment of Impact
1	moderate	4191	5196	4735	3422	4425	3987	16	moderate adverse
2	moderate	3676	4453	4053	2689	3418	3073	24	major adverse
3	moderate	3361	4088	3704	2183	2760	2492	33	major adverse
4	moderate	2888	3636	3272	1720	2238	1985	39	major adverse
5	moderate	2581	3078	2773	1414	1795	1548	44	major adverse
6	moderate	4805	5175	4983	4190	4513	4324	13	moderate adverse
7	moderate	4579	5043	4796	3471	3881	3744	22	major adverse
8	moderate	4140	4606	4428	2937	3416	3159	29	major adverse
9	moderate	3631	4238	3919	2307	2807	2561	35	major adverse
10	moderate	3136	3596	3375	1845	2218	1999	41	major adverse
11	moderate	4642	4960	4821	4098	4446	4295	11	moderate adverse
12	moderate	4505	4222	4687	3655	4113	3859	18	moderate adverse
13	moderate	4200	4635	4405	3076	3570	3375	23	major adverse
14	moderate	3812	4139	3971	2651	3073	2842	28	major adverse
15	moderate	3239	3713	3530	2090	2484	2329	34	major adverse

Note: Refer to assessment terminology section for information on receptor sensitivity and impact ratings. The use of the interior spaces served by the windows / receptor locations tested and therefore the sensitivity of impacting on them was not clear in all cases. Where receptor sensitivity ratings could not be irrefutably established at the time of compiling this report, assumptions were made based on available information.

Daylight Planning Guidance

The performance recommendations indicated in the Building Research Establishment's design guide 'Site Layout Planning for Daylight and Sunlight' are those typically identified in local authority planning guidance as the ones by which the daylight and sunlight performance of a proposed development will be assessed. BRE guidelines recommend that a daylight reduction equal to or less than 20% is acceptable.

Daylight Access (extract)

If the vertical sky component is greater than 27% then enough skylight should still be reaching the window of existing buildings. Any reduction below this level should be kept to a minimum. If the vertical sky component, with the new development in place, is both less than 27% or less than 0.8 times its former value, then occupants of the existing building will notice the reduction in the amount of skylight. The area lit by the window is likely to appear more gloomy, and electric lighting will be needed more of the time.

Note: Reduction in access to direct daylight is directly proportional to reduction in vertical sky component.

Daylight Analysis Observations

With reference to the daylight good practice planning guidance section, a reduction in direct daylight of not more than 20% on the identified test planes indicates good practice compliance.

Table 1 presents the values our analysis indicates are likely to be on the identified test planes around the site in the base and proposed case for the 21st June, the standard BRE test date.

Observations:

1) Our analysis indicates 11 of the 15 test planes identified on the properties to the East of the site would have a daylight reduction of more than the good practice guidance of 20% with the proposed development in place.

2) Our analysis indicates that test planes above the 3rd storey on the properties to the East of the site would have a daylight reduction of less than the good practice guidance of 20% with the proposed development in place.

3) Our analysis indicates daylight reduction of less than the good practice guidance of 20% is likely occur to windows / receptors located toward the bottom of the building the further South they are located.

4) It is unlikely that the majority of test planes identified currently receive good practice daylight levels in the base condition due to inherent overshadowing form the mixed use development under construction to the West.

Figures 5 and 6 are perspective views of the light levels around the site with the base and proposed condition buildings in place. The images were generated from the radiosity models used to calculate the values in Table 1.

Figure 6: Daylight levels around the site, base conditions

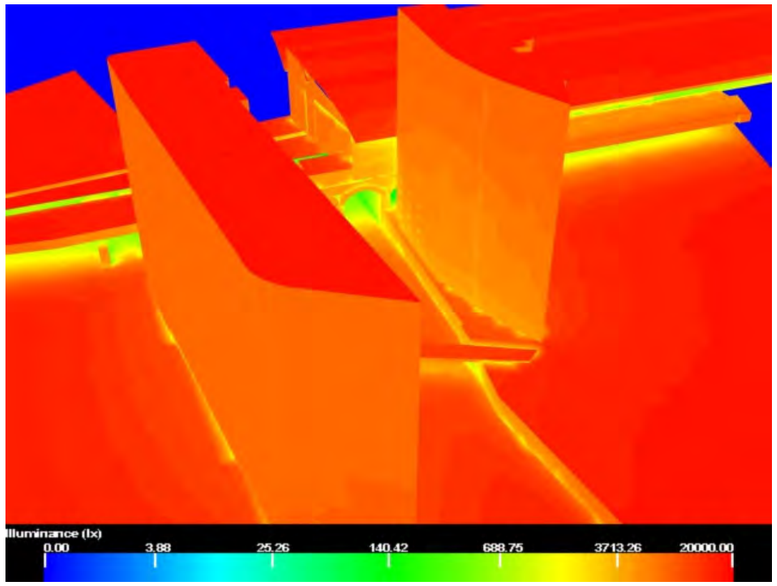
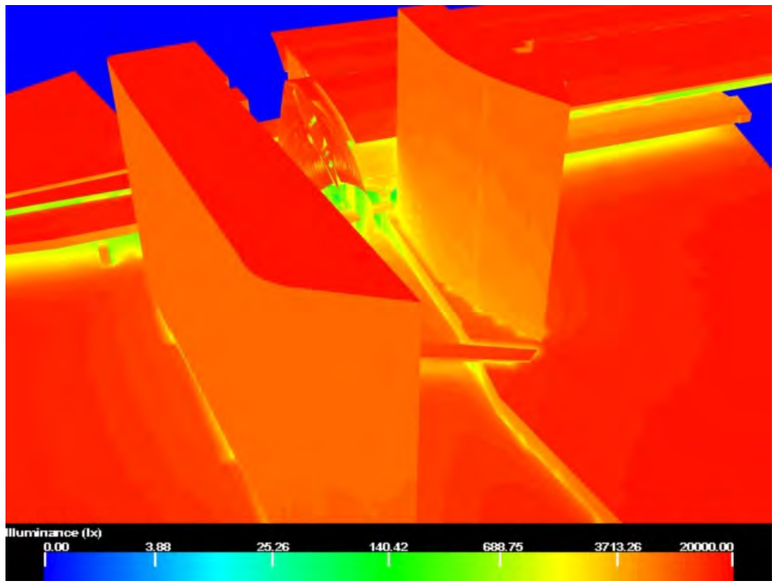


Figure 7: Daylight levels around the site, proposed conditions



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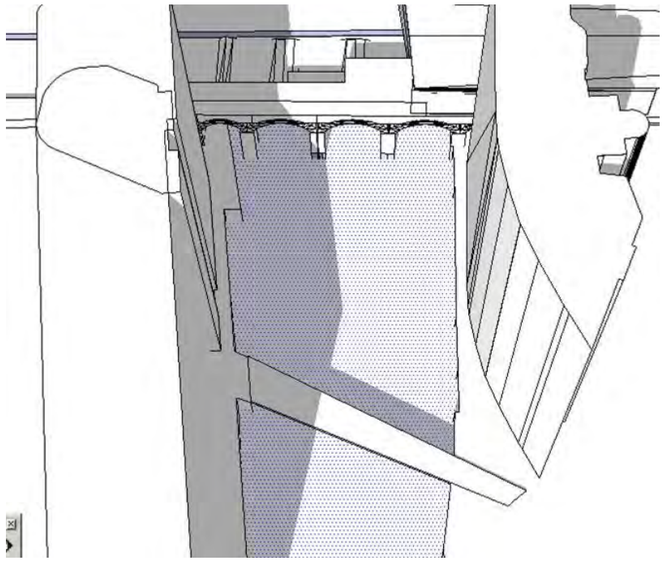
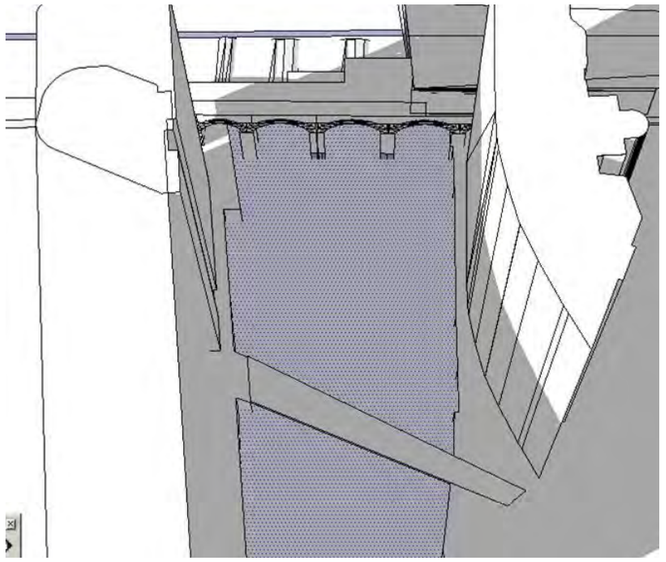
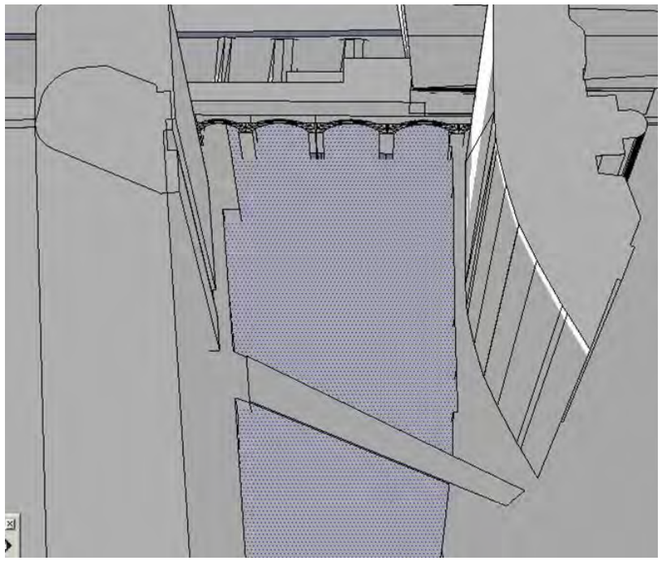
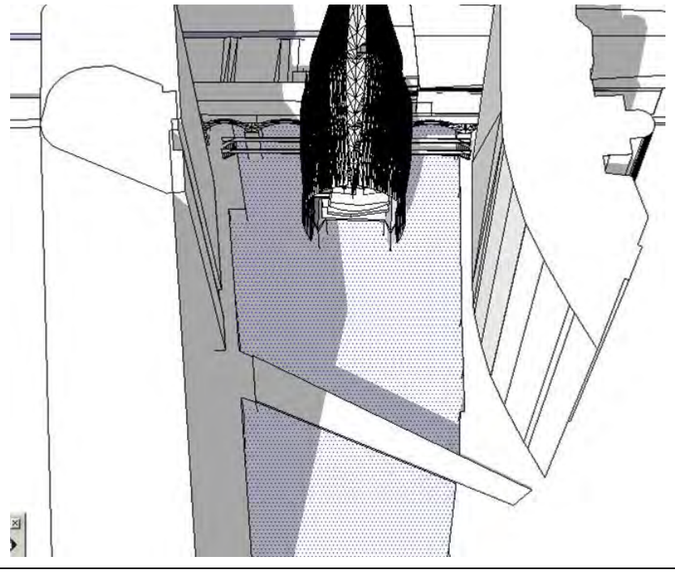
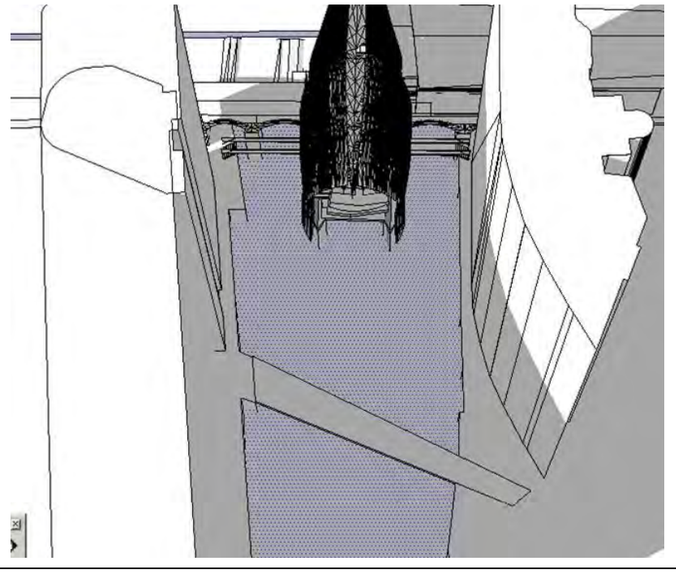
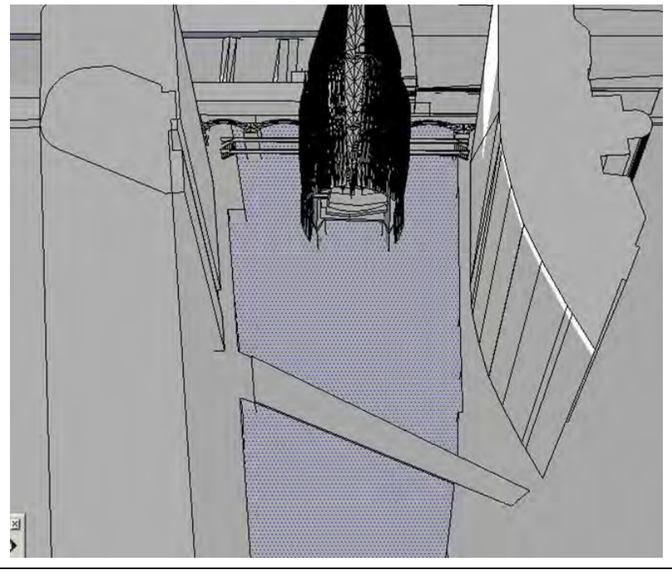
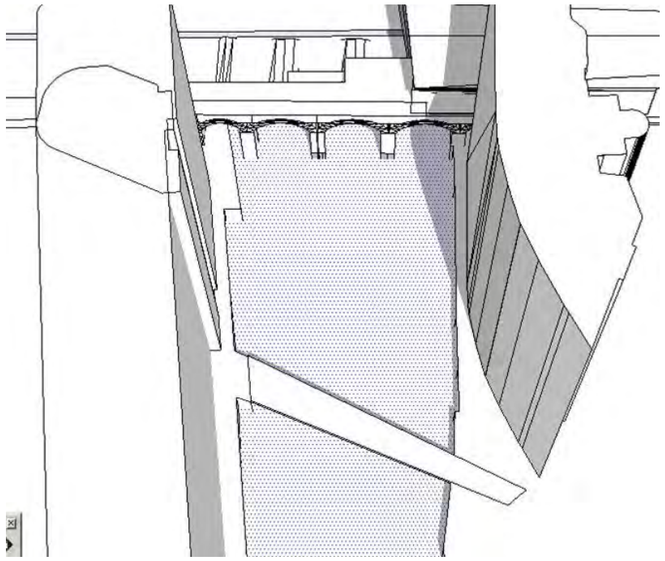
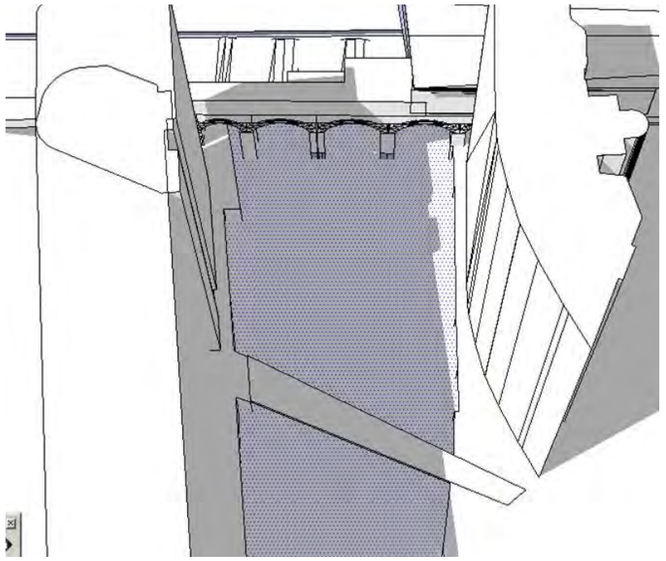
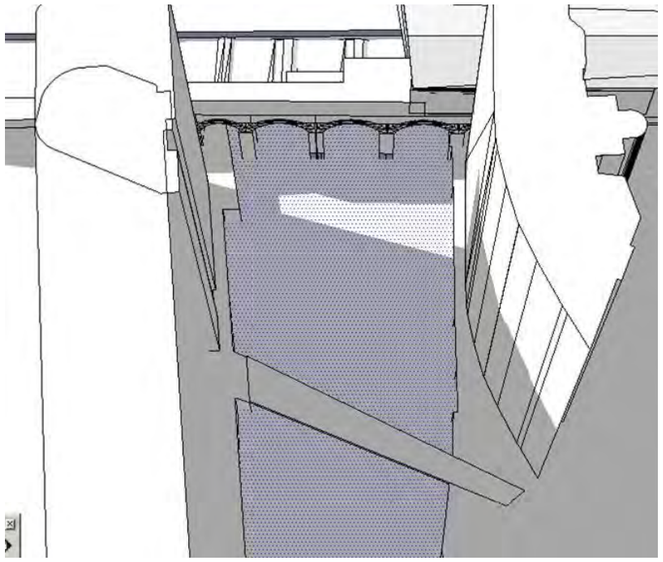
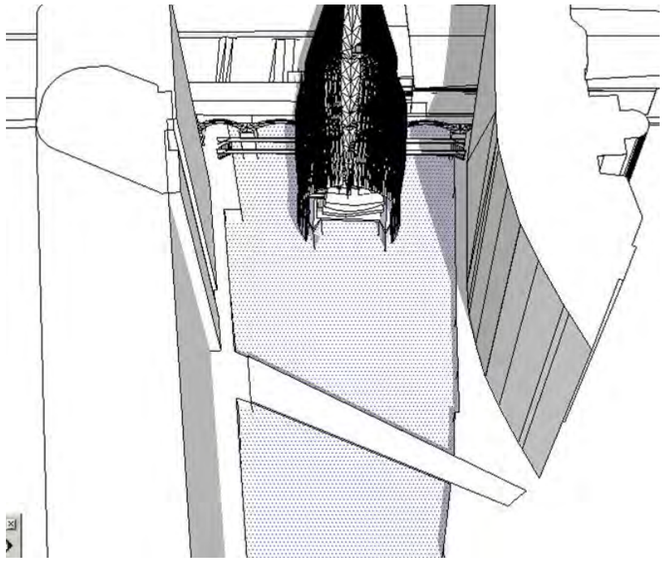
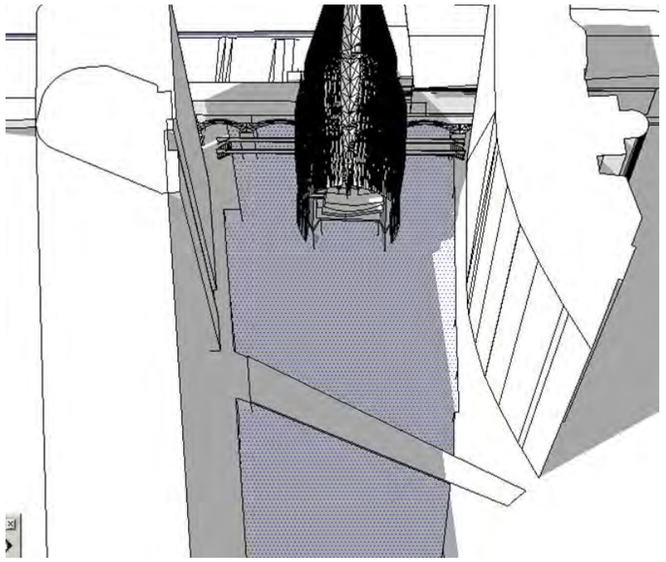
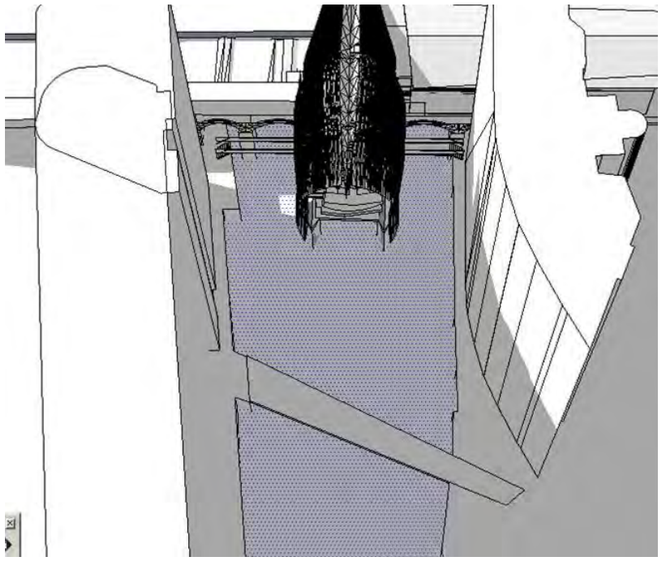
Sunlight Analysis

Shadow Analysis: March 21st

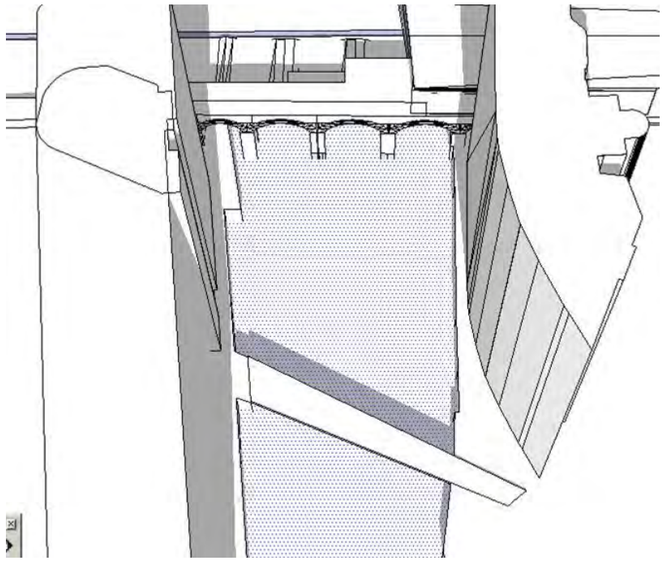
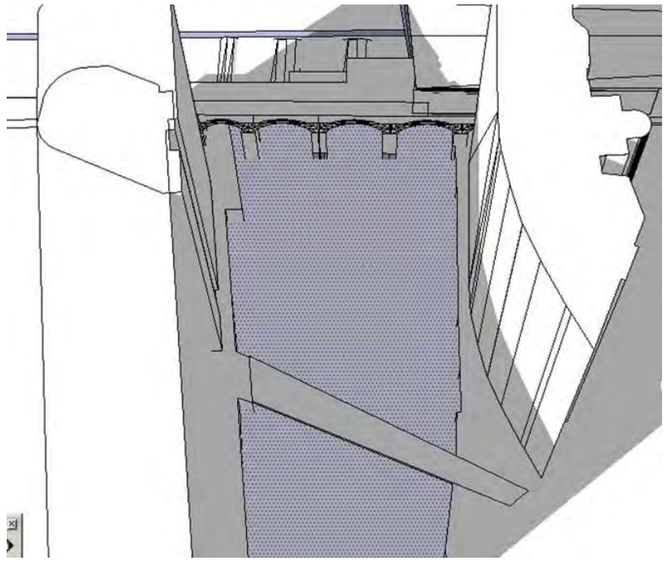
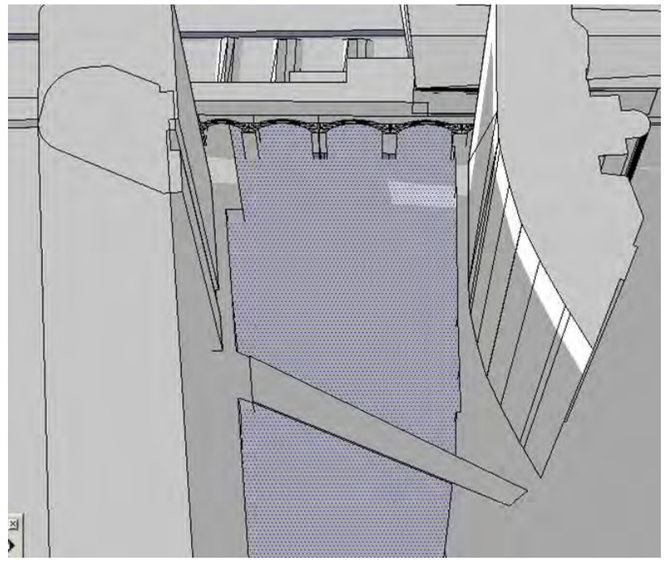
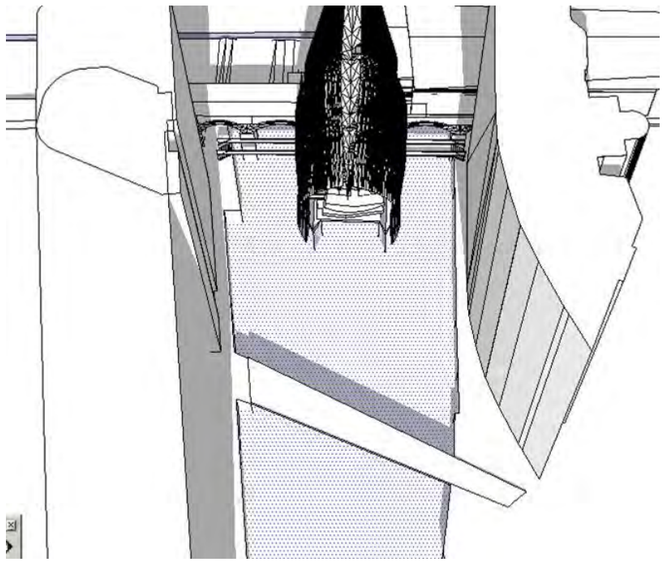
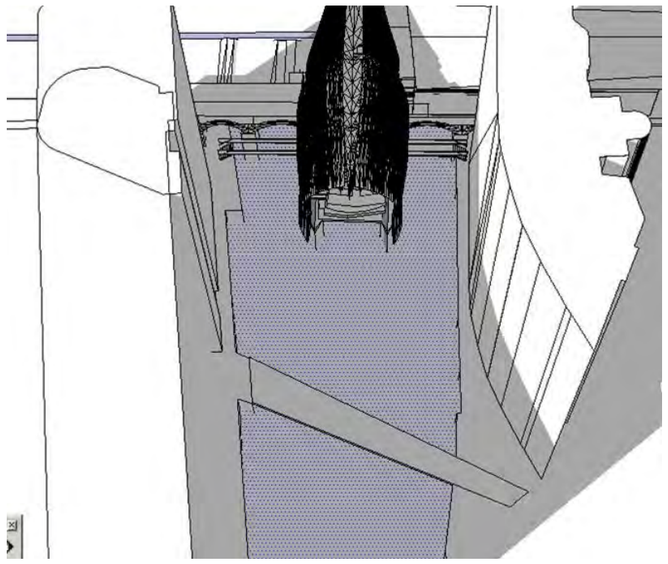
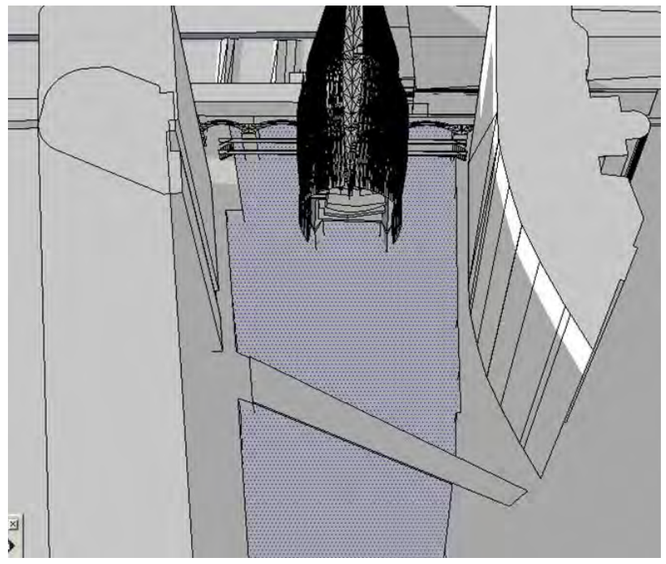
Figures 8 – 29 present a graphical assessment of sunlight obstruction around the site with the base buildings and the proposed development in place.

Existing Conditions	Figure 8: March 21st – 12.00	Figure 10: March 21st – 15.00	Figure 12: March 21st – 18.00
			
Proposed Conditions	Figure 9: March 21st – 12.00	Figure 11: March 21st – 15.00	Figure 13: March 21st – 18.00
			

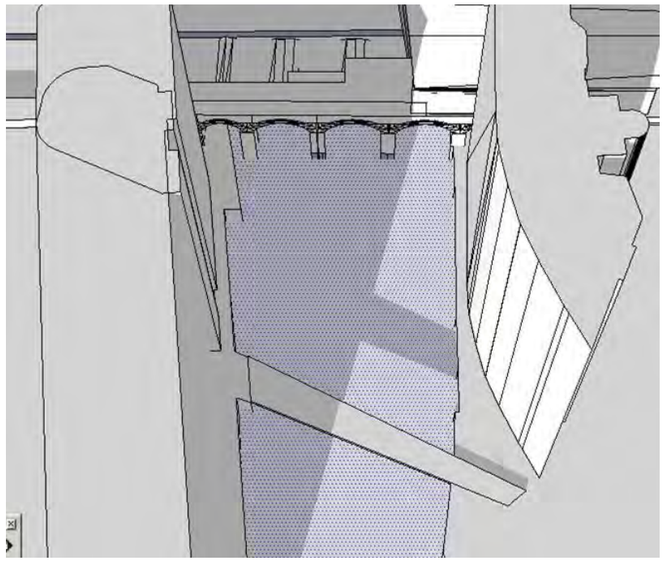
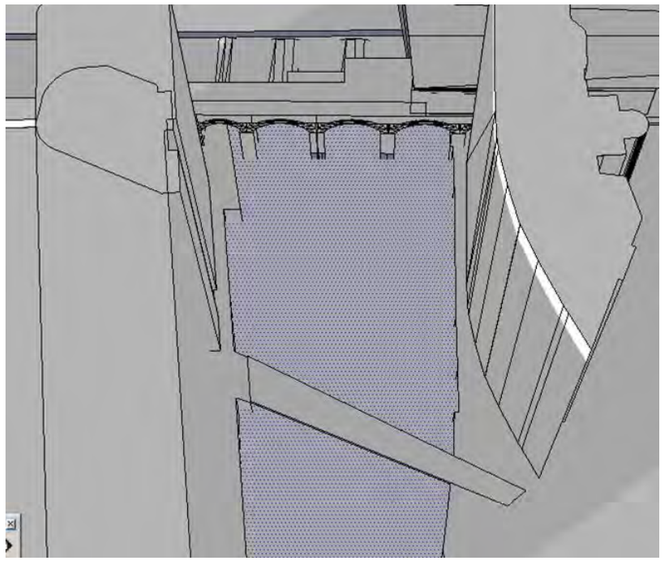
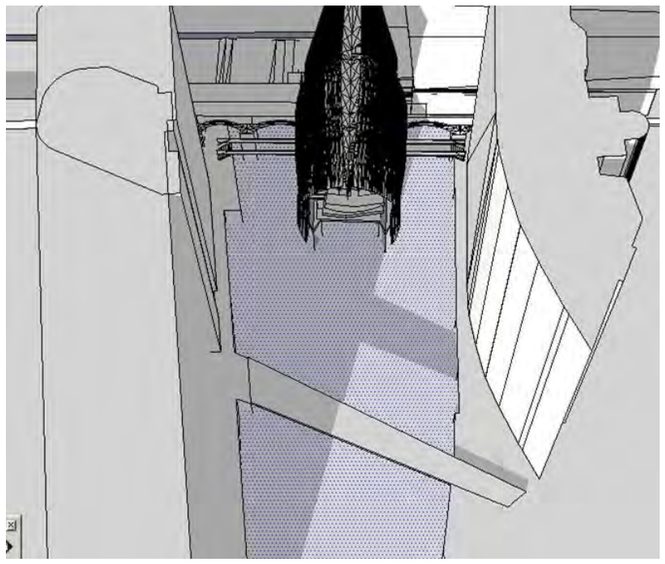
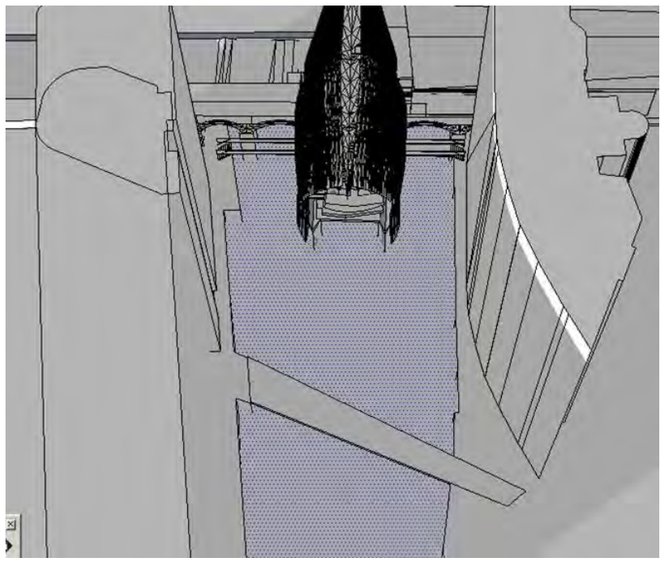
Shadow Analysis: June 21st

Existing Conditions	Figure14: June 21st – 12.00	Figure 16: June 21st – 15.00	Figure 18: June 21st – 18.00
			
Proposed Conditions	Figure 15: June 21st – 12.00	Figure 17: June 21st – 15.00	Figure 19: June 21st – 18.00
			

Shadow Analysis: September 21st

Existing Conditions	Figure 20: September 21st – 12.00	Figure 22: September 21st – 15.00	Figure 24: September 21st – 18.00
			
Proposed Conditions	Figure 21: September 21st – 12.00	Figure 23: September 21st – 15.00	Figure 25: September 21st – 18.00
			

Shadow Analysis: December 21st

Existing Conditions	Figure 26: December 21st – 12.00	Figure 28: December 21st – 15.00	
			
Proposed Conditions	Figure 27: December 21st – 12.00	Figure 29: December 21st – 15.00	
			

Sunlight Planning Guidance

The performance recommendations indicated in the Building Research Establishment's design guide 'Site Layout Planning for Daylight and Sunlight' are those typically identified in local authority planning guidance as the ones by which the daylight and sunlight performance of a proposed development will be assessed.

Sunlight Access (extracts)

Where a large building is proposed which may affect a number of buildings or open spaces it is often illustrative to plot a shadow plan showing the location of shadows at different times of day and year.

Sunlight Analysis Observations

With reference to the sunlight good practice planning guidance section, we have undertaken shadow plot analysis to assess the shadow variance between the base and proposed conditions on the 21st of March, the standard BRE test date, and at other key dates throughout the year. Figures 8 – 35.

Observations:

1) Figures 8 – 29 indicate that the residential properties to the East of the site are likely to experience a minor increase in overshadowing in the late afternoon due to the proposed development.

2) Figures 8 – 29 indicate that for the majority of the year inherent overshadowing of the residential properties to the East of the site exists in the late afternoon due to the under construction mixed use development to the West of the site.

Conclusions

Daylight Performance

Our daylight analysis indicates the majority of test planes identified on the residential properties to the East of the site are likely to have a major adverse reduction in direct daylight with the proposed development in place. Access to direct daylight is inherently limited to these properties due to overshadowing by the under construction mixed use development to the West of the site.

Our daylight analysis indicates that windows / receptors above the 3rd storey adjacent to Leeds Station and the Dark Arches are likely to have a moderate-minor adverse reduction in direct daylight with the proposed development in place. This effect is increased toward the bottom of the building the further South these receptors are located.

Sunlight Performance

Our sunlight analysis indicates the residential properties to the East of the site are likely to experience a minor adverse reduction in direct sunlight with the proposed development in place. Access to direct sunlight is inherently limited to these properties due to overshadowing by the under construction mixed use development to the West of the site

Glossary

Accessibility	The existing pedestrian desire lines and integration of modes of public transport
Activities	The interaction and relationships between building frontages, points of access, pedestrian activities and other social activities (pavement cafes with outdoor seating)
Appearance and Culture	The local distinctiveness of the buildings and structures in the area, the characteristics of the local materials, façade treatments, styles and lighting. Listed buildings and distinctive street patterns are also taken into account
Daylight	Light that can be considered to be the same as skylight, a widely scattered non-directional light, available irrespective of building orientation.
Density and Scale	General densities in the area, the heights and the massing of the existing townscape
Land Uses	Existing land uses and their destinations
Legibility	Existing strategic views, vistas, landmarks and important view points including relationship to individual receptors' views of the landscape, e.g. local residents or pedestrians passing through the area
Light trespass (Light intrusion)	The spilling of light beyond the boundary of the property
Permeability	Permeability or connectivity describes the extent to which urban forms permit (or restrict) movement of people or vehicles in different directions
Public Open Spaces	The existing important public open spaces and squares
Sky glow	The brightening of the night sky.
'Soft' Landscape Features	Important features of the existing vegetation, landform and water
Sunlight	Directional light from the sun excluding the contribution of daylight. Sunlight direction varies with date and time.
Townscape	Comprises those physical components that together form the appearance of the urban environment, including its shapes, colours and textures. The term also reflects the way in which these various components combine to create distinctive townscape characters that are particular to localities
Urban Layout	The pattern of the arrangement, area of the buildings and their plots, open space in the settlement and the pattern of streets and junctions, e.g. small and frequent (fine grain) or large and infrequent (coarse grain);
Visual Envelope	The area within which views of the proposed development may be achieved. The visual envelope is influenced by many factors including topography and intermediate visual intrusions, such as street furniture

	and traffic, but in the urban situation, largely by buildings
Visual Receptors	Within the visual envelope, key viewpoints from residential areas, open spaces, roads and pedestrian routes are identified. The location of potential visual receptors, including local residents, users of open spaces, office workers, passing motorists and pedestrians are also identified