

South Wales Metro

Task Order 028-I – Taffs Well Depot Outline
Planning – External Lighting Strategy

March 2018

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1 Introduction

1.1 Project Description and Scope of Works

Mott MacDonald has been commissioned by Transport for Wales (TfW) to provide planning and technical support during the current procurement phase for the next 'Wales and Borders Rail Service' which will include the development of the South Wales Metro Phase 2, focusing specifically on the Core Valley Lines (CVL). This programme of works, funded by the Welsh and UK Governments and the European Commission, will transform the rail network involving extensive investment in new rolling stock, stations and associated infrastructure. It will deliver a step change in the public transport offer bringing about improved connectivity between the CVL and Cardiff and providing a much needed modern, reliable and efficient public transport system.

As part of the investment required to transform the rail network, additional depot and stabling facilities are required to accommodate the new fleet of rolling stock. As such, Welsh Government undertook a comprehensive site search process to find suitable and available land. This has resulted in Welsh Government acquiring the former 'Forgemasters' building and associated land at Garth Works Industrial Estate in Taffs Well. The whole site area, including the associated works to Taffs Well Station, extends to some 5.4 hectares and is shown on drawing number 367590-28I-XX-DR-C-0005.

In order to ensure early delivery of investment for the CVL and minimise risk to the preferred bidder (who will be named the Operator and Development Partner (ODP) once the procurement process is concluded, Welsh Government and TfW are seeking to secure outline planning permission for the depot and associated works.

In order to accommodate the specific operational requirements of the preferred ODP, the planning permission needs to have flexibility and as such, a 'Hybrid' Planning Application for the depot and associated works is being sought from Rhondda Cynon Taf County Borough Council as the Local Planning Authority. The hybrid planning application will seek full planning permission for the demolition of the existing buildings within the industrial estate and outline planning permission for construction of the depot and associated works. This approach provides flexibility for TfW in allowing demolition and site clearance works to commence in advance of works for the main depot and then the detailed design of the depot and associated works being dealt with through a Reserved Matters Planning Application. It is anticipated however, that the outline element of the planning permission for the depot and associated works will be subject to maximum parameters in terms of built floorspace, car parking and general alignment of highway infrastructure. These parameters and principles will then need to be reflected in the preferred ODP's detailed design solution through any Reserved Matters application.

An indicative masterplan (Drawings 367590-28I-XX-DR-C-0002 and 0003) of the Taffs Well Depot has been prepared which indicates the construction of the following:

- A new rolling stock depot comprising of:
 - Multiple stabling lines.
 - A maintenance workshop with offices above.
 - A rolling stock washing facility.
 - A sand replenishment plant.
 - A delivery track where rolling stock will be delivered on HGVs and lifted onto the depot tracks.
 - A substation.

- Staff parking and increased park and ride spaces.
- Associated works will include:
 - Local highways and rail infrastructure improvements.
 - A new footbridge over Taffs Well Station.
 - Extension to the existing Taffs Well Station western platform.
 - Improvements to the Taff Trail.

The key parameters are listed below:

- Whole site area is 5.4 hectares. This includes all land within the red line boundary (Drawing number 367590-28I-XX-DR-C-0004) which includes the associated works at and around Taffs Well Station.
- Developable site area is 3.6 hectares. This is the main depot site between the A470 and Ffordd Bleddyn, as shown on drawing 367590-28I-XX-DR-C-0005.
- Total approximate floor space will be as below:
 - 3800m² of workshop floor space.
 - 2400m² of office floor space over two floors.
 - 400m² and 100m² of storage buildings floor space.
 - Combined this comes to a total of approximately 6700m².
- The tallest building is the maintenance workshop with offices above at 13.5m tall, smaller than the existing 15m tall Forgemasters building.
- The design of the depot allows for different types and sizes of rolling stock and power options including electric and diesel.

The full development description for the project is as follows:

- Hybrid Planning Application for the construction of the Taffs Well Depot on land at the Garth Works Industrial Estate in Taffs Well.
- Part A: Full planning application for the demolition and site clearance works associated with existing buildings and structures on the Garth Works Industrial Estate.
- Part B: Outline planning application with all matters reserved for the construction of the Taffs Well Depot including: multiple stabling lines; a maintenance workshop with offices above; a rolling stock washing facility; a sand replenishment plant; a delivery track; a substation; staff parking and increased park and ride spaces; highways and rail infrastructure improvements; modifications to Taffs Well Station and landscaping.

The purpose of this report is to identify best practice for each lighting scenario and to provide technical detail and principles of lighting.

For an overview of the different areas of use within the proposed Taffs Well Depot site, reference should be made to drawings '367590-MMD-28I-XX-DR-C-0002 - Master Plan (Sheet 1 of 2) P2' and '367590-MMD-28I-XX-DR-C-0003 - Master Plan (Sheet 2 of 2) P2' in Appendix A and Appendix B respectively, along with 'MMD-367590-C-DR-00-XX-0100 - Location Plan-P3' in Appendix C.

2 Performance Objectives

- Deliver high quality and efficient lighting which creates an attractive and safe environment for users and workers alike.
- Create a lighting solution, which aspires to make use of modern luminaire and lamp technology to provide an energy efficient and flexible lighting scheme.
- To provide an environment where people feel safe and secure.
- Be sensitive to the setting while creating an enhanced and vibrant environment.
- Pay particular attention to the sites environment and identify areas of darkness in order to preserve the landscape, minimise environmental impact and minimise cost.
- Provide a lighting installation which minimises sky glow, light spill and the luminous intensity which can be experienced from luminaires.
- Provide safe, attractive and clear key routes during the evening for users and workers.

The proposed lighting will need to be designed in accordance with current versions of relevant European and British Standards with reference being made to “Rhondda Cynon Taf County Borough Local Development Plan”. Lighting intended to be adopted by Rhondda Cynon Taf County Borough Council (RCTCBC) will need to be designed and installed in accordance with the current version of the RCTCBC Street Lighting Standard Specification for Roads, Streets and Footpaths.

At the time of writing this report the current versions of the following documents are referenced:

- British Standard Code of practice for the design of road lighting BS 5489-1:2013
- British Standard Road Lighting – Part 2: Performance requirements BS EN 13201-2:2015
- British Standard Light and Lighting – Lighting of Outdoor Workplaces BS EN 12464-2:2014
- British Standard Code of practice - Design of buildings and their approaches to meet the needs of disabled people BS 8300:2009+A1:2010
- British Standard Railway applications - Fixed installations – Electrical safety, earthing and the return circuit – Part 1: Protective provisions against electric shock BS EN 50122-1:2011+A4:2017
- Institution of Lighting Professionals (ILP) – Guidance Notes for the Reduction of Obtrusive Light, GN01:2011
- Institution of Lighting Professionals (ILP) – Professional Lighting Guide 05: The Brightness of Illuminated Advertisements, PLG05 2015

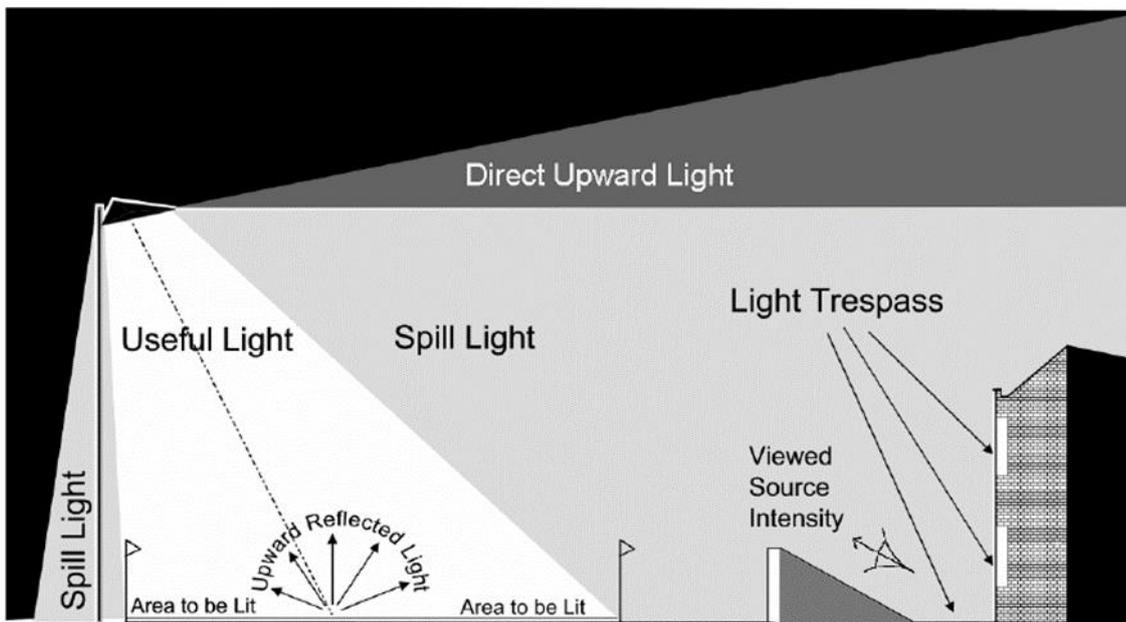
The remainder of this report considers that these documents are current, however prior to carrying out design work these documents should be verified as current and, if superseded, the standards and lighting levels discussed in this report should be reassessed.

3 Environmental Considerations – Obtrusive Light

3.1 Obtrusive Light Limitation Design Guidance

Luminaires, lamps, and ancillary equipment shall be specified and located to minimise any direct upward light, light trespass and spill light. The photometric distribution of each luminaire type should be considered to ensure it does not result in severe lighting contrast on light receiving surfaces such as floors and walls.

Figure 1: Types of Obtrusive Light



Source: Guidance Notes for the Reduction of Obtrusive Light GN01:2011 (ILP/2011)

3.2 Environmental Zone Classification

To assess the appropriate levels of obtrusive light as defined within the ILP 'Guidance Notes for the Reduction of Obtrusive Light, GN01:2011', an appraisal has been carried out to classify the site in terms of its 'environmental zone', which equates to the district brightness of the site and its surroundings. Table 1 shows descriptions of the environment zones, this table is extracted from the ILP 'Guidance Notes for the Reduction of Obtrusive Light, GN01:2011' which is included in Appendix D

With reference to the design parameters, and based upon previous practical experience, the following classification forms the basis of the criteria which must be met by the external lighting installation.

The site is currently used as a commercial/industrial estate, and is almost entirely encircled by illuminated highway. The site lies on the edges of both residential and industrial areas. To the east, the site is separated from a large area of woodland by the A470. Therefore, in line with ILP guidance, we have applied an 'E3' environmental zone which equates to 'Medium district

brightness area’. Further to the sites categorisation as an ‘E3’ zone it is imperative that impacts to identified sensitive ecology are minimised to negligible levels

Table 1: Environmental Zone Categorised as E3 - Suburban

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

Source: Guidance Notes for the Reduction of Obtrusive Light GN01:2011 (ILP/2011)

3.3 Obtrusive Light Limitations

It can be seen from Table 1 that a lighting installation located in an area deemed to be more sensitive will understandably equate to greater constraints with regards to obtrusive light. Based on our appraisal, see Table 2 for maximum levels of obtrusive light associated with an E3 Zone.

Table 2: Obtrusive Light Limitations (ILP Guidance Notes for the Reduction of Obtrusive Light 2011)

Environmental Zone	Sky Glow ULR (Max %)	Light Intrusion (Into Windows) Ev (Lux)		Luminaire Intensity I (Candelas)		Building Luminance Pre-curfew Average, L (cd/m ²)
		Pre-curfew*	Post-curfew*	Pre-curfew*	Post-curfew*	
E0	0	0	0	0	0	0
E1	0	2	0	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: Guidance Notes for the Reduction of Obtrusive Light GN01:2011 (ILP/2011)

*Curfew: The time after which more stringent requirements (for control of obtrusive light) will apply; often a condition of use of lighting by the local planning authority. If not otherwise stated 23:00 hours, is suggested by the ILP.

Given the sites proximity to the A470 dual carriageway, the limitations given in the ILP Guidance Notes for the Reduction of Obtrusive Light (GN01:2011) - Table 3 “Obtrusive Light Limitations for Exterior Lighting Installations – Road Users should not be exceeded. see Table 3 for maximum levels of obtrusive light associated with road users.

Table 3: Table 3 - Obtrusive Light Limitations for Exterior Lighting Installations - Road Users

Road Classification	Threshold Increment (TI)	Veiling Luminance (Lv)
No road lighting	15% based on adaptation luminance of 0.1cd/m ²	0.04
ME6/ME5	15% based on adaptation luminance of 1cd/m ²	0.25
ME4/ME3	15% based on adaptation luminance of 2cd/m ²	0.40

Road Classification	Threshold Increment (TI)	Veiling Luminance (Lv)
ME2/ME1	15% based on adaptation luminance of 5cd/m ²	0.84

Source: Guidance Notes for the Reduction of Obtrusive Light GN01:2011 (ILP/2011)

4 Local Environmental Constraints

Environmental considerations are a key element to any lighting design and impacts to sensitive flora or fauna and dwellings in the vicinity of the installation should be kept to a minimum.

The proposed Taffs Well Depot site is currently an industrial area bordered by existing highway and Core Valley Lines to the west with a residential estate beyond that. To the east the site is separated from the Forest Fawr by the A470 highway. A raised level walkway which is lined with vegetation lies along the north and north-east boundary separating the proposed site from an industrial estate. The surrounding industrial and residential areas should not be adversely affected if the recommendations in section 2 are followed.

At the time of writing, ecological surveying and assessment is underway for the existing site. The initial feedback from ecologists is that the site is relatively free of light sensitive ecology, however the results of the completed assessment will need to be reviewed to understand whether there are any more specific environmental considerations that could be affected by proposed lighting. Further guidance on obtrusive light limitations is provided in section 2.

Given the sites borders with existing illuminated highway, existing use as an industrial area and setting within an industrial area, it is anticipated that no further environmental/ecological factors will be identified by the additional ecological assessment, this should be confirmed or updated prior to commencement of any further design work.

5 Proposed Lighting Requirements

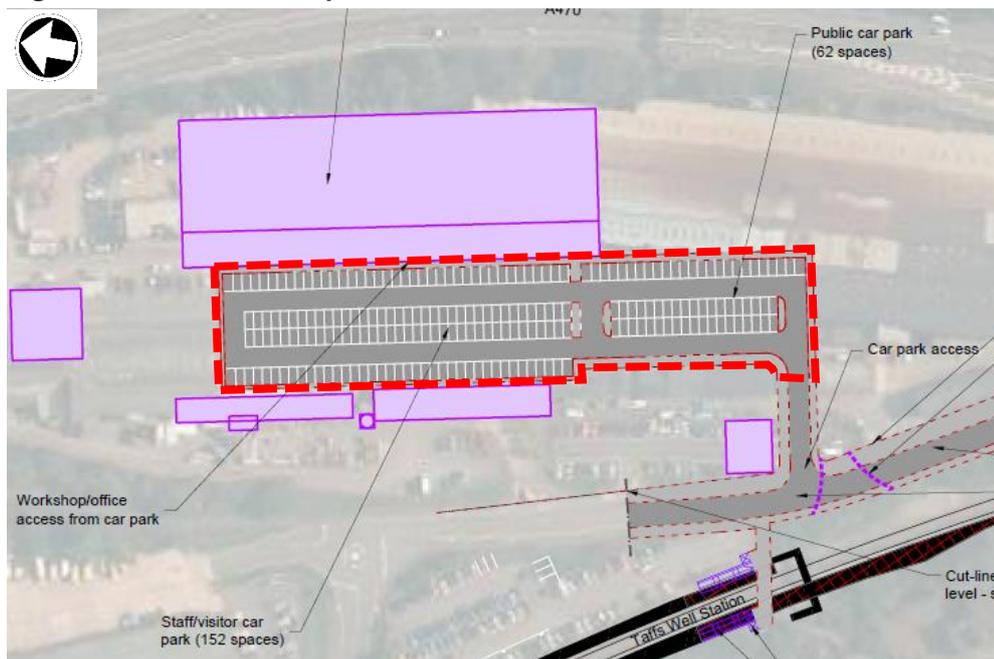
For a development of this nature with vehicle/pedestrian movements, lighting will provide many benefits including a sense of security and wellbeing to the users. It is our recommendation that during hours of darkness and where the facilities will be in use appropriate lighting should be provided. In addition to pedestrian and vehicle movements the proposed depot will have several work activities in different areas around the site.

To ascertain the appropriate lighting levels for the indicative layout, the facility has been divided into areas based on their type of usage.

5.1 Parking Areas

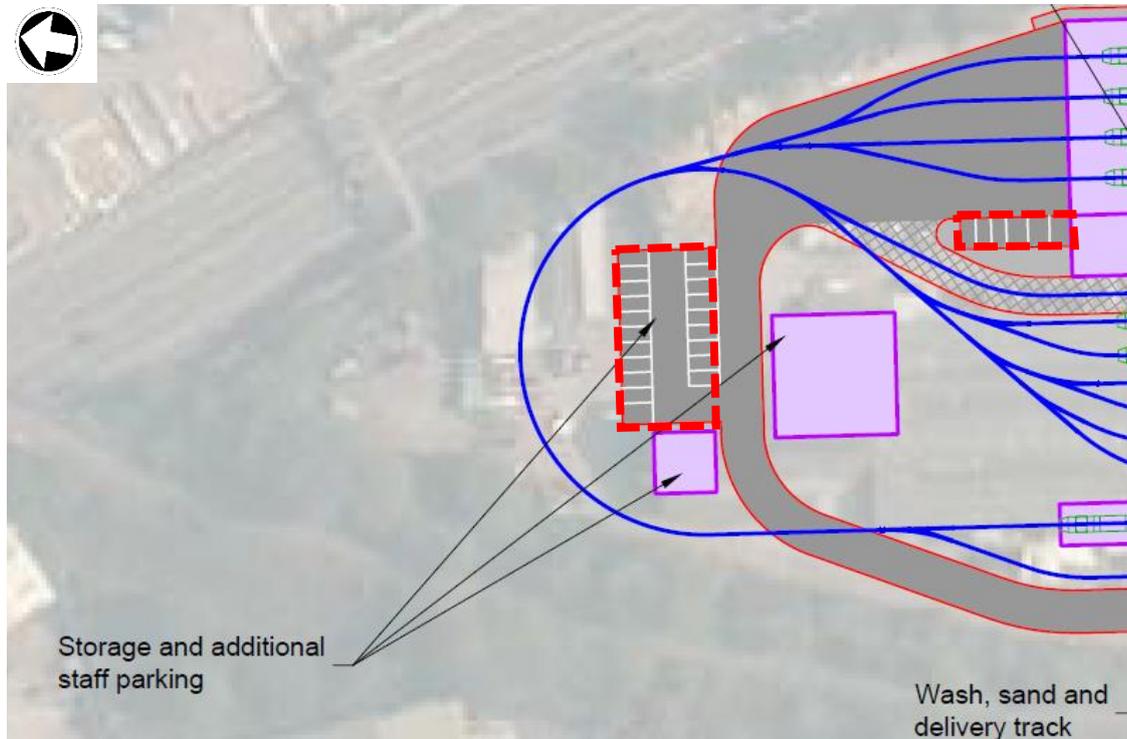
A car park is situated on a deck above the main stabling area (shown in Figure 2). The car park will provide access into the proposed offices which will be contained within the workshop building. The car park will provide approximately 150 parking spaces for staff/visitors and will also include a segregated area for approximately 62 public parking spaces. The existing highway will be vertically re-aligned to provide access to the proposed car park.

Figure 2: Office/Workshop Car Park



Source: 367590-MMD-28I-XX-DR-C-003 Upper Level Master Plan (Mott MacDonald 2017)

Figure 3: Additional Staff Parking



Source: 367590-MMD-28I-XX-DR-C-002 Ground Level Master Plan (Mott MacDonald 2017)

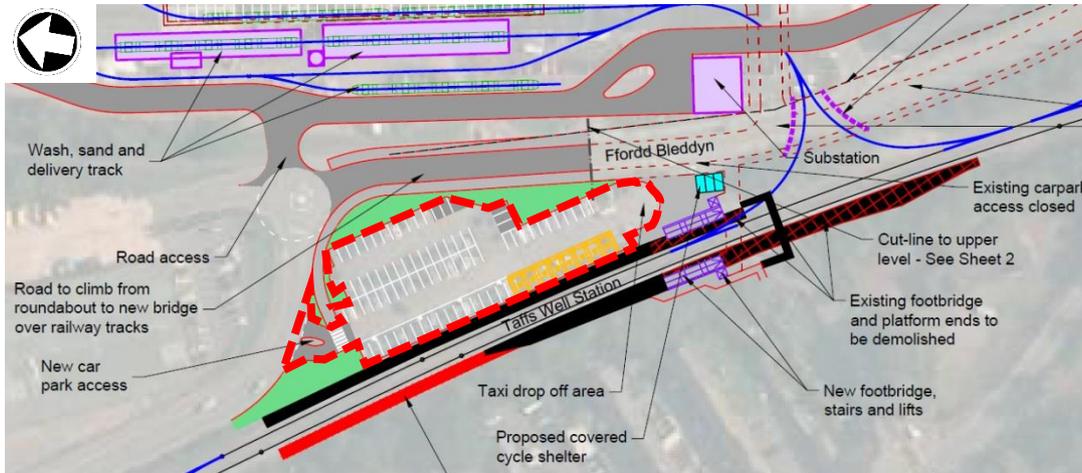
Table 5 of BS 5489-1:2013 provides lighting levels for car parks based on their level of usage. BS 5489-1:2013 defines a medium trafficked car park as “Parking for department stores, office buildings, plants, sports and multipurpose building complexes”. The layouts provided in Appendix A and Appendix B show the proposed depot’s car parking areas.

Due to the anticipated level of usage during peak times it is recommended that the parking areas and the associated access road are lit to the levels associated with a ‘Medium Traffic’ parking area. An overview of BS 5489-1:2013 lighting standards for car parks is shown in Table 4.

In addition to the main car park a smaller, additional staff only car park will be provided towards the northern tip of the proposed site (shown in Figure 3), this car park will have approximately 20 spaces, given the low level of use and low number of spaces it is recommended that this car park is lit to levels associated with a ‘Light Traffic’ parking area as shown in Table 4.

The existing station car park is currently illuminated by columns assumed to be 10 metres in height, fitted with luminaires for 150W high pressure sodium (SON-T) lamps. The existing car park will be extended, adding a Taxi drop off area. The extension will take the place of the existing access/egress point with a new entrance proposed to the north, tying in to existing highway approximately 30 metres west of an existing roundabout. The proposed amendments to the existing car park area is highlighted in Figure 4. It is recommended that the existing lighting levels and the existing lighting installation is assessed and replaced/supplemented as necessary to ensure compliance with a ‘Medium Traffic’ parking area as defined in BS 5489-1:2013 and shown in Table 4. It will also be beneficial to ensure that light sources are consistent across the existing car park, should supplementary lighting be required.

Figure 4: Existing Station Parking Area



Source: 367590-MMD-28I-XX-DR-C-002 Ground Level Master Plan (Mott MacDonald 2017)

Table 4: Car Park Lighting Levels

Level of Usage	Type of Usage	Average Illuminance (Lux)	Uniformity
Light Traffic	Parking for shops, terraced and apartment houses and cycle paths	5	0.25
Medium Traffic	Parking for department stores, office buildings, plants, sports and multipurpose building complexes	10	0.25
Heavy Traffic	Parking for schools, churches, major sports and multipurpose sports and building complexes	20	0.25

Source: BS 5489-1:2013 Table 5

Typical column mounting heights for these standards of lighting in a car parking area are 8 to 10 metres. It is recommended that 10 metre mounting heights are utilised on ground level car parking areas whereas lower mounting heights may be required for the decked car park. All lighting column positions and heights must be carefully considered to ensure that that car park lighting does not obtrusively impact upon users of the nearby railway line, A470 dual carriageway or nearby environmental receptors such as potential bat foraging routes and residential properties.

Where designated accessible car parking spaces are provided, both the accessible spaces and designated accessible routes should be designed in line with the requirements of BS 8300:2009+A1:2010 'Code of practice - Design of buildings and their approaches to meet the needs of disabled people'. The requirements for lighting associated with these accessible routes and parking areas are summarised in Table 5.

Table 5: Overview Lighting Levels for Disabled Access routes and Parking Spaces

Area	Required Lighting Level
Disabled parking spaces and accessible routes	20 Lux minimum
Ramps or steps along accessible routes	100 Lux minimum

Source: BS 8300:2009+A1:2010

5.2 Pedestrian / Cycle Routes in Proximity to Car Parks

Any walking/cycling routes located in the parking areas will be sufficiently illuminated by the lighting provided for the parking areas. The lighting columns for parking should be located sympathetically to provide illumination to these areas. If pedestrian/cycle routes fall short of the applicable lighting requirements, supplementation could be provided by low level illuminated bollards. Provision of columns/luminaires to the same specification as those specified for car parking areas could also be used to light footpaths where bollards are not appropriate. Typical column mounting heights for subsidiary roads and pedestrian/cycle paths are 4 to 6 metres.

5.3 Roads Within the Depot Site

Where roadways are proposed within the site, lighting should be specified in line with the lighting classes from BS EN 12464-2:2014 Table 5.1 – “General requirements for areas and for cleaning at outdoor workplaces” and shown in Table 6.

Table 6: Overview of Lighting Levels for Traffic Areas

Ref No.	Type of area, task or activity	Em (maintained Average - Lux)	Uo (Minimum Uniformity)	RGL (Glare Rating)	RA (Colour Rendering)	Specific requirements
5.1.2	Traffic areas for slowly moving vehicles (max. 10km/h)	10	0.4	50	20	-
5.1.3	Regular vehicle traffic (max 40km/h)	20	0.4	0.45	20	-

Source: BS EN 12464-2:2014 Table 5.1

Typical column mounting heights for subsidiary roads and pedestrian/cycle paths are 8 to 10 metres.

5.4 Pedestrian / Cycle Routes within Rail Areas

Lighting for roads and pedestrian routes within the rail areas of the site will need to be specified in line with more specific railway/tramway guidance detailed in BS EN 12464-2:2014 Table 5.12 – “Railways and Tramways”, the relevant lighting classes are summarised in Table 7.

Table 7: Overview of Railway and Tramway Lighting classes related to Pedestrian routes

Ref No.	Type of area, task or activity	Em (maintained Average - Lux)	Uo (Minimum Uniformity)	RGL (Glare Rating)	RA (Colour Rendering)	Specific requirements
5.12.7	walkways in railway areas, open footbridges	10	0.25	50	20	
5.12.8	Level crossings	20	0.4	45	20	
5.12.15	Stairs, small number of passengers	50	0.4	45	40	
5.12.20	Stairs, large number of passengers	100	0.5	45	40	

Source: BS EN 12464-2:2014 Table 5.12

5.5 Railway Areas

5.5.1 Depot Areas

The current layout makes provisions for an area of stabling for approximately 25 rail vehicles (50m), along with wash, sand and delivery tracks. It is recommended that, for the type of layout, lighting should, as a minimum, achieve the levels detailed in BS EN 12464-2:2014 Table 5.12 for the relevant type and level of use, an overview of these lighting classes is shown in Table 8. The scope of this report extends only to external lighting; however, some areas of stabling will be covered by the decked car park. These covered areas should be illuminated in line with the requirements of any relevant indoor workplace standards.

Table 8: Overview of lighting classes for rail depot tasks/areas

Ref No.	Type of area, task or activity	Em (maintained Average - Lux)	Uo (Minimum Uniformity)	RGL (Glare Rating)	RA (Colour Rendering)	Specific requirements
5.12.2	Tracks in passenger station areas including stabling	10	0.25	50	20	Ud* \geq 1/8
5.12.3	Railway yards flat marshalling, retarder and classification yards	10	0.4	50	20	Ud \geq 1/5
5.12.4	Hump areas	10	0.4	45	20	Ud \geq 1/5
5.12.1 2	Servicing trains and locomotives	20	0.4	50	40	Ud \geq 1/5
5.12.1 3	Railway yards handling areas	30	0.4	50	20	Ud \geq 1/5
5.12.1 4	Coupling area	30	0.4	45	20	Ud \geq 1/5
5.12.2 2	Inspection pit	100	0.5	40	40	Use low-glare local lighting

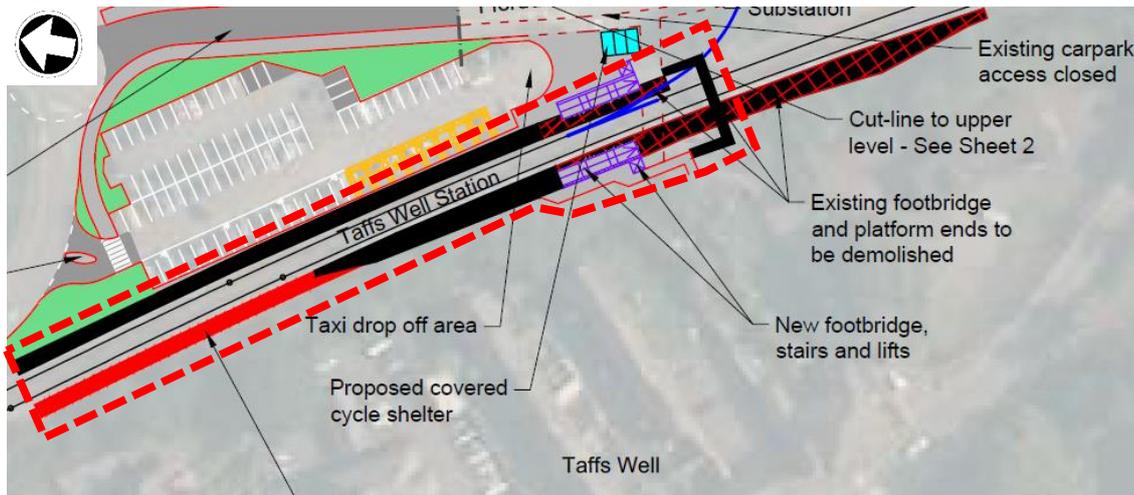
Source: BS EN 12464-2:2014 Table 5.12

*Ud or diversity, is the ratio between minimum and maximum levels of illuminance or luminance.

5.5.2 Platforms

The existing platforms are to be amended. The current layout proposes approximately half of the existing platform on the west of the railway to be removed with the platform being extended to the north (shown in Figure 5). On the eastern side of the railway the platform will remain largely unchanged except at the southern end where the extent of the platform will be reduced to allow for a new track which will provide access into the proposed depot.

Figure 5: Proposed Changes to Existing Platform



Source: 367590-MMD-28I-XX-DR-C-002 Ground Level Master Plan (Mott MacDonald 2017)

The existing platform lighting is currently illuminated by columns assumed to be 4 metres in height, fitted with luminaires for 150W high pressure sodium (SON-T) lamps. If the platforms change in size and shape it is recommended that a new platform lighting design is carried out, which utilises a low maintenance LED solution. Proposed column heights should not increase beyond the existing column heights. Columns proposed for the new/ extended platforms should be hinged to allow columns to be lowered for maintenance purposes. A review of adequate clearances and safety measures will need to be undertaken in accordance with BS EN 50122-1:2011+A4:2017. Platform lighting should, as a minimum, achieve the levels detailed in BS EN 12464-2:2014 Table 5.12 for the relevant platform type and level of use, these are summarised in Table 9.

Table 9: Extract of railways and tramways – lighting classes relating to open platforms.

Ref No.	Type of area, task or activity	Em (maintained Average - Lux)	Uo (Minimum Uniformity)	RGL (Glare Rating)	RA (Colour Rendering)	Specific requirements
5.12.1	Open platforms, very small number of passengers, e.g. train stops	5	0.2	55	20	1. Special attention to the edge of platform 2. $U_d \geq 1/10$
5.12.6	Open platforms, small number of passengers, e.g. rural and local trains	10	0.25	50	20	1. Special attention to the edge of platform 2. $U_d \geq 1/8$

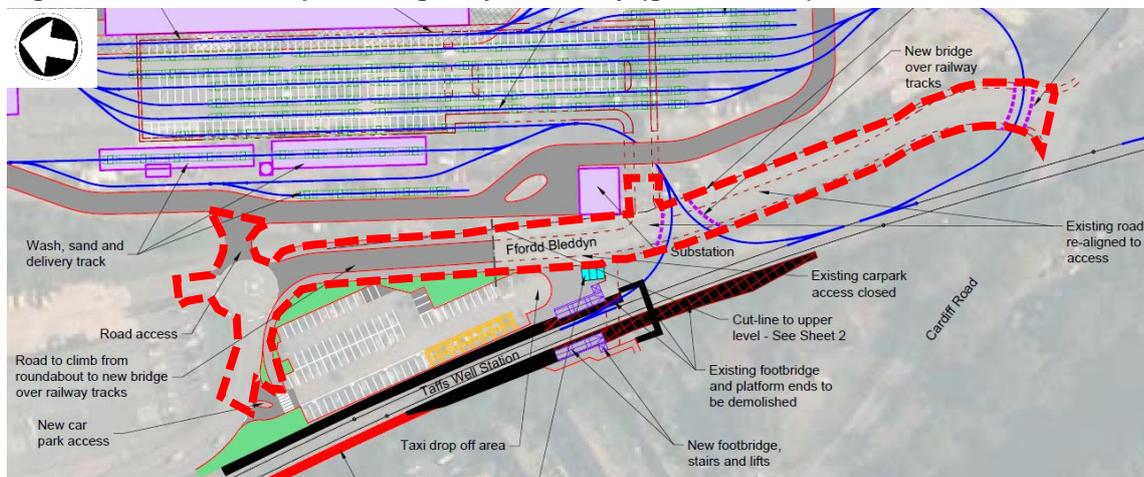
Ref No.	Type of area, task or activity	Em (maintained Average - Lux)	Uo (Minimum Uniformity)	RGL (Glare Rating)	RA (Colour Rendering)	Specific requirements
5.12.9	Open platforms, medium number of passengers, e.g. suburban or regional trains or inter-city services	20	0.3	45	20	1. Special attention to the edge of platform 2. Ud ≥1/6
5.12.16	Open platforms, large number of passengers, e.g. inter-city services	50	0.4	45	20	1. Special attention to the edge of platform 2. Ud ≥1/5

Source: BS EN 12464-2:2014 Table 5.12

5.6 Changes to Adopted Highway

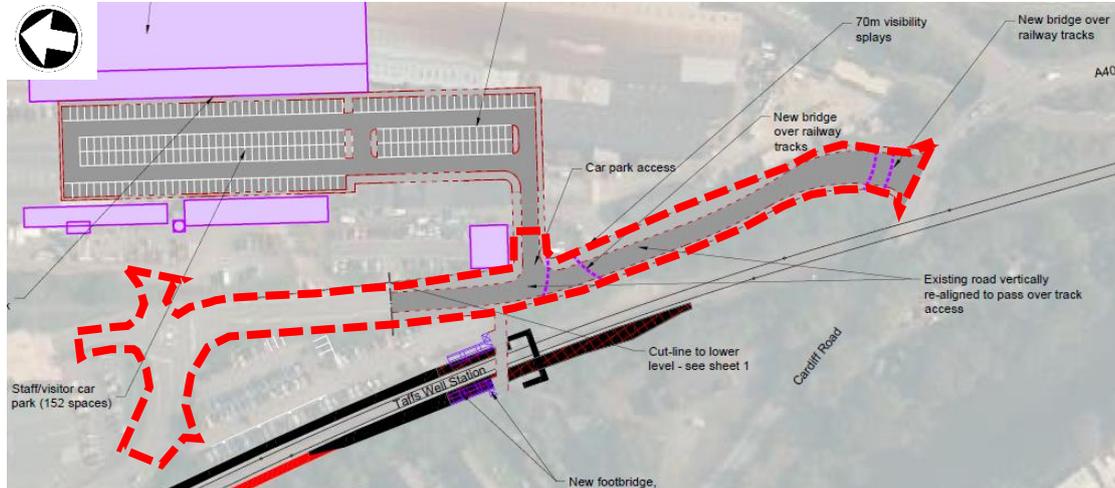
From the existing junction with the A4054 and based on the current layout, the existing roadway will need to be vertically re-aligned to allow adequate clearance for the new rolling stock to access the depot site. From this point the highway and adjacent footpath runs in between the proposed depot and the existing station/station car park. This section of highway will connect to the proposed station footbridge and provide access to the staff, visitor and public car park associated with the workshop/office building. An existing mini roundabout will be amended to provide vehicular access to the ground floor of the development. All changes to existing lighting or provision of new lighting for this section of highway should be designed to RCTCBC adoptable standards, liaison will be required with RCTCBC to confirm an adoptable standard, to tie-in effectively and to enable future adoption by RCTCBC if deemed appropriate. Annual Average Daily Traffic (AADT) flow figures must be ascertained to inform the lighting class selection process defined in BS 5489-1:2013. The boundary of any adoption is to be confirmed prior to any design work being undertaken, an assumed boundary for adoptable highway is shown in Figures 6 and 7. This boundary is indicative only and confirmation of both the boundary and scope of adoptable works should be confirmed in liaison with the local highway authority (RCTCBC) prior to any design of construction work.

Figure 6 Indicative Adoptable Highway Boundary (ground level)



Source: 367590-MMD-28I-XX-DR-C-002 Ground Level Master Plan (Mott MacDonald 2017)

Figure 7: Indicative Adoptable Highway Boundary (upper level)



Source: 367590-MMD-28I-XX-DR-C-003 Upper Level Master Plan (Mott MacDonald 2017)

5.7 Building Façade Lighting

It is assumed that decorative building façade lighting will not be required, however should façade lighting be required, the ILP advises that building luminance should be limited to avoid over lighting and should be in keeping with the general brightness of the area. It is recommended that façade and decorative lighting is not used in areas that are in proximity to ecologically sensitive areas discussed in section 3.

5.8 Illuminated Advertisements

Any proposed illuminated advertisements should be designed in accordance with the Town and Country Planning (Control of Advertisements) Regulation 2007 and associated guidance documents. The recommendations of the ILP Professional Lighting Guide 05 - Brightness of Illuminated Advertisements, offer additional guidance in this regard, Table 10 shows maximum luminance levels relative to the size of the illuminated advertisement and the environmental zone in which it is located.

Table 10: Recommended Maximum Permitted Luminance (cd/m²)

Illuminated Area (m ²)	Zone E0	Zone E1	Zone E2	Zone E3	Zone E4
Up to 10	0	100	400	600	600
Over 10	0	N/A	200	300	30

Source: PLG05 The Brightness of Illuminated Advertisements (ILP/2015)

6 Energy Management

Energy management and consumption will be a major factor in the running costs of the lighting installation as the cost of energy is likely to increase with time.

The correct design and specification of lighting can significantly affect the energy profile of the installation and this is discussed further in section 6, however with the correct management of the installation further energy savings can be made using the following techniques:

- Dimming – The lighting standards discussed in section 4 are based on peak times. These lighting levels could be reduced in line with lower levels of usage. This can be achieved with stand-alone dimmable electronic ballasts which can be programmed with pre-set dimming stages.
- Switch Off – The lighting could be switched off during periods where the site is closed. If it is preferred to retain the operation of the lighting during the night for security concerns dimming could be a more appropriate option. Lighting can be switched on and off using timers or override switches.
- Trimming – Control or switching of the lighting would normally be carried out by photocell. The ambient levels of natural light will determine when the lighting becomes operational. The setting of the photocell can be adjusted so that the lighting switches on later in the evening and off earlier in the morning.
- Central Management System (CMS) – CMS can provide energy monitoring, dimming, switching and trimming all through one centrally controlled system although costs can be prohibitive on some smaller developments.
- Luminous Efficacy – Luminous Efficacy is the measurement of the amount of lighting emitted from a light source measured in lumens compared to the amount of energy that is consumed by the light source measured in watts (N.B. the measurement of watts shall include the overall circuit losses within the luminaire such as control gear losses). This measurement is represented by lumens per watt (lm/w) figures.
- BREEAM, which is an assessment of development sustainability, provides recommendations based on the location, type and colour rendering (Ra) properties of the light source as shown in Table 11.

Table 11: BREEAM Assessment Lm/w

Location of External Lighting	Light Fittings Measured in Lamp Lumens/Circuit Watt, When:		LED Luminaires Where the Lamp is Integral to the Fitting Measured in Luminaire Lumens/Circuit Watt. When:	
	Ra ≥60	Ra ≤60	Ra ≥60	Ra ≤60
Buildings, access ways and pathways	50	60	40	50
Car parking, associated roads and floodlights	70	80	55	60

Source: BREEAM Ene 03 External Lighting

While the figures provided by BREEAM should be used as a base point, with the improvements and evolution of LED light sources and the advancement of some traditional high intensity discharge light sources, it is our recommendation that the figures provided by BREEAM should be improved and that the lighting installation should aspire to achieve figures of 100 lm/w.

7 Operational Equipment Specification

Typical equipment specifications have been included for guidance for the detailed design stage.

Glare and light pollution should be minimised wherever possible which can be achieved through the correct specification of equipment.

Mounting angles of luminaires should ideally be limited to 5° and 0° to reduce glare, upward light and light spill beyond the boundary of the development. Luminous intensity classes for all luminaires should be considered to reduce glare and upward light. A reduction in glare will have less impact on surrounding areas and enhance the safety of the development. Although driving speeds will be low, within parking areas viewing tasks can become complicated by pedestrian movements, other vehicles and distractions such as parking, as such reducing glare will mean that the viewing tasks are not complicated further.

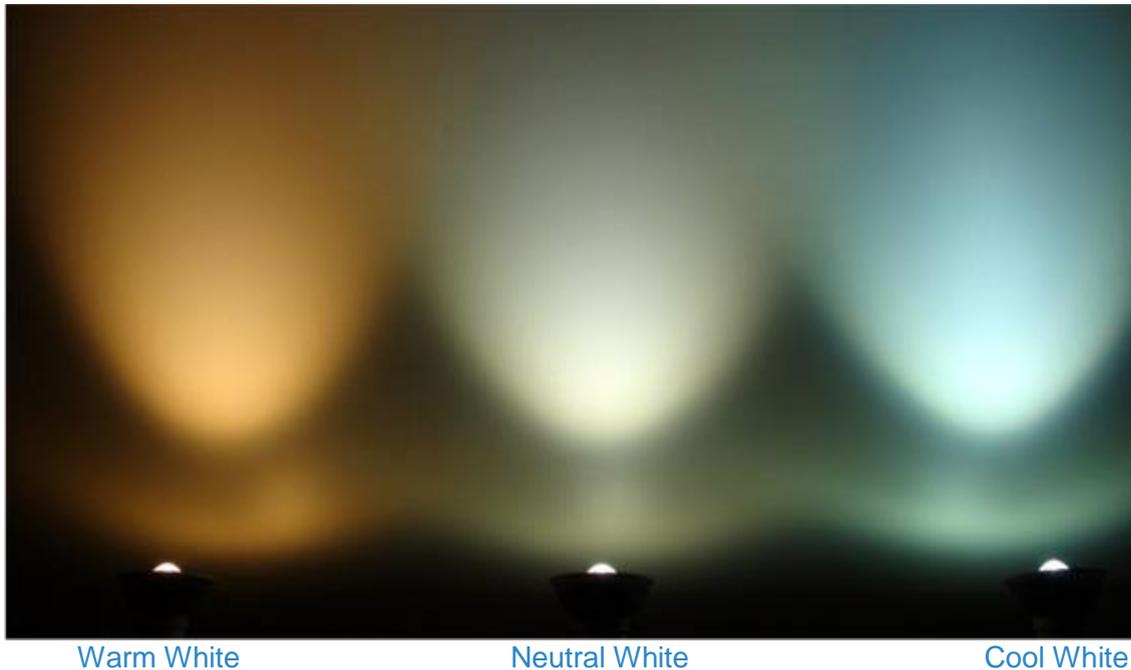
Luminaires should be orientated so that they are facing into the development with light shields and baffles installed in areas deemed sensitive. The distribution of the light source should be specified so that luminaires located on the development boundary distribute most of their light in a forward throwing manner in a 'Double Asymmetrical' distribution pattern. Luminaires located within the parking areas will benefit more from an 'Asymmetrical' or 'Symmetrical' distribution pattern.

Luminaire mounting heights should be limited to reduce light spill however this should not be detrimental to the efficiency of the lighting scheme. Typical column heights for car parks, footpaths, roads and platforms are given in section 4. Task lighting should be positioned with a view to minimising shadowing between parked rail vehicles which can be detrimental to the tasks being undertaken.

LED light sources are known to emit a very low level of Ultra Violet (UV) compared to traditional discharge lighting. Lower levels of UV are known to limit the number of insects attracted to the light source. This should therefore cause less disruption to any natural foraging routes of bats. (N.B. This should be quantified on an individual manufacturer basis, statement based on information received regarding the Philips WRTL LUMA LED Luminaire).

LED light sources are available in various shades or 'temperatures' of white, the three main shades of white for LED's are referred to as; cool white, neutral white and warm white, see Figure 8 for a visual representation of these colours. The colour of the light emitted by these 'near white' light sources is described by a correlated colour temperature (CCT). This is a measure of the 'warmth' or 'coolness' of the light emitted and is measured in Kelvin (K). The lower the kelvin value, the 'warmer' the colour of the light and conversely the higher the kelvin value the 'cooler' the light colour appears.

Figure 8: Example of Correlated Colour Temperature



Source: lightingmatters.com.au

Where it has not been explicitly specified the colour rendering index (Ra) of the light source specified should be suitably high enough to enable the different users of the site to have good colour recognition which can improve awareness and assist in facial recognition. It is recommended that a light source with a Ra greater than 65 should be specified, however in areas where CCTV is intended to be used for prosecution purposes a light source with a Ra greater than 80 may need to be specified.

Any lighting that is used to light the façade of buildings should be ideally orientated downwards. Up-lighting is often preferred for the lighting of building frontages, if this is the case then lighting should be provided with shields, baffles and louvres to minimise spill light and any sky glow contributions.

Lighting for the car parking areas should be provided by traditional road lighting luminaires. Examples of typical street lighting luminaires could be the Urbis Ampera, Philips Luma or Thorn R2L2 (Figures 9-11 respectively). A road lighting luminaire or similar could also be used in the depot areas, although high-mast mounted floodlights such as the CU Phosco FL800R (shown in Figure 12) may be a more efficient solution in terms of energy, dependant on the locations in which columns/high masts can be installed.

Lighting specified for the proposed footbridge and associated stairway should be provided by hand rails with integral LED lighting module. Equipment for this specification could be the Urbis LED Handrail shown in Figure 13.

Lighting for the areas to be adopted by RCTCBC must comply with the RCTCBC Street Lighting Standard Specification for Roads, Streets and Footpaths.

Figure 9: Urbis - Ampera



Source: Urbis Schröder

Figure 10: Philips WRTL - Luma



Source: Philips Lighting

Figure 11: Thorn - R2L2



Source: Thorn Lighting

Figure 12: CU Phosco – FL800R



Source: CU Phosco

Figure 13: DW Windsor - Garda Handrail



Source: DW Windsor lighting

8 Summary

To summarise the lighting strategy detailed within this report, the key principles that will need to be carried forward to future design development stages are as follows:

- Ensure that areas identified within the development are lit adequately to the correct technical specification, depending on the nature and intended use to ensure users' safety.
- Minimise crime and the fear of crime.
- Obtrusive light will need to be minimised to both existing residential properties and ecological receptors such as areas identified as bat foraging/ commuting routes. The obtrusive light limitations set out in Table 2 – 'Obtrusive Light Limitations' should not be exceeded.
- Ensure that lighting specified for the site does not have a negative impact from glare or spill light on the highways and railways adjacent to the site.
- Ensure that the lighting installation does not impact upon existing vegetation around the site's border so not to preclude use as a habitat for light sensitive species.
- Providing a design and specification which considers the reduction of energy wherever possible.

Appendices

A.	367590-MMD-28I-XX-DR-C-0002 - Master Plan (Sheet 1 of 2)	23
B.	367590-MMD-28I-XX-DR-C-0003 - Master Plan (Sheet 2 of 2)	24
C.	MMD-367590-C-DR-00-XX-0100 - Location Plan	25
D.	ILP – Guidance Notes for the Reduction of Obtrusive Lighting GN01:2011	26

A. 367590-MMD-28I-XX-DR-C-0002 - Master Plan (Sheet 1 of 2)



Notes

- All dimensions are in metres unless otherwise stated.
- Do not scale any items or information from this drawing.
- This drawing is prepared for the purpose of outline planning for the proposed Taffs Well Depot and is not intended for any other purpose. It is not intended to reflect any specific proposal under the Wales and Borders Procurement and is instead indicative of the planned development.

Key to symbols

	Highway to be constructed		New track
	Footpath/footbridge to be constructed		Existing track
	Cycle Storage		Existing platform
	Verge/landscaping		Cycle lane
	New building		Track Numbering
	New platform		
	Platform to be removed		

Reference drawings

367590-MMD-281-XX-DR-C-0001 - Location Plan
 367590-MMD-281-XX-DR-C-0003 - Upper Level Master Plan (Sheet 2 of 2)
 367590-MMD-281-XX-DR-C-0004 - Red Line Boundary
 367590-MMD-281-XX-DR-C-0005 - Parameters Plan
 367590-MMD-281-XX-DR-C-0006 - Sections and Elevations (Sheet 1 of 2)
 367590-MMD-281-XX-DR-C-0007 - Sections and Elevations (Sheet 2 of 2)
 367590-MMD-281-XX-DR-C-0008 - Indicative Construction Phasing

Rev	Date	Drawn	Description	Ch'k'd	App'd
P4	09.03.18	RT	Hybrid Planning Application	RM	WW
P3	21.11.17	RT	RCTCBC First Review	WW	DF
P2	20.10.17	RT	Preliminary Issue	GL	WW
P1	03.08.17	PR	Preliminary Issue	GL	WW

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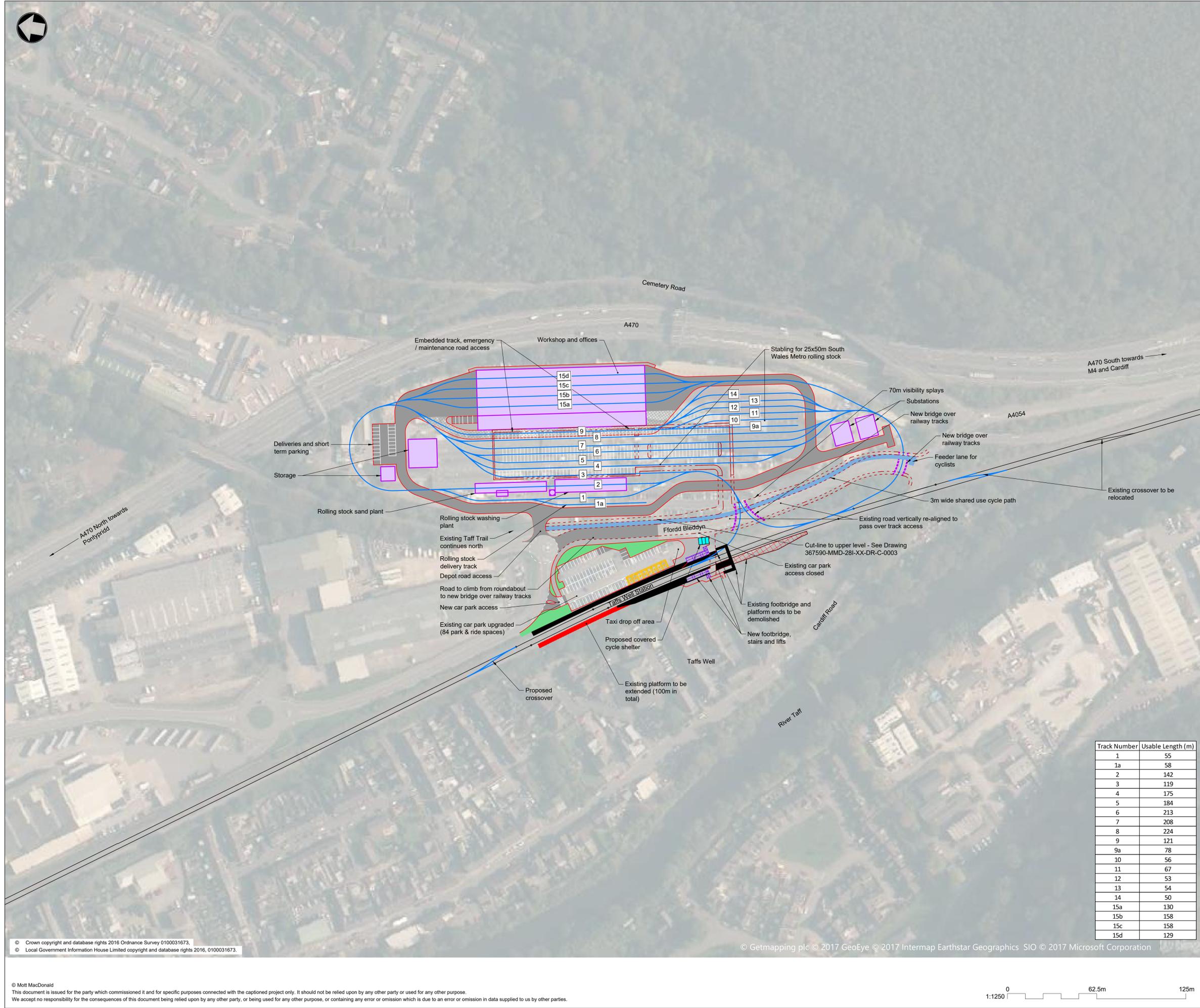
Client

Transport for Wales
 Southgate House
 Wood Street
 Cardiff, CF10 1EW
 United Kingdom

Title

South Wales Metro - Task Order 028-1
 Taffs Well Depot Outline Planning
 Ground Level Master Plan
 (Sheet 1 of 2)

Designed	O Mares/P Richardson	OM/PR	Eng check	G Last	GL
Drawn	P Richardson	PR	Coordination	G Last	GL
Dwg check	D Sansome	DS	Approved	W Wootten	WW
Scale at A1	Status	Rev	Security		
1:1250	PRE	P4	STD		
Drawing Number 367590-MMD-281-XX-DR-C-0002					

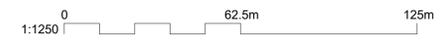


Track Number	Usable Length (m)
1	55
1a	58
2	142
3	119
4	175
5	184
6	213
7	208
8	224
9	121
9a	78
10	56
11	67
12	53
13	54
14	50
15a	130
15b	158
15c	158
15d	129

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B. 367590-MMD-28I-XX-DR-C-0003 - Master Plan (Sheet 2 of 2)



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Key to symbols

	Highway to be constructed		New track
	Footpath/footbridge to be constructed		Existing track
	Cycle Storage		Existing platform
	Verge/landscaping		Cycle Path
	New building		
	New platform		
	Platform to be removed		

- Reference drawings
- 367590-MMD-281-XX-DR-C-0001 - Location Plan
 - 367590-MMD-281-XX-DR-C-0002 - Ground Level Master Plan (Sheet 1 of 2)
 - 367590-MMD-281-XX-DR-C-0004 - Red Line Boundary
 - 367590-MMD-281-XX-DR-C-0005 - Parameters Plan
 - 367590-MMD-281-XX-DR-C-0006 - Sections and Elevations (Sheet 1 of 2)
 - 367590-MMD-281-XX-DR-C-0007 - Sections and Elevations (Sheet 2 of 2)
 - 367590-MMD-281-XX-DR-C-0008 - Indicative Construction Phasing

Rev	Date	Drawn	Description	Ch'k'd	App'd
P4	09.03.18	RT	Hybrid Planning Application	RM	WW
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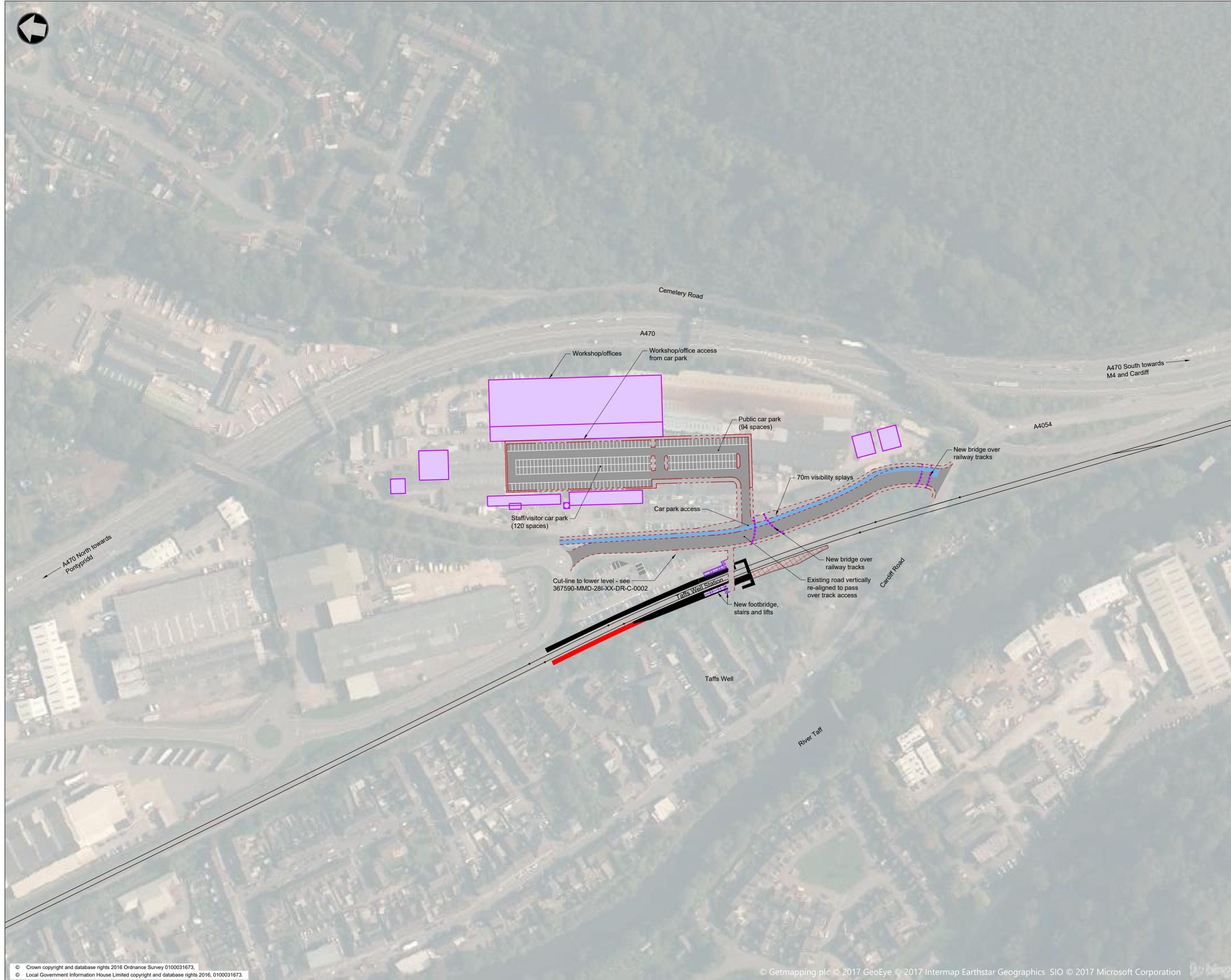
Client
Transport for Wales
 Southgate House
 Wood Street
 Cardiff, CF10 1EW
 United Kingdom

Title
South Wales Metro - Task Order 028-1
Taffs Well Depot Outline Planning
Upper Level Master Plan
(Sheet 2 of 2)

Designed	O Mares/ P Richardson	OM/PR	Eng check	G Last	GL
Drawn	P Richardson	PR	Coordination	G Last	GL
Dwg check	D Sansome	DS	Approved	W Wootten	WW

Scale at A1	Status	Rev	Security
1:1250	PRE	P4	STD

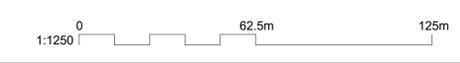
Drawing Number
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C. MMD-367590-C-DR-00-XX-0100 - Location Plan



Notes

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2. Do not scale any items or information from this drawing.
3. This drawing is prepared for the purpose of outline planning for the proposed Taffs Well Depot and is not intended for any other purpose. It is not intended to reflect any specific proposal under the Wales and Borders Procurement and is instead indicative of the planned development.

Key to symbols

— Red Line Boundary

Reference drawings

367590-MMD-281-XX-DR-C-0002 - Ground Level Master Plan (Sheet 1 of 2)
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Rev	Date	Drawn	Description	Ch'k'd	App'd
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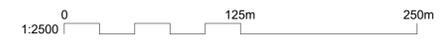
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Drawn	P Richardson	PR	Coordination	G Last	GL
Dwg check	J Kirby	JK	Approved	W Wootten	WW

Scale at A1	Status	Rev	Security
1:2500	PRE	P3	STD

Drawing Number
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D. ILP – Guidance Notes for the Reduction of Obtrusive Lighting GN01:2011

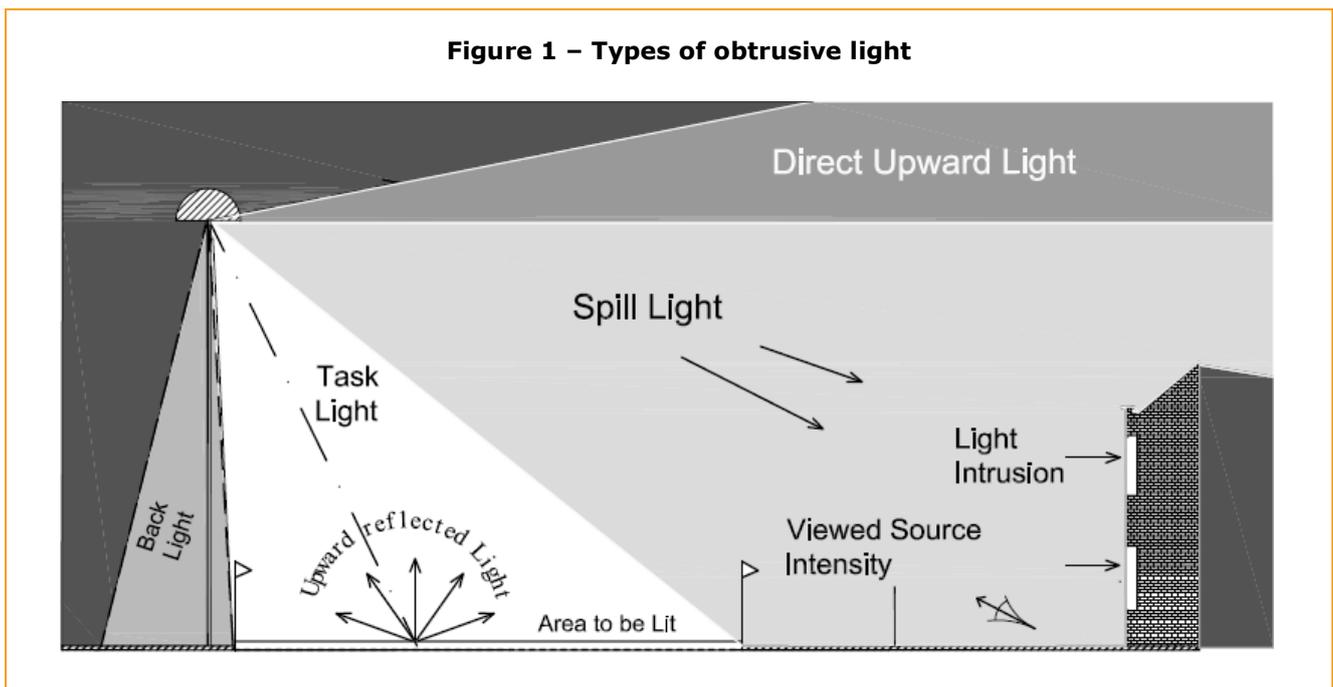
GUIDANCE NOTES FOR THE REDUCTION OF OBTRUSIVE LIGHT

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

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

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

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



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

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

“Good Design equals Good Lighting”

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

Light sources (Lamps)

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

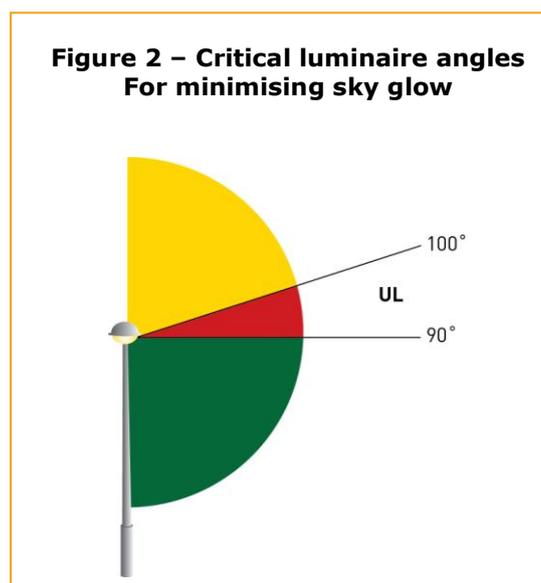
Most nighttime visual tasks are only dependant on light radiated within the visual spectrum. It is therefore NOT necessary for light sources to emit either ultra-violet or infra-red radiation unless specifically designed to do so. It is also understood that light from the shorter wavelengths of the spectrum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

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

Luminaires

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

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



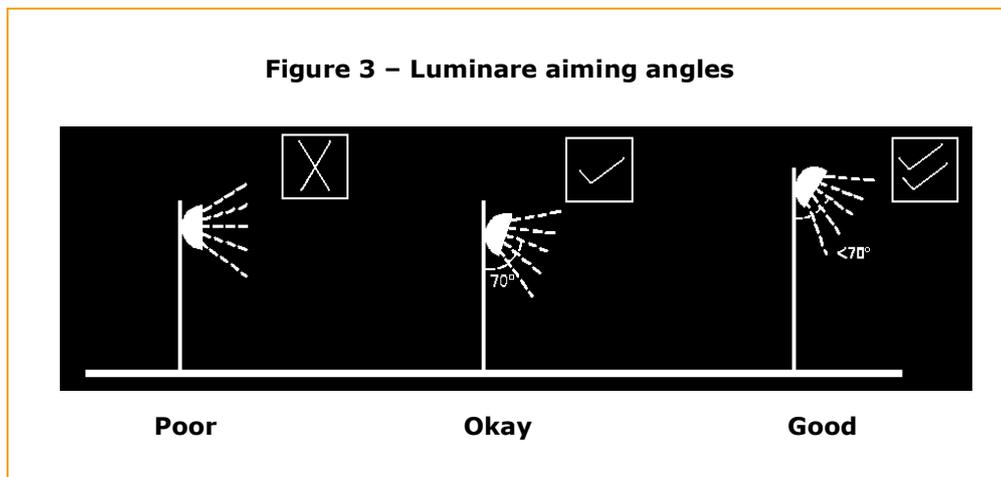
For most sports and area lighting installations the use of luminaires with double-asymmetric beams designed so that the front glazing is kept at or near parallel to the surface being lit should, if correctly aimed, ensures minimum obtrusive light.

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

Installation

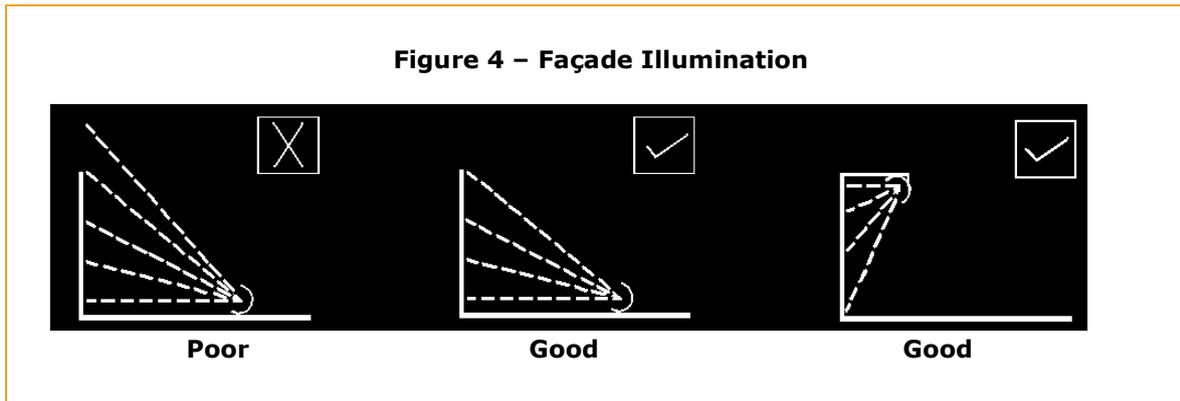
In most cases it will be beneficial to use as high a mounting height as possible, giving due regard to the daytime appearance of the installation. The requirements to control glare for the safety of road users are given in Table 3.

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



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

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



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

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

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

ENVIRONMENTAL ZONES

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

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

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

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

DESIGN GUIDANCE

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

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

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

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

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

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

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

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

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

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

(2) Light Intrusion (into Windows) – These values are suggested maxima and need to take account of existing light intrusion at the point of measurement. In the case of road lighting on public highways where building facades are adjacent to the lit highway, these levels may not be obtainable. In such cases where a specific complaint has been received, the Highway Authority should endeavour to reduce the light intrusion into the window down to the post curfew value by fitting a shield, replacing the luminaire, or by varying the lighting level.

(3) Luminaire Intensity – This applies to each luminaire in the potentially obtrusive direction, outside of the area being lit. The figures given are for general guidance only and for some sports lighting applications with limited mounting heights, may be difficult to achieve.

(4) Building Luminance – This should be limited to avoid over lighting, and related to the general district brightness. In this reference building luminance is applicable to buildings directly illuminated as a night-time feature as against the illumination of a building caused by spill light from adjacent luminaires or luminaires fixed to the building but used to light an adjacent area.

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

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

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

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

RELEVANT PUBLICATIONS AND STANDARDS:

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

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

APPENDIX 1 - PROPOSED OUTDOOR LUMINAIRE CLASSIFICATION SYSTEM

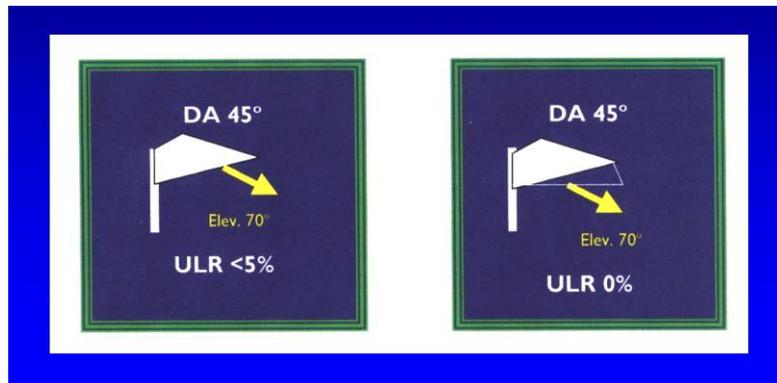
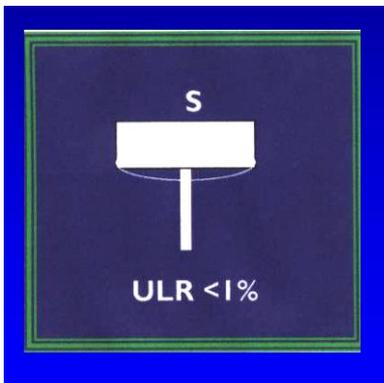
Variable Aim Luminaires – General Classifications:

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

Proposed labelling System:

Fixed Position luminaires

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



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

Cowl (or Hood)



External Louvre



SHIELD



SHIELD "Barn Doors"



Double Asymmetric Luminaire



Simple Hood



Circular Louvre



Cowl & Louvre



Internal Louvre (horizontal)



Internal Louvre (vertical)



