Hillingdon Hospital Redevelopment
External Lighting Report

The Hillingdon Hospitals NHS Foundation Trust

RIBA Stage 2

THHR_01-ACM-ZZ-XX-RP-E-125002
27th April 2022

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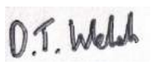
Quality information

Prepared by	Checked by		Approved by
			Paul Stannard
Daniel Welsh Engineer	Stephen J Rowlands Associate Director		Paul Stannard Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position
P01	21/02/2022	Draft for Review	SJR	Stephen J Rowlands	Associate Director
P02	04/04/2022	Updated Draft for Review	SJR	Stephen J Rowlands	Associate Director
P03	25/04/2022	Final Issue	SJR	Stephen J Rowlands	Associate Director
P04	27/04/2022	Updated following further Comments received	SJR	Stephen J Rowlands	Associate Director

Distribution List

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Figures

Tables

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1. Executive Summary

This External Lighting Report has been prepared by AECOM to accompany hybrid planning application being submitted by the Applicant, Hillingdon Hospital NHS Foundation Trust, to the London Borough of Hillingdon.

The proposal comprises of hybrid planning application for:

1. FULL application seeking planning permission for demolition of existing buildings and redevelopment of the site to provide the new Hillingdon Hospital, multi-storey car park and mobility hub, vehicle access, highways works, associated plant, generators, substation, new internal roads, landscaping and public open space, utilities, servicing area, surface car park/ expansion space, and other works incidental to the proposed development.

2. OUTLINE planning application (all matters reserved, except for access) for the demolition of buildings and structures on the remaining site (excluding the Grade II Furze and Tudor Centre) for a mixed-use development comprising residential (Class C3) and supporting Commercial, Business and Service uses (Class E), new pedestrian and vehicular access; public realm, amenity space, car and cycling parking.

The information in this report is mainly based on the external site plan from the Architect, IBI, as well as the Client's Strategic Outline Case (SOC), which formed the initial brief for the scheme.

The document will also form the basis of design principles and how the external lighting design has been approached for the project.

Project Overview

The External Lighting Report pertains to the phase 1A, phase 1B, and phase 1C scope of works:

- Replacement hospital building (79,603.6 sqm GIA) of basement, ground plus seven storeys on the western extent of the site incorporating a linked mobility hub and multi storey car park (MSCP) for 781 car spaces.
- High quality landscaping buffer fronting Royal Lane.
- New bus stop arrangements and improved connections to the hospital on Pield Heath Road.
- Large central green open space for use by the hospital and wider community.
- 161 surface level car parking spaces with the ability to cater for up to 14,000 sqm of expansion space for future hospital expansion (if required).
- New Vehicle access to site.

The new Hospital & MSCP will be built on the site of the existing Hillingdon Hospital, where the existing Hospital building/s must stay operational until the new Hospital is completed, and services can be transferred across. On completion the existing Hospital will be demolished.

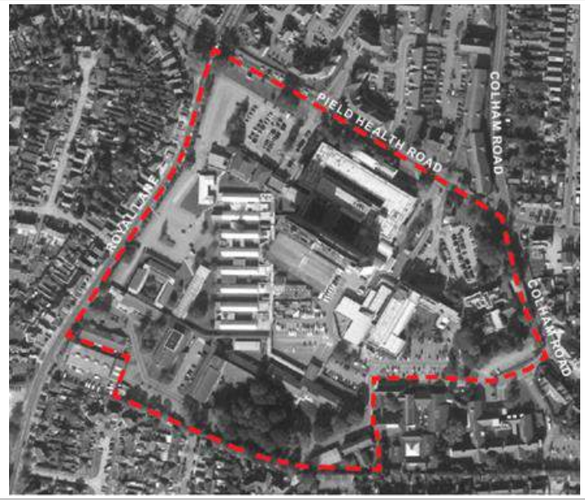
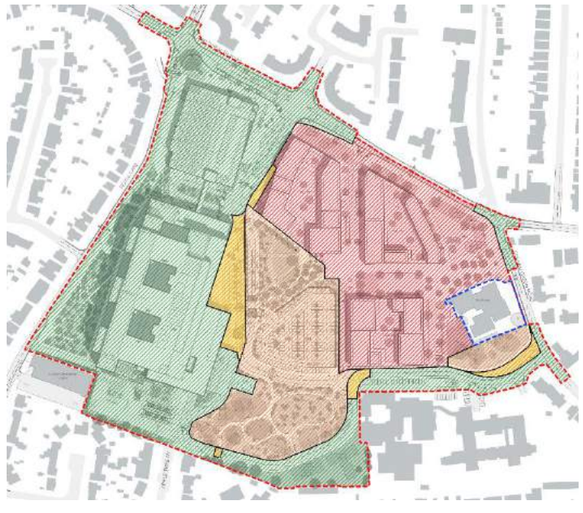
The design strategy for the new buildings will allow for future expansion/growth by incorporating Modern Methods of Construction (MMC), allowance for future plant, and allowance for maintenance via dedicated access routes.

The existing site layout, the proposed site layout and the phasing plan are shown on the adjacent images. The areas outside of the Hospital site boundary i.e Phase 2 areas (red shaded), and highway roads that would be adoptable by 'Highways' are not within scope of this report.

A Developer will liaise with the relevant parties at the 'reserved matters stage' on the Phase 2 and Highway elements.

Assumptions

This report is subject to consideration of information by others – site layout, landscape design, environmental demands etc.

Existing Hillingdon Hospital Site: Site Address: Hillingdon Hospital Pield Heath Road, Uxbridge, UB8 3NN	
Proposed Hillingdon Hospital Site: • **New Hillingdon Hospital and Multi-storey Car Park (blue)** • **Public Open Spaces (green)** • **Surface Car Park (red)** • **Residential Plots (yellow).** • **FM/Service Yard (purple)** **Red dotted line indicates application boundary.** **Blue dotted line indicates other land in applicant's ownership.**	
Included in this report: • **Phase 1A (green)** • **Phase 1B (yellow)** • **Phase 1C (brown)** **Excluded from this report:** • **Areas adoptable by 'Highways'** • **Phase 2 (red)**	

2. Existing Site – Strategy for Lighting Improvement

2.1 Site Constraints

There is no remit for this report to address or improve the areas of the existing Hillingdon Hospital site that extend beyond the identified new site boundary. The new site will be cleared of all existing services ahead of the new Hillingdon Hospital redevelopment to form an ‘exclusion zone’ for new construction works.

3. New Site - Lighting Design

3.1 Overview

Ref: Figure 1 – the external lighting design will consider the new Hospital & MSCP development site which comprises of multiple phases.

The areas in the site boundary which are adoptable by 'Highways' will not be covered in this report.

3.1.1 Phase 1A

Phase 1A consists of the initial build which won't be modified by later phases. This includes:

- New main vehicular/cyclist/pedestrian access road to the north of the site from Pield Health Road.
- New vehicular/cyclist/pedestrian access road to the north west of the site to enter the new MSCP from Royal Lane.
- New vehicular/cyclist/pedestrian access road from Royal Lane behind the London Ambulance Station.
- New vehicular/cyclist/pedestrian access road to the east of the site from Colham Green Road.
- New vehicular access road to the south of the site to for Ambulances, FM, Plant Access & Replacement, and Delivery/Waste collection access.
- New pedestrian walkways and landscaping to the west of the new Hospital jointing the existing Royal Lane and around the perimeter of the MSCP.
- New native Hedges planted along the west side of the Royal Lane site boundary.
- New short stay car park and servicing bays near the Hospital and MSCP entrances.
- New FM, Delivery, Waste and Plant service yard to the south of the site and adjacent to the VIE Tanks near the ambulance yard.
- New surface cark park to the south east of the site.
- New ambulance yard to the south east of the Hospital.
- New 3m wide pedestrian/cycle path to the south from the site to Apple Tree Avenue.

3.1.2 Phase 1B

Phase 1B consists of all the interim elements that will eventually be modified or replaced by phase 1C of the detailed application being built. This includes:

- The slope and structure opposite the MSCP entrance on the Pield Health Road access road.
- The emergency-walk in entrance access road with short stay parking.
- The Colham Green Road access road junction.
- The turn from the Colham Green Road access road to the Ambulance, FM, Plant Access & Replacement, and Delivery road.
- The pedestrian crossing linking the woodland area to the pedestrian/cycle path to the south of the site.

3.1.3 Phase 1C

Phase 1C consists of the elements that can only be built upon demolition of the existing hospital. This includes:

- New bus stop arrangements and modification of the emergency walk-in entrance access roads.
- New public open space in the centre of the site.
- New surface car park in the centre of the site
- New link road between the A&E entrance and access route from Colham Green Road.
- New public open woodlands area space to the south of the site.
- New woodlands area to the southeast of the site.

3.1.4 Phase 2

Phase 2 consists of elements involved in the outline planning application for the residential areas. Phase 2 will not be covered in this report.

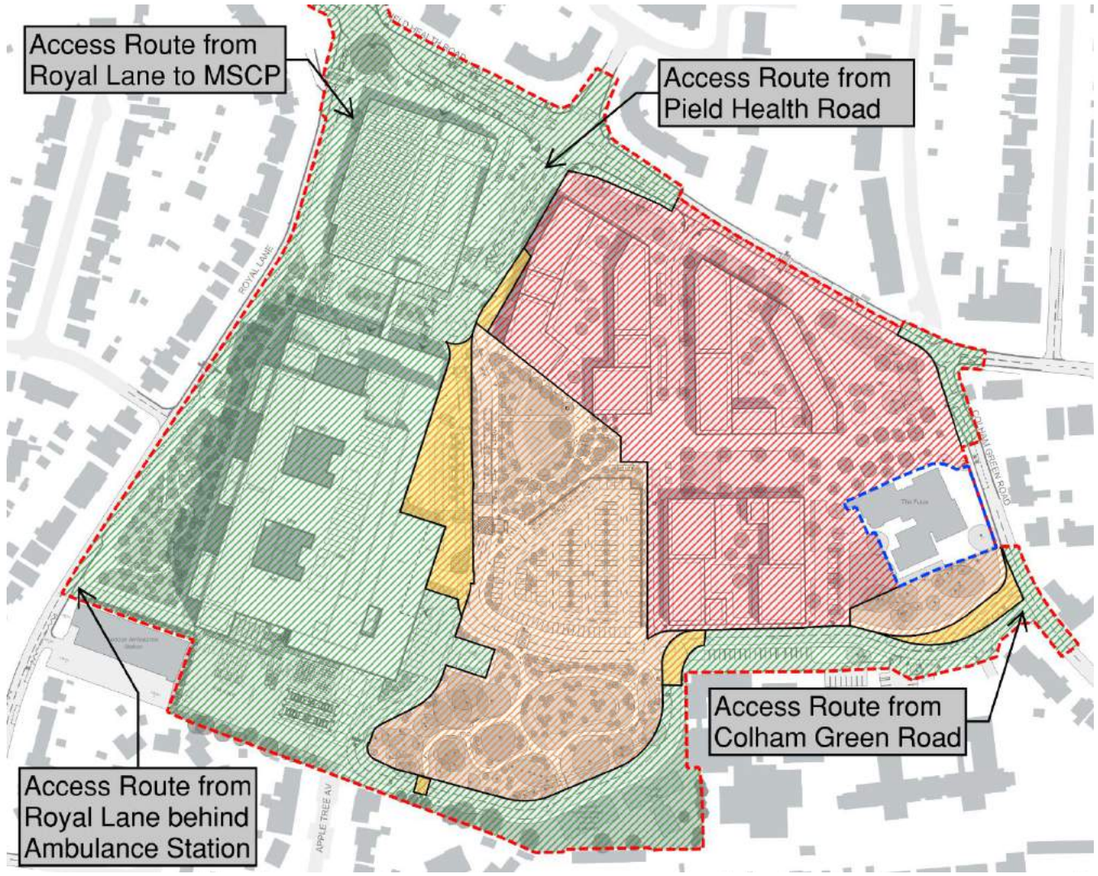


Figure 1: Site Overview

3.2 Design Considerations

A number of key considerations have been taken into account in the external lighting design for the new site.

3.2.1 Lighting Performance

The overall lighting performance of the development has been designed to provide an appropriate level of illumination for safe access and the different tasks to be carried out in different areas. Key elements have been considered in the design:

- Illumination Level
- Uniformity
- Energy Efficiency / Efficacy
- Colour Rendering Index
- Low Maintenance
- Minimise Light Pollution (Glare, Wildlife and ULOR etc)
- Adjacent Properties

3.2.2 Security

Appropriate lighting is required for a variety of security reasons which can reduce and prevent crime:

- Safety of Staff working after dark
- Safety for visitors to the premises
- To enable clear CCTV facial image
- Deterring potential offenders
- Traffic movements

3.2.3 Environmental Zone

Base on the geographical location of the site and surrounding environment, according to definition in *ILP Guidance notes for the reduction of obstructive light – table 2,* the Environmental zone to be applied to Hillingdon Hospital site is:

- **E3 Suburban**

Table 2: Environmental zones

Zone	Surrounding	Lighting environment	Examples
E0	Protected	Dark (SQM 20.5+)	Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places
E1	Natural	Dark (SQM 20 to 20.5)	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc.
E2	Rural	Low district brightness (SQM ~15 to 20)	Sparsely inhabited rural areas, village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Well inhabited rural and urban settlements, small town centres of suburban locations
E4	Urban	High district brightness	Town/city centres with high levels of night-time activity

3.2.4 Minimising Lighting Pollution

Light trespass/encroachment

Excessive lighting spill into the adjacent neighbouring windows could cause issue with the occupier. Control or limit the lighting aiming angle and/or providing additional shielding guides at the lighting source can prevent this lighting pollution.

Sky glow

Sky glow is probably the most common negative impact lighting pollution brings. This is caused by the unwanted upward lighting components emitted above the horizontal plane from the lighting luminaires. The Environmental zone **E3** set a limit of ULOR to be 5% or below according to *Guidance notes for the reduction of obstructive light – table 6*.

Good practise to reduce the ULOR is to utilise luminaires with ULOR = 0. Where this is not possible, reduce aiming angle to reduce the upward lighting as much as possible to the requirement limit.

Table 6 (CIE 150 table 5): Maximum values of upward light ratio (ULR) of luminaires.

Light technical parameter	Environmental zones				
	E0	E1	E2	E3	E4
Upward light ratio (ULR)/%	0	0	2.5	5	15

Note:

This does not take into account the effect of light reflected upwards from ground that also contributes to sky glow. This is the traditional method to limit sky glow and is suitable to compare different single luminaires.

Glare

Glare occurs where the user sees light directly from the fixture or light source. With a mix of road users in various places around the new hospital site, it is a good practice to design the light source as high as it practically possible.

The below table extracted from *BSEN 12464-2 Lighting of work places -part 2 outdoor work places* recommends a maximum glare rate (GL) < 50.

5.4 Lighting requirements for areas, tasks and activities

Table 5.1 — General requirements for areas and for cleaning at outdoor work places

Ref. no.	Type of area, task or activity	$\overline{E}_m$ lx	U_o –	R_{GL} –	R_a –	Specific requirements
5.1.1	Walkways exclusively for pedestrians	5	0,25	50	20	
5.1.2	Traffic areas for slowly moving vehicles (max. 10 km/h), e.g. bicycles, trucks and excavators	10	0,40	50	20	
5.1.3	Regular vehicle traffic (max. 40 km/h)	20	0,40	45	20	At shipyards and in docks, R_{GL} may be 50
5.1.4	Pedestrian passages, vehicle turning, loading and unloading points	50	0,40	50	20	
5.1.5	Cleaning and servicing	50	0,25	50	20	All relevant surfaces

3.2.5 Wildlife

The AECOM wildlife report/s indicate that there are bat activities around the existing perimeters of the site, and it is understood that there is the potential of using some of the existing buildings and large trees to provide roosting places for bats. However, we would expect there to be further surveys and discussion to be carried out in the later design stages to confirm the exact requirements for the new development - reference should be made to the current AECOM Ecologist reports for further details.

Following discussions with the AECOM Ecologist, areas were identified where bat roosting and/or foraging corridors require consideration to minimise the impact to the bats natural behaviour, and maintain clear access to their roosting, mating and feeding grounds. The principles in order to minimise the impact of Lighting (which also needs to consider for example safety and access), have been applied to the proposals indicated in this report. In particular the guidance set out in document ‘Bats and Lighting in the UK” by the Bat Conservation Trust’.

As mentioned above some useful awareness and mitigation strategies are highlighted within “Bats and Lighting in the UK” by the Bat Conservation Trust” i.e.

a) Lighting levels: should be “as low as guidelines permit”

b) Light colour temperature; Reduce UV light emission by using warmer colour temperature lighting (3000K).

c) Lighting column height: should be as “short as possible” to reduce ecological impact.

With regard to point c) above, the proposals in this report apply low level Bollard options for the areas identified for minimising Lighting impact on the wildlife, whilst maintaining safety and access requirements.

3.2.6 Efficient and Green

The design is aiming to utilise energy efficient LED lighting source throughout the new development to help achieve BREEAM ‘Excellent’ accreditation. Other important factors to be taken into consideration to minimise carbon footprint:

- Avoid over lighting
- Appropriate lighting control strategy
- High efficacy light source and luminaires
- Selection of luminaires with suitable photometry for application
- Lifecycle analysis
- LED colour temperature range

3.3 Design Criteria

3.3.1 Design Standards, Recommendations and Guidance

The relevant Standards, Recommendation and Guidance documents are closely followed to form the basis of the project’s design principles and criteria across the various types of external areas. Typically, the following standards (but not limited to) will be considered:

- SSL CIBSE Lighting Guide 2 - Lighting for Healthcare Premises
- SSL CIBSE Lighting Guide 6 - Lighting for the Exterior Environment
- PD CEN/TR 13201-1 Road Lighting - Part 1 Guidelines on Selection of Lighting Classes
- BSEN 13201-2 Road Lighting - Part 2 Performance requirements
- BS5489-1 Code of Practice for the Design of Road Lighting
- BSEN 12464-2 Lighting of Work Places - Part 2 Outdoor Work Places
- BS 5489-4 Road lighting - Part 3 Code of practice for lighting for subsidiary roads and associated pedestrian areas
- BS 5489-4 Road lighting - Part 4 Code of practice for lighting for single-level road junctions including roundabouts
- Secure by Design – Lighting against Crime
- ILP Guidance Note 1 for the reduction of obtrusive light v4
- Bats and Lighting in the UK” by the Bat Conservation Trust

3.3.2 Design Criteria Summary Table

The below table summarises the lighting performance design criteria requirements.

<table>
<tr><th>Area</th><th>Type of Lighting Proposed</th><th>Average Lighting Level E (lx)</th><th>Working Plane</th><th>Uniformity Uo</th><th>Standard and Guidance References</th></tr>
<tr><td>Access Roads</td><td>Lighting Columns</td><td>15</td><td>At Floor Level</td><td>0.25</td><td>BSEN 13201
BS 5489</td><td>
BSEN 13201-2
Lighting Class P1 – Pedestrian is determined by using the Sum of Weighting Values (VWS)
Table 3 — P lighting classes
<table>
<tr><th rowspan="2">Class</th><th colspan="2">Horizontal illuminance</th><th colspan="2">Additional requirement if facial recognition is necessary</th></tr>
<tr><th>$\bar{E}$ [a] [minimum maintained] lx</th><th>E_{min} [maintained] lx</th><th>$E_{v,min}$ [maintained] lx</th><th>$E_{sc,min}$ [maintained] lx</th></tr>
<tr><td>P1</td><td>15,0</td><td>3,00</td><td>5,0</td><td>5,0</td></tr>
<tr><td>P2</td><td>10,0</td><td>2,00</td><td>3,0</td><td>2,0</td></tr>
<tr><td>P3</td><td>7,50</td><td>1,50</td><td>2,5</td><td>1,5</td></tr>
<tr><td>P4</td><td>5,00</td><td>1,00</td><td>1,5</td><td>1,0</td></tr>
<tr><td>P5</td><td>3,00</td><td>0,60</td><td>1,0</td><td>0,6</td></tr>
<tr><td>P6</td><td>2,00</td><td>0,40</td><td>0,6</td><td>0,2</td></tr>
<tr><td>P7</td><td>performance not determined</td><td>performance not determined</td><td></td><td></td></tr>
</table>
[a] To provide for uniformity, the actual value of the maintained average illuminance shall not exceed 1.5 times the minimum $\bar{E}$ value indicated for the class.

BSEN 13201-1
Lighting Class P1 or S1
Table A.7 Variation of maintained lighting level with S/P ratio of light source
Values in lux
<table>
<tr><th rowspan="2">Lighting class</th><th colspan="2">Benchmark (e.g. R_a < 60 or when S/P ratio of light source is not known or specified)</th><th colspan="2">S/P ratio = 1.2 and $R_a \geq 60$ (e.g. some types of warm white lamp such as metal halide)</th><th colspan="2">S/P ratio = 2 and $R_a \geq 60$ (e.g. some types of cool white compact fluorescent or LED)</th></tr>
<tr><th>$\bar{E}$</th><th>E_{min}</th><th>$\bar{E}$</th><th>E_{min}</th><th>$\bar{E}$</th><th>E_{min}</th></tr>
<tr><td>P1 or S1</td><td>15.0</td><td>3.0</td><td>13.4</td><td>2.7</td><td>12.3</td><td>2.5</td></tr>
<tr><td>P2 or S2</td><td>10.0</td><td>2.0</td><td>8.6</td><td>1.7</td><td>7.7</td><td>1.5</td></tr>
<tr><td>P3 or S3</td><td>7.5</td><td>1.5</td><td>6.3</td><td>1.3</td><td>5.5</td><td>1.1</td></tr>
<tr><td>P4 or S4</td><td>5.0</td><td>1.0</td><td>4.0</td><td>0.8</td><td>3.4</td><td>0.7</td></tr>
<tr><td>P5 or S5</td><td>3.0</td><td>0.6</td><td>2.2</td><td>0.4</td><td>1.8</td><td>0.4</td></tr>
<tr><td>P6 or S6</td><td>2.0</td><td>0.4</td><td>1.4</td><td>0.4</td><td>1.1</td><td>0.4</td></tr>
</table>
BSEN 5489-1
Lighting Class M3 – Motorist is determined by using the Sum of Weighting Values (VWS)

Lighting Class comparable level for different classes
Table A.1 Lighting classes of comparable level
<table>
<tr><th>ME or M class</th><th>CE or C class</th><th>S or P class</th></tr>
<tr><td>—</td><td>CE0 or C0</td><td>—</td></tr>
<tr><td>ME1 or M1</td><td>CE1 or C1</td><td>—</td></tr>
<tr><td>ME2 or M2</td><td>CE2 or C2</td><td>–</td></tr>
<tr><td>ME3 or M3</td><td>CE3 or C3</td><td>S1 or P1</td></tr>
<tr><td>ME4 or M4</td><td>CE4 or C4</td><td>S2 or P2</td></tr>
<tr><td>ME5 or M5</td><td>CE5 or C5</td><td>S3 or P3</td></tr>
<tr><td>ME6 or M6</td><td>—</td><td>S4 or P4</td></tr>
<tr><td>—</td><td>—</td><td>S5 or P5</td></tr>
<tr><td>—</td><td>—</td><td>S6 or P6</td></tr>
</table>
NOTE The data in this table is extrapolated from PD CEN/TR 13201-1:2004 (undergoing revision).

BSEN 5489-1
Table A.5 Lighting classes for subsidiary roads with a typical speed of main user $v \leq 30$ mph
<table>
<tr><th rowspan="2">Traffic flow</th><th colspan="4">Lighting class</th></tr>
<tr><th>Ambient luminance: very low (E1)</th><th>Ambient luminance: low (E2)</th><th>Ambient luminance: moderate (E3)</th><th>Ambient luminance: high (E4)</th></tr>
<tr><td>Busy [A)]</td><td>S3 or P3</td><td>S3 or P3</td><td>S2 or P2</td><td>S2 or P2</td></tr>
<tr><td>Normal [B)]</td><td>S4 or P4</td><td>S4 or P4</td><td>S3 or P3</td><td>S3 or P3</td></tr>
<tr><td>Quiet [C)]</td><td>S5 or P5</td><td>S5 or P5</td><td>S4 or P4</td><td>S4 or P4</td></tr>
</table>
</td></tr>
</table>

<table>
<tr>
<td>Junctions</td>
<td>Lighting Columns</td>
<td>20</td>
<td>At Floor Level</td>
<td>0.4</td>
<td>BSEN 13201
BS 5489</td>
<td>BSEN 5489-1
Lighting Class comparable level for conflict areas C class

Table A.4 Lighting classes for conflict areas
<table><tr><th>Traffic route lighting class</th><th>Conflict area lighting class</th></tr><tr><td>ME1 or M1</td><td>CE0 or C0</td></tr><tr><td>ME2 or M2</td><td>CE1 or C1</td></tr><tr><td>ME3 or M3</td><td>CE2 or C2</td></tr><tr><td>ME4 or M4</td><td>CE3 or C3</td></tr><tr><td>ME5 or M5</td><td>CE4 or C4</td></tr><tr><td>ME6 or M6</td><td>CE5 or C5</td></tr></table>
BSEN 5489-2
Lighting Class C3 – Conflict Area

Table 2 — C lighting classes based on road surface illuminance
<table><tr><th>Class</th><th colspan="2">Horizontal illuminance</th></tr><tr><th></th><th>$\bar{E}$ [minimum maintained] lx</th><th>U_o [minimum]</th></tr><tr><td>C0</td><td>50</td><td>0,40</td></tr><tr><td>C1</td><td>30</td><td>0,40</td></tr><tr><td>C2</td><td>20,0</td><td>0,40</td></tr><tr><td>C3</td><td>15,0</td><td>0,40</td></tr><tr><td>C4</td><td>10,0</td><td>0,40</td></tr><tr><td>C5</td><td>7,50</td><td>0,40</td></tr></table></td>
</tr>
<tr>
<td>Parking / Drop-off</td>
<td>Lighting Columns</td>
<td>20</td>
<td>At Floor Level</td>
<td>0.25</td>
<td>BSEN 12464
BS 5489
LG2
LG6</td>
<td>BS 5489-1

Table 5 Maintained lighting levels for outdoor car parks
<table><tr><th>Type of area and usage</th><th>$\bar{E}$ lx</th><th>U_o</th></tr><tr><td>Light traffic, e.g. parking areas of shops, terraced and apartment houses; cycle parks</td><td>5</td><td>0.25</td></tr><tr><td>Medium traffic, e.g. parking areas of department stores, office buildings, plants, sports and multipurpose building complexes</td><td>10</td><td>0.25</td></tr><tr><td>Heavy traffic, e.g. parking areas of schools, churches, major sports and multipurpose sports and building complexes</td><td>20</td><td>0.25</td></tr></table></td>
</tr>
</table>

<table>
<tr><td>Main Entrance (Hospital and MSCP)</td><td colspan="5">Subject to canopy design</td><td rowspan="2">LG2
Table 2 General lighting schedule; external lighting
<table><tr><th>Area</th><th>Maintained average illuminance (lux)</th><th>Uniformity</th><th>Min. R_a</th></tr><tr><td>Roadway lighting (environmental zones E3 and E4):</td><td></td><td></td><td></td></tr><tr><td>— busy</td><td>10</td><td>0.2</td><td>20</td></tr><tr><td>— normal</td><td>7.5</td><td>0.2</td><td>20</td></tr><tr><td>— quiet</td><td>5</td><td>0.2</td><td>20</td></tr><tr><td>Car parking (large)</td><td>20</td><td>0.25</td><td>20</td></tr><tr><td>Multistorey car park:</td><td></td><td></td><td></td></tr><tr><td>— in/out ramps (day)</td><td>300</td><td>0.4</td><td>40</td></tr><tr><td>— in/out ramps (night)</td><td>75</td><td>0.4</td><td>40</td></tr><tr><td>— traffic lanes and parking areas</td><td>75</td><td>0.4</td><td>40</td></tr><tr><td>Ambulance drop-off</td><td>100</td><td>0.4</td><td>60</td></tr><tr><td>Pedestrian areas:</td><td></td><td></td><td></td></tr><tr><td>— footpaths</td><td>5</td><td>0.25</td><td>20</td></tr><tr><td>— cycle ways</td><td>10</td><td>0.4</td><td>20</td></tr><tr><td>— ramps/stairs</td><td>100</td><td>0.4</td><td>60</td></tr><tr><td>— entrances</td><td>75–100</td><td>0.4</td><td>60</td></tr></table></td></tr>
<tr><td>Emergency Entrance</td><td colspan="5">Subject to canopy design</td></tr>
<tr><td rowspan="2">Ambulance Yard</td><td rowspan="2">Façade luminaires and Lighting Columns</td><td>15 – General Access (Same as ‘Access Road’)</td><td>At Floor Level</td><td>0.25</td><td>LG2</td><td rowspan="3">BSEN 12464-2
5.4 Lighting requirements for areas, tasks and activities
Table 5.1 — General requirements for areas and for cleaning at outdoor work places
<table><tr><th>Ref. no.</th><th>Type of area, task or activity</th><th>$\overline{E}_m$ lx</th><th>U_o –</th><th>R_{GL} –</th><th>R_a –</th><th>Specific requirements</th></tr><tr><td>5.1.1</td><td>Walkways exclusively for pedestrians</td><td>5</td><td>0,25</td><td>50</td><td>20</td><td></td></tr><tr><td>5.1.2</td><td>Traffic areas for slowly moving vehicles (max. 10 km/h), e.g. bicycles, trucks and excavators</td><td>10</td><td>0,40</td><td>50</td><td>20</td><td></td></tr><tr><td>5.1.3</td><td>Regular vehicle traffic (max. 40 km/h)</td><td>20</td><td>0,40</td><td>45</td><td>20</td><td>At shipyards and in docks, R_{GL} may be 50</td></tr><tr><td>5.1.4</td><td>Pedestrian passages, vehicle turning, loading and unloading points</td><td>50</td><td>0,40</td><td>50</td><td>20</td><td></td></tr><tr><td>5.1.5</td><td>Cleaning and servicing</td><td>50</td><td>0,25</td><td>50</td><td>20</td><td>All relevant surfaces</td></tr></table></td></tr>
<tr><td>50 - Task Area</td><td>At Floor Level</td><td>0.4 under canopy</td><td>BSEN 12464</td></tr>
<tr><td rowspan="2">FM Yard</td><td rowspan="2">Facade luminaires and Lighting Columns</td><td>15 – General Access (Same as ‘Access Road’)</td><td>At Floor Level</td><td>0.25</td><td>LG2</td></tr>
<tr><td>50 - Task Area</td><td>At Floor Level</td><td>0.4 under canopy</td><td>BSEN 12464</td></tr>
<tr><td>Generator Compound</td><td>Façade luminaires and Lighting Columns</td><td>20</td><td>At Floor Level</td><td>0.25</td><td>BSEN 12464</td><td>BSEN 12464-2
Table 5.7 — Industrial sites and storage areas
<table><tr><th>Ref. no.</th><th>Type of area, task or activity</th><th>$\overline{E}_m$ lx</th><th>U_o –</th><th>R_{GL} –</th><th>R_a –</th><th>Specific requirements</th></tr><tr><td>5.7.1</td><td>Short-term handling of large units and raw materials, loading and unloading of solid bulk goods</td><td>20</td><td>0,25</td><td>55</td><td>20</td><td></td></tr><tr><td>5.7.2</td><td>Continuous handling of large units and raw materials, loading and unloading of freight, lifting and descending location for cranes, open loading platforms</td><td>50</td><td>0,40</td><td>50</td><td>20</td><td></td></tr><tr><td>5.7.3</td><td>Reading of addresses, covered loading platforms, use of tools, ordinary reinforcement and casting tasks in concrete plants</td><td>100</td><td>0,50</td><td>45</td><td>20</td><td></td></tr><tr><td>5.7.4</td><td>Demanding electrical, machine and piping installations, inspection</td><td>200</td><td>0,50</td><td>45</td><td>60</td><td>Use local lighting</td></tr></table></td></tr>
</table>

<table>
<tr>
<td>Walkway/Footpath</td>
<td>Low Level Lighting Bollards</td>
<td>5</td>
<td>At Floor Level</td>
<td>0.25</td>
<td>BSEN 12464
BS 5489
LG2
LG6</td>
<td>LG2
Table 2 General lighting schedule; external lighting
<table>
<tr><th>Area</th><th>Maintained average illuminance (lux)</th><th>Uniformity</th><th>Min. R_a</th></tr>
<tr><td>Pedestrian areas:</td><td></td><td></td><td></td></tr>
<tr><td>— footpaths</td><td>5</td><td>0.25</td><td>20</td></tr>
<tr><td>— cycle ways</td><td>10</td><td>0.4</td><td>20</td></tr>
<tr><td>— ramps/stairs</td><td>100</td><td>0.4</td><td>60</td></tr>
<tr><td>— entrances</td><td>75–100</td><td>0.4</td><td>60</td></tr>
</table>
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<tr><td>5.1.5</td><td>Cleaning and servicing</td><td>50</td><td>0,25</td><td>50</td><td>20</td><td>All relevant surfaces</td></tr>
</table>
</td>
</tr>
<tr>
<td>Cycle Lanes</td>
<td>Lighting Columns</td>
<td>10</td>
<td>Floor</td>
<td>0.4</td>
<td>BSEN 12464
BS 5489
LG2
LG6</td>
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<tr><td>— cycle ways</td><td>10</td><td>0.4</td><td>20</td></tr>
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</table>
</td>
</tr>
</table>

3.4 Design Approach

3.4.1 Pield Health Road Access Road

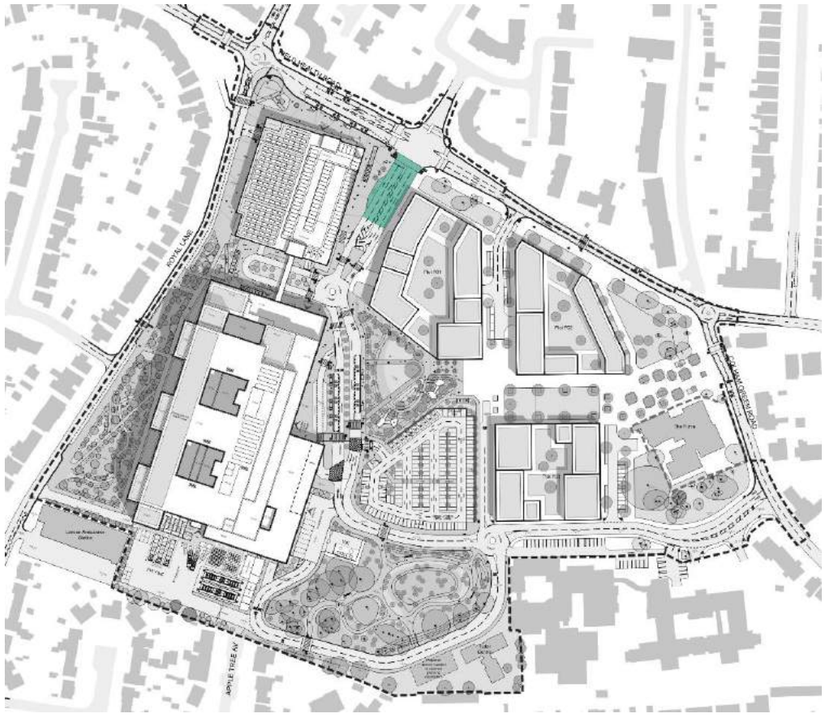
Lighting Class: M3/S1/P1

Luminaire Type:

- 6m Lighting Column
    - Column Spacing: Approx. 18 - 20m

Lighting Design (calculated):

- $E_{ave.}$ = 20 lx. @ Floor Level;
- U_o = 0.52
- Optics: Asymmetrical and Forward throw distribution
- Lamp Type: 52W LED, 3000K
- ULOR: 0%
- CRI: > 80
- GR < 50
- Control: Dimmable



Key Plan

3.4.2 Royal Lane Access Road to MSCP Entrance

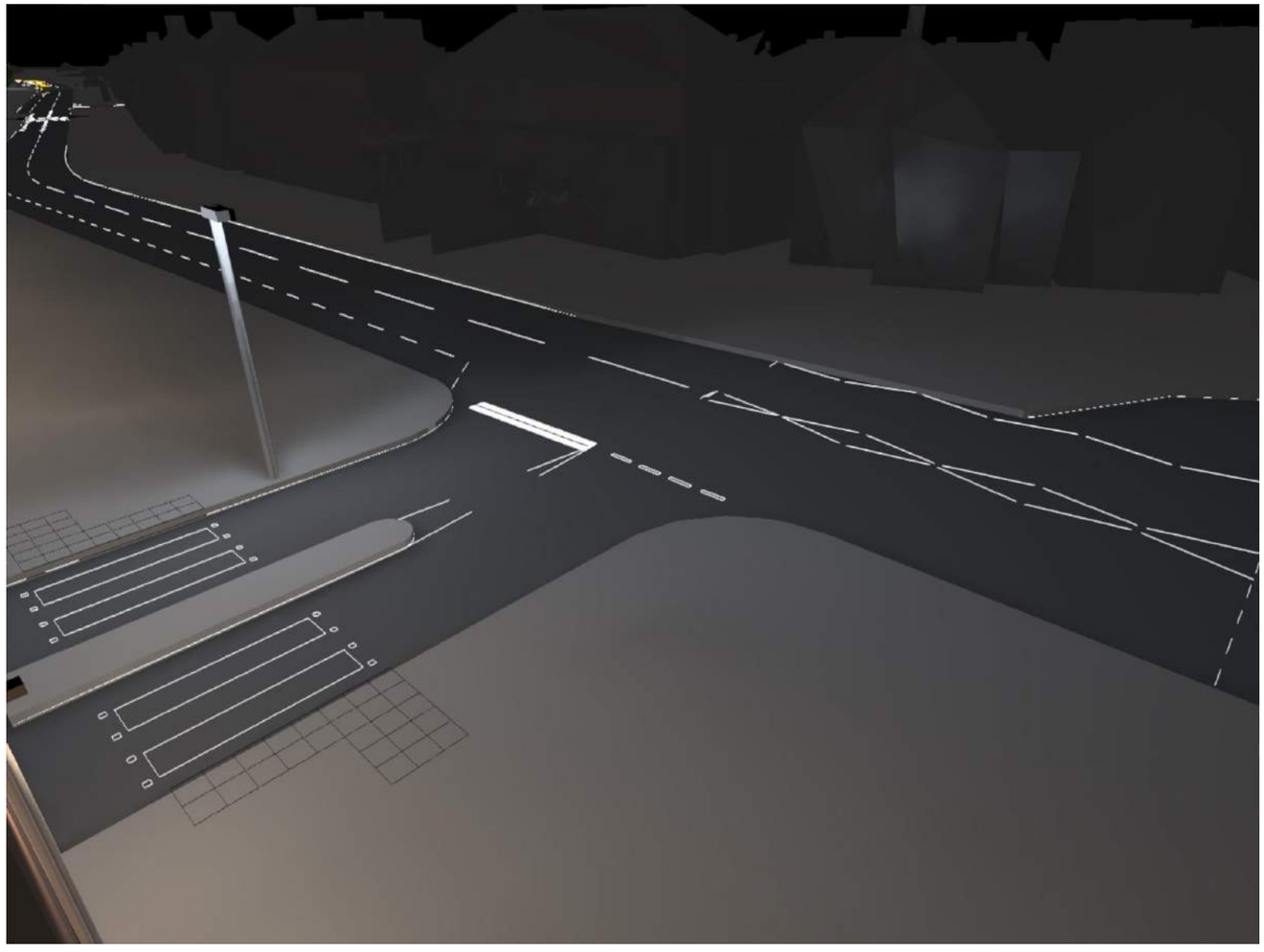
Lighting Class: M3/S1/P1

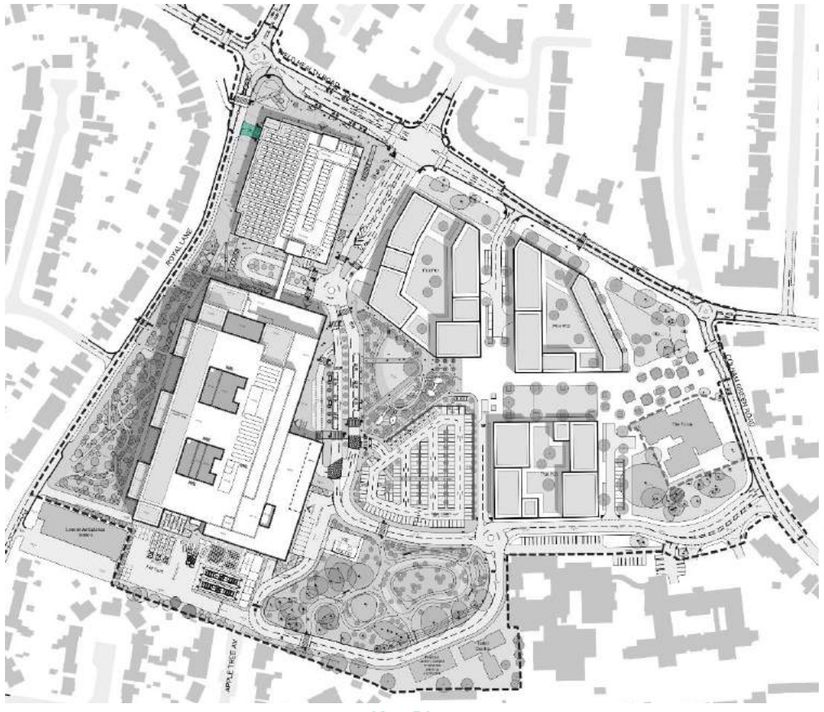
Luminaire Type:

- 6m Lighting Column

Lighting Design (calculated):

- Eave. = 15 lx. @ Floor Level;
- Uo = 0.54
- Optics: Asymmetrical and Forward throw distribution
- Lamp Type: 52W LED, 3000K
- ULOR: 0%
- CRI: > 80
- GR < 50
- Control: Dimmable





Key Plan

3.4.3 Pield Health Access Road to MSCP Entrance Junction

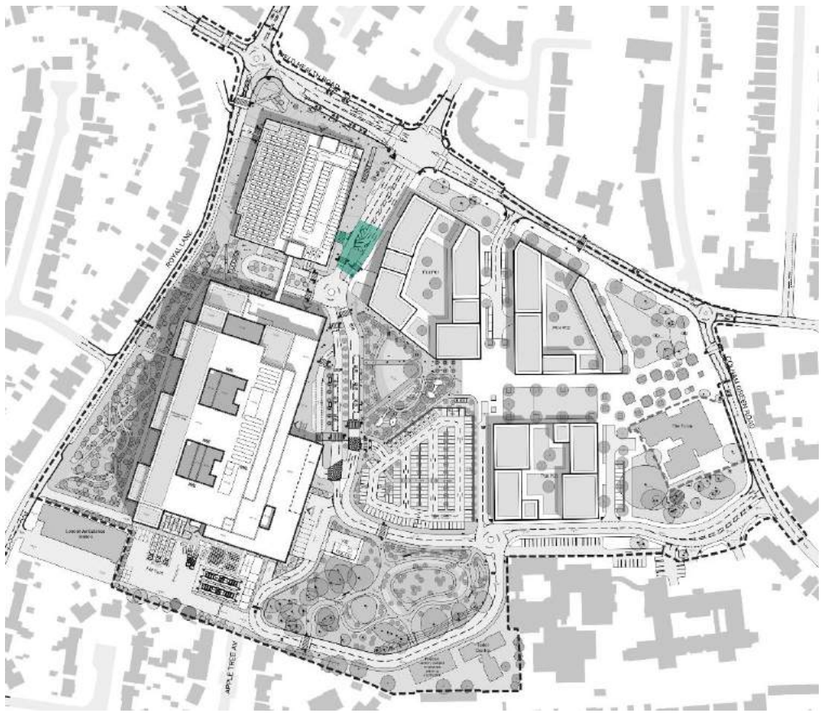
Lighting Class: M3/S1/P1

Luminaire Type: 6m Lighting Column

- 6m Lighting Column
    - Column Spacing: Approx. 12 - 18m

Lighting Design (calculated):

- Eave. = 23 lx. @ Floor Level;
- Uo = 0.54
- Optics: Asymmetrical and Forward throw distribution
- Lamp Type: 52W LED, 3000K
- ULOR: 0%
- CRI: > 80
- GR < 50
- Control: Dimmable



Key Plan

3.4.4 Pield Health Access Road Roundabout

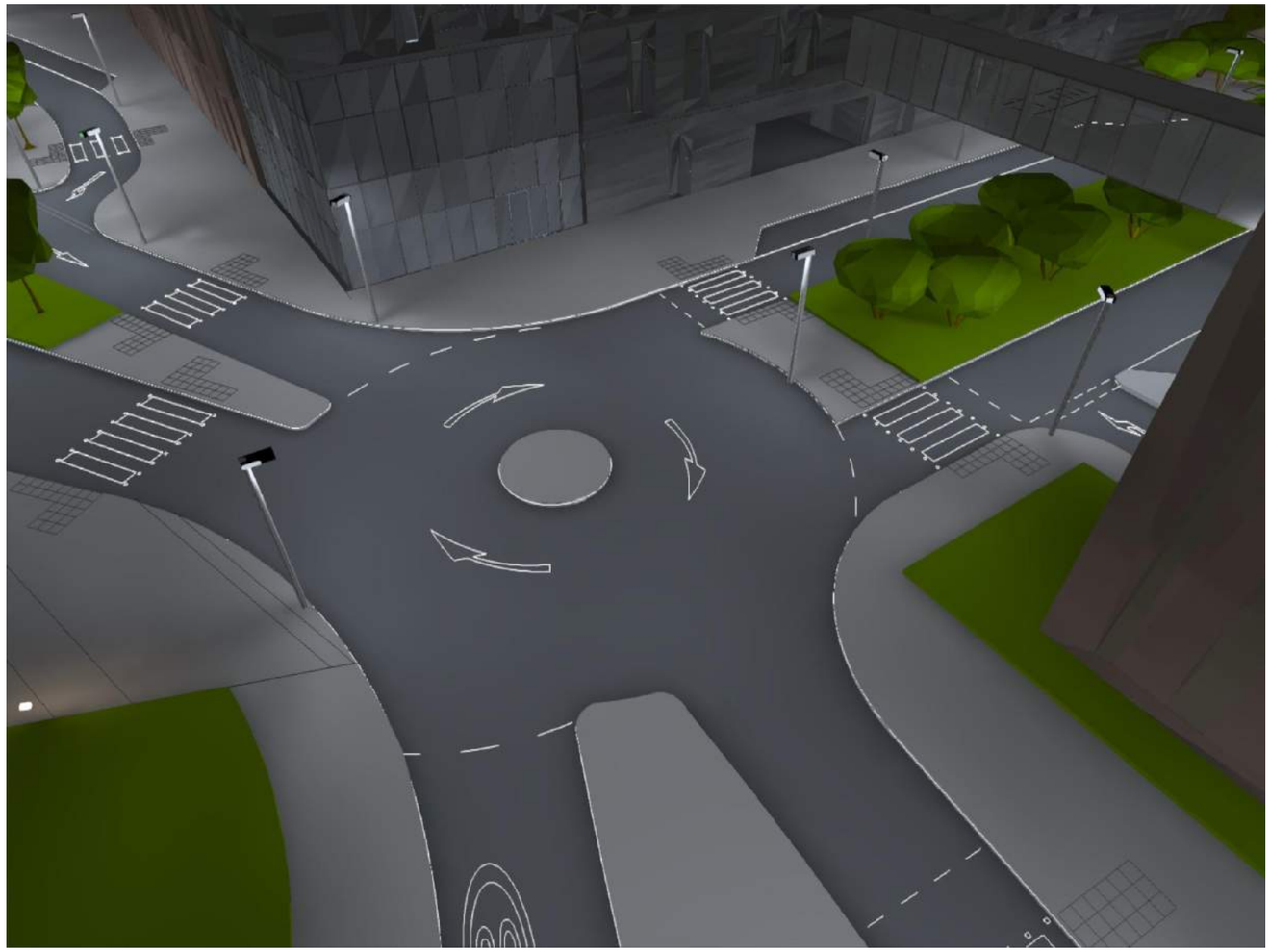
Lighting Class: M3/S1/P1

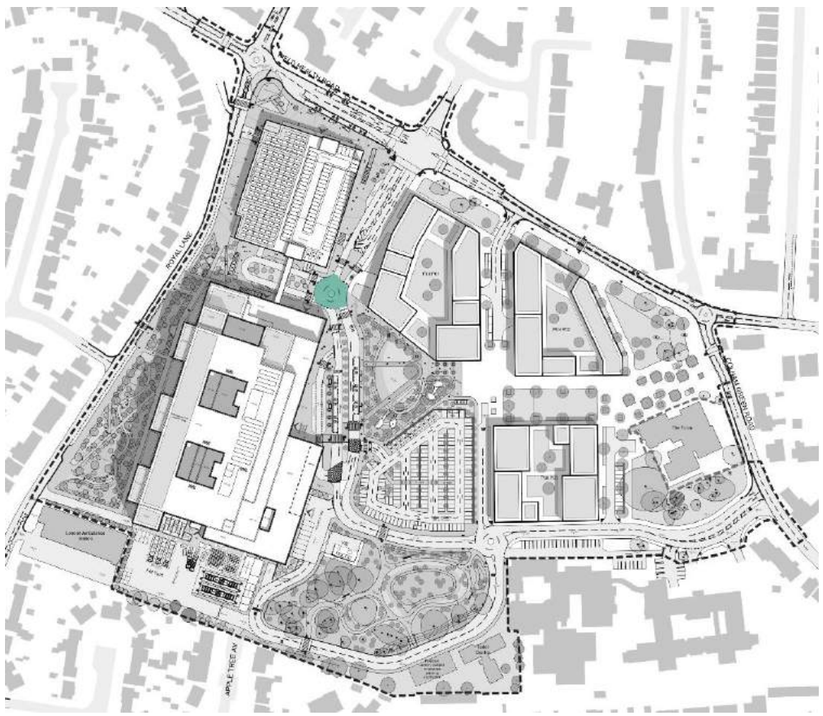
Luminaire Type:

- 6m Lighting Column
    - Column Spacing: Perimeter of Roundabout

Lighting Design (calculated):

- $E_{ave.}$ = 22 lx. @ Floor Level;
- Uo = 0.57
- Optics: Asymmetrical and Forward throw distribution
- Lamp Type: 52W LED, 3000K
- ULOR: 0%
- CRI: > 80
- GR < 50
- Control: Dimmable





Key Plan

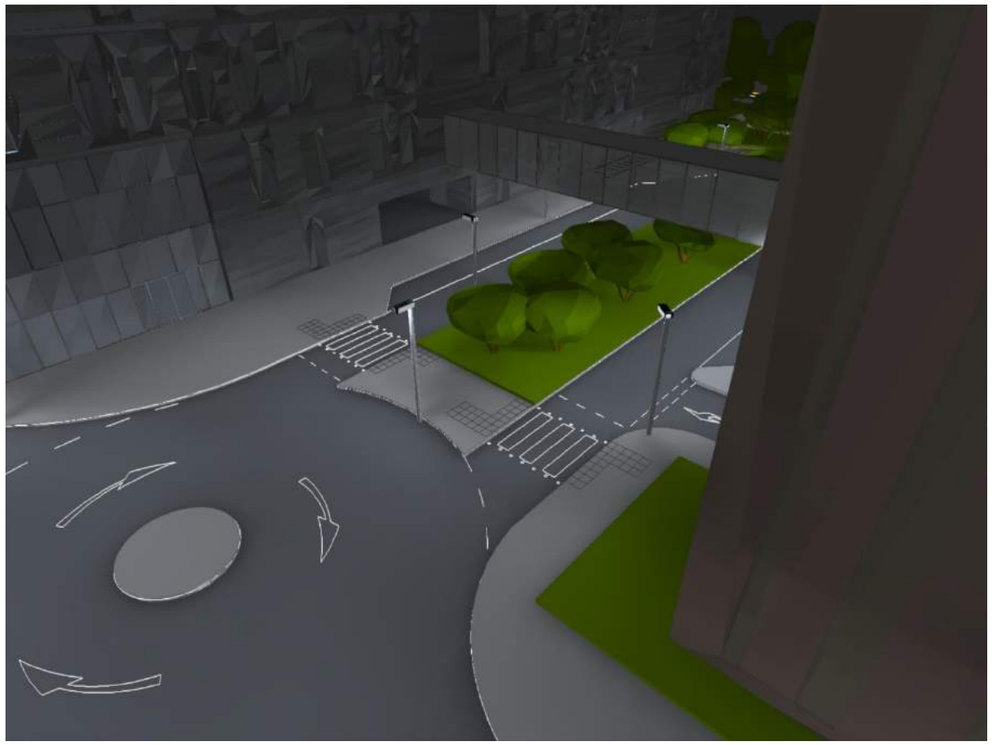
3.4.5 Patient Transfer Drop-off Areas

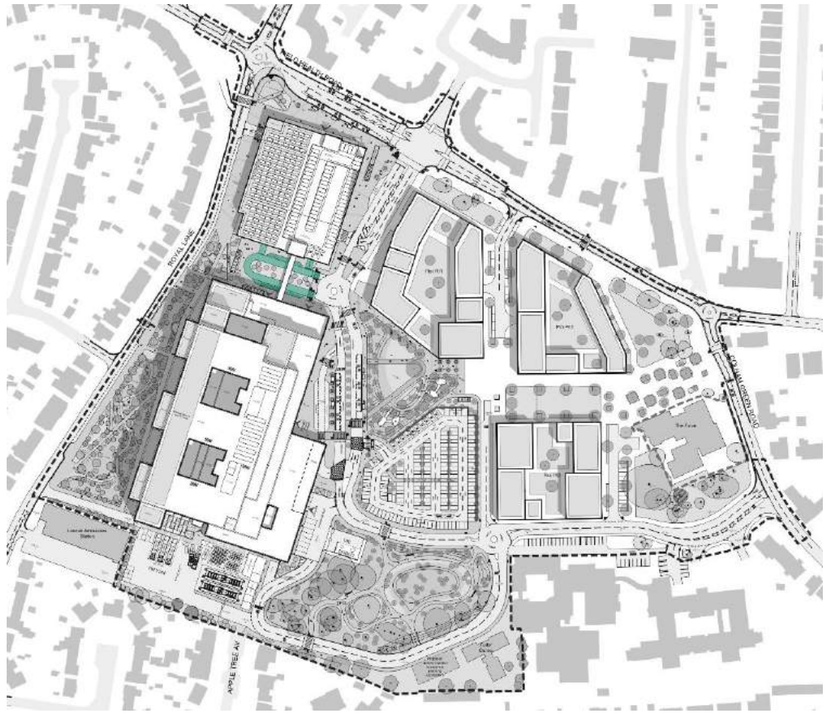
Luminaire Type:

- 6m Lighting Column
    - Column Spacing: Approx. 15m

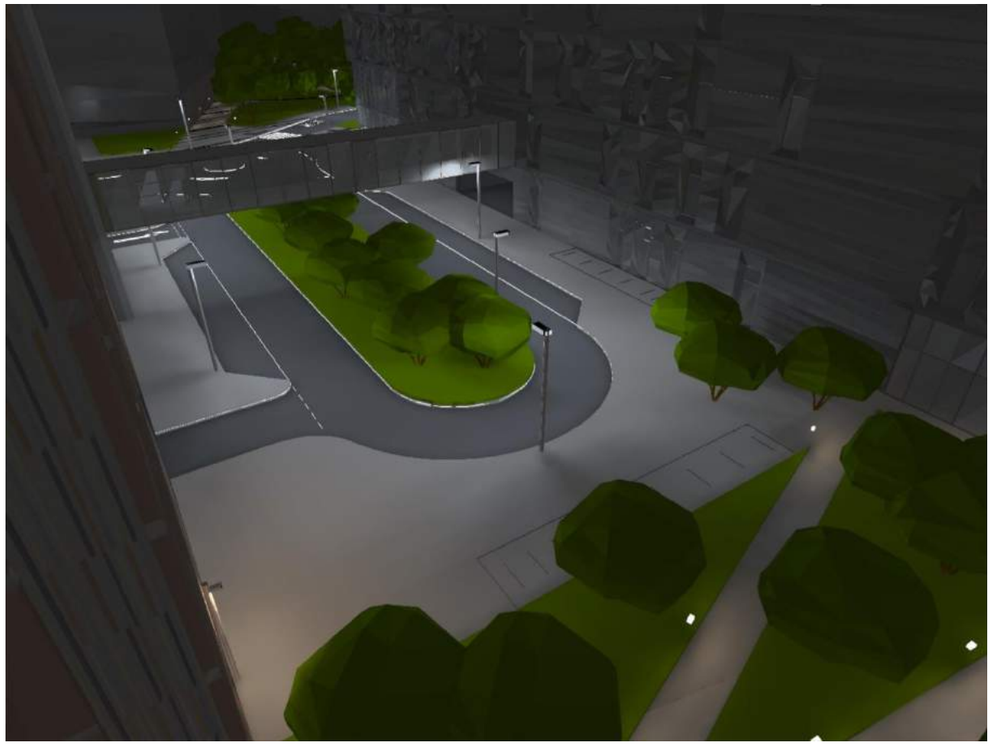
Lighting Design (calculated):

- $E_{ave.}$ = 25 lx. @ Floor Level;
- Uo = 0.50
- Optics: Asymmetrical and Forward throw distribution
- Lamp Type: 52W LED, 3000K
- ULOR: 0%
- CRI: > 80
- GR < 50
- Control: Dimmable
- 100 lx in Main Entrance expected further to canopy design development





Key Plan



3.4.6 Emergency Walk-In Entrance Access Road

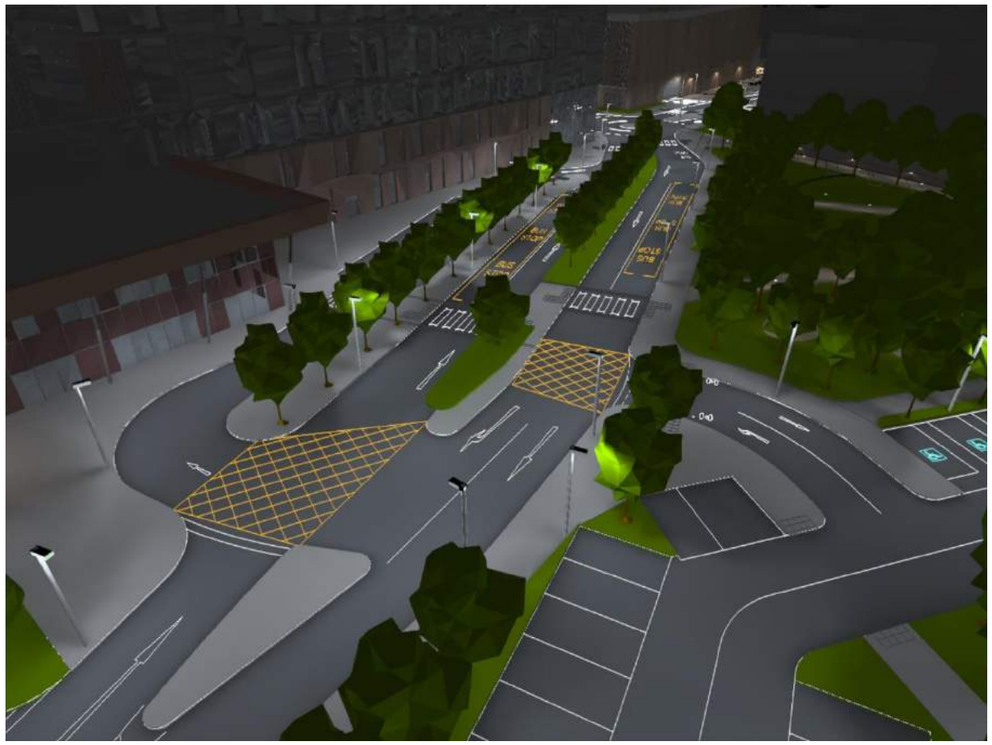
Lighting Class: M3/S1/P1

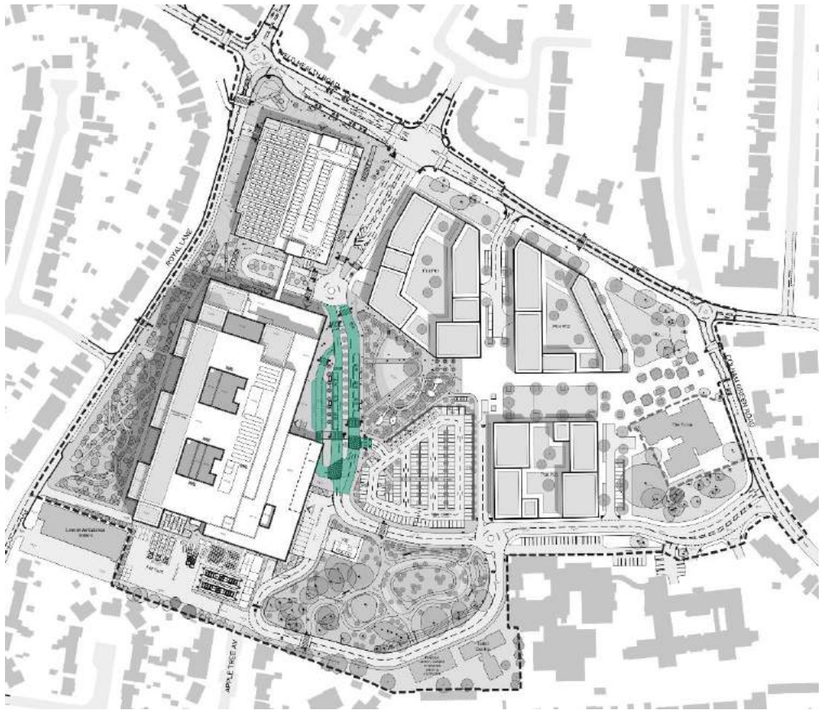
Luminaire Type:

- 6m Lighting Column
    - Column Spacing: Approx. 14 - 24m

Lighting Design (calculated):

- $E_{ave.}$ = 25 lx. @ Floor Level;
- U_o > 0.54
- Optics: Asymmetrical and Forward throw distribution
- Lamp Type: 52W LED, 3000K
- ULOR: 0%
- CRI: > 80
- GR < 50
- Control: Dimmable
- 100 lx in Emergency Entrance expected further to facade design development





Key Plan

3.4.7 Access Link Road

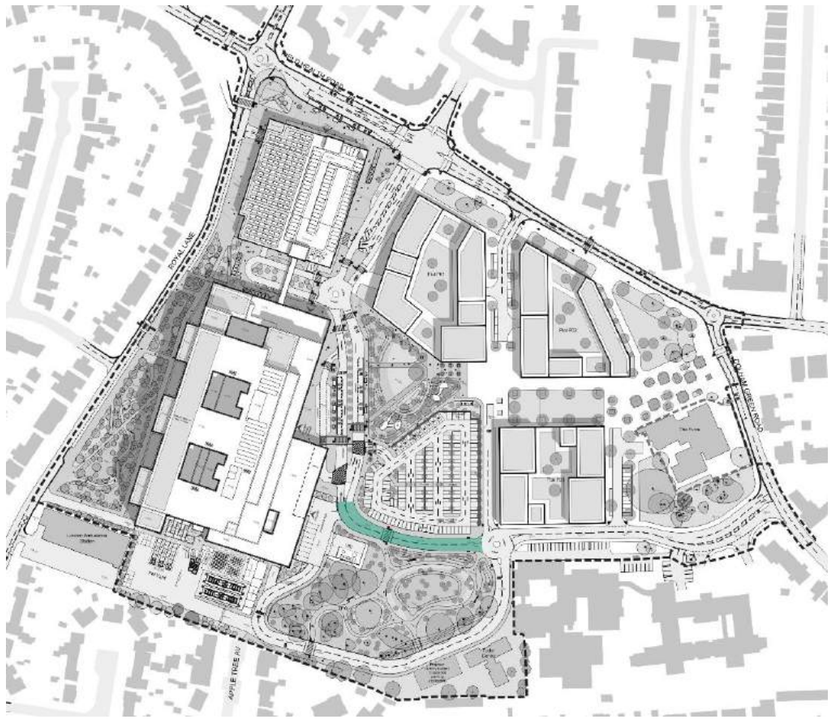
Lighting Class: M3/S1/P1

Luminaire Type:

- 6m Lighting Columns
    - Column Spacing: Approx. 20 - 24m

Lighting Design (calculated):

- $E_{ave.}$ = 16 lx. @ Floor Level
- U_o = 0.48
- Optics: Asymmetrical distribution
- Lamp Type: 52W LED, 3000K
- ULOR: 0%
- CRI: > 80
- GR < 50
- Control: Dimmable



Key Plan

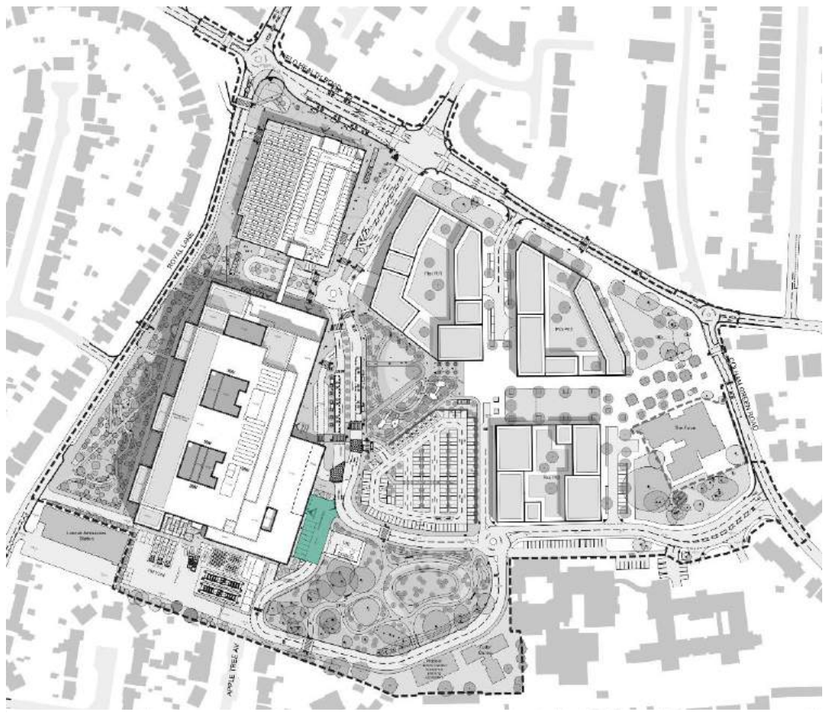
3.4.8 Ambulance Yard

Luminaire Type:

- 6m Lighting Column
    - Column Spacing: Perimeter of Ambulance Yard
- 4m Building mounted bulkheads around Ambulance entrance
    - Bulkhead Spacing: Approx. 16m

Lighting Design (calculated):

- $E_{ave.}$ = 21 lx. @ Floor Level;
- 50 lx in task area expected further to Ambulance Yard canopy design development
- Uo = 0.55
- Optics: Asymmetrical and Forward throw distribution
- Lamp Type: 52W LED, 3000K
- ULOR: 0%
- CRI: > 80
- GR < 50
- Control: Dimmable



Key Plan

3.4.9 Plant Service and Blue Light Road

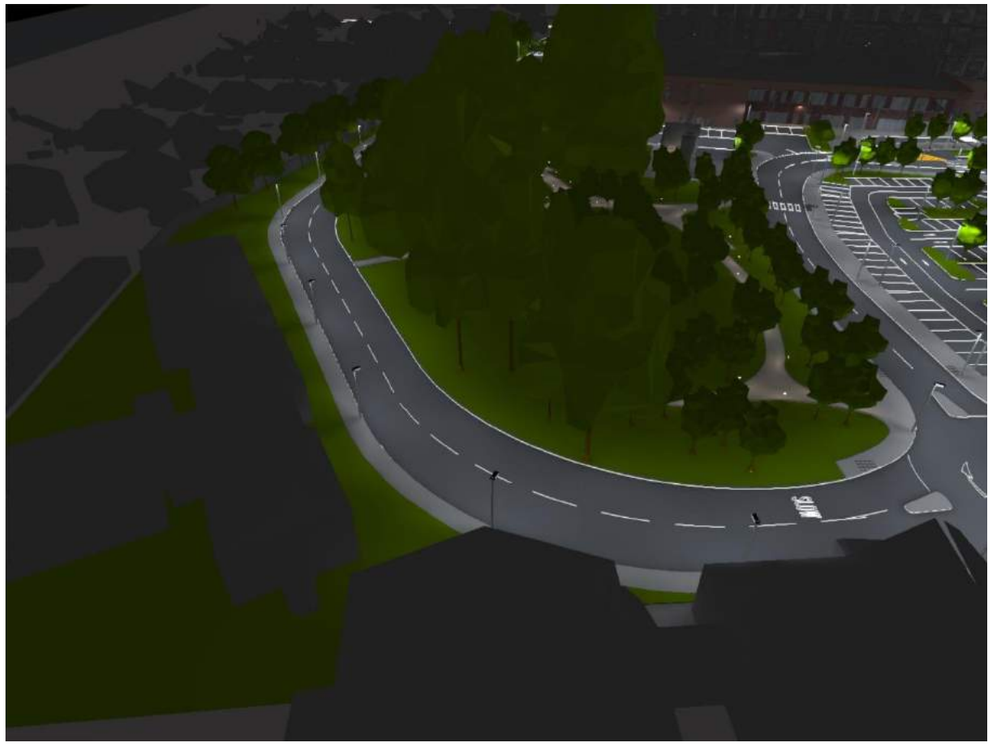
Luminaire Types:

- 6m Lighting Column
    - Column Spacing: Approx. 18m

Lighting Design (calculated):

- $E_{ave.}$ = 17.9 lx. @ Floor Level;
- Uo = 0.58
- Optics: Asymmetrical distribution
- Lamp Type: 52W LED, 3000K
- ULOR: 0%
- CRI: > 80
- GR < 50
- Control: Dimmable

Key Plan



3.4.10 FM, Delivery, Waste and Plant Service Yards

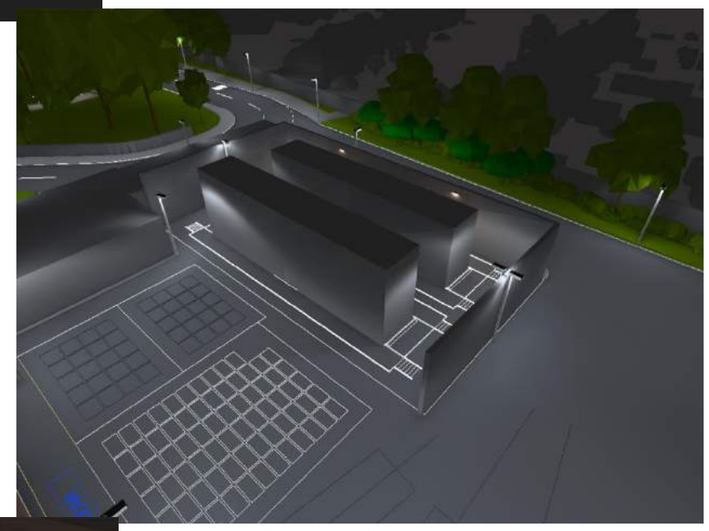
Luminaire Types:

- 6m Lighting Columns in general areas,
    - Column Spacing: Approx. 20 - 24m
- 4m Building mounted bulkheads around FM entrance, Generator Compound and VIE Tank Enclosure,
    - Column Spacing: Approx. 12m

Lighting Design (calculated):

- $E_{ave.}$ = 16 lx. @ Floor Level (General area)
- 50 lx in task areas expected further to FM Yard canopy design and enclosure developments
- U_o = 0.41
- Optics: Asymmetrical and Forward throw distribution
- Lamp Type: 52W LED, 3000K
- ULOR: 0%
- CRI: > 80
- GR < 50
- Control: Dimmable

FM Yard



Generator Compound

Key Plan

VIE Tanks

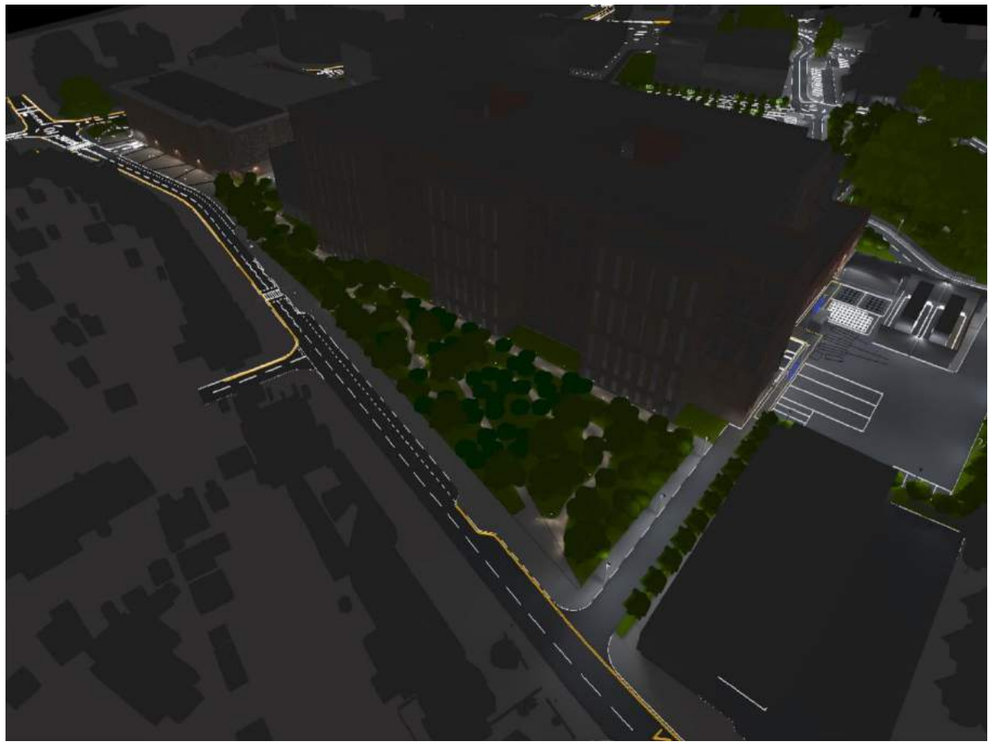
3.4.11 Royal Lane Public Open Space

Luminaire Type:

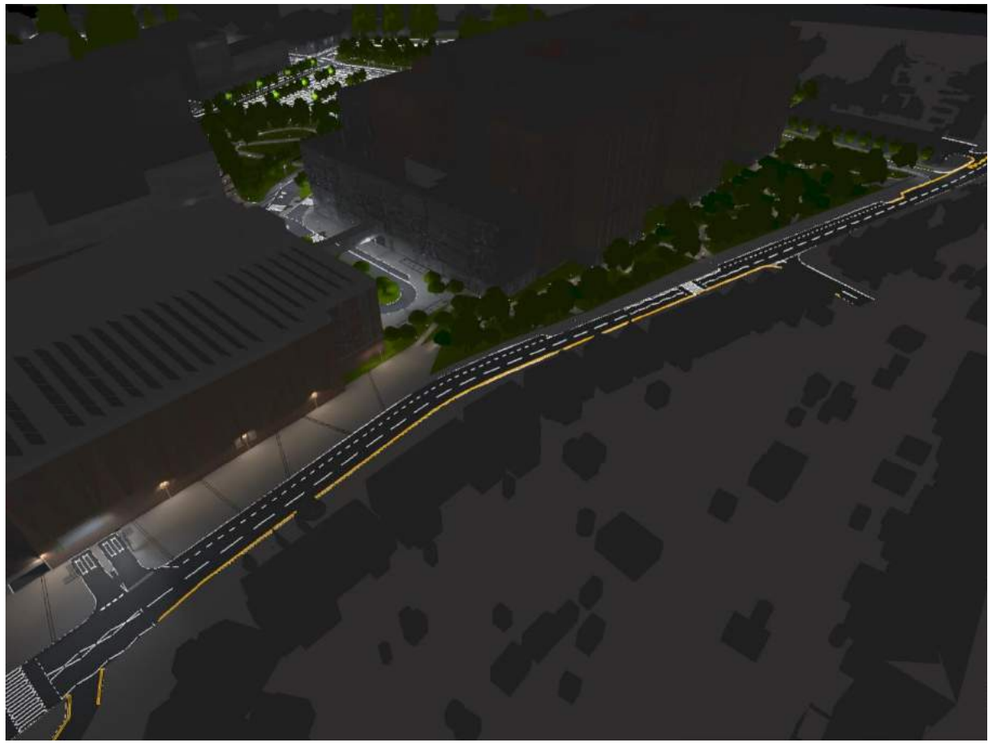
- 1m Lighting Bollards in Public Open Space and providing reduced height light distribution and spill in consideration of Biodiversity.
    - Bollard Spacing: Approx. 8m
- 4m Lighting Column around MSCP Perimeter

Lighting Design (calculated):

- $E_{ave.}$ = 5 lx. @ Floor Level
- Uo > 0.25
- Optics: Asymmetric and Long & Narrow Distribution
- Lamp Type: 6W/15W LED, 3000K
- ULOR: 0%
- CRI: > 80
- GR < 50
- Control: Dimmable



Key Plan



3.4.12 Colham Green Road Access Road Roundabout

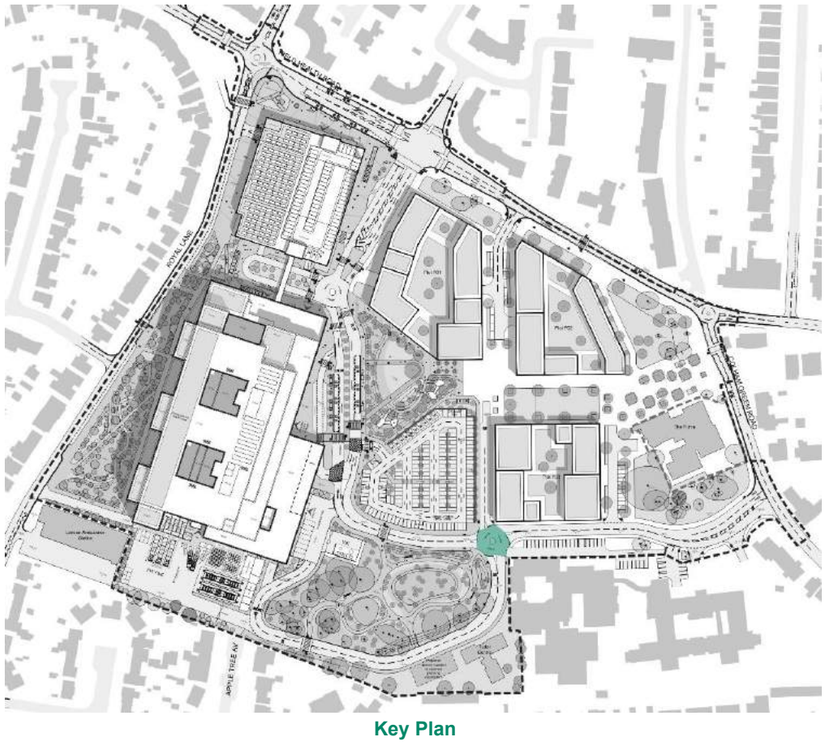
Lighting Class: M3/S1/P1

Luminaire Type:

- 6m Lighting Column
    - Column Spacing: Perimeter of Roundabout

Lighting Design (calculated):

- $E_{ave.}$ = 21.6 lx. @ Floor Level
- U_o = 0.58
- Lighting Column Optics: Asymmetrical distribution
- Lighting Column Lamp Type: 15W LED, 3000K
- ULOR: 0%
- CRI: > 80
- GR < 50
- Control: Dimmable



Key Plan

3.4.13 Colham Green Road Access Road

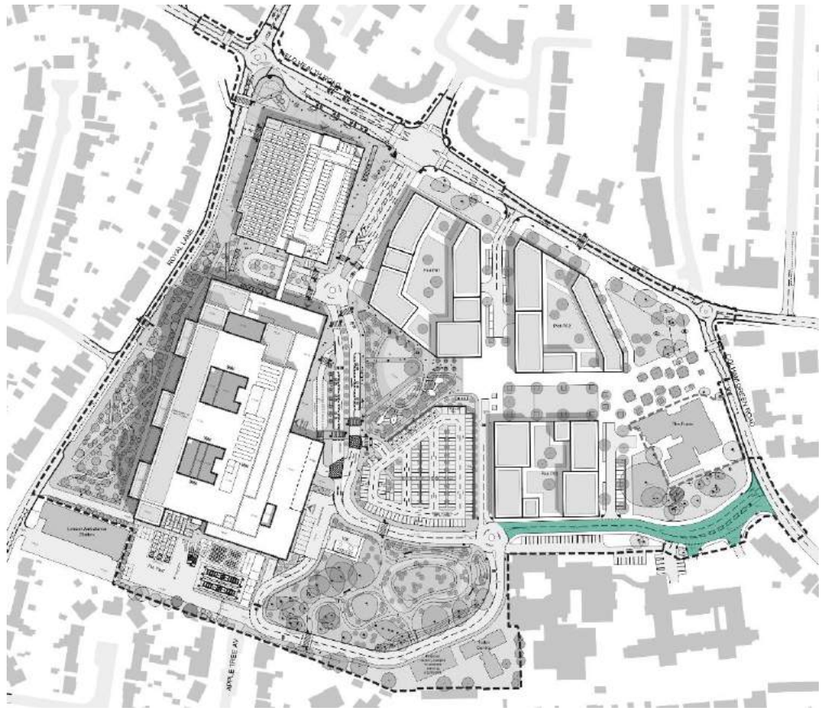
Lighting Class: M3/S1/P1

Luminaire Type:

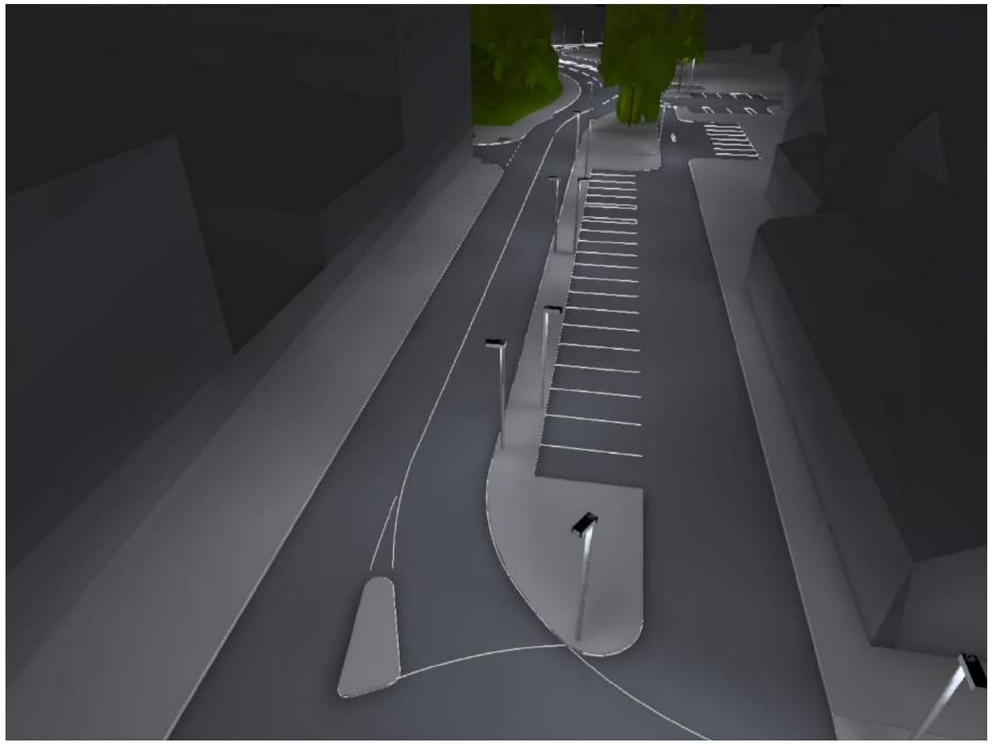
- 6m Lighting Column
    - Column Spacing: Approx. 14 – 24m

Lighting Design (calculated):

- $E_{ave.}$ = 19.4 lx. @ Floor Level
- U_o = 0.39.
- Lighting Column Optics: Asymmetrical distribution
- Lighting Column Lamp Type: 52W LED, 3000K
- ULOR: 0%
- CRI: > 80
- GR < 50
- Control: Dimmable



Key Plan



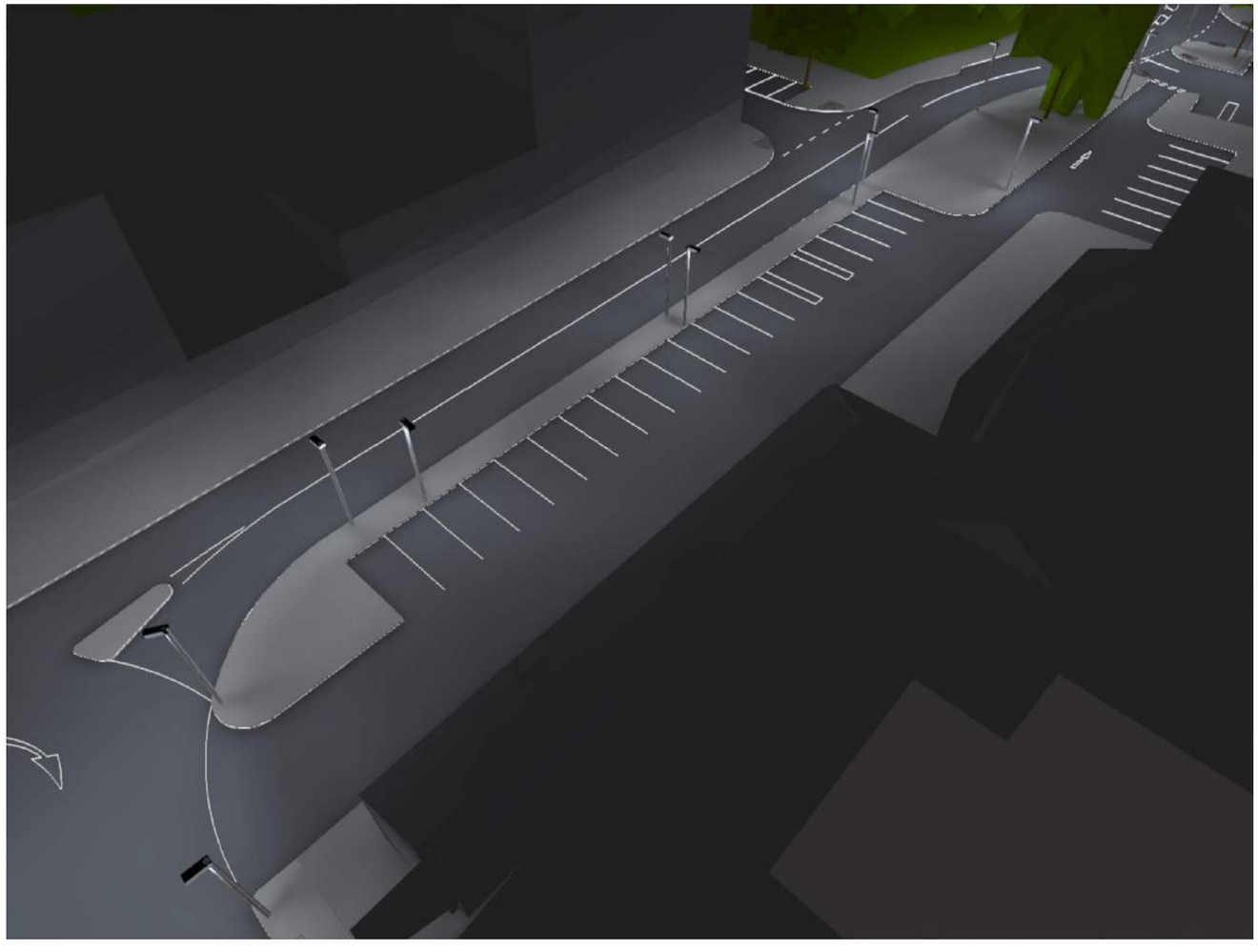
3.4.14 Colham Green Road Access Surface Car Park

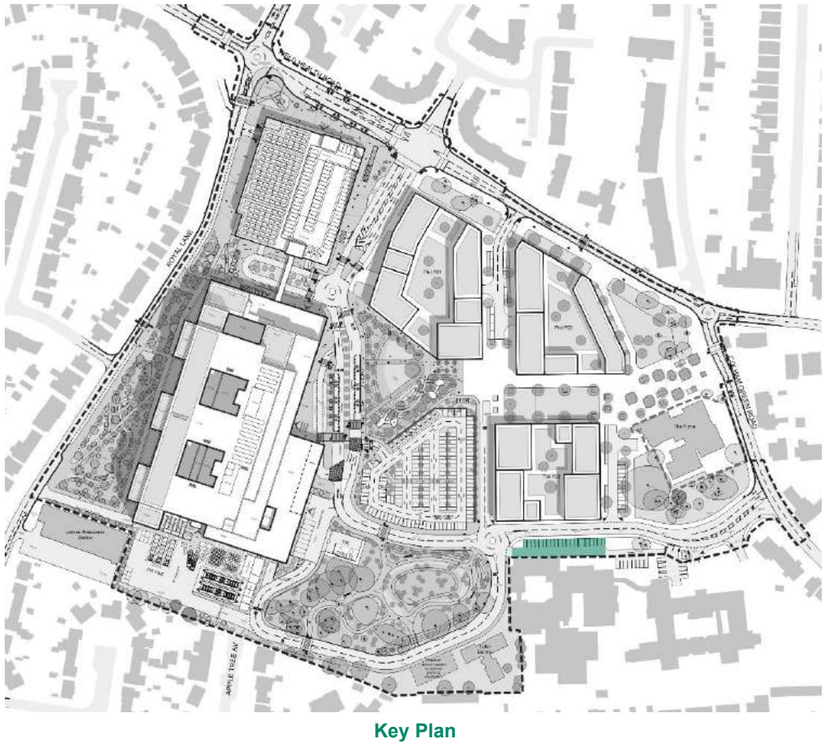
Luminaire Type:

- 6m Lighting Column
    - Column Spacing: Approx. 20m

Lighting Design (calculated):

- $E_{ave.}$ = 20.4 lx. @ Floor Level
- U_o = 0.64.
- Lighting Column Optics: Asymmetrical distribution
- Lighting Column Lamp Type: 52W LED, 3000K
- ULOR: 0%
- CRI: > 80
- GR < 50
- Control: Dimmable





Key Plan

3.4.15 Cycle Path to Apple Tree Avenue

Luminaire Type:

- 6m Lighting Column
    - Column Spacing: Approx. 18m

Lighting Design (calculated):

- $E_{ave.}$ = 12.7 lx. @ Floor Level
- U_o = 0.40.
- Lighting Column Optics: Asymmetrical distribution
- Lighting Column Lamp Type: 52W LED, 3000K
- ULOR: 0%
- CRI: > 80
- GR < 50
- Control: Dimmable

Key Plan

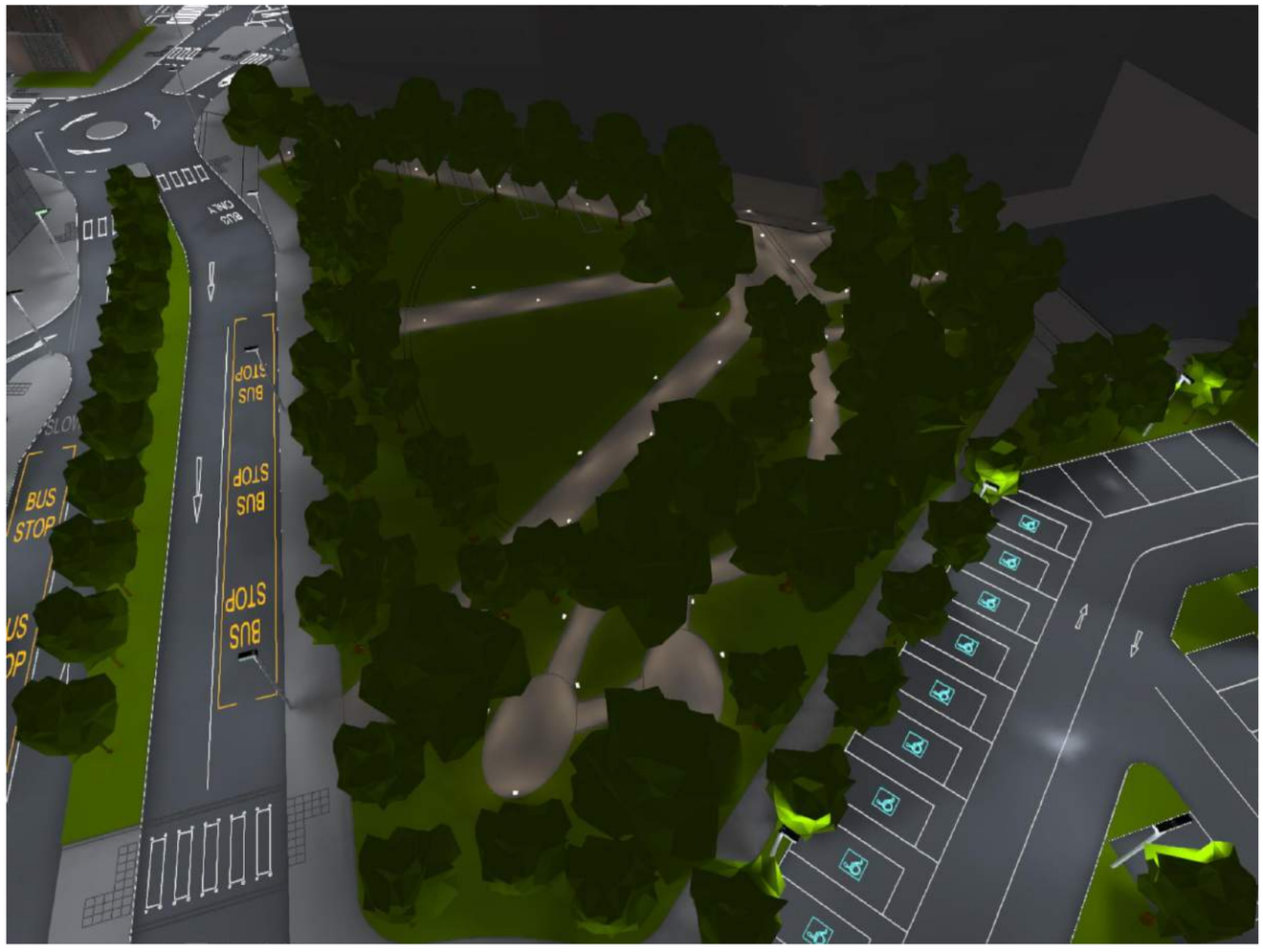
3.4.16 Central Public Open Space

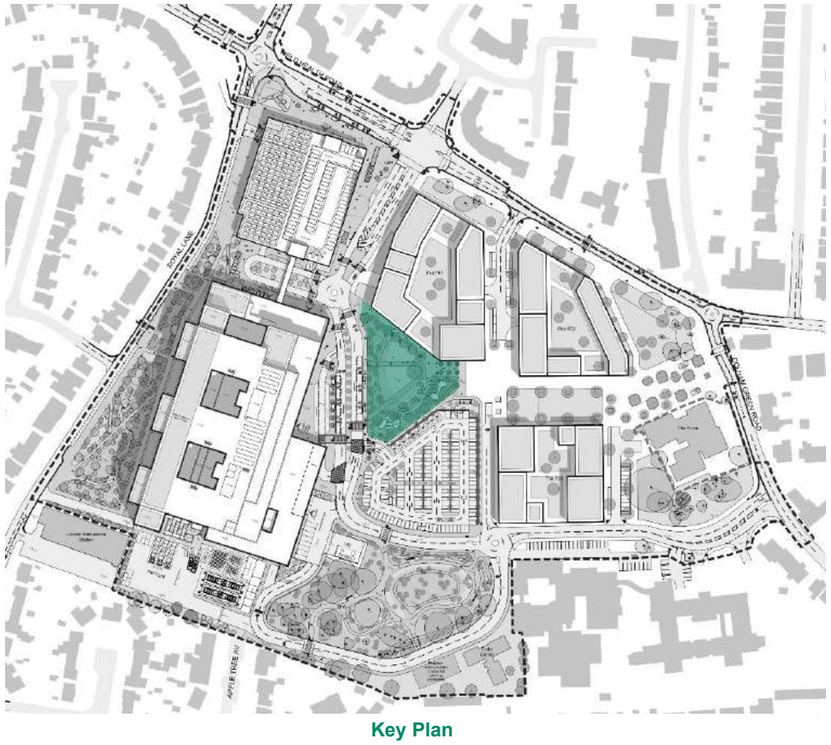
Luminaire Type:

- 1m Lighting Bollards in Public Open Space and providing reduced height light distribution and spill in consideration of Biodiversity.
    - Bollard Spacing: Approx. 8m

Lighting Design (calculated):

- $E_{ave.}$ = 5 lx. @ Floor Level
- Uo > 0.27
- Optics: Long & Narrow Distribution
- Lamp Type: 6W LED, 3000K
- ULOR: 0%
- CRI: > 80
- GR < 50
- Control: Dimmable





Key Plan

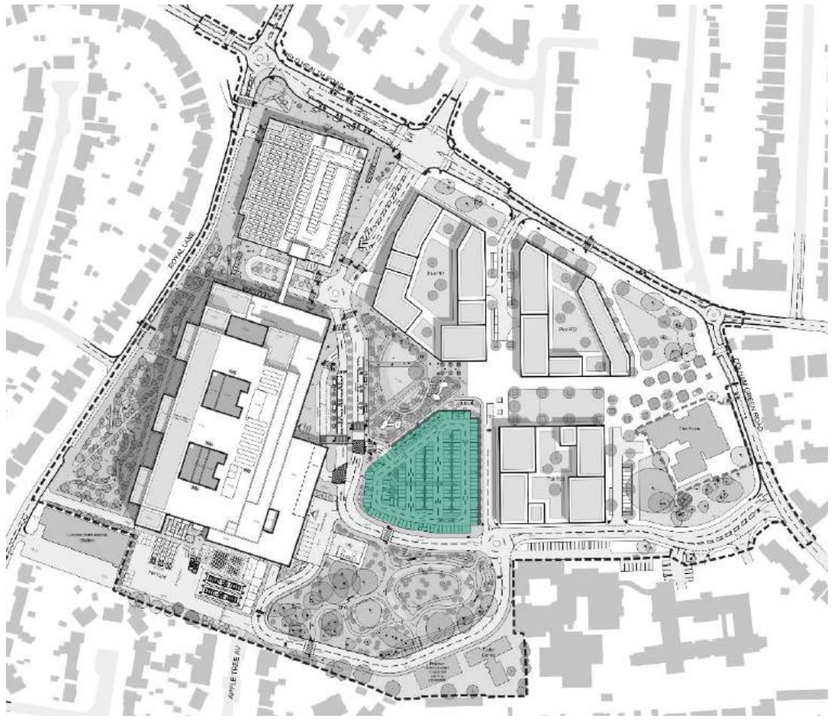
3.4.17 Surface Car Park

Luminaire Type:

- 6m Lighting Column
    - Column Spacing: Approx. 18m

Lighting Design (calculated):

- $E_{ave.}$ = 20 lx. @ Floor Level
- U_o > 0.62.
- Lighting Column Optics: Asymmetrical distribution
- Lighting Column Lamp Type: 52W LED, 3000K
- ULOR: 0%
- CRI: > 80
- GR < 50
- Control: Dimmable



Key Plan

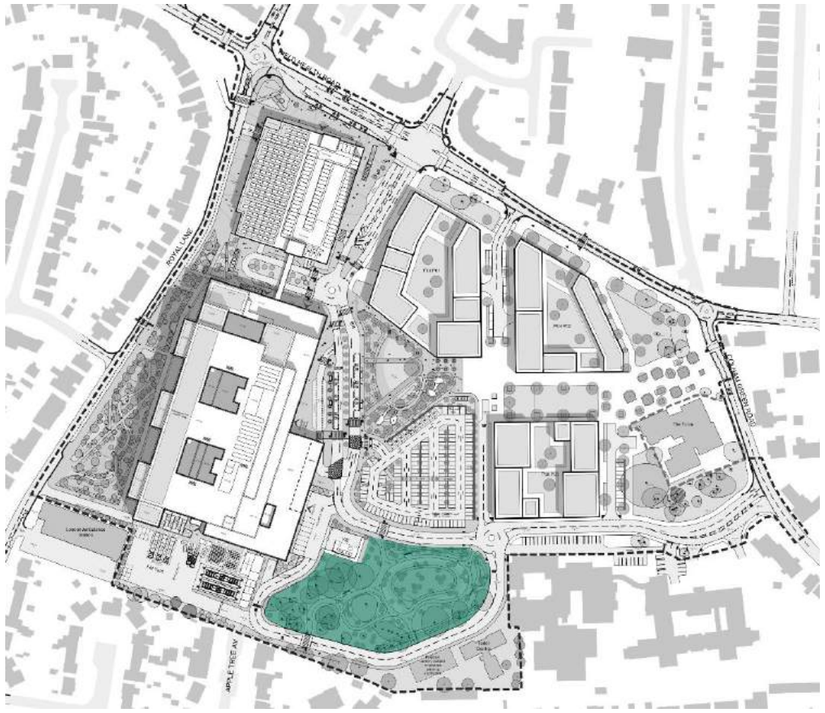
3.4.18 Woodlands Public Open Space

Luminaire Type:

- 1m Lighting Bollards in Public Open Space and providing reduced height light distribution and spill in consideration of Biodiversity.
    - Bollard Spacing: Approx. 8m

Lighting Design (calculated):

- $E_{ave.}$ = 5 lx. @ Floor Level
- Uo > 0.27
- Optics: Long & Narrow Distribution
- Lamp Type: 6W LED, 3000K
- ULOR: 0%
- CRI: > 80
- GR < 50
- Control: Dimmable



Key Plan

3.5 Lighting Control

3.5.1 Overview

The lighting control strategy for the new development will be further discussed and agreed with the client. Effective lighting control will help reducing energy wastage however this must not compromise the overall lighting performance required for the tasks to be carried out in that area.

All external luminaires will be integrated with DALI enabled control gear in order to maximise the flexibility of monitoring and control.

The following sections discuss different aspects of lighting control and best practice design approaches for the new development.

3.5.2 Local Manual Control vs. Automatic Control

Local manual switching is the most direct method of controlling the lighting in the area. However, this presents an opportunity for the lighting to be accidentally left on for undesired long period of time. This can be overcome by introducing automatic control to the lighting. Suitability of the control method for each area will need to be carefully considered and agreed with the client and end users.

In general, all external lighting will be provided with automatic control - as discussed in the below sections i.e. time clock, daylight and night time dimming. However, in certain areas such as FM yard, a manual override switch may be beneficial for the user to increase the lighting to a suitable higher level that manual handling task is required.

3.5.3 Time clock Control

Time clock control is an effective way of reducing the energy consumption during the hours that a certain lighting level is not required to be maintained. The time clock control via lighting contactors to enable lighting to be switched on/off/dimmed at pre-set period of time for different areas.

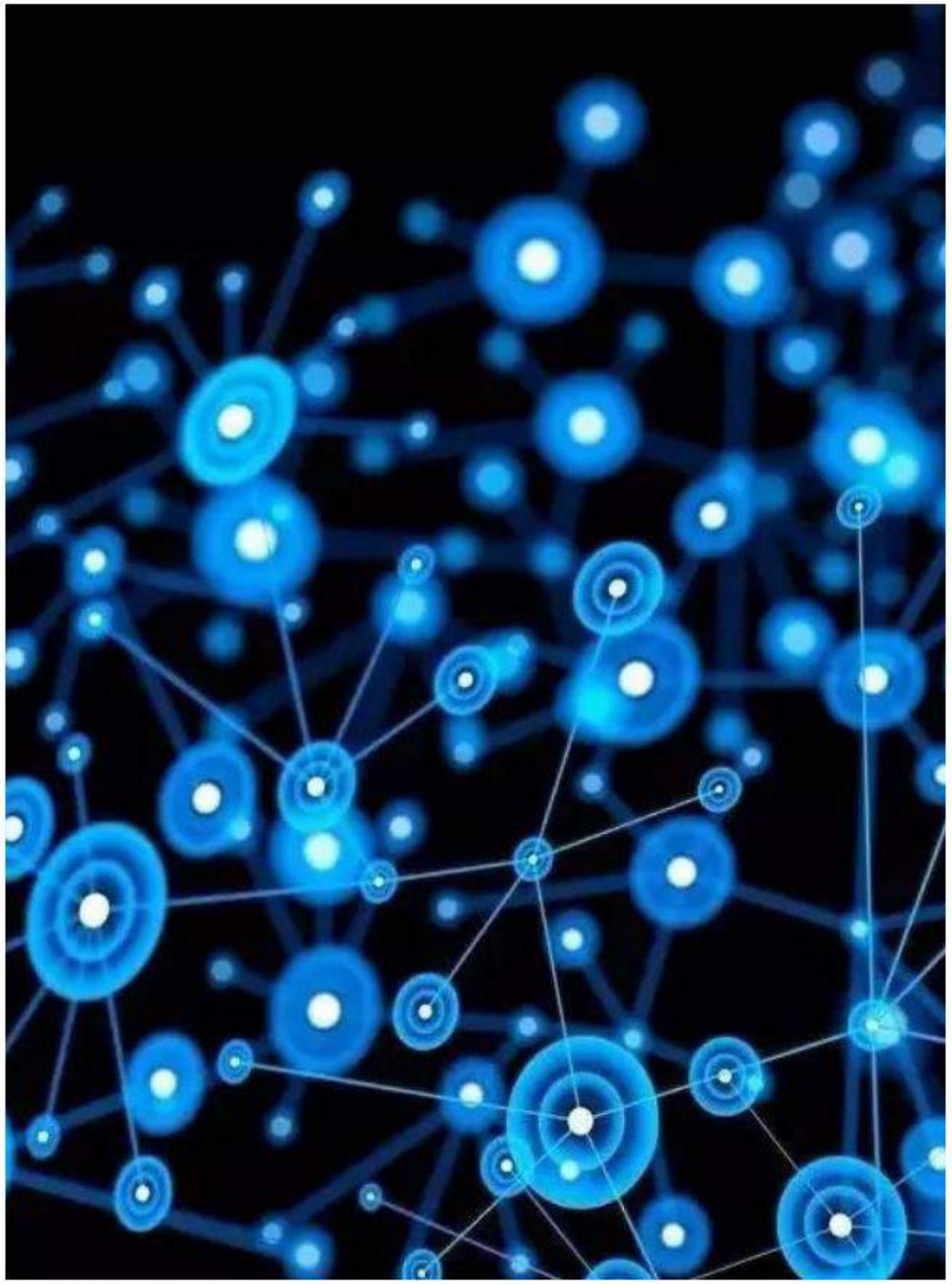
This method of control will not apply to certain areas that need to be lit and maintain the same illumination level 24/7. i.e., Emergency and Main entrances.

3.5.4 Daylight Dimming

To maximise the use of natural light, daylight sensors will be utilised to dim down or switch off the luminaires across the development when sufficient daylight is presented. This can be achieved via either sensor integral to the individual luminaire or sensor fitted separately to control a group of luminaires that are on the same control circuit.

3.5.5 Night Time Dimming

In areas that are not operating 24/7, however a certain lighting level is beneficial for security reasons and safe movement of hospital users, it is recommended that lighting in those areas are to be dimmed down during the night hours. The exact hours night time dimming and the light level to be maintained during these hours are to be further discussed with the client and hospital users.



Appendix A – External Lighting Strategy Layout

Reference	Description	Example Image
1	1m Lighting Bollards (Long & Narrow Distribution)	
2	4m Lighting Columns (Asymmetric Distribution)	
3	6m Lighting Columns (Forward Throw Distribution)	
4	6m Lighting Columns (Asymmetric Distribution)	
5	Wall-mounted Bulkhead	
6	1m Lighting Bollards (Asymmetric Distribution)	
	Other Land in Applicant's Ownership	
	Application Boundary	

Appendix B – Isolux Line Plot

Colour	Lux Level (Ground Level)
	1.0
	3.0
	5.0
	7.0
	10.0
	15.0
	20.0
	30.0
	40.0
	50.0

Reference	Description
	Other Land in Applicant's Ownership
	Application Boundary