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MEP & Public Lighting Report

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1 Introduction

This document details the key MEP features for the engineering services for the proposed new data centre campus in Profile Park, near Dublin, Ireland.

The information presented in this document is provided with a view to obtaining permission from the relevant authorities to proceed with the project.

Detailed in this document are the following:

- Electrical services overview
- Mechanical services overview
- Public health services overview

1.1 Description of the Site

The planning application proposes two data centres, energy generation and all other associate works on a site of 6.181ha at Profile Park, Nangor Road, Clondalkin, Dublin 22.

The application proposes two data centres, one to the south west of the site and the other to the south east of the site.

The first, known as DUB15, is located to the south west of the site. This data centre comprises a total Gross Floor Area of 16,865m2 over two floors. The building is rectangular in shape with the main body of the building comprising data halls, with ancillary office and welfare space to the north over two floors. Proposed at ground floor is 7,340m^2 of data hall space with 940m^2 ancillary space to the north. At first floor there will be 7,333m^2 data hall space with 1,049m^2 ancillary space to the north. Roof level will comprise three small elements of staircore totalling 74m^2 with ancillary space measuring 131m^2 to the north.

The data halls within DUB 15 comprise a large data hall area with smaller technical rooms to the west. The ancillary space comprises various uses such as a loading bay, conference room, welfare, security and technical room at ground floor with office, switchrooms, welfare and breakout space at first floor. Staircores, ancillary roof and roof mounted mechanical plant are proposed at roof level.

A single storey screened generator compound is proposed to the south and west of DUB 15.

DUB15 comprises two storeys with ancillary plant at roof level. The proposed building reaches a height of 20m. The parapet level will be at 96.7mOD.

The northern elevation comprises the building entrance and the ancillary floorspace is also located towards this side of the building. The proposed elevation will comprise powder coated vertical profiled metal cladding. The cladding proposed will comprise a mix of colours including medium grey, Pearl, Moonstone, Pigeon Blue and Dark Grey. The north elevation will also comprise curtain wall glazing to provide light to the ancillary floor space. High level signage is proposed.

The southern elevation comprises predominantly powder coated medium grey metal cladding. A number of doors are proposed for service/escape and polished steel generator flues extend from the generator compound.

The eastern elevation also comprises predominantly powder coated medium grey metal cladding. Some glazed curtain walling and access doors are proposed towards the north where the ancillary space is located. Two stair cores are proposed on the eastern elevation, one to the north and one to the south. These are finished in a perforated metal screen.

The western elevation also comprises medium grey metal screening with polished steel flues extending from the generator yard. Louvres and access doors are proposed where required. Additional interest is provided through the use of varying colours towards the north of the western elevation. Signage is also proposed.

The second data centre, named DUB16, is proposed to the south east of the site. This data centre comprises a total Gross Floor Area of 16,712m^2 over two floors. The building is also rectangular in shape with the main body of the building comprising data halls, with ancillary office and welfare space to the north over three floors. At first floor there will be 7,279m^2 data hall space with 940m^2 ancillary space to the north. At first floor there will be 7,274m^2 data hall space with 1,028m^2 ancillary space to the north. The third floor will comprise two small elements of data hall at the south east and south west corners totalling 56m^2 with 133m^2 ancillary floorspace to the north.

The data halls within DUB16 comprise a large data hall area with smaller technical rooms to the south. The ancillary space comprises a range of uses such as loading bay, security, entrance lobby, conference room and welfare at ground floor with offices, switchrooms and welfare at first floor. Staircores, ancillary roof and roof mounted mechanical plant are proposed at roof level.

A single storey screened generator compound is proposed to the south of DUB 16.

DUB16 comprises two storeys with ancillary plant at roof level. The proposed building reaches a height of 20m. The parapet level will be at 97.69mOD.

The northern elevation comprises the building entrance and the ancillary floorspace is also located towards this side of the building. The proposed elevation will comprise powder coated vertical profiled metal cladding. The cladding proposed will comprise a mix of colours including medium grey, Pearl, Moonstone, Pigeon Blue and Dark Grey. The north elevation will also comprise curtain wall glazing to provide light to the ancillary floor space. High level signage is proposed.

The southern elevation comprises predominantly powder coated medium grey metal cladding. A number of polished steel flues arise from the generator yard to the south. This generator yard is screened; four doors provide access to the generator yard.

The eastern elevation also comprises predominantly powder coated medium grey metal cladding. Some glazed curtain walling and access doors are proposed towards the north where the ancillary space is located. Polished steel flues to the south of the site will be visible from the east. High level signage is proposed.

The western elevation also comprises medium grey metal screening with polished steel flues extending from the generator yard. Louvres and access doors are proposed where required. Additional interest is provided through the use of varying colours towards the north of the western elevation. Access doors and louvres are provided as required.

An energy generation compound is proposed to the north east. This will comprise five generators in their own acoustic containers, the heat recovery plant room (c.35m^2), the

distribution gas compound building (c.28m^2), MV switchgear rooms (80m^2) and an electrical substation (c.623m^2) building within this compound.

The generators provide the first phase of DUB15 with power. Future phases will import power from the grid. This will allow the data centre to use renewable power when available. During times of low renewable generation or grid constraints, the site will import power from the new natural gas power station in Profile Park.

Drainage will be provided across the site as well as Sustainable Urban Drainage measures to control run-off from the site.

There is a watercourse which runs through the site having been repositioned there during works to facilitate DUB13 and 14. The application proposes to reroute this watercourse to the east of the site. The relocation of the watercourse has several ecological benefits which are set out in the accompanying documentation.

In order to ensure that the watercourse is suitably accommodated, additional work to the watercourse is proposed to the north of the site. This widening and clearing of the watercourse will have ecological and flood risk benefits.

The application proposes two significant buildings on EE zoned land. Significant planting is proposed around the site and in particular to the south to ensure the visual impact of the proposals are softened.

Access to the site will be from existing roads to the north west. New access roads are proposed throughout the site to provide access for employees, visitors, deliveries where relevant and for emergency services should they require it. 71 car parking spaces are proposed. This level of car parking will ensure that the sufficient parking will be provided for employees and there will be no overflow onto the surrounding roads. Of the 71 spaces, 4 are disabled spaces. 8 spaces will be available for the charging of electric vehicles. Covered cycle parking is provided on site, 13 Sheffield stands will provide parking for 26 bicycles.

Other ancillary buildings throughout the site will include a pump room (c.52m^2) and two refuse stores (c.25m^2). The total floor area of all ancillary structures measures circa 2,717m^2.

Security fencing and entrances are proposed around the site as required.

Due to the scale of the development, it is requested that the applicant be allowed 10 years in which to implement the permission.

1.2 Mechanical & Electrical Description

The site is designed to support up to 40MW of IT equipment, with an option to upgrade to 48MW. For the purposes of this report the calculations have therefore been based upon the maximum possible IT equipment load of 48MW.

The associated electrical and mechanical cooling equipment supporting the Data Centre are configured in "fundamental blocks" each of which support a maximum of 12MW of critical IT load. These fundamental blocks are completely independent of each other and the cooling and electrical blocks operate separately and therefore can be considered as separate discrete systems. There is a total of 2 fundamental blocks within each of the proposed Data Centre buildings.

Each Data Centre building will be a two-storey building, (ground and first floors). Each floor will be identical, comprising of 4 data halls on each floor, it is within these data halls where the IT servers will be located. Electrical switchrooms will be located internally adjacent to the data halls.

Equipment for data hall cooling will be located on the roof of the building, with standby emergency generators located in external compounds at ground level.

In order to meet the resilience requirements of the Data Centre, redundant components are incorporated into the Data Centre electrical and cooling infrastructure. As such there are redundant components built into the systems, this allows for equipment to be removed from operation for maintenance or due to failure. Under normal operation all units will be running at part load, sharing the load.

Each data hall shall have ability to support 2000kW of IT load and will be designed to allow for an increase in IT load to support a total IT load of 3000kW. Each data hall is approximately 1000sqm, this therefore equates to a data hall design load density of approximately 2.0 to 3.0kW/m^2.

The following will be accommodated in each of the main building areas:

- Data Centre Technical Areas
    - Data halls
    - Low voltage switchgear, UPS and battery rooms
    - Water services plant room
    - Fire suppression tank and valve rooms
    - Storage and waste areas
    - POP and IDF rooms
- External Ground Level
    - Containerised MV generators (with belly fuel tanks)
    - Containerised MV switchgear
- Office and Logistics Area
    - Security and entrance facilities
    - Loading bay and debox area
    - Toilets and showers
    - Office areas
- Roof
    - Air handling units providing fresh air to the offices and other Power Base Build (PBB) spaces.
    - Air handling units providing make-up air the data halls

- Air handling units providing make-up air to electrical plantrooms (UPS rooms and battery rooms)
- Medium voltage switchrooms
- MV/LV transformers
- Refrigerant condenser systems (direct expansion and variable refrigerant volume) supporting space heating and cooling units, and the air handling units.

Data hall cooling equipment will be located on the Data Centre roof, air conditioning equipment will reject heat and provide coolth to the datahall computer room air conditioners.

Each building will have its own standalone back-up generator system from the containerised generators located adjacent to each building. In total there will be a maximum of 32no generators across the site if the full upgrade potential is deployed. These shall provide power to the site in the event of a grid outage or the incoming Energy Centre MV supply is unavailable.

The air conditioning equipment used for the facility will be highly efficient at both full load and part load conditions. When external temperatures suit, the units will operate in free cooling mode without the compressors, improving efficiency further.

The mechanical and electrical systems shall be designed such that there are no single points of failure that result in down-time of the critical IT systems. The systems shall be designed in accordance with the principles set out in the client design guides and local regulations.

2 Incoming Utilities

2.1 Power

The first phase of DUB15 shall be supplied with redundant incoming MV feeds from the on-site gas generation Energy Centre. These feeds will connect directly to the MV fundamental block switchrooms located at roof level. Future phases will import power from the grid. This will allow the data centre to use renewable power when available. During times of low renewable generation or grid constraints, the site will import power from the new natural gas power station in Profile Park.

2.2 Water

Potable water will be provided for the staff amenities (WC sinks, showers, WCs and any future coffee points / kitchenettes etc).

A small amount of water shall be used for filling mechanical systems as required, at system start-up in humidification, and in general maintenance. The selected cooling systems does not evaporate water as part of the cooling process, nor does the system depend on the continuous provision of water to operate.

2.3 Drainage

Drainage connections will be required for the foul and rainwater outlets from the site.

2.4 Gas

The first phase of DUB15 shall be supplied from an on-site gas generation Energy Centre. The incoming voltage to the site will be rated at 11kV.

3 Electrical Services

3.1 Overview

This section provides a high-level overview of the proposed electrical system infrastructure for the data centre.

The electrical infrastructure will be designed in accordance with Irish Codes and Regulations and will be aligned with clients own Design Engineering Guides and reference design.

3.2 Medium Voltage Systems

There will be two redundant incoming supplies (A and B) to each of the DUB 15/16 facilities. These supplies will be rated at 11kV and will provide the full final day requirement of 55 MVA for the facilities.

Centralised 11kV MV generator supplies will be provided for this facility as a means of back-up generation and will be connected to each of the building fundamental block MV-A & MV-B switchboards in an open ring configuration.

3.3 Low Voltage Systems

Distribution to the data halls will be at low voltage.

The critical IT load of the Data Centre is split across 8 data halls per facility, with 2000kW IT load, all halls are enabled to be upgraded to 3000kW, with a maximum load of 24MW IT.

1800kVA midel filled transformers will be used to step down the voltage from 11kV to 400V. Each pair of data halls will have five or six dedicated transformers and associated LV switchboards. This provides the data halls with N+1 resilience.

Each LV switchboard will supply the following loads:

- Data hall IT load (via UPS)
- Data hall cooling plant
- Data hall and plant room lighting

The critical data hall load will be supplied via a static UPS, this will provide an uninterrupted electrical supply to IT cabinets of the customers. The UPS will be backed up by batteries.

Distribution from the UPS backed switchboard will be via busbar. The busbars shall be configured such that a single LV switchboard / UPS / transformer can be taken out of service (either through failure or maintenance) and still support the full load and cooling requirements of the data halls.

Additionally, two transformers and LV switchboards will be provided to serve common and office equipment and services.

3.4 Back-up Generation

3.4.1 Generators

The back-up generating plant will be centralised for all the data halls of each facility and will cater for the IT load and associated mechanical load for the building.

It is expected that the site will have 32 sets of 2.75MVA / 2.2MW standby MV rated generators.

8 generators are to be connected in a ring formed of four generator MV switchboards per facility. There will be 2 generators per generator MV switchboard.

7 generators will be able to support the building block load, with the 8th generator providing further resilience to the system should a generator be unavailable.

The generators will be containerised sets with appropriate acoustic attenuators installed in order to meet the required acoustic performance which conforms to local codes and requirements.

The containers will be located externally at ground floor.

Total electrical site capacity of generators = 70.4MWe

Run time hour counters will be provided on each generator.

3.4.2 Fuel Storage

The clients design standard states that the diesel storage provided should be adequate for 48 hours of generator operation at full load.

Initial calculations indicate that at full load for 48 hours each generator will require 26,851.5 litres of fuel (526.5 l/hr per generator)

At full build out when there will be a total of 32 no. generators, these will require 859,248 litres of fuel. The generator fuel tanks will be located within each generator container ("belly tanks").

All fuel storage shall be integrally bunded with leak detection. The installation, distribution system and safety measures will conform to Irish regulations.

3.5 Maximum Demand, PUE and Energy Usage

The table below lists the electrical loads for the proposed data centre site (DUB15 & DUB16), these have been calculated based on the proposed major plant, typical W/m² allowances and experience designing similar facilities running during peak load in summer.

Type	Description	Load (kW)	Notes
Electrical	Office block small power & lighting	100	Based on 20W/m^2 x 5000m^2
Mechanical	Office block heating & cooling	200	Based on 40W/m^2 x 5000m^2
Electrical	Lifts	230	Based on 4no. 25kW lift motors & 6no. 35kW lift motors and 75% diversity
Electrical	Ancillary systems	150	Allowance for site wide systems
Electrical	Data hall IT load	48,000	Based on 16 data halls across the site at 3MW IT load per data hall
Electrical	Data hall small power & lighting	37	Based on 5W/m^2 x 29240m^2 and 25% diversity (as typically unoccupied space)
Mechanical	Data hall cooling	14,568	Based on 8no. data halls, each with 7no. 280kWe A/C units and 36no. 13kWe CRAH at 75% load
Total		**63,285**	

From the table above the maximum demand for the site, which would be running at full load in summer, is 63MW, this translates to a peak Power Usage Effectiveness (PUE) of approximately 1.32, the annualised PUE figure is expected to be lower at approximately 1.2.

Based on the annualised PUE this along with the maximum IT load of 48MW, and the number of hours per year (8760) the estimated annual energy usage at full build out can be calculated at 504,576 MWh.

3.6 Lighting & Emergency Lighting

Lighting shall be provided throughout the facility and will be designed in accordance with all the relevant and applicable Irish codes and regulations.

Typically, energy efficient LED lighting shall be used and supplied by generator backed switchboards, emergency lighting shall be provided with additional battery backup to ensure occupants can egress from the building safely.

Emergency exit signage will be in line with the fire strategy documentation and will either be an illuminated sign or have an emergency light located close by.

3.7 Batteries

3.7.1 UPS Room Batteries

The batteries associated with the UPS systems will be located within dedicated battery rooms adjacent to the LV switchroom.

Access to the battery room will be via its respective LV Switchroom and access will be restricted to trained Operations personnel who have key-card access permissions to the room.

The UPS batteries will be valve regulated lead-acid (VRLA) batteries, with option for Li-Ion, located on open battery racks and provide 5 minutes back-up in the event of power failure. A battery circuit breaker will be installed in order to disconnect the batteries from the system in the event of a fault or maintenance.

Within each battery room there will be approximately 294 VRLA batteries in order to achieve the required back-up. The battery sizing is based on achieving a minimum of 5 minutes autonomy at the batteries end of life (EOL) design cycle of 10 years.

3.7.2 Generator Starter Batteries

Starter batteries will be provided within each emergency standby generator container.

The generator container will be securely locked therefore access to this area will be restricted to trained Operations personnel.

Each generator will have two batteries which will be of valve regulated lead-acid (VRLA) type, with option for Li-Ion.

4 Mechanical Services

4.1 Overview

This section provides a high-level overview of the proposed mechanical system for the data centre. The mechanical systems design shall be developed in order to provide a highly energy efficient solution.

The mechanical systems will be designed in accordance with Irish Codes and Regulations and will be aligned with clients own Design Engineering Guides.

The air conditioning equipment used for the facility will be highly efficient at both full load and part load conditions. The datahalls shall be conditioned using computer room air handlers (CRAHs) located in cooling corridors with heat rejection via air cooled chillers located on the roof. When external temperatures suit, the air conditioning equipment will operate in free cooling mode without the compressors, improving efficiency further.

UPS cooling is provided via CRAH units, with heat rejection being provided by the roof-mounted air-cooled chillers serving the datahalls. Space shall be retained for provision for future UPS condensers to be located on the roof should these be required.

The battery rooms are cooled using DX fan coil units, with condensers located on the roof for heat rejection. A battery room extract fan is located at roof level to exhaust air from the battery rooms such that the possible build-up of hydrogen discharge from the batteries, in line with good practice guidelines, is prevented. An air handling unit shall supply and extract air from the UPS rooms, circulation spaces, storerooms and the various other plantrooms. Where required electric heaters shall be installed to provide frost protection.

The heating, ventilation and air conditioning (HVAC) strategy for the PBB office area shall be via an air handling unit and any dedicated extract fans to provide ventilation. Air conditioning, both heating and cooling shall be via a variable refrigerant flow (VRF) system with indoor fan coil units (FCUs) and outdoor condensers. Supplementary electric heaters shall be provided to overcome cold drafts and maintain minimum temperature requirements in winter where required. PBB HVAC plant shall be roof mounted.

4.2 External Design Conditions

As per the Uptime Institute requirements, critical systems shall be specified to achieve design capacity at the local ASHRAE design conditions. The ASHRAE (2017) 20-year file for Dublin Airport has been used in this case consistent with existing practice on the Profile Park site.

- Dry bulb temperature: 27.4°C (extreme annual condition for n = 20 years)
- Wet bulb temperature: 21.2°C (extreme maximum wet bulb)

The Uptime Institute requirements do not specify a winter design condition. The heating and humidification design conditions stated below have been taken for the critical systems.

- Dry bulb temperature: -8.7°C (extreme annual condition for n = 20 years)
- Humidity: 100% Relative Humidity at the above dry bulb temperature

Non-critical systems and other building services shall be designed to the ASHRAE 0.4% / 99.6% design criteria for Dublin as below:

- Cooling processes: 21.9°C dry bulb, 17.0°C mean coincident wet bulb
- Evaporative processes: 17.8°C wet bulb, 20.6°C mean coincident dry bulb
- Heating processes: -2.7°C dry bulb
- Humidification processes: -4.4°C dew point, -0.5°C mean coincident dry bulb

All humidification systems designed as per non-critical humidification conditions.

4.3 Data Hall Cooling System

4.3.1 Internal Conditions

The internal data hall conditions will be based on the ASHRAE "recommended" limits for Class A server inlet conditions. These are detailed below:

- Recommended temperature range: 18-27°C
- Recommended humidity range: 5.5°C DP – 60% RH & 15°C DP
- Target supply temperature: 24°C

4.3.2 Data Hall Cooling and Ventilation Strategy

The cooling strategy for the data halls will allow for a phased fit-out of the facility. Each data hall and building of the facility will be treated as a standalone zone to provide a high level of resilience and flexibility for future changes.

The data hall cooling will be designed to support an IT load of up to 3000W/m^2 with a resilience of N+1 cooling units per data hall.

The data halls will be cooled by a closed loop chilled water system. 6 no. air-cooled chillers at N+1, shall be installed to serve each 5MW system. There are 12 no. chillers required for a 10MW fundamental block. Capacity for a 7th chiller shall be provided for future fit out of a 6MW system, upgrading the block to 12MW. Space provision should also be provided to allow for a total of 16 no. chillers per block to allow for a 12MW block with 4 independent 3MW systems. Chillers will be located on the roof of the building.

Computer Room Air Handlers (CRAH) units will be located within cooling corridors connected to the data halls. Each CRAH will connect to pipework served by air conditioning equipment and associated pumps located on the roof.

Only very small quantities of water are anticipated to be discharged to drain as a function of the main data centre cooling system.

The cold water shall be recirculated within a closed system with no discharge to drain under normal operation.

Off the shelf sodium nitrite scale inhibitor and biocide will be contained within the closed loop chilled water systems. The inhibitor contains Nitrate (NO−2), and the Biocide contains either a Methyl-2H or Methyl-4 (3:1) Mixture of EC NO 220-239-6.

High-efficiency data hall cooling technologies are regularly developed and brought to market, an alternative high efficiency data hall cooling solution may also be deployed as part of future data hall fit out.

The datahalls shall be pressurised using supply only air handling units. Air handling units shall supply air into the datahalls to positively pressurise the halls. Datahall AHUs shall be in N+1 arrangement, with humidifiers included to control humidity in the datahall. In order to improve reliability and reduce maintenance work, each air handling unit humidifier will be supplied with highly purified reverse osmosis (RO) water by a dedicated packaged system for each AHU.

4.4 UPS Room Cooling

4.4.1 Internal Conditions

The UPS rooms are considered critical spaces but can accept higher temperatures without failure of the electrical equipment than in the data halls. The criteria are set out below:

- High temperature limit: 35°C
  40°C for 8 hours
- Low temperature limit: Not Controlled
- Normal temperature: 25 ± 5°C
- Allowable humidity range: Not Controlled

4.4.2 UPS Cooling and Ventilation Strategy

The UPS rooms will be conditioned using Computer Room Air Handlers (CRAH) units connected to the same closed loop chilled water system which serves the data halls. Chillers will be located on the roof of the building.

The systems will be designed with a resilience of N+1 cooling units per UPS room. The UPS rooms will be designed to support a UPS load of up to 1000KW.

Condensate drainage will be pumped to the foul drainage system via condensate drains. Chilled water pipework shall be routed from the mains CHW system serving the datahall.

Fresh air will be supplied to the UPS rooms to provide ventilation to the space. An air handling unit shall supply and extract air from the UPS rooms, circulation spaces, storerooms and the various other plantrooms. Where required electric heaters shall be installed to provide frost protection.

4.5 Battery Rooms

4.5.1 Internal Conditions

The battery rooms are to be designed to the criteria are set out below:

- Space temperature: 22 ± 2°C

- Allowable humidity range: Not Controlled

4.5.2 Battery Room Cooling and Ventilation Strategy

The battery rooms will be conditioned using split DX systems, with fan coil units located inside the battery rooms and DX units located at roof level. The systems will be designed with a resilience of N+1 per battery room. Each internal unit is connected to a single outdoor unit mounted at roof level.

Air will be exhausted from the battery rooms to prevent the possible build-up of hydrogen discharge from the batteries, in line with good practice guidelines. Exhaust will be via a dedicated battery room extract fan located at roof level.

4.6 Office and Ancillary Areas

4.6.1 Internal Conditions

The PBB areas will be conditioned in line with the following design criteria.

Space	Winter		Summer		Ventilation	Internal Loads			Noise levels from HVAC plant
	Internal Design Temperature	Humidity	Internal Design Temperature	Humidity		Occupancy	Lighting	Small Power	
	[°C]	[%RH]	[°C]	[%RH]	See table	[m²/person]	[W/m²]	[W/m²]	[NR]
General Offices	21±2	Not controlled	23±2	Not controlled	10l/s/person	8	8	25	38
Meeting Rooms	21±2	Not controlled	23±2	Not controlled	10l/s/person	2 or number seats	8	25	35
Reception	21±2	Not controlled	23±2	Not controlled	10l/s/person	10	8	10	38
Breakout Kitchenettes	21±2	Not controlled	23±2	Not controlled	6ACH	10	8	10	40
Tech Ops	21±2	Not controlled	23±2	Not controlled	10l/s/person	8	8	25	38
Loading Bay	15°C min	Not controlled	Not controlled	Not controlled	Natural ventilation	-	-	-	40
Toilets	18°C min	Not controlled	Not controlled	Not controlled	6ACH	-	-	-	40
Showers	18°C min	Not controlled	Not controlled	Not controlled	10ACH	-	-	-	40
P-Pop Plantrooms	18°C min	Not controlled	25°C max	Not controlled	0.5ACH	-	8	TBC	TBC
PBB Switch Room	18°C min	Not controlled	45°C max	Not controlled	0.5ACH	-	8	TBC	TBC

Cleaners Cupboard	18°C min	Not controlled	Not Controlled	Not controlled	6ACH	-	-	-	40
Store	18°C min	Not controlled	Not Controlled	Not controlled	0.6l/s/m²	-	-	-	40
Corridors/ Circulation Spaces	18°C min	Not controlled	Not Controlled	Not controlled	-	-	-	-	40

4.6.2 HVAC strategy

An AHU will provide fresh air to the PBB office and ancillary areas. Ventilation rates provided to each space in line with the design criteria above.

The AHU is located on the roof of the PBB. The AHU is fixed speed minimum fresh air, and consisting of, relevant intake and extract dampers, supply and return filters, heat recovery sections, supply and extract fans.

Heating and cooling will be provided by a variable refrigerant flow system, which will serve fan coil units located at high level in the PBB areas.

A waste heat recovery system is being investigated which would recover heat from the data halls to serve the PBB areas.

5 Public Health Services

5.1 Potable Water System

Potable cold water will be provided for the administration areas of the development to serve kitchenette sinks, showers and WCs. Domestic hot water will be provided by a centralised air-to-water heat pump.

5.2 Humidification Water System

Humidification will be provided to the data centre via the data hall air handling units to control the data hall space conditions within the recommended humidity range. Make-up water shall be provided via a dedicated humidifier cold water tank and booster set. Water usage will be minimised as humidification will only be required during winter below a dew point temperature of 5.5°C.

5.3 Foul Water and Roof Rainwater Drainage

Foul and surface water drainage systems will be designed in accordance with all the relevant and applicable Irish codes and regulations.

5.4 Potable Legionella Risk Mitigation

The potable water system will be provided with an automated flushing system linked to temperature sensors to mitigate the risk of legionella proliferation within the domestic potable water system.

5.5 Humidification Legionella Risk Mitigation

The humidification system will be provided with an approved chemical dosing system to mitigate the risk of bacterial growth in the humidification system.

6 Fire Strategy

A fire strategy for the facility has been be developed to comply with the Irish requirements, as well as any specific client or insurer's goals. The detail of the fire strategy solution, including any performance-based aspects of the design will be incorporated into the building MEP design.

7 Fire Suppression

A water mist fire suppression system will be provided as a minimum to protect the data halls and electrical plant rooms. The water mist system will be designed in accordance with local Codes and Regulations, and the clients Design Guides and will meet FM Global requirements (the Clients insurer).

Other areas of the building will be provided with fire suppression as dictated by the fire strategy for the building.

This system is a client enhancement and is not required as part of the life safety measures for the building as detailed in the Fire Strategy Report.

8 Fire Detection

A fully addressable fire detection system will be provided throughout the entire data centre.

9 Acoustic Requirements

Acoustic modelling shall be performed, and a separate report submitted as part of the planning process. This shall demonstrate compliance with the local noise requirements at the peak summer load condition as well as outlining the expected noise level under emergency conditions (site supported on generators due to a utility power failure).

10 Technical Guidance Document Part L 2017 (NZEB)

Each facility consists of unheated operational space for the data centre facility and heated ancillary office space. With respect to the Building Regulations, Technical Guidance Document (TGD) Part L notes that spaces with installed heat capacity of less than 10 W/m^2 are exempt from meeting the requirements of the TGD Part L document. As such the data centre operational space is exempt from TGD Part L 2017.

The PBB office area will be a fully air-conditioned space and will meet the requirements of the TGD Part L 2017.

11 Sustainability & Energy Efficiency

The data centre and supporting MEP systems is based on the client's design principals which has a strong focus on energy efficiency, sustainability and the reduction of NOx emissions. A key criterion in selecting mechanical and electrical equipment is a high energy efficiency which ensures both the sustainable focus of the design and lower operating costs.

Some of the key features of the data centre include:

- Free cooling of whitespace utilised whenever ambient conditions allow;
- Energy efficient UPS system with multiple operating modes to increase efficiency;
- High temperature differentials between supply and return temperatures to reduce pump duty;
- High operating temperature for chilled water systems to minimise power use;
- Smart building management and control systems which monitor and manage load on equipment to ensure they operate at maximum efficiency and only deliver the cooling required to the white space.
- Energy efficient EC motors with variable speed drives are utilised on pumps and fans;
- Energy efficient LED lighting combined with smart control systems to ensure that lights automatically turn off in areas when not required.

The above measures detailed above contribute to the achieving a low PUE for the data centre. The key driver is the selection of the cooling equipment for the data centre and how it operates.

In addition to the features above, there will be measures put in place within the data halls to mitigate the mixing of hot and cold air. This allows the air temperatures within the data hall to be higher, thus improving the efficiency of the cooling.

Hot Aisle Containment (HAC) is used to maximise efficiency of these systems and ensure that the cooling air is provided to the equipment, without short-circuiting. The HAC deployed within the White space captures all the hot air discharged from the ICT equipment and

returns it directly to the cooling units using the hot air ceiling plenum. Cabinet blanking panels are used in the containment to block unused ICT equipment positions and avoid any cold air short circuiting. These blanking panels work alongside the room pressure fan control to reduce overall energy consumption.

12 Public Lighting

12.1 Proposed Public Lighting

Roadways

The roadway lighting will be designed in accordance with IS EN 13201-1:2015 Table 4, and IS EN 13201-2:2015 Table 3.

The lighting class will be obtained from Table 4, as follows:

Table 4 - Parameter for selection of lighting class (From IS EN 13201-1:2015, Part 1)		
Parameter	**Options**	**Weighting Value, V_w**
Travel Speed	Low ($v \leq 40$ km/h)	1
Use intensity	Normal	0
Traffic Composition	Pedestrians and motorised traffic	1
Parked vehicles	Present	1
Ambient luminosity	Low	-1
Facial Recognition	Not necessary	0
Sum of weighting values (VWS)		**2**

Number of Lighting Class, P = 6 - VWS

P = 4

The light levels will be obtained from Table 3. For P4 Class the average illuminance level (E_{av}) to be 5 lux and a Minimum illuminance (E_{min}) of 1 lux requirements.

Footpaths

The footpath lighting will be designed in accordance with EN 12464-2:201A, Table 5.1.1, for a minimum average illuminance E_{av} of 5 lux and a minimum overall uniformity (U_o) of 0.25.

The footpaths will be treated as walkways exclusively for pedestrians.

Carparks

The lighting for car parking areas was designed to IS EN 12464-2:201, Table 5.9.2, Minimum Average illuminance Eav of 10 lux and a Minimum Overall luminance uniformity (Uo) of 0.25.

Generator Yard

The Generator Yard lighting will consist of low level, switchable luminaires to provide safe movement and access for maintenance staff. The Generator Yard is surrounded by a 9-metre-high fence.

Gas Generation Energy Centre

The Energy Centre lighting will consist of low level, switchable luminaires to provide safe movement and access for maintenance staff.

In summary, illuminance levels will be:

Area	Light Level
Car Parks	10 Lux
Walkways	5 Lux
Road Ways	5 Lux

All external lights will use the latest generation LED technology and have efficiencies of over 100 Lumens per Watt. The external lighting will be controlled by an astronomical time clock, that will be programmed to illuminate during the hours of darkness only.

Light fittings will be mounted at 6m along the building façade. Where light poles are used they will be 6m high along roadways.

The light fittings proposed are the Thorn Areaflood Pro Small and the Thorn R2L2 for both roads, carparks & walk ways.

Figure 1. Thorn R2L2 LED Street Light

Figure 2. Thorn Areaflood Pro Small LED Street Light

The public lighting is shown on the accompanying drawing in Appendix A:

IE-DUBZZ-STE1-E0-ARP-DR-E-63000

The lighting calculation report is shown in Appendix B.

Appendix A

Public Lighting Drawing

A1

Appendix B

Lighting Calculation Report

B1

DATE:	**20 July 2021**
DESIGNER:	**Arup Ireland**
PROJECT No:	**280503-00**
PROJECT NAME:	**Public Lighting**

LIGHTING
REALITY

DUB15

Layout Report

General Data

Dimensions in Metres Angles in Degrees

Calculation Grids

ID	Grid Name	X	Y	X' Length	Y' Length	X' Spacing	Y' Spacing
1	Site Road 1	703708.26	730229.87	10.04	111.01	1.43	1.41
2	Site Road 2	703715.98	730227.41	126.09	8.34	1.48	1.39
3	Site Road 3	703832.20	730170.54	81.88	16.24	1.49	1.48
4	Site Road 4	703915.56	730170.81	130.24	8.17	1.50	1.36
5	Watercourse	703928.67	730168.07	129.91	12.17	1.49	1.35
6	Site Road 5	703814.49	730194.35	9.97	110.09	1.42	1.49
7	DUB 15 Car Park	703743.31	730338.65	81.12	17.08	1.47	1.42
8	Site Road 6	703897.79	730307.14	45.70	13.25	1.47	1.47
9	Entrance Road	703818.97	730300.65	75.00	57.28	1.50	1.47
10	DUB 16 Car Park	703902.74	730320.05	17.66	49.14	1.47	1.49

Luminaires

Luminaire A Data

Supplier	
Type	VFL540 [S70] IP66:LED-24/48W/4K;VFL540, Street and Area Light
Lamp(s)	LED-24/48W/840 - 4000K
LampFlux(klm)/Colour	5.90 4000K/80
File Name	B1.ldt
Maintenance Factor	0.80
Imax70,80,90(cd/klm)	834.9, 43.3, 0.0
No. in Project	8

Luminaire C Data

Supplier	
Type	R2L2 S 24L35 EWS 740 CL1
Lamp(s)	R2L2_24L35-740EWS 28W
LampFlux(klm)/Colour	4.01 4000/70
File Name	R2L2 Extra Wide Road.LDT
Maintenance Factor	0.80
Imax70,80,90(cd/klm)	714.5, 193.2, 0.0
No. in Project	9

Luminaire D Data

Supplier	
Type	96644728 (STD - standard)
Lamp(s)	AFP24L35-740EWR 28W
Lamp Flux (klm)	4.08
File Name	96644728_(STD).IES
Maintenance Factor	0.80
Imax70,80,90(cd/klm)	514.6, 54.3, 0.0
No. in Project	25

Luminaire E Data

Supplier	
Type	DOVER450 - 24 LED- 700mA - 4k- 61W-FLAT GLAZING-Optic C
Lamp(s)	24 x 4K LED 61W
Lamp Flux (klm)	5.08
File Name	DO 450 - 24 LED- 700mA - 4k- 61W-FLAT GLAZING-Optic C.ies
Maintenance Factor	0.80
Imax70,80,90(cd/klm)	95.2, 31.6, 0.0
No. in Project	5

Layout

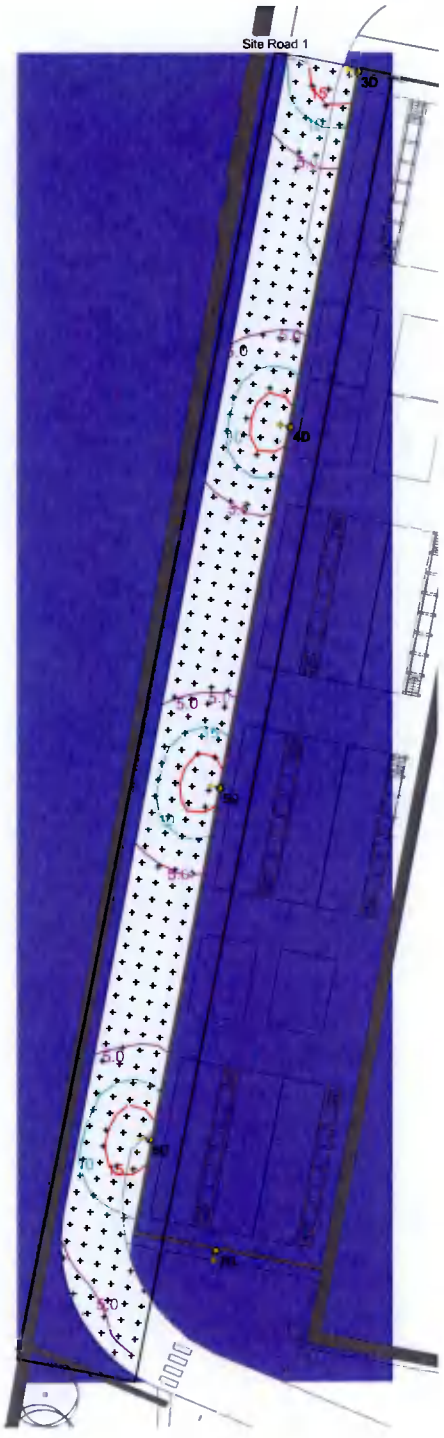
ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
1	A	703738.23	730377.92	6.00	348.00	0.00	0.00	0.20			
2	A	703734.37	730358.32	6.00	348.00	0.00	0.00	0.20			
3	D	703736.75	730337.07	6.00	163.00	0.00	0.00	0.20			
4	D	703731.11	730307.69	6.00	167.00	0.00	0.00	0.20			
5	D	703725.22	730277.73	6.00	166.00	0.00	0.00	0.20			
6	D	703719.37	730248.29	6.00	169.00	0.00	0.00	0.20			
7	D	703724.88	730238.94	6.00	257.00	0.00	0.00	0.20			
8	D	703752.04	730227.65	6.00	263.00	0.00	0.00	0.20			
9	D	703777.44	730209.72	6.00	249.00	0.00	0.00	0.20			
10	D	703800.67	730201.69	6.00	262.00	0.00	0.00	0.20			
11	D	703829.23	730187.50	6.00	253.00	0.00	0.00	0.20			
13	D	703884.15	730176.77	6.00	259.00	0.00	0.00	0.20			
14	D	703907.81	730172.35	6.00	259.00	0.00	0.00	0.20			
15	D	703856.99	730182.12	6.00	259.00	0.00	0.00	0.20			
16	D	703912.88	730194.33	6.00	347.00	0.00	0.00	0.20			
17	D	703918.51	730223.74	6.00	348.00	0.00	0.00	0.20			
18	D	703924.19	730253.27	6.00	345.00	0.00	0.00	0.20			
19	D	703929.92	730282.72	6.00	345.00	0.00	0.00	0.20			
20	A	703846.87	730331.12	6.00	293.00	0.00	0.00	0.20			
22	D	703827.09	730199.81	6.00	168.00	0.00	0.00	0.20			
23	D	703833.03	730232.35	6.00	167.00	0.00	0.00	0.20			
26	A	703795.64	730345.73	6.00	259.00	0.00	0.00	0.20			
27	A	703751.75	730349.33	6.00	259.00	0.00	0.00	0.20			
28	A	703772.17	730350.36	6.00	262.00	0.00	0.00	0.20			
29	A	703813.17	730337.22	6.00	257.00	0.00	0.00	0.20			
30	A	703827.82	730334.30	6.00	260.00	0.00	0.00	0.20			
31	D	703752.82	730334.20	6.00	76.00	0.00	0.00	0.20			
32	D	703775.75	730328.25	6.00	80.00	0.00	0.00	0.20			
33	D	703804.35	730321.41	6.00	76.00	0.00	0.00	0.20			
33	D	703927.66	730300.38	6.00	78.00	0.00	0.00	0.20			
34	D	703904.01	730308.71	6.00	76.00	0.00	0.00	0.20			
35	C	703836.50	730302.42	6.00	79.00	5.00	0.00	0.20			
36	C	703857.79	730316.32	6.00	167.00	5.00	0.00	0.20			
37	C	703905.96	730336.91	6.00	347.00	5.00	0.00	0.20			
38	C	703893.55	730314.13	6.00	79.00	5.00	0.00	0.20			
39	C	703829.54	730319.14	6.00	345.00	5.00	0.00	0.20			

Layout Continued

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
40	E	703901.84	730444.67	10.00	349.00	0.00	0.00	1.00			
41	E	703906.87	730412.11	10.00	168.00	0.00	0.00	1.00			
42	E	703892.89	730396.85	10.00	350.00	0.00	0.00	1.00			
43	E	703886.06	730362.78	10.00	350.00	0.00	0.00	1.00			
44	E	703892.89	730340.94	10.00	174.00	0.00	0.00	1.00			
45	C	703873.42	730328.45	6.00	295.00	5.00	0.00	0.20			
46	D	703839.32	730264.95	6.00	167.00	0.00	0.00	0.20			
47	D	703845.64	730297.10	6.00	169.00	0.00	0.00	0.20			
49	C	703909.14	730354.18	6.00	347.00	5.00	0.00	0.20			
51	C	703925.91	730350.95	6.00	168.00	5.00	0.00	0.20			
52	C	703922.61	730333.61	6.00	168.00	5.00	0.00	0.20			

Horizontal Illuminance (lux)

Site Road 1

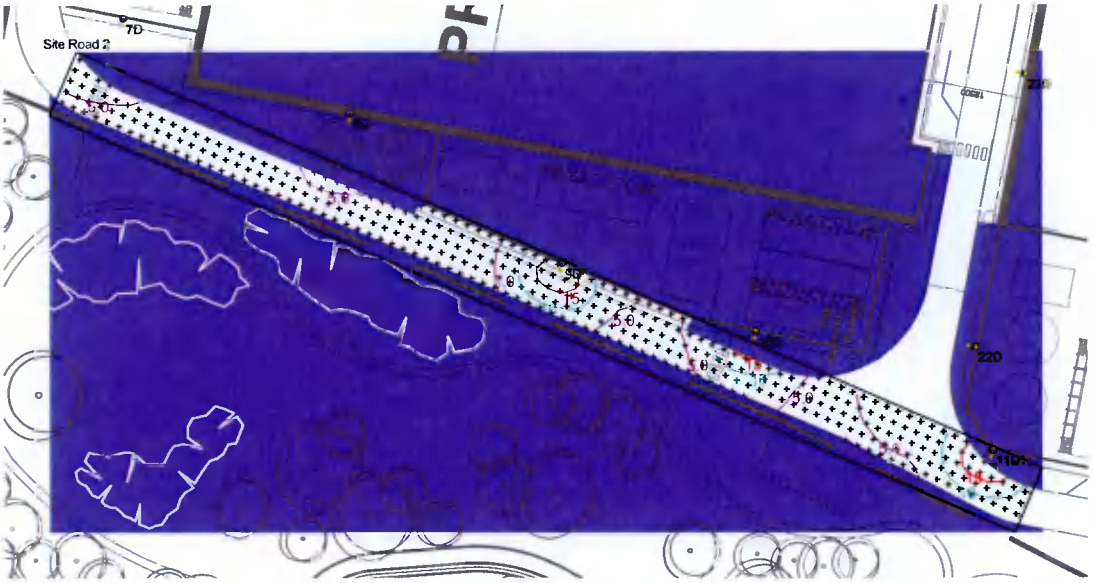


Results

Eav	7.31
Emin	2.84
Emax	19.97
Emin/Emax	0.14
Emin/Eav	0.39

Horizontal Illuminance (lux)

Site Road 2

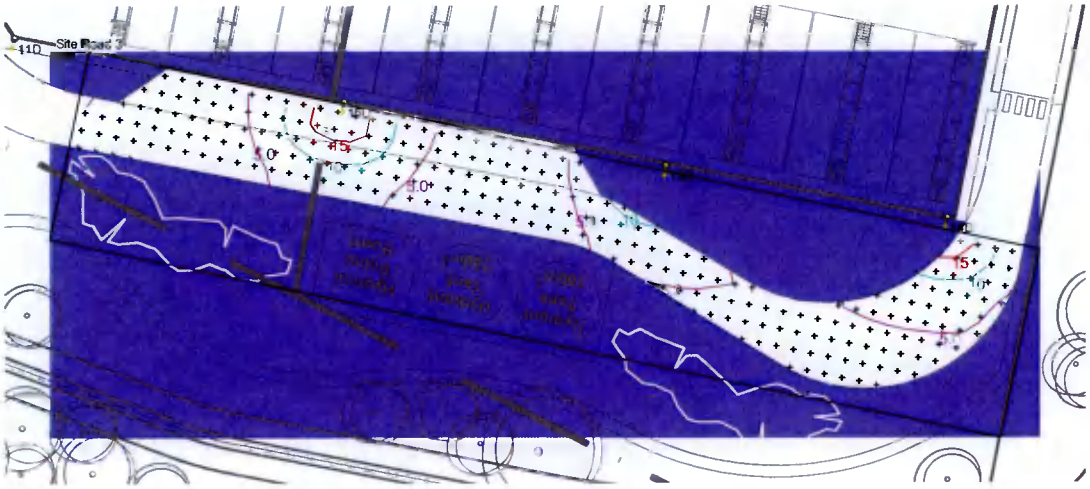


Results

Eav	6.05
Emin	1.57
Emax	19.86
Emin/Emax	0.08
Emin/Eav	0.26

Horizontal Illuminance (lux)

Site Road 3



Results

Eav	5.68
Emin	1.49
Emax	17.76
Emin/Emax	0.08
Emin/Eav	0.26

Horizontal Illuminance (lux)

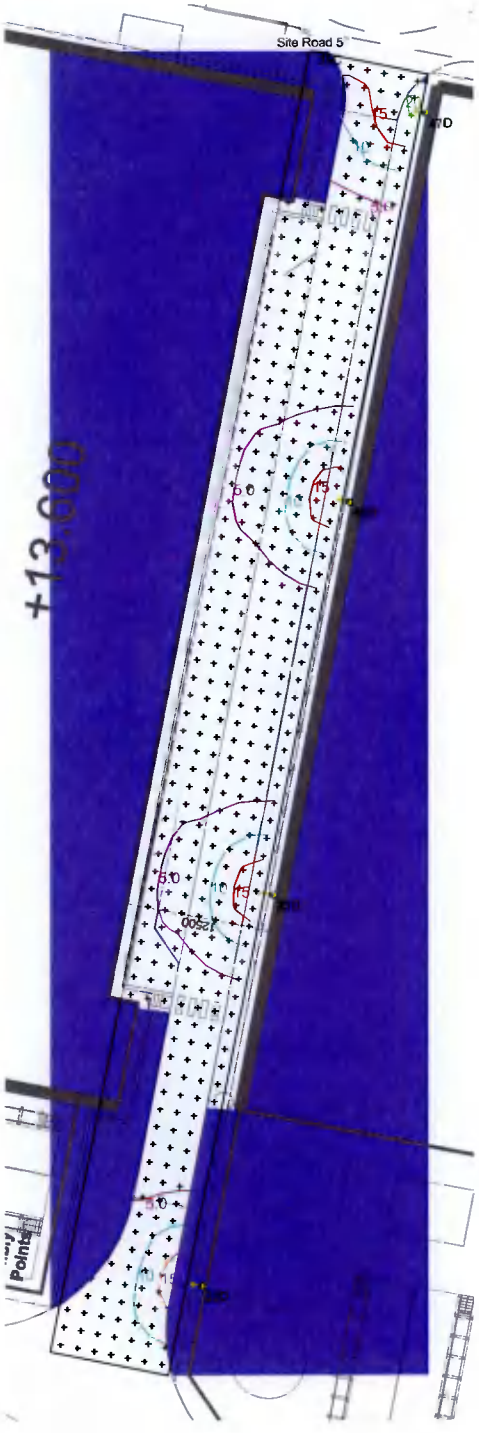
Site Road 4

Results

Eav	6.90
Emin	2.36
Emax	17.84
Emin/Emax	0.13
Emin/Eav	0.34

Horizontal Illuminance (lux)

Site Road 5

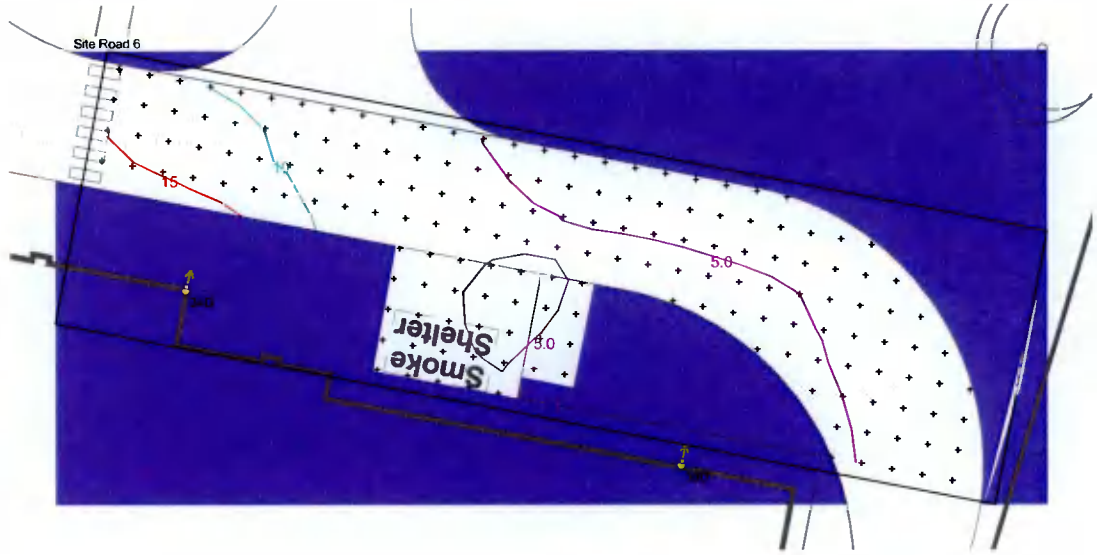


Results

Eav	5.84
Emin	2.01
Emax	20.19
Emin/Emax	0.10
Emin/Eav	0.34

Horizontal Illuminance (lux)

Site Road 6

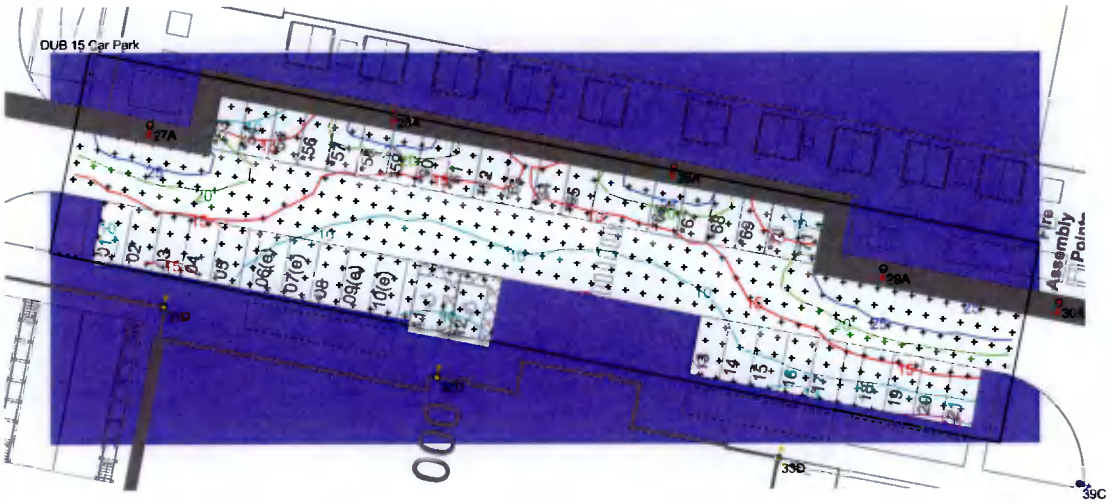


Results

Eav	6.03
Emin	2.23
Emax	16.47
Emin/Emax	0.14
Emin/Eav	0.37

Horizontal Illuminance (lux)

DUB 15 Car Park

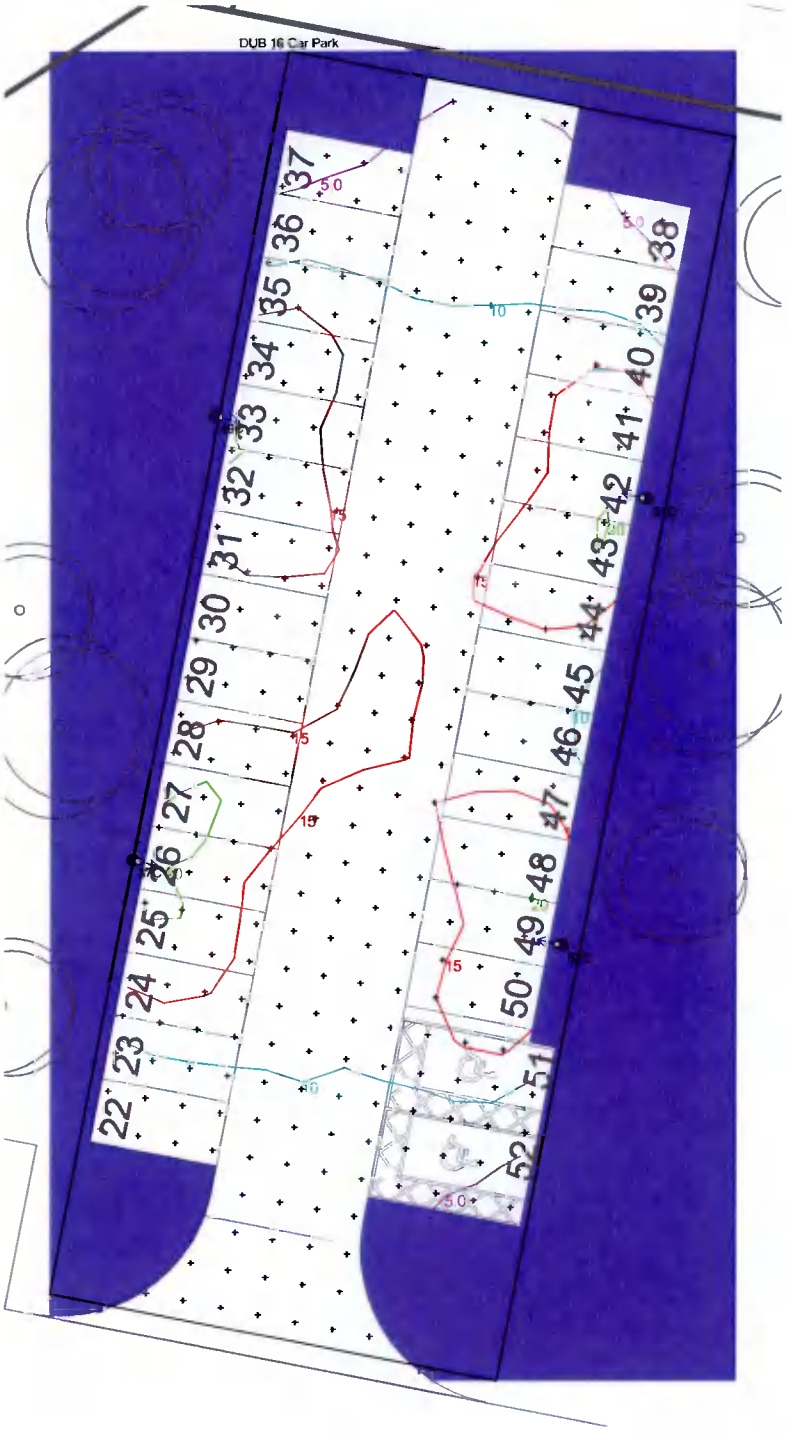


Results

Eav	14.72
Emin	4.74
Emax	39.41
Emin/Emax	0.12
Emin/Eav	0.32

Horizontal Illuminance (lux)

DUB 16 Car Park

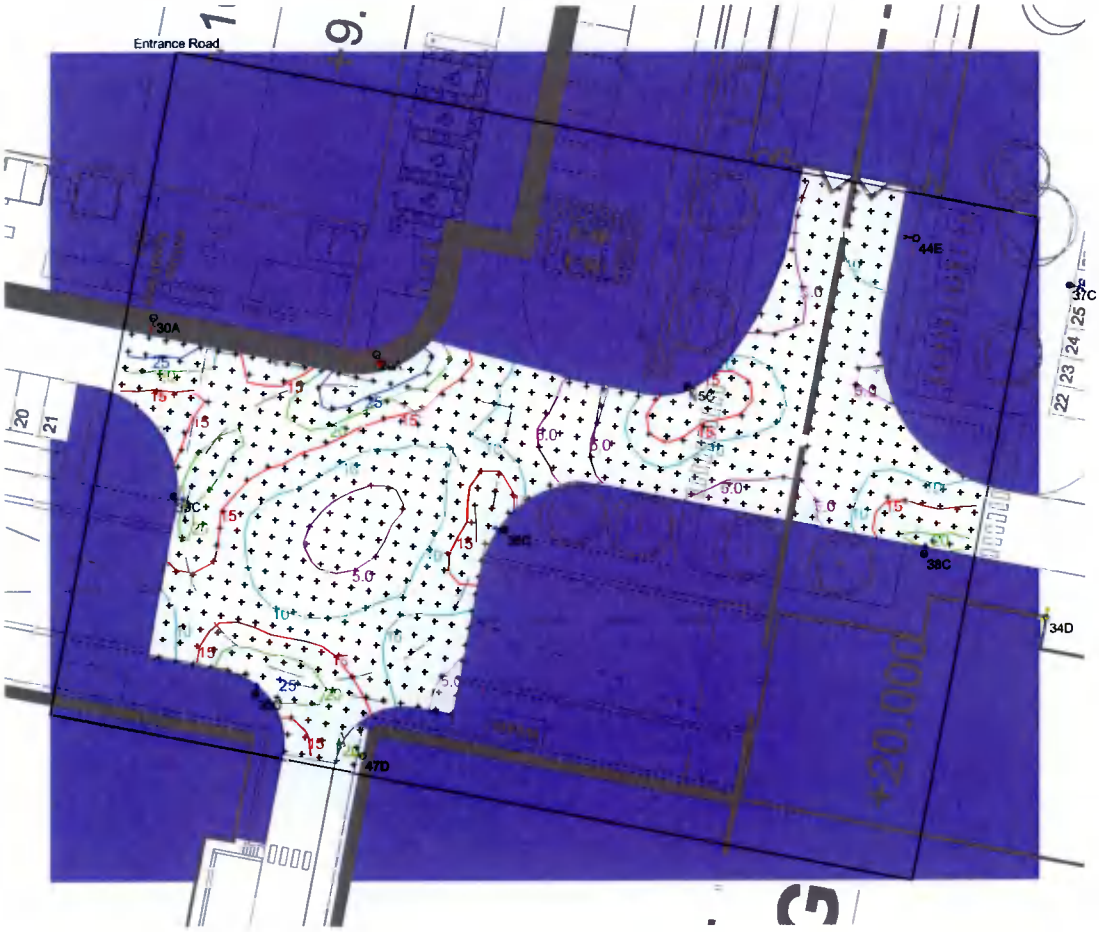


Results

Eav	12.36
Emin	3.33
Emax	20.95
Emin/Emax	0.16
Emin/Eav	0.27

Horizontal Illuminance (lux)

Entrance Road

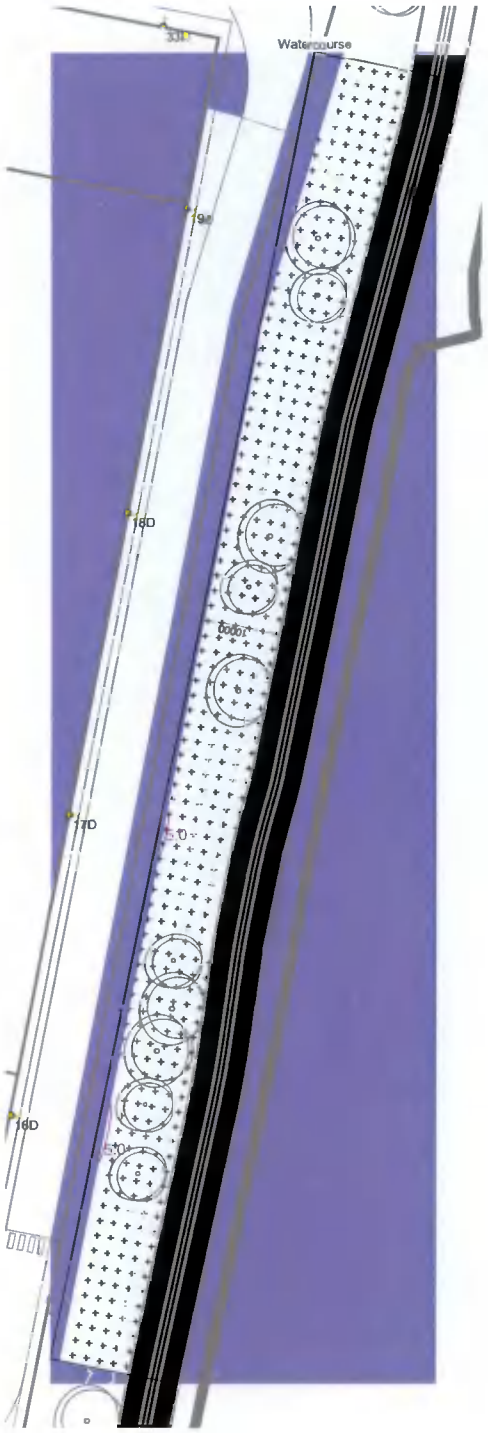


Results

Eav	11.83
Emin	2.97
Emax	37.28
Emin/Emax	0.08
Emin/Eav	0.25

Horizontal Illuminance (lux)

Watercourse



Results

Eav	2.11
Emin	0.24
Emax	5.10
Emin/Emax	0.05
Emin/Eav	0.12

Rev	Date	By	Chkd	Appd
P01	20/07/21	AS	AD/VH	TB
	For Information			

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Digital Netherlands VIII B.V.

Project Title
INXN DUB15/16

Drawing Title
Public Lighting
Site Layout

Scale at A1 1:500
Role MEP
Suitability Issued for Planning
Arup Job No 280503-00
Rev P01
Name IE-DUBZZ-STE1-E0-ARP-DR-E-63000