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# Merthyr Tydfil CBC
# Goat Mill Road Development

## Lighting Strategy

2026-11-09

2107-WSP-XX-XX-RP-EO-0001

# Document distribution

## Merthyr Tydfil CBC

## Goat Mill Road Development

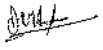
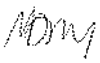
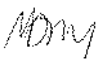
## Lighting Strategy

2026-11-09

2107-WSP-XX-XX-RP-EO-0001

## Prepared by

WSP UK
1 Capital Quarter Tyndall Street Cardiff CF10 4BZ United Kingdom

| Quality control | Name | Date | Signature |
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| Approved by: | Mark Bray | 09-Nov-26 |  |

## Revisions

| Rev | Date | Details |
|---|---|---|
| 0 | 09-Nov-26 | First issue |

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# 1. Introduction

## 1.1 Background

Merthyr Tydfil County Borough Council (MTCBC) is proposing a redevelopment of a former industrial site to the east of Goat Mill Road to create an enterprise zone. The site is brownfield and is bounded by Goat Mill Road to the west and the A4060 trunk road to the east.

WSP UK was appointed to carry out a planning application (RIBA Stage 3) for the site access from the existing roundabouts on Goat Mill Road, the main site spine road and accesses to the development plots. Also included is an active travel route connecting the site to local housing.

The statement describes the proposed external lighting arrangement shown on drawings (Appendix A):

- 2107-WSP-XX-XX-DR-EO-0001, Road Lighting, Sheet 1 of 2
- 2107-WSP-XX-XX-DR-EO-0002, Road Lighting, Sheet 2 of 2

The drawings have been issued at Status S3, “For Review”. The lighting proposals therefore represent a RIBA Stage 3 design and will be developed and confirmed during the detailed design stage.

# 2. Lighting Proposals

The proposed development comprises highway works along Goat Mill Road, including new estate and access roads, roundabouts, footways, footpaths and areas adjoining attenuation ponds. The lighting design extends through the development from the western section of the scheme to the existing Goat Mill Road connection at its eastern end.

The purpose of the lighting installation is to:

- support the safe movement of vehicles, pedestrians and other highway users;
- provide appropriate illumination at junctions, roundabouts and other conflict areas;
- provide suitable lighting for access roads, footways and footpaths;
- assist with route identification and personal security;
- minimise unnecessary light spill, glare, upward light and energy consumption; and
- limit the effects of artificial lighting on adjacent habitats and potentially sensitive ecological receptors.

The drawings identify proposed lighting column positions, projected horizontal illuminance contours at ground level, excluding the screening effects of buildings, trees, hedges or other physical obstructions.

## 2.1 Lighting Standards and Design Criteria

The lighting layout has been developed in accordance with the requirements of BS 5489-1:2020 and BS EN 13201-2:2015. The design criteria identified on the drawings are shown in Table 2.1.

**Table 2.1 Proposed target lighting classes and operating hours**

| Location | Proposed lighting class | | | |
|---|---|---|---|---|
| | Pre-curfew | | Post-curfew (2000hrs to 0600hrs) | |
| Conflict area (roundabout) | C4 | 10.0 lux min. | C5 | 7.5 lux min. |
| Main Access Spine Roads | P3 | 7.5 to 11.25 lux | P4 | 5.0 to 7.5 lux |
| Spur Access Roads | P4 | 5.0 to 7.5 lux | P5 | 3.0 to 4.5 lux |
| Off-highway footpaths | P5 | 3.0 to 4.5 lux | P6 | 2.0-3.5 lux |

The proposed installation is also required to comply with Merthyr Tydfil County Borough Council's street lighting specification and the Manual of Contract Documents for Highway Works.

The selected lighting classes provide enhanced illumination at locations where vehicle or pedestrian movements interact, while allowing lower lighting levels to be used on less intensively trafficked roads and footpaths. This approach avoids applying a uniform and unnecessarily high lighting level throughout the development.

## 2.2 Proposed Lighting Equipment

The main access spine roads and conflict area lighting will be achieved with post-top mounted TRT Aspect Generation 2 LED luminaires on 8m mounting height columns. Active travel links and other lower use routes would generally be illuminated using 6m mounting height columns fitted with post-top TRT Optio Nano LED luminaires.

The columns are proposed to be of aluminium construction, incorporating flush doors, dual anti-vandal locking arrangements and root protection. The drawings identify Aluminium Lighting Company 6000 Series columns, or an approved equivalent subject to the detailed specification. Column manufacture and installation would take account of the manufacturer's requirements, local ground conditions and the applicable wind-loading assessment.

The use of 8m columns for the main access spine roads allows the required lighting distribution to be achieved without an excessive number of lighting points. The luminaires mounted on 6m columns provide a more proportionate scale of lighting for active travel routes and low speed vehicle movements.



**Figure 1 TRT Aspect Gen 2 Luminaire (Access Roads)**



**Figure 2 TRT Optio Nano Luminaire (Active Travel Routes)**

## 2.3 Control of Obtrusive Light

The lighting layout has been designed to direct illumination towards the highways and active travel links that require lighting. Full cut-off directional LED luminaires are proposed, with no light emitted above the horizontal. This is intended to limit upward light and reduce unnecessary spill beyond the areas being illuminated, as advised by the Institution of Lighting Professionals (ILP) Guidance Note GN01/26, ‘Guidance Notes for the Reduction of Obtrusive Light’.

The final position and optical selection of the luminaires will be confirmed during detailed design. Where required, additional measures such as alternative optical distributions, rear shields, reduced output settings or amended column positions will be used to control light spill towards:

- retained vegetation and habitat corridors;
- attenuation ponds and associated margins;
- the boundaries of the development; and
- other ecologically sensitive or unlit areas.

The proposed LED luminaires provide controlled optical distributions and would not rely on tilting the luminaires above the horizontal to achieve the required coverage.

# 3. Environmental considerations

The lighting proposals incorporate measures to reduce the potential effects of artificial lighting on retained habitats and protected or notable species.

The luminaires are specified with a warm white colour temperature of 2700K, with no ultraviolet output and a reduced blue light component. This follows the general principles identified in the ILP and Bat Conservation Trust guidance GN08/23, ‘Bats and Artificial Lighting in the UK’.

The design uses directional, full cut-off luminaires to concentrate light within the adopted highway and pedestrian areas. Particular consideration has been given to the edges of the scheme, attenuation ponds, retained habitats and sections of footpath that adjoin less developed land.

The detailed design will retain dark areas and ecological connections where identified by the project ecologist. If subsequent ecological assessment identifies a particularly sensitive receptor or confirmed bat commuting route, the lighting design will be reviewed locally and adjusted as necessary. Appropriate adjustments may include:

- reducing the lighting output;
- changing the optical distribution;
- fitting shields;
- repositioning or omitting a lighting column where highway-safety requirements permit; or
- applying a more restrictive dimming or switching profile;
- lanterns are ‘DarkSky International’ approved.

To minimise obtrusive light and its impact on the local ecology within and beyond the development special considerations are necessary, the key objectives being to:

- Only provide light where and when it is necessary to ensure road safety and assist road users, pedestrians and cyclists in accessing the proposed plots during the hours of darkness;
- Keep the number and wattage of light sources to a minimum;
- Keep the height of light sources to a minimum;
- Avoid direct upward light above the horizontal to maintain a ‘dark sky’; and
- Follow the principles described in the ILP Guidance Notes GN01/26, ‘The Reduction of Obtrusive Light’ and GN08/23 ‘Bats and artificial lighting in the UK’.

## 3.1 Energy Efficiency and Lighting Control

The installation would use energy-efficient LED luminaires throughout.

The roadway and footpath luminaires are to incorporate constant light output technology. This allows the light output to be controlled over the operational life of the luminaire, reducing the need to over-light the highway when the equipment is new to compensate for anticipated future LED and optic degradation.

The installation is also intended to be connected to the Council's central management system, enabling Merthyr Tydfil County Borough Council to remotely monitor, dim and switch the luminaires following completion of the development.

Dimming is discussed in Section 3.2 below.

## 3.2 Post-curfew

The proposed lighting is to be dimmed by the utilisation of Merthyr Tydfil CBC's Central Management System. As such a variable lighting profile will offer both environmental and economic benefits.

BS5489-1:2020 states:

> Variable lighting is often referred to as dimming, but more appropriately is lighting to the correct lighting class to meet specific road parameters at a particular time. It might be that the highest lighting level an installation can achieve is only used on rare occasions, where traffic density is higher than normal (such as match days near to a football stadium), while the everyday lighting level might in reality be when the installation is operated at a lower lighting class.
>
> There are additional environmental benefits of using variable lighting levels, including reduced light intrusion, light pollution, electrical energy consumption and carbon emissions.

In mitigation of the impact on local ecology, it is proposed to dim the lighting to 70% output between the hours of 2000hrs and 0600hrs. The final dimming regime would be agreed with the Council at detailed design and commissioning. Subject to the Council's operational requirements and the findings of the final lighting assessment, reduced outputs may be applied during periods of lower traffic and pedestrian activity.

# 4. Installation and Operation

## 4.1 Electrical Installation and Commissioning

The electrical supplies to the proposed lighting columns are to be confirmed at the detailed design stage.

The installation would be installed, inspected, tested and commissioned in accordance with the applicable edition of BS 7671, Requirements for Electrical Installations, together with the Council's street-lighting requirements and the relevant requirements of the Manual of Contract Documents for Highway Works.

On completion, the appropriate electrical test certificates, commissioning records and asset information would be provided to the project manager and the adopting authority.

The final construction information will also confirm:

- the source and arrangement of each electrical supply;
- cable routes and cable sizes;
- protective devices and earthing arrangements;
- column foundation requirements;
- column setback and passive-safety requirements, where applicable;
- central-management-system nodes and commissioning details;
- approved dimming and switching profiles; and
- the final lighting calculations and schedule of equipment.

## 4.2 Maintenance and Operation

The proposed luminaires are LED units selected to provide efficient operation and reduced routine maintenance compared with traditional discharge-lighting equipment.

Access for inspection and maintenance would be from the adopted highway or other maintainable areas. Column positions shall be coordinated during detailed design with drainage features, services, vehicle accesses, visibility requirements, landscaping, trees, structures and vehicle-restraint systems.

The completed installation would be incorporated into Merthyr Tydfil County Borough Council's street-lighting asset-management arrangements, subject to the Council's technical approval and adoption procedures.

# 5. Summary

The proposed lighting arrangement for Goat Mill Road provides a coordinated system of highway and pedestrian lighting across the new roads, junctions, roundabouts, access roads and footpaths.

The design applies lighting classes appropriate to the function of each part of the highway network and uses warm white, full cut-off LED luminaires to direct light towards the areas requiring illumination. Lower output luminaires and lower mounting heights are used for footpath areas, while enhanced lighting is concentrated at junctions, roundabouts and other conflict areas.

The incorporation of controlled optics, warm colour temperatures, constant light output and central-management system control would assist in limiting obtrusive light, ecological effects and energy consumption.

The projected horizontal illuminance contours indicate that the impact on the environment will be low with the design layout only providing lighting where and when it is needed to maintain safety. The key features of the scheme are:

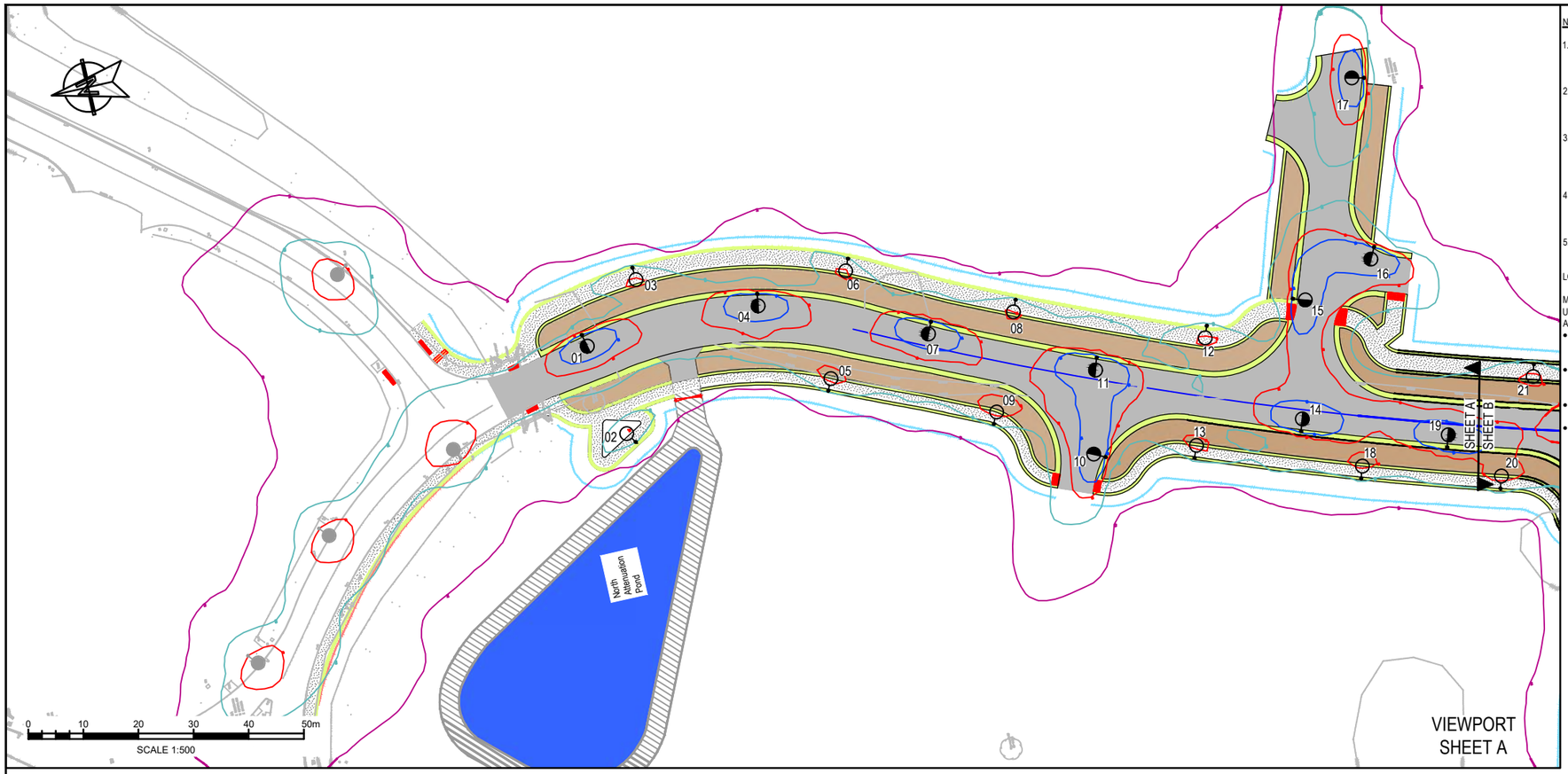
- An environmentally sensitive lighting scheme with low lighting levels, directional LED light sources with no UV content;
- Curfew hours when the lighting is dimmed by one lighting class;
- The lighting proposals follow the principles and guidance set out in Guidance Note 08/23 Bats and artificial lighting in the UK (Bat Conversation Trust/ILP), 2023.

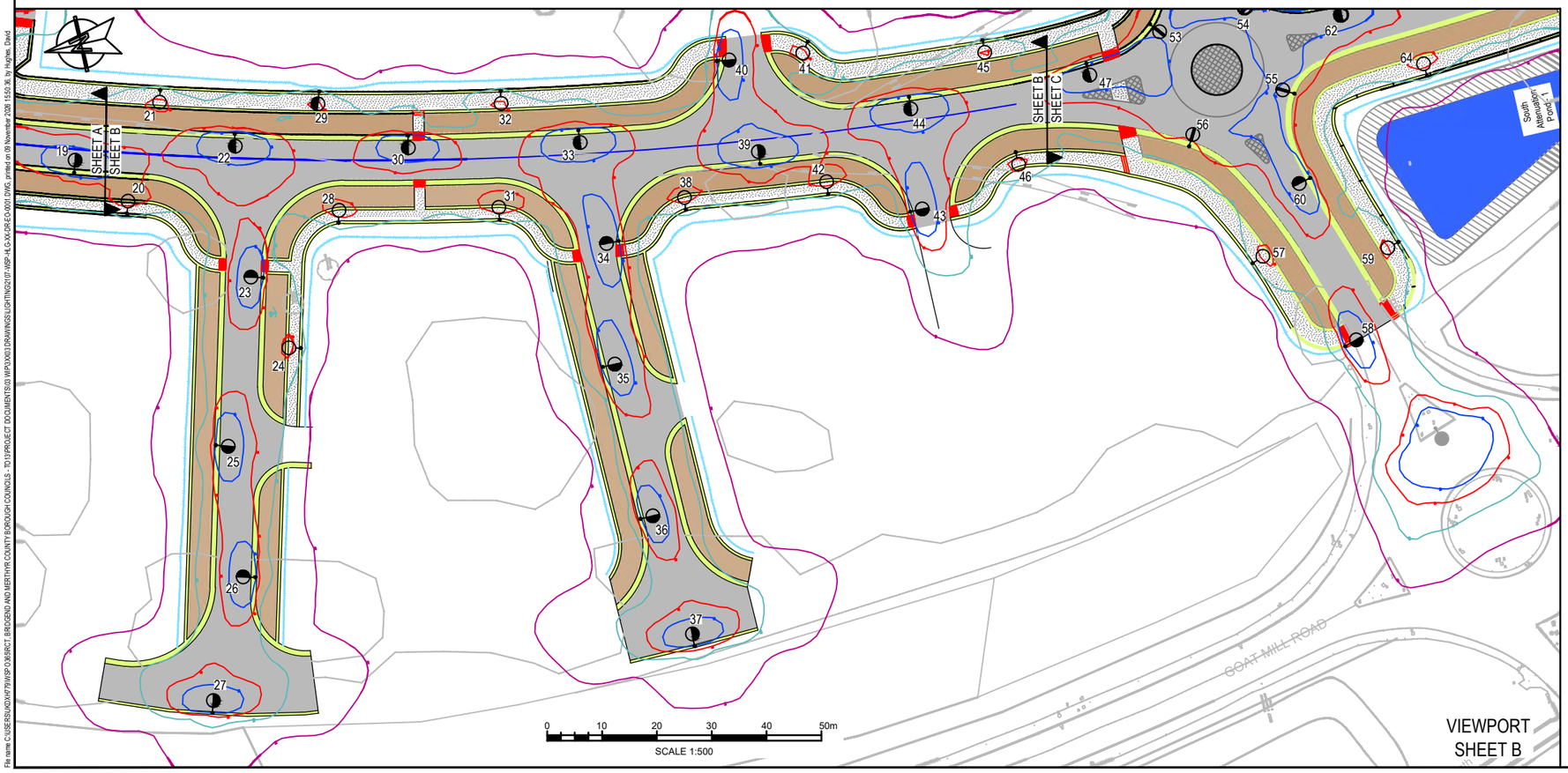
In summary, the sympathetic lighting design and control measures will ensure that any adverse impacts in all sensitive receptors are minimal, including ecological receptors (primarily bats), the night sky and viewpoints in the surrounding area.

Subject to confirmation through detailed design, final lighting calculations, ecological coordination and approval by Merthyr Tydfil County Borough Council, the proposals are considered capable of providing an appropriate balance between highway safety, pedestrian accessibility, environmental protection and energy efficiency.

# Appendices

# Appendix A – Street Lighting design drawings




NOTES

1. THE STREET LIGHTING LAYOUT SHALL COMPLY WITH THE REQUIREMENTS OF BS5489-1:2020 AND BS EN 13201-2:2015 CLASS C4 (10 LUX) FOR CONFLICT AREAS, CLASS P3 (7.5 LUX) FOR ESTATE ROADS, CLASS P4 FOR ACCESS ROADS AND CLASS P5 (3.5 LUX) FOR FOOTPATHS.
2. THE STREET LIGHTING INSTALLATION SHALL COMPLY FULLY WITH MERTHYR TYDFIL COUNTY BOROUGH COUNCIL'S STREET LIGHTING SPECIFICATION AND THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS. ELECTRICAL SUPPLIES TO BE CONFIRMED AT DETAILED DESIGN STAGE.
3. ROAD LIGHTING COLUMNS SHALL BE ALUMINIUM CONSTRUCTION WITH FLUSH DOOR, DUAL ANTI-VANDAL LOCKING MECHANISM AND ROOT PROTECTION, AS MANUFACTURED BY THE ALUMINIUM LIGHTING COMPANY (6000 SERIES). COLUMNS SHALL BE FABRICATED AND INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS, TAKING ACCOUNT OF LOCAL SOIL CONDITIONS AND WIND FACTOR.
4. THE INSTALLATION SHALL BE INSTALLED, TESTED AND COMMISSIONED IN ACCORDANCE WITH "REQUIREMENTS FOR ELECTRICAL INSTALLATIONS - IET WIRING REGULATIONS (18TH EDITION) WITH APPROPRIATE TEST CERTIFICATES ISSUED TO THE PROJECT MANAGER ON COMPLETION OF THE WORKS.
5. THIS DRAWING SHALL BE USED SOLELY FOR THE PURPOSE DESCRIBED IN THE DRAWING TITLE, AS OTHER DETAILS MAY BE INACCURATE.

LOCAL ECOLOGY

MITIGATION MEASURES TO ENSURE THAT RETAINED HABITATS IN AND AROUND THE SITE USED BY PROTECTED AND NOTABLE SPECIES WILL NOT BE ADVERSELY AFFECTED BY ARTIFICIAL LIGHT:

- SPECIFICATION OF FULL CUT-OFF DIRECTIONAL LED LUMINAIRES WITH NO LIGHTSPILL ABOVE THE HORIZONTAL IN ACCORDANCE WITH ILP GUIDANCE NOTE FOR THE REDUCTION OF OBTRUSIVE LIGHT (GN 01/26).
- SPECIFICATION OF WARM WHITE (2700K) LED COLOUR TEMPERATURE LUMINAIRES WITH NO UV AND A LOWER BLUE LIGHT CONTENT IN ACCORDANCE WITH GUIDANCE IN ILP/BCT GUIDANCE NOTE - BATS AND ARTIFICIAL LIGHTING IN THE UK (GN 08/23).
- CELTEK CENTRAL MANAGEMENT SYSTEM ALLOWS REMOTE DIMMING AND SWITCHING OF LUMINAIRES BY MTCBC POST CONSTRUCTION.
- LED LUMINAIRES TO BE PROVIDED WITH CLO TECHNOLOGY, MINIMISING EXCESSIVE LIGHT OUTPUT AT EARLY STAGES ON INSTALLATION.



TRT ASPECT GEN 2



TRT OPTIO NANO

DO NOT SCALE




KEY

PROPOSED 8.0m LIGHTING COLUMN WITH POST-TOP MOUNTED TRT ASPECT A32/GEN2/43W/CLO/GR5/5.92 klm 2700K LED LUMINAIRE. UMSUG CODE 42 0043 0000 100.

PROPOSED 8.0m LIGHTING COLUMN WITH POST-TOP MOUNTED TRT ASPECT A32/GEN2/32W/CLO/GR4/4.19 klm 2700K LED LUMINAIRE. UMSUG CODE 42 0032 0000 100.

PROPOSED 6.0m LIGHTING COLUMN WITH POST-TOP MOUNTED TRT OPTIO NANO OPN12/LED/10W/CLO/GR7/1.02 klm 2700K LED LUMINAIRE. UMSUG CODE 42 0010 0000 100.

HORIZONTAL ILLUMINANCE (CONTOURS INDICATE PROJECTED LUX VALUES AT GROUND LEVEL, EXCLUDING THE SCREENING EFFECT OF BUILDINGS, TREES, HEDGES, ETC.)

HEALTH AND SAFETY SYMBOLS LEGEND
Refer to T446: Design Risk Management Schedule for more details

- INDICATES A RESIDUAL RISK REQUIRING A COMPULSORY ACTION
- CONVEYS INFORMATION ABOUT A RESIDUAL RISK
- INDICATES A RESIDUAL RISK REQUIRING A SPECIFIC ACTION TO BE AVOIDED
- WARNS OF A RESIDUAL RISK OR INFORMATION THAT IS UNUSUAL AND CANNOT BE DESIGNED OUT
- INDICATES AN ENVIRONMENTAL HAZARD

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TITLE: ROAD LIGHTING (SHEET 1 OF 2)

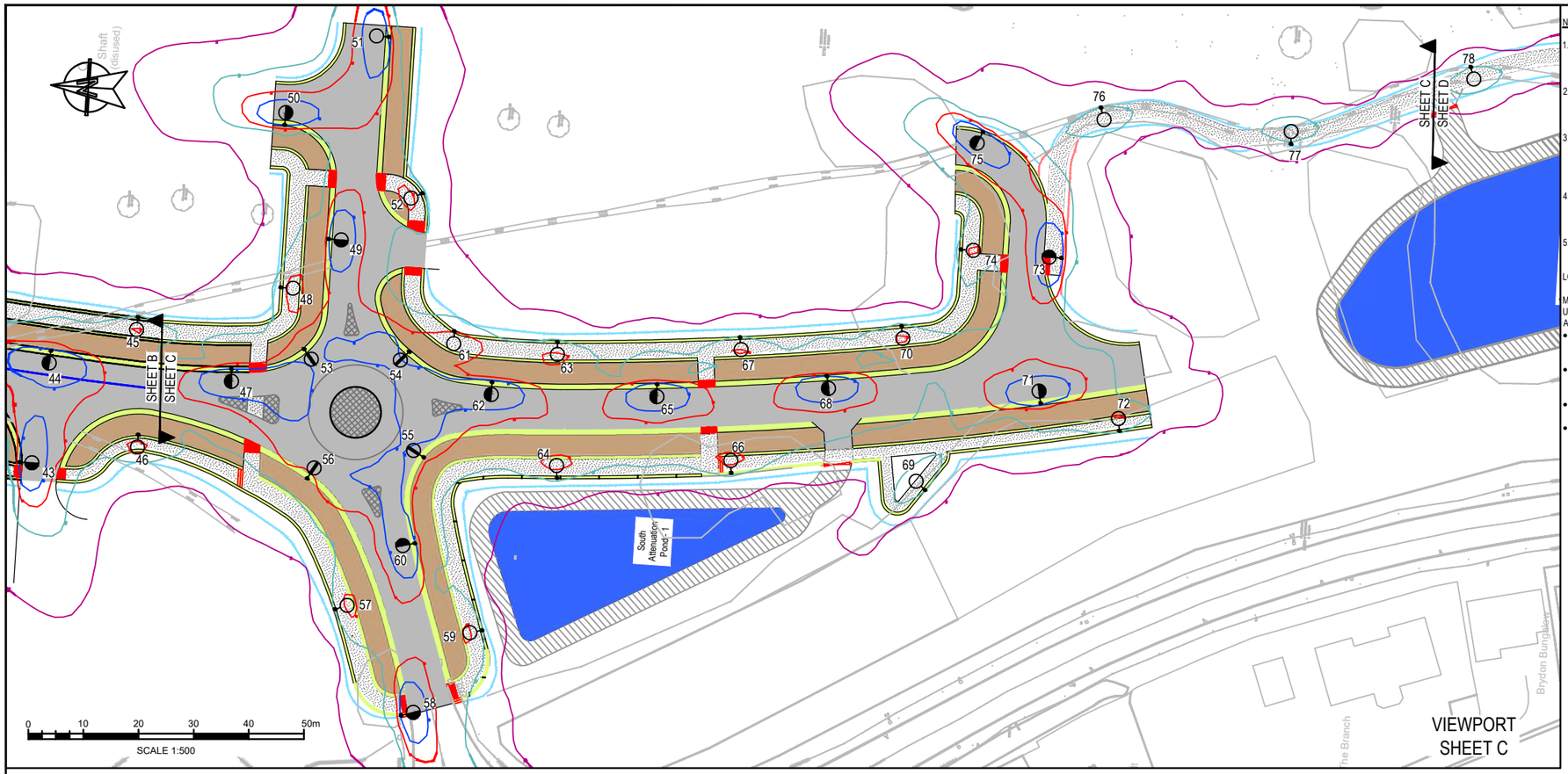
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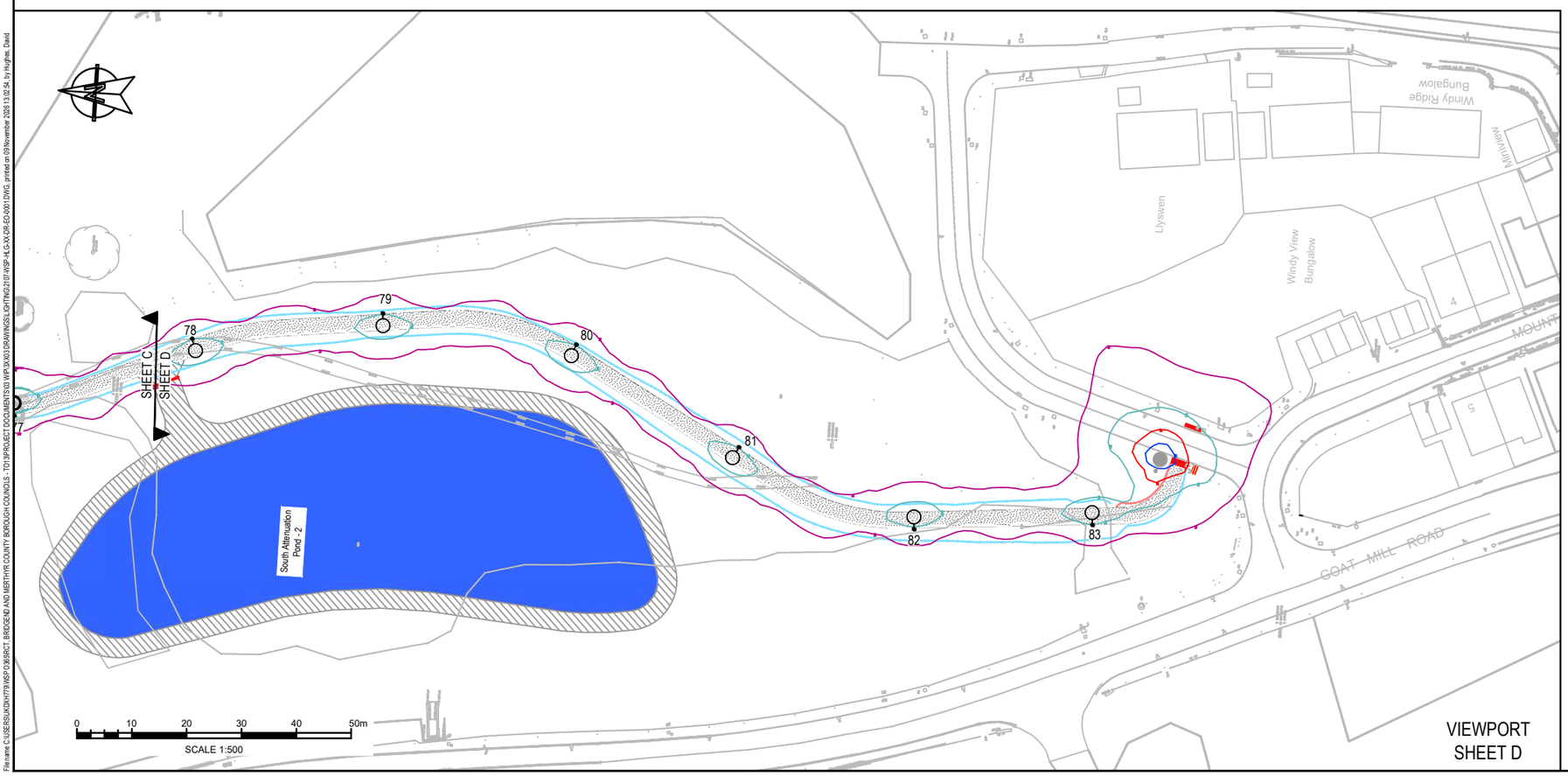
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NOTES

1. THE STREET LIGHTING LAYOUT SHALL COMPLY WITH THE REQUIREMENTS OF BS5489-1:2020 AND BS EN 13201-2:2015 CLASS C4 (10 LUX) FOR CONFLICT AREAS, CLASS P3 (7.5 LUX) FOR ESTATE ROADS, CLASS P4 FOR ACCESS ROADS AND CLASS P5 (3.5 LUX) FOR FOOTPATHS.
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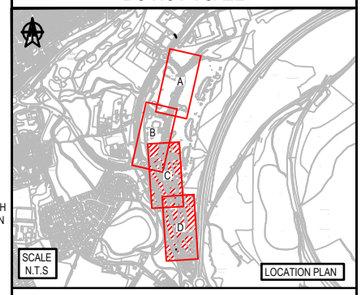


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HORIZONTAL ILLUMINANCE (CONTOURS INDICATE PROJECTED LUX VALUES AT GROUND LEVEL, EXCLUDING THE SCREENING EFFECT OF BUILDINGS, TREES, HEDGES, ETC.)

1.0
5.0
10.0
15.0

HEALTH AND SAFETY SYMBOLS LEGEND
Refer to T446: Design Risk Management Schedule for more details

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SITE/PROJECT: GOAT MILL ROAD DEVELOPMENT

TITLE: ROAD LIGHTING (SHEET 2 OF 2)

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# Appendix B – Design Calculation Report

| | |
|---|---|
| **DATE:** | **2 November 2026** |
| **DESIGNER:** | **David Hughes** |
| **PROJECT No:** | **UK0041132.2107** |
| **PROJECT NAME:** | **Goat Mill Road** |

LIGHTING REALITY

# Outdoor Lighting Report

# 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 | Grid 1 - Roadway (P3) | 306156.23 | 206617.47 | 33.21 | 127.07 | 1.44 | 1.48 |
| 2 | Grid 2 - Footpath (P5) | 306219.42 | 206506.52 | 42.63 | 130.74 | 1.47 | 1.49 |
| 3 | Grid 3 - Footpath (P5) | 306200.83 | 206360.00 | 39.46 | 154.71 | 1.46 | 1.49 |
| 4 | Grid 4 - Roundabout (C4) | 306144.76 | 206746.43 | 39.55 | 44.57 | 1.46 | 1.49 |
| 5 | Grid 5 | 306178.25 | 207145.15 | 88.00 | 64.79 | 1.49 | 1.47 |
| 6 | Grid 6 - Access Roads (P4) | 306048.21 | 206873.59 | 104.37 | 134.40 | 1.49 | 1.49 |
| 7 | Grid 7 | 306216.27 | 206969.35 | 54.92 | 40.18 | 1.48 | 1.49 |
| 8 | Grid 8 | 306183.60 | 206741.49 | 95.03 | 61.21 | 1.48 | 1.49 |
| 9 | Grid 9 - Footpaths (P5) | 306063.72 | 206792.49 | 185.38 | 369.41 | 1.49 | 1.50 |
| 10 | Grid 10 - Footpaths (P5) | 306118.51 | 206611.55 | 146.52 | 179.72 | 1.50 | 1.50 |
| 11 | Grid 11 | 306112.83 | 206734.91 | 43.49 | 31.20 | 1.50 | 1.49 |
| 12 | Grid 12 | 306010.55 | 206327.06 | 337.23 | 919.58 | 1.50 | 3.68 |
| 13 | Grid 13 - Roadway (P3) | 306132.59 | 206802.02 | 48.79 | 345.46 | 1.43 | 1.49 |

## Luminaires



### Luminaire B Data

| | |
|---|---|
| Supplier | TRT Lighting |
| Type | A32_GEN2_LED_43W_GR5_(Blue)_G0_2700K_FG |
| Lamp(s) | 42 0043 0000 100 |
| Lamp Flux (klm) | 5.92 |
| File Name | A32_GEN2_LED_43W_GR5_(Blue)_G0_2700K_FG.ies |
| Maintenance Factor | 0.84 |
| Lum. Int. Class | None |
| No. in Project | 37 |



### Luminaire C Data

| | |
|---|---|
| Supplier | TRT Lighting |
| Type | A24_GEN2_LED_32W_GR4_(Pink)_G0_2700K_FG |
| Lamp(s) | 42 0032 0000 100 |
| Lamp Flux (klm) | 4.19 |
| File Name | A24_GEN2_LED_32W_GR4_(Pink)_G0_2700K_FG.ies |
| Maintenance Factor | 0.84 |
| Lum. Int. Class | None |
| No. in Project | 4 |



### Luminaire D Data

| | |
|---|---|
| Supplier | TRT Lighting |
| Type | OPN12_LED-V1_10W_GR7 (Green)_2700 K_EXP_PSO |
| Lamp(s) | 42 0010 0000 100 |
| Lamp Flux (klm) | 1.18 |
| File Name | OPN12_LED-V1_10W_GR7 (Green)_2700 K_EXP_PSO.ies |
| Maintenance Factor | 1.00 |
| Lum. Int. Class | G3 |
| No. in Project | 42 |



### Luminaire Z Data

| | |
|---|---|
| Supplier | TRT Lighting |
| Type | A32_GEN2_LED_75W_GA2_(Yellow)_G1_2700K_FG |
| Lamp(s) | 42 0075 0000 100 |
| Lamp Flux (klm) | 9.74 |
| File Name | A32_GEN2_LED_75W_GA2_(Yellow)_G1_2700K_FG.ies |
| Maintenance Factor | 1.00 |
| Lum. Int. Class | G1 |
| No. in Project | 6 |

## Layout

| ID | Type | X | Y | Height | Angle | Tilt | Cant | Out-reach | Dimmed to | Target X | Target Y | Target Z |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | B | 306246.49 | 207121.99 | 8.00 | 192.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 3 | B | 306221.82 | 207031.85 | 8.00 | 156.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 4 | B | 306224.38 | 206994.85 | 8.00 | 252.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 5 | C | 306174.97 | 206775.98 | 8.00 | 220.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 6 | B | 306246.78 | 207089.35 | 8.00 | 166.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 7 | B | 306107.47 | 206886.53 | 8.00 | 275.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 10 | B | 306185.06 | 206912.48 | 8.00 | 166.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 10 | D | 306128.28 | 206767.23 | 6.00 | 287.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 13 | B | 306171.24 | 206741.62 | 8.00 | 180.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 14 | B | 306176.15 | 206681.01 | 8.00 | 186.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 16 | B | 306230.19 | 206978.37 | 8.00 | 153.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 17 | B | 306179.30 | 206881.92 | 8.00 | 172.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 18 | B | 306203.91 | 207034.19 | 8.00 | 68.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 17 | B | 306173.57 | 206641.97 | 8.00 | 10.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 23 | B | 306222.44 | 206655.38 | 8.00 | 150.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 24 | D | 306216.23 | 206402.08 | 6.00 | 7.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 25 | D | 306239.53 | 206568.02 | 6.00 | 199.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 18 | D | 306226.16 | 206467.32 | 6.00 | 153.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 27 | B | 306200.22 | 206639.83 | 8.00 | 90.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 28 | D | 306242.92 | 206498.06 | 6.00 | 158.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 29 | Z | 306226.67 | 206391.18 | 6.00 | 345.00 | 0.00 | 0.00 | 0.40 | 40% | | | |
| 34 | B | 306151.23 | 206826.18 | 8.00 | 272.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 26 | B | 306165.80 | 206850.97 | 8.00 | 350.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 32 | B | 306136.07 | 206887.06 | 8.00 | 275.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 28 | B | 306165.63 | 206943.99 | 8.00 | 72.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 33 | C | 306156.74 | 206753.16 | 8.00 | 54.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 34 | B | 306200.59 | 206998.56 | 8.00 | 337.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 31 | B | 306109.82 | 206754.18 | 8.00 | 283.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 33 | Z | 306222.85 | 207176.29 | 8.00 | 214.00 | 0.00 | 0.00 | 0.40 | 50% | | | |
| 34 | B | 306192.42 | 206943.21 | 8.00 | 164.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 35 | D | 306246.33 | 206533.62 | 6.00 | 185.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 32 | D | 306213.58 | 206434.49 | 6.00 | 5.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 33 | Z | 306203.12 | 207193.94 | 8.00 | 214.00 | 0.00 | 0.00 | 0.40 | 50% | | | |
| 38 | C | 306151.64 | 206773.94 | 8.00 | 327.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 39 | C | 306175.74 | 206756.88 | 8.00 | 136.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 40 | B | 306232.50 | 206764.24 | 8.00 | 97.00 | 0.00 | 0.00 | 0.40 | 100% | | | |

## Layout Continued

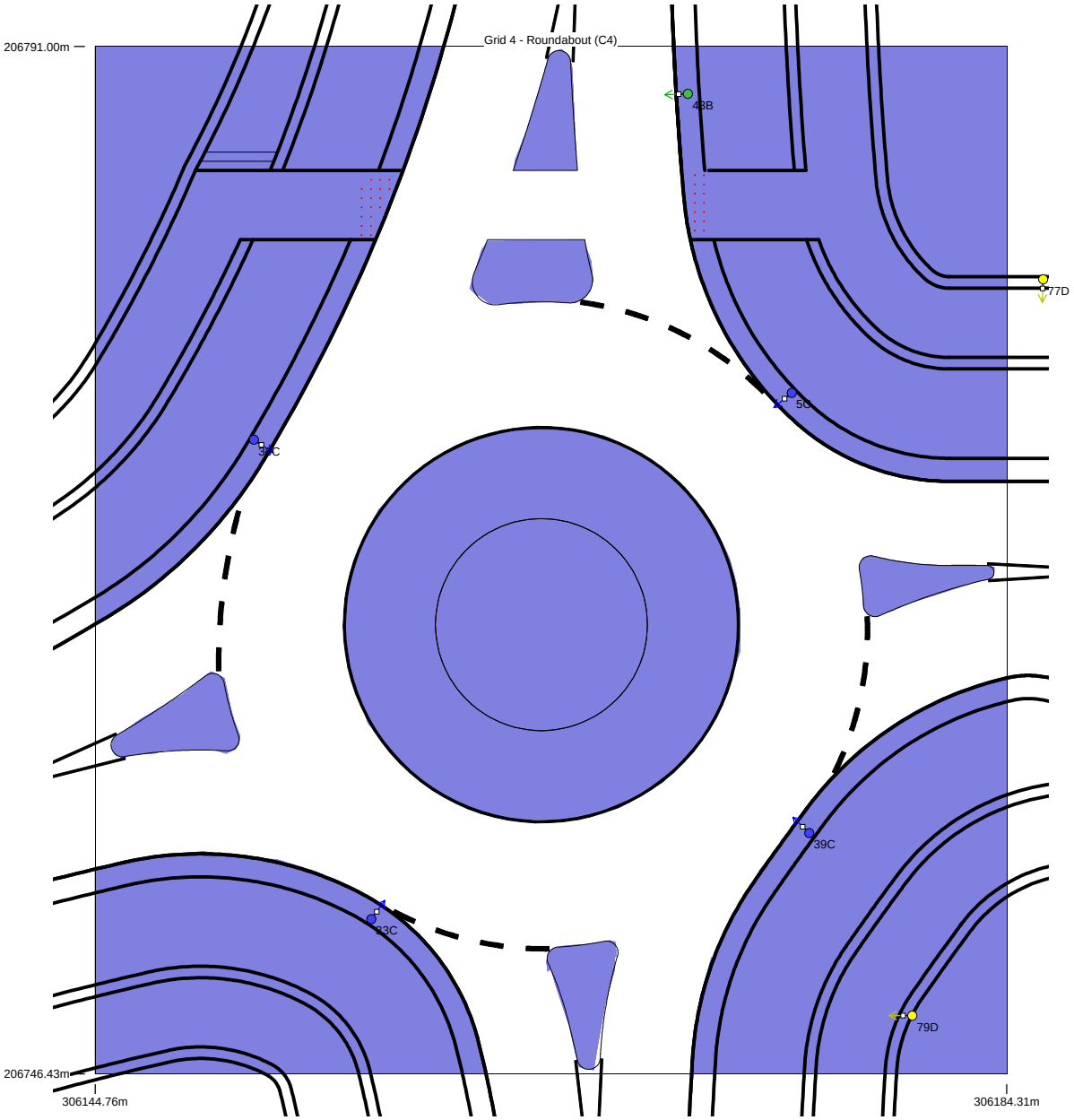
| ID | Type | X | Y | Height | Angle | Tilt | Cant | Out-reach | Dimmed to | Target X | Target Y | Target Z |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 41 | B | 306215.32 | 206782.03 | 8.00 | 1.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 42 | B | 306195.19 | 206772.78 | 8.00 | 270.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 43 | B | 306170.47 | 206788.94 | 8.00 | 182.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 44 | D | 306156.55 | 206661.80 | 6.00 | 48.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 46 | B | 306171.84 | 206821.78 | 8.00 | 176.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 47 | B | 306137.75 | 206959.15 | 8.00 | 257.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 48 | B | 306112.61 | 206957.47 | 8.00 | 75.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 50 | B | 306260.58 | 206973.29 | 8.00 | 79.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 51 | Z | 306229.39 | 207148.30 | 8.00 | 25.00 | 0.00 | 0.00 | 0.40 | 50% | | | |
| 52 | B | 306234.81 | 207059.72 | 8.00 | 155.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 53 | B | 306090.21 | 206970.57 | 8.00 | 346.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 54 | B | 306082.65 | 206882.07 | 8.00 | 358.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 55 | B | 306157.79 | 206879.26 | 8.00 | 89.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 56 | Z | 306091.63 | 206741.43 | 6.00 | 195.00 | 0.00 | 0.00 | 1.00 | 100% | | | |
| 51 | D | 306227.90 | 206634.51 | 6.00 | 199.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 52 | D | 306223.82 | 206599.75 | 6.00 | 5.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 53 | Z | 306268.26 | 207160.95 | 8.00 | 125.00 | 0.00 | 0.00 | 0.40 | 50% | | | |
| 54 | B | 306191.57 | 206973.56 | 8.00 | 337.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 55 | D | 306256.37 | 207110.35 | 6.00 | 173.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 56 | D | 306249.32 | 207071.88 | 6.00 | 140.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 57 | D | 306235.32 | 207043.82 | 6.00 | 157.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 58 | D | 306223.09 | 207011.04 | 6.00 | 163.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 59 | D | 306225.35 | 207116.70 | 6.00 | 24.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 60 | D | 306151.43 | 206939.86 | 6.00 | 69.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 61 | D | 306226.84 | 207080.61 | 6.00 | 328.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 62 | D | 306214.45 | 207052.48 | 6.00 | 337.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 63 | D | 306200.19 | 207018.48 | 6.00 | 328.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 64 | D | 306172.06 | 206928.46 | 6.00 | 337.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 65 | D | 306196.44 | 206926.52 | 6.00 | 159.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 66 | D | 306190.14 | 206989.73 | 6.00 | 344.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 67 | D | 306182.49 | 206965.58 | 6.00 | 344.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 68 | D | 306203.16 | 206954.74 | 6.00 | 159.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 69 | D | 306189.21 | 206894.23 | 6.00 | 159.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 70 | D | 306166.47 | 206899.51 | 6.00 | 348.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 71 | D | 306160.65 | 206866.07 | 6.00 | 358.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 72 | D | 306157.72 | 206840.11 | 6.00 | 355.00 | 0.00 | 0.00 | 0.40 | 100% | | | |

## Layout Continued

| ID | Type | X | Y | Height | Angle | Tilt | Cant | Out-reach | Dimmed to | Target X | Target Y | Target Z |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 73 | D | 306178.75 | 206806.35 | 6.00 | 180.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 74 | D | 306157.56 | 206805.00 | 6.00 | 180.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 75 | B | 306185.87 | 206854.53 | 8.00 | 256.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 76 | D | 306185.65 | 206837.47 | 6.00 | 139.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 77 | D | 306185.87 | 206780.91 | 6.00 | 268.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 78 | D | 306204.53 | 206756.45 | 6.00 | 119.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 79 | D | 306180.20 | 206748.97 | 6.00 | 180.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 80 | D | 306126.14 | 206740.51 | 6.00 | 106.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 81 | B | 306141.13 | 206753.67 | 8.00 | 107.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 82 | B | 306172.68 | 206711.69 | 8.00 | 186.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 83 | D | 306154.50 | 206728.69 | 6.00 | 5.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 84 | D | 306178.89 | 206730.17 | 6.00 | 185.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 85 | D | 306157.31 | 206697.20 | 6.00 | 5.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 86 | D | 306182.14 | 206697.20 | 6.00 | 184.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 87 | D | 306186.14 | 206668.08 | 6.00 | 184.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 88 | D | 306200.63 | 206658.62 | 6.00 | 265.00 | 0.00 | 0.00 | 0.40 | 100% | | | |
| 89 | D | 306169.40 | 206627.36 | 6.00 | 14.00 | 0.00 | 0.00 | 0.40 | 100% | | | |

# Horizontal Illuminance (lux)

Grid 4 - Roundabout (C4)

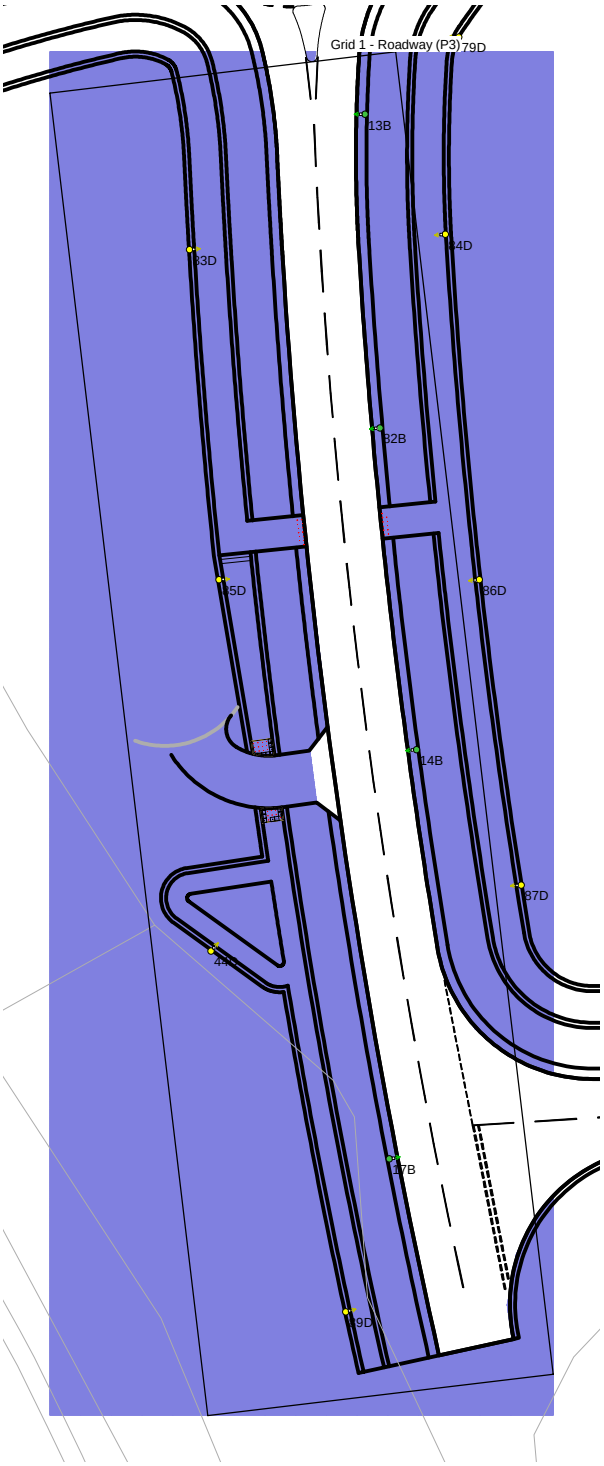



## Results

| | |
|---|---|
| Eav | 14.80 |
| Emin | 6.61 |
| Emax | 27.73 |
| Emin/Emax | 0.24 |
| Emin/Eav | 0.45 |
| | |

# Horizontal Illuminance (lux)

Grid 1 - Roadway (P3)



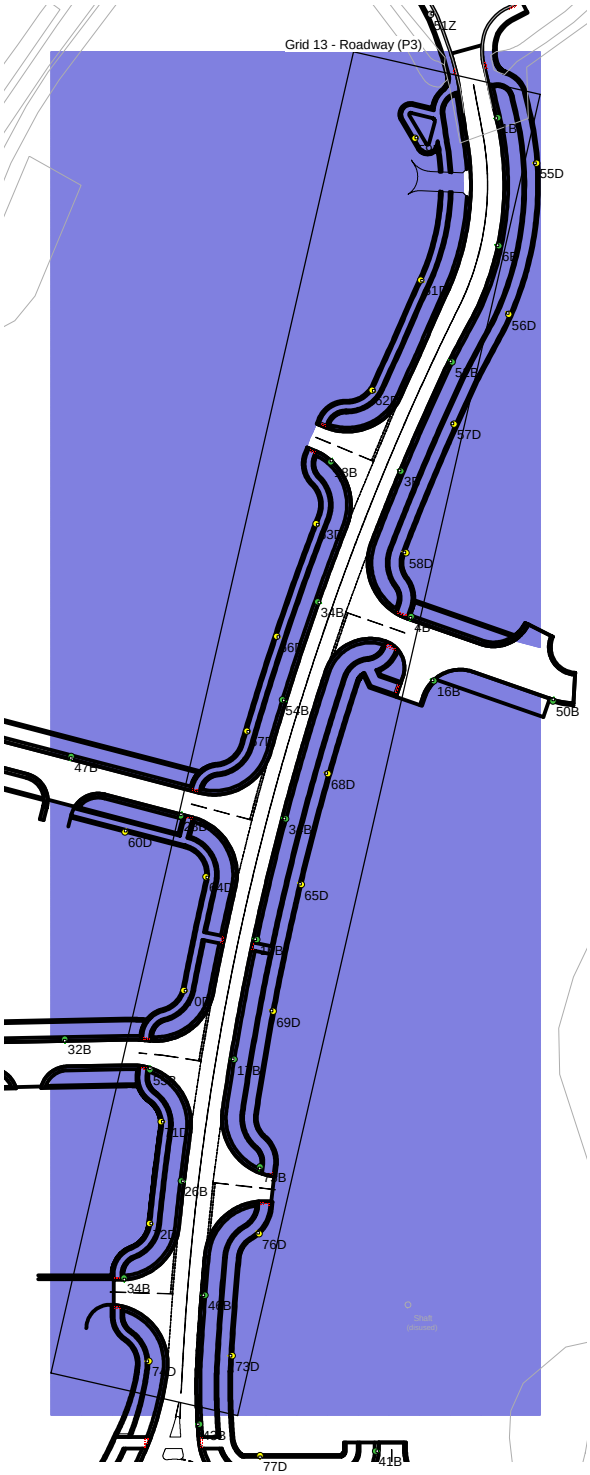

## Results

| | |
|---|---|
| Eav | 10.37 |
| Emin | 2.72 |
| Emax | 27.67 |
| Emin/Emax | 0.10 |
| Emin/Eav | 0.26 |
| | |

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# Horizontal Illuminance (lux)

Grid 13 - Roadway (P3)

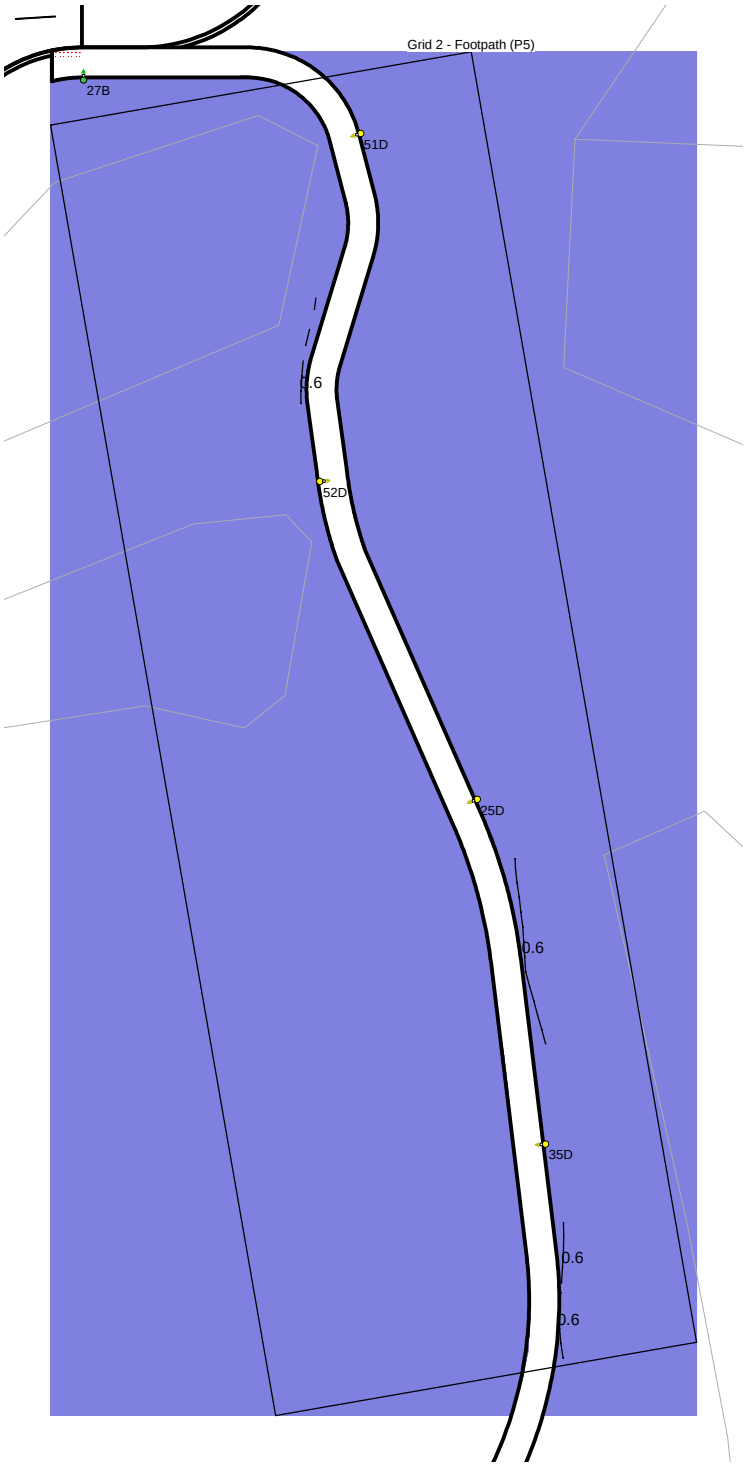



## Results

| | |
|---|---|
| Eav | 12.36 |
| Emin | 4.77 |
| Emax | 29.96 |
| Emin/Emax | 0.16 |
| Emin/Eav | 0.39 |
| | |

# Horizontal Illuminance (lux)

Grid 2 - Footpath (P5)



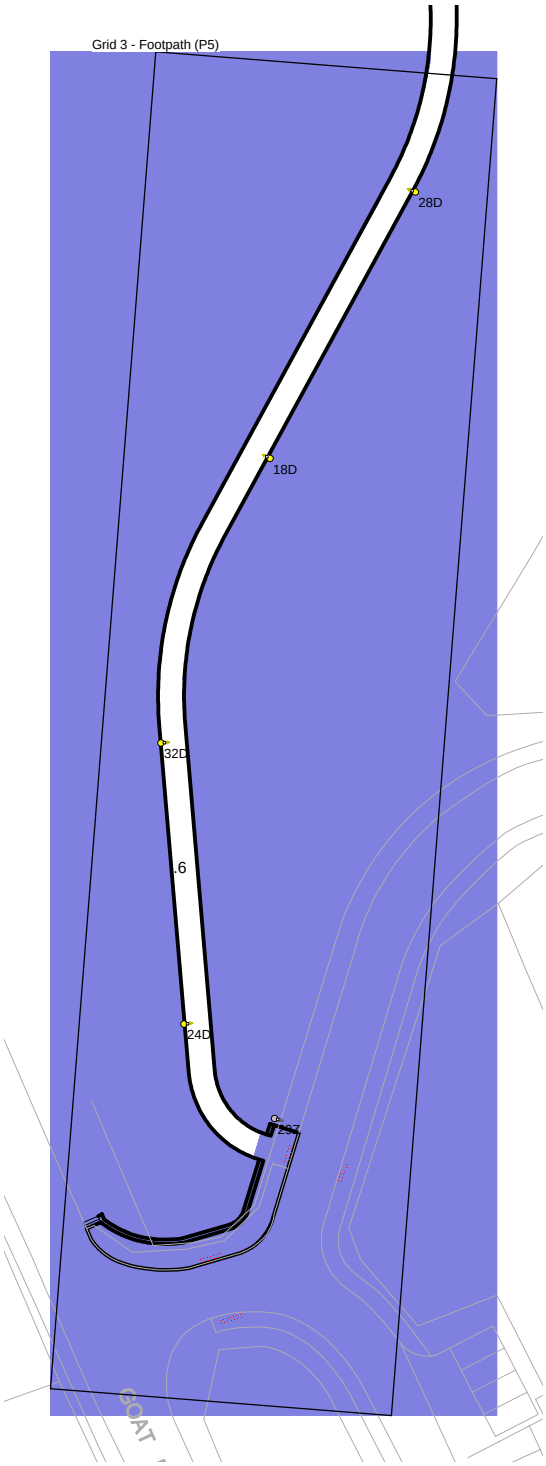

## Results

| | |
|---|---|
| Eav | 4.24 |
| Emin | 0.71 |
| Emax | 12.62 |
| Emin/Emax | 0.06 |
| Emin/Eav | 0.17 |
| | |

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# Horizontal Illuminance (lux)

Grid 3 - Footpath (P5)




## Results

| | |
|---|---|
| Eav | 4.41 |
| Emin | 0.81 |
| Emax | 12.48 |
| Emin/Emax | 0.06 |
| Emin/Eav | 0.18 |
| | |

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