

**East Midlands Gateway  
Phase 2 (EMG2)**

**Document DCO 6.11D/MCO 6.11D**

ENVIRONMENTAL STATEMENT

**Technical Appendices**

Appendix 11D

# Obtrusive Light Calculation

August 2025

11

The East Midlands Gateway Phase 2  
and Highway Order 202X and The East Midlands Gateway  
Rail Freight and Highway (Amendment) Order 202X

**[SEGRO.COM/SLPEMG2](https://segro.com/slpemg2)**

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02/05/2025



· LIGHTING DESIGN · ELECTRICAL · SMART CITIES ·  
ENERGY REDUCTION · LIGHTING IMPACT

# EAST MIDLANDS GATEWAY

## CHAPTER 11 APPENDIX 11D

### OBTRUSIVE LIGHT CALCULATIONS

### DOCUMENT DCO/MCO 6.11D

#### DFL-UK

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| PROJECT NUMBER: 2389 |                     | DOCUMENT REF: 2389-DFL-ELG-XX-RP-EO-13003 |         |          |            |
|----------------------|---------------------|-------------------------------------------|---------|----------|------------|
| P04                  | Final Issue         | DA                                        | AS      | AS       | 14/08/2025 |
| P03                  | Thid Issue          | DS                                        | AS      | AS       | 10/06/2025 |
| P02                  | Second Issue        | DS                                        | AS      | AS       | 02/05/2025 |
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| Revision             | Purpose Description | Originated                                | Checked | Approved | Date       |

Designs for Lighting (DFL) is a business built on successfully collaborating with our clients. We have over 20 years proven experience in our industry, listening to the challenges our clients face, developing the best solutions and being innovators in our specialism. Our role is to find the most effective and sustainable outcome to enhance and support your projects. We proudly work with recognised industry bodies to promote and shape the future of the industry and ensure our staff are trained to exceed the required competency levels of our industries. Above all, we ensure each project delivers against our values.



Quality



Knowledgeable



Dependable



Clear Advice

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## 1. INTRODUCTION

- 1.1.1. This technical appendix details the obtrusive light calculation that have been conducted for the EMG2 Project.
- 1.1.2. This includes horizontal light spill diagrams for EMG2 Main Site and EMG1 Plot 16.
- 1.1.3. Both horizontal light spill diagrams and vertical illuminance calculation have been conducted for these two sites.
- 1.1.4. All calculations use a maintenance factor of 1, thus they represent luminaire output at the start of luminaire life. This is the point in the luminaires useable life where it has the highest light output, and therefore the calculation represents a reasonable worst-case scenario.
- 1.1.5. The embedded mitigation as detailed in **Appendix 11A (Document DCO/MCO 6.11A)** and **Chapter 11 (Document DCO/MCO 6.11)** is included in the lighting calculations where it is possible to do so.
- 1.1.6. All obtrusive light calculations have been conducted based on the illustrative masterplans (**Document DCO 2.6 and Document MCO 2.6**). These plans are subject to change at the detailed design phase. These plans provide a reasonable basis for the assessment of lighting effects from the EMG 2 Project.

## 2. EMG2 MAIN SITE OBTRUSIVE LIGHT CALCULATIONS

- 2.1.1. The following pages show the results of the obtrusive light calculations for EMG2 Main Site.
- 2.1.2. This includes a Light Spill Diagram and Vertical Illuminance Calculations.
- 2.1.3. All obtrusive light calculations have been conducted based on the illustrative masterplans (**Document DCO 2.6**). This plan is subject to change at the detailed design phase. This plan provide a reasonable basis for the assessment of lighting effects from the EMG 2 Main Site.

## 2.2. EMG 2 Main Site Horizontal Light Spill Diagram



### 2.3. EMG 2 Main Site Vertical Illuminance Calculations

**DATE:** 16 December 2024  
**DESIGNER:** DFL-UK (LM)  
**PROJECT No:** 2398  
**PROJECT NAME:** East Midlands Gateway 2



This document shows the obtrusive light calculations for the sensitive receptors that have been identified in ES Chapter 11.

This document forms an appendix to ES Chapter 11 and therefore must be read in conjunction with this chapter.

All lighting calculations have been conducted using a maintenance factor of 1 and shows a reasonable worst case at the start of luminaire life.

## **2398-DFL-ELG-XX-CA-13001**

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## 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    | 445407.16 | 323938.65 | 1929.07   | 1779.82   | 7.72       | 7.12       |
| 2  | PHAR 001  | 445737.53 | 324496.67 | 614.35    | 12.00     | 2.46       | 1.50       |
| 3  | PHAR 004  | 446092.10 | 323982.28 | 356.22    | 12.00     | 1.50       | 1.50       |
| 4  | PHAR 003  | 447222.26 | 323907.22 | 726.44    | 12.00     | 2.91       | 1.50       |
| 5  | PSEER 002 | 446594.77 | 325136.42 | 297.20    | 12.00     | 1.49       | 1.50       |
| 6  | PSEER 002 | 446594.04 | 325137.53 | 347.64    | 12.00     | 1.50       | 1.50       |
| 7  | PHAR 002  | 445346.29 | 325161.68 | 242.69    | 12.00     | 1.50       | 1.50       |

### Luminaires

#### Luminaire B Data



|                      |                                                      |
|----------------------|------------------------------------------------------|
| Supplier             | D W Windsor                                          |
| Type                 | Sabre 64LED 3k C2 1000mA UMSUG 42 019 8 0000 100     |
| Lamp(s)              | 64 x 3k LED                                          |
| Lamp Flux (klm)      | 20.34                                                |
| File Name            | Sabre 64LED 3k C2_1000mA UMSUG 42 019 8 0000 100.ies |
| Maintenance Factor   | 1.00                                                 |
| Imax70,80,90(cd/klm) | 853.5, 62.5, 0.0                                     |
| No. in Project       | 234                                                  |

#### Luminaire C Data



|                      |                                                                                 |
|----------------------|---------------------------------------------------------------------------------|
| Supplier             | Urbis Schreder                                                                  |
| Type                 | AXIA 3.3 5267 Integrated lenses 48 OSLOM SQUARE GIANT@400mA                     |
| Lamp(s)              | 48 OSLOM SQUARE GIANT@400mA WW 73 0 230V                                        |
| LampFlux(klm)/Colour | 8.12 WW 3000K/70                                                                |
| File Name            | AXIA 3.3 5267 48 OSLOM SQUARE GIANT 4 00mA WW 730 56W 429224 Integrated lens... |
| Maintenance Factor   | 1.00                                                                            |
| Imax70,80,90(cd/klm) | 980.0, 156.0, 9.0                                                               |
| No. in Project       | 137                                                                             |

#### Luminaire D Data



|                      |                                                             |
|----------------------|-------------------------------------------------------------|
| Supplier             | D W Windsor                                                 |
| Type                 | Milano Classic-16LED-3k-C3 800mA UMSUG 42 0148 0000 100     |
| Lamp(s)              | 16 x 3k LED                                                 |
| Lamp Flux (klm)      | 17.36                                                       |
| File Name            | Milano Classic-16LED-3k-C3_800mA UMSUG 42 0148 0000 100.ies |
| Maintenance Factor   | 1.00                                                        |
| Imax70,80,90(cd/klm) | 336.0, 30.0, 2.0                                            |
| No. in Project       | 42                                                          |

#### Luminaire E Data



|                      |                                                                                 |
|----------------------|---------------------------------------------------------------------------------|
| Supplier             | Urbis Schreder                                                                  |
| Type                 | AXIA 3.3 5279 Integrated lenses 48 OSLOM SQUARE GIANT@400mA                     |
| Lamp(s)              | 48 OSLOM SQUARE GIANT@400mA WW 73 0 230V                                        |
| LampFlux(klm)/Colour | 8.12 WW 3000K/70                                                                |
| File Name            | AXIA 3.3 5279 48 OSLOM SQUARE GIANT 4 00mA WW 730 56W 429344 Integrated lens... |
| Maintenance Factor   | 1.00                                                                            |
| Imax70,80,90(cd/klm) | 781.4, 152.7, 3.9                                                               |
| No. in Project       | 25                                                                              |

### Layout

| ID | Type | X         | Y         | Height | Angle | Tilt | Cant | Out-reach | Dimmed to | Target X | Target Y | Target Z |
|----|------|-----------|-----------|--------|-------|------|------|-----------|-----------|----------|----------|----------|
| 1  | D    | 446140.04 | 325372.45 | 8.00   | 90.35 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 2  | D    | 446180.02 | 325372.69 | 8.00   | 90.35 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 3  | D    | 446220.00 | 325372.93 | 8.00   | 90.35 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 4  | D    | 446259.99 | 325373.17 | 8.00   | 90.35 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |

## Layout Continued

| ID | Type | X         | Y         | Height | Angle  | Tilt | Cant | Out-reach | Dimmed to | Target X | Target Y | Target Z |
|----|------|-----------|-----------|--------|--------|------|------|-----------|-----------|----------|----------|----------|
| 5  | D    | 446299.97 | 325373.41 | 8.00   | 90.35  | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 6  | D    | 446339.95 | 325373.65 | 8.00   | 90.35  | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 7  | C    | 446159.85 | 325352.64 | 8.00   | 95.00  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 8  | C    | 446200.08 | 325352.64 | 8.00   | 95.00  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 9  | C    | 446240.00 | 325352.94 | 8.00   | 95.00  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 10 | C    | 446279.92 | 325352.94 | 8.00   | 95.00  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 11 | C    | 446320.29 | 325353.09 | 8.00   | 95.00  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 12 | C    | 446341.04 | 325317.61 | 8.00   | 359.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 13 | C    | 446321.02 | 325391.39 | 8.00   | 269.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 14 | C    | 446278.67 | 325391.22 | 8.00   | 273.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 15 | C    | 446238.47 | 325390.62 | 8.00   | 275.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 16 | C    | 446127.30 | 325355.41 | 8.00   | 158.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 17 | C    | 446340.81 | 325344.19 | 8.00   | 1.00   | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 18 | C    | 445812.87 | 325356.67 | 8.00   | 270.44 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 19 | C    | 445838.47 | 325356.90 | 8.00   | 270.44 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 20 | C    | 445866.17 | 325357.06 | 8.00   | 270.44 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 21 | C    | 445893.89 | 325357.28 | 8.00   | 270.44 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 22 | C    | 445921.61 | 325357.43 | 8.00   | 270.44 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 23 | C    | 445949.28 | 325357.62 | 8.00   | 270.44 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 24 | C    | 445975.40 | 325357.78 | 8.00   | 270.44 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 25 | C    | 446005.27 | 325357.94 | 8.00   | 270.44 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 26 | C    | 446030.36 | 325358.20 | 8.00   | 270.44 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 27 | C    | 446055.29 | 325358.33 | 8.00   | 270.44 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 28 | C    | 446076.67 | 325341.03 | 8.00   | 180.48 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 29 | C    | 446076.99 | 325302.98 | 8.00   | 180.48 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 30 | C    | 446077.31 | 325264.94 | 8.00   | 180.48 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 31 | C    | 446077.63 | 325226.89 | 8.00   | 180.48 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 32 | C    | 446056.81 | 325322.43 | 8.00   | 359.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 33 | C    | 446056.95 | 325281.04 | 8.00   | 357.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 34 | C    | 446056.95 | 325243.11 | 8.00   | 359.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 35 | D    | 446059.64 | 325163.09 | 8.00   | 0.39   | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 36 | D    | 446059.89 | 325125.89 | 8.00   | 0.39   | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 37 | D    | 446060.14 | 325088.69 | 8.00   | 0.39   | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 38 | D    | 446060.40 | 325051.49 | 8.00   | 0.39   | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 39 | D    | 446101.44 | 325094.67 | 8.00   | 95.00  | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 40 | D    | 446102.07 | 325064.06 | 8.00   | 95.00  | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |

## Layout Continued

| ID | Type | X         | Y         | Height | Angle  | Tilt | Cant | Out-reach | Dimmed to | Target X | Target Y | Target Z |
|----|------|-----------|-----------|--------|--------|------|------|-----------|-----------|----------|----------|----------|
| 41 | C    | 446038.97 | 325144.16 | 8.00   | 357.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 42 | C    | 446039.07 | 325106.78 | 8.00   | 357.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 43 | C    | 446039.71 | 325068.86 | 8.00   | 357.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 44 | C    | 446098.29 | 325047.35 | 8.00   | 123.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 45 | C    | 446088.60 | 325153.99 | 8.00   | 175.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 46 | C    | 446088.69 | 325127.87 | 8.00   | 181.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 47 | D    | 446123.74 | 325077.98 | 8.00   | 357.00 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 48 | D    | 446349.55 | 325061.50 | 8.00   | 265.00 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 49 | D    | 446348.82 | 325040.24 | 8.00   | 265.00 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 50 | D    | 446348.10 | 325020.33 | 8.00   | 263.00 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 51 | D    | 446347.09 | 324999.52 | 8.00   | 263.00 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 52 | D    | 446316.32 | 325043.16 | 8.00   | 357.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 53 | D    | 446314.45 | 325000.87 | 8.00   | 357.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 54 | C    | 446292.10 | 325009.94 | 8.00   | 357.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 55 | C    | 446296.43 | 325038.94 | 8.00   | 357.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 56 | C    | 446326.85 | 325066.27 | 8.00   | 313.00 | 0.00 | 0.00 | 0.40      | 0%        |          |          |          |
| 57 | D    | 446254.79 | 324963.82 | 8.00   | 0.00   | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 58 | D    | 446253.45 | 324929.81 | 8.00   | 27.00  | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 59 | D    | 446252.10 | 324895.79 | 8.00   | 24.00  | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 60 | D    | 446250.76 | 324861.77 | 8.00   | 30.00  | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 61 | D    | 446218.23 | 324862.43 | 8.00   | 177.00 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 62 | D    | 446222.16 | 324966.20 | 8.00   | 178.00 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 63 | D    | 446220.72 | 324931.23 | 8.00   | 180.00 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 64 | D    | 446219.28 | 324897.12 | 8.00   | 181.00 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 65 | C    | 446134.51 | 324916.34 | 8.00   | 0.00   | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 66 | C    | 446133.17 | 324892.41 | 8.00   | 0.00   | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 67 | C    | 446131.83 | 324868.49 | 8.00   | 0.00   | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 68 | C    | 446130.48 | 324844.56 | 8.00   | 0.00   | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 69 | C    | 446166.22 | 324842.85 | 8.00   | 176.65 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 70 | C    | 446167.62 | 324866.85 | 8.00   | 176.65 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 71 | C    | 446169.03 | 324890.85 | 8.00   | 176.65 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 72 | C    | 446170.23 | 324915.59 | 8.00   | 176.65 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 73 | C    | 446147.71 | 324824.21 | 8.00   | 92.00  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 74 | C    | 446152.81 | 324924.01 | 8.00   | 268.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 75 | C    | 446122.39 | 324703.32 | 8.00   | 356.60 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 76 | C    | 446124.26 | 324738.25 | 8.00   | 356.60 | 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 |
|-----|------|-----------|-----------|--------|--------|------|------|-----------|-----------|----------|----------|----------|
| 77  | C    | 446126.43 | 324774.88 | 8.00   | 356.60 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 78  | C    | 446128.45 | 324811.58 | 8.00   | 356.60 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 79  | C    | 446163.89 | 324805.95 | 8.00   | 177.31 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 80  | C    | 446162.57 | 324780.82 | 8.00   | 177.31 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 81  | C    | 446160.72 | 324750.90 | 8.00   | 177.31 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 82  | C    | 446159.04 | 324719.73 | 8.00   | 177.31 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 83  | C    | 446157.23 | 324688.57 | 8.00   | 177.31 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 84  | C    | 446106.52 | 324699.14 | 8.00   | 271.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 85  | C    | 446114.41 | 324677.48 | 8.00   | 85.00  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 86  | C    | 446140.14 | 324676.06 | 8.00   | 90.00  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 87  | D    | 446140.17 | 324578.39 | 8.00   | 0.00   | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 88  | D    | 446138.83 | 324554.38 | 8.00   | 0.00   | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 89  | D    | 446137.49 | 324530.37 | 8.00   | 0.00   | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 90  | D    | 446136.15 | 324506.37 | 8.00   | 0.00   | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 91  | C    | 446169.65 | 324584.68 | 8.00   | 176.98 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 92  | C    | 446168.11 | 324555.61 | 8.00   | 176.98 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 93  | C    | 446166.58 | 324526.53 | 8.00   | 176.98 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 94  | C    | 446165.04 | 324497.46 | 8.00   | 176.98 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 102 | C    | 446257.55 | 324657.06 | 8.00   | 178.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 103 | C    | 446255.57 | 324619.35 | 8.00   | 173.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 104 | C    | 446253.91 | 324580.92 | 8.00   | 179.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 105 | C    | 446251.97 | 324542.25 | 8.00   | 177.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 106 | C    | 446252.25 | 324514.89 | 8.00   | 267.31 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 107 | C    | 446270.63 | 324514.02 | 8.00   | 267.31 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 108 | C    | 446289.01 | 324513.16 | 8.00   | 267.31 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 109 | C    | 446307.39 | 324512.30 | 8.00   | 267.31 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 110 | C    | 446325.77 | 324511.43 | 8.00   | 267.31 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 111 | C    | 446185.16 | 324480.81 | 8.00   | 357.30 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 112 | C    | 446186.39 | 324505.13 | 8.00   | 357.30 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 113 | C    | 446187.52 | 324529.52 | 8.00   | 357.30 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 114 | C    | 446188.71 | 324553.94 | 8.00   | 357.30 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 115 | C    | 446189.88 | 324578.33 | 8.00   | 357.30 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 116 | C    | 446191.07 | 324602.73 | 8.00   | 357.30 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 117 | C    | 446192.31 | 324627.12 | 8.00   | 357.30 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 118 | C    | 446193.54 | 324651.40 | 8.00   | 357.30 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 120 | C    | 446194.19 | 324664.87 | 8.00   | 357.40 | 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 |
|-----|------|-----------|-----------|--------|--------|------|------|-----------|-----------|----------|----------|----------|
| 121 | C    | 446195.17 | 324685.20 | 8.00   | 357.40 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 122 | C    | 446196.12 | 324705.50 | 8.00   | 357.40 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 123 | C    | 446197.14 | 324725.80 | 8.00   | 357.40 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 124 | D    | 446213.47 | 324486.38 | 8.00   | 357.20 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 125 | D    | 446215.08 | 324519.33 | 8.00   | 357.20 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 126 | D    | 446216.69 | 324552.28 | 8.00   | 357.20 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 127 | D    | 446218.31 | 324585.22 | 8.00   | 357.20 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 128 | D    | 446219.92 | 324618.17 | 8.00   | 357.20 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 129 | D    | 446221.53 | 324651.11 | 8.00   | 357.20 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 138 | D    | 446244.01 | 324487.25 | 8.00   | 310.00 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 139 | D    | 446281.08 | 324485.35 | 8.00   | 267.00 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 140 | D    | 446318.15 | 324483.46 | 8.00   | 219.00 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 133 | D    | 446223.14 | 324684.06 | 8.00   | 357.20 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 134 | D    | 446224.75 | 324717.01 | 8.00   | 357.20 | 0.00 | 0.00 | 0.00      | 100%      |          |          |          |
| 135 | C    | 446254.98 | 324718.96 | 8.00   | 178.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 136 | C    | 446253.64 | 324681.32 | 8.00   | 178.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 1   | B    | 446499.32 | 325324.17 | 10.00  | 1.01   | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 3   | B    | 446498.17 | 325351.84 | 10.00  | 1.01   | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 4   | B    | 446497.22 | 325379.13 | 10.00  | 1.01   | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 5   | B    | 446515.46 | 325398.01 | 10.00  | 272.16 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 6   | B    | 446539.87 | 325398.90 | 10.00  | 272.16 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 7   | B    | 446564.46 | 325399.82 | 10.00  | 272.16 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 8   | B    | 446588.97 | 325400.77 | 10.00  | 272.16 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 9   | B    | 446613.65 | 325401.62 | 10.00  | 272.16 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 10  | B    | 446638.06 | 325402.58 | 10.00  | 272.16 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 11  | B    | 446662.65 | 325403.46 | 10.00  | 272.16 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 12  | B    | 446485.81 | 325323.21 | 10.00  | 249.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 13  | B    | 446540.86 | 325320.47 | 10.00  | 291.92 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 15  | B    | 446574.19 | 325332.51 | 10.00  | 291.92 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 17  | B    | 446605.98 | 325346.21 | 10.00  | 291.92 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 19  | B    | 446682.98 | 325376.18 | 10.00  | 186.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 20  | B    | 446646.44 | 325352.13 | 10.00  | 116.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 21  | B    | 446559.09 | 325346.91 | 10.00  | 91.83  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 23  | B    | 446595.27 | 325348.24 | 10.00  | 91.83  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 26  | B    | 446554.16 | 325337.32 | 10.00  | 0.00   | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 20  | B    | 446142.21 | 325206.00 | 10.00  | 270.60 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |

## Layout Continued

| ID | Type | X         | Y         | Height | Angle  | Tilt | Cant | Out-reach | Dimmed to | Target X | Target Y | Target Z |
|----|------|-----------|-----------|--------|--------|------|------|-----------|-----------|----------|----------|----------|
| 21 | B    | 446158.35 | 325206.17 | 10.00  | 270.60 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 22 | B    | 446174.50 | 325206.34 | 10.00  | 270.60 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 23 | B    | 446190.64 | 325206.51 | 10.00  | 270.60 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 24 | B    | 446206.78 | 325206.68 | 10.00  | 270.60 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 25 | B    | 446116.93 | 325160.94 | 10.00  | 0.00   | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 26 | B    | 446116.93 | 325196.86 | 10.00  | 0.00   | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 27 | B    | 446169.12 | 325155.43 | 10.00  | 90.47  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 28 | B    | 446194.83 | 325155.64 | 10.00  | 90.47  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 29 | B    | 446220.55 | 325155.85 | 10.00  | 90.47  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 30 | B    | 446246.26 | 325156.06 | 10.00  | 90.47  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 31 | B    | 446271.97 | 325156.27 | 10.00  | 90.47  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 32 | B    | 446297.68 | 325156.48 | 10.00  | 90.47  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 33 | B    | 446229.92 | 325207.28 | 10.00  | 270.36 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 34 | B    | 446245.68 | 325207.38 | 10.00  | 270.36 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 35 | B    | 446261.45 | 325207.48 | 10.00  | 270.36 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 36 | B    | 446277.21 | 325207.58 | 10.00  | 270.36 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 37 | B    | 446292.97 | 325207.67 | 10.00  | 270.36 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 38 | B    | 446308.73 | 325207.77 | 10.00  | 270.36 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 39 | B    | 446156.85 | 325137.66 | 8.00   | 152.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 40 | B    | 445821.56 | 325224.21 | 10.00  | 270.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 41 | B    | 445837.46 | 325224.37 | 10.00  | 270.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 42 | B    | 445853.36 | 325224.53 | 10.00  | 270.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 43 | B    | 445869.26 | 325224.69 | 10.00  | 270.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 44 | B    | 445885.16 | 325224.85 | 10.00  | 270.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 45 | B    | 445901.06 | 325225.01 | 10.00  | 270.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 46 | B    | 445916.97 | 325225.17 | 10.00  | 270.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 47 | B    | 445940.47 | 325225.79 | 10.00  | 270.28 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 48 | B    | 445954.64 | 325225.86 | 10.00  | 270.28 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 49 | B    | 445968.81 | 325225.93 | 10.00  | 270.28 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 50 | B    | 445982.98 | 325226.00 | 10.00  | 270.28 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 51 | B    | 445997.15 | 325226.07 | 10.00  | 270.28 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 52 | B    | 446011.32 | 325226.13 | 10.00  | 270.28 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 53 | B    | 446025.49 | 325226.20 | 10.00  | 270.28 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 54 | B    | 445820.52 | 325171.75 | 10.00  | 90.42  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 55 | B    | 445861.71 | 325172.05 | 10.00  | 90.42  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 56 | B    | 445902.89 | 325172.35 | 10.00  | 90.42  | 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 |
|----|------|-----------|-----------|--------|--------|------|------|-----------|-----------|----------|----------|----------|
| 57 | B    | 445944.08 | 325172.65 | 10.00  | 90.42  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 58 | B    | 445985.26 | 325172.95 | 10.00  | 90.42  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 59 | B    | 446026.45 | 325173.25 | 10.00  | 90.42  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 60 | B    | 446055.22 | 325212.16 | 10.00  | 270.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 61 | B    | 445824.38 | 325025.67 | 10.00  | 270.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 62 | B    | 445839.41 | 325025.82 | 10.00  | 270.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 63 | B    | 445854.45 | 325025.97 | 10.00  | 270.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 64 | B    | 445869.48 | 325026.13 | 10.00  | 270.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 65 | B    | 445884.52 | 325026.28 | 10.00  | 270.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 66 | B    | 445899.55 | 325026.43 | 10.00  | 270.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 67 | B    | 445914.58 | 325026.59 | 10.00  | 270.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 68 | B    | 445937.23 | 325026.40 | 10.00  | 270.62 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 69 | B    | 445954.13 | 325026.59 | 10.00  | 270.62 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 70 | B    | 445971.03 | 325026.77 | 10.00  | 270.62 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 71 | B    | 445987.93 | 325026.95 | 10.00  | 270.62 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 72 | B    | 446004.83 | 325027.14 | 10.00  | 270.62 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 73 | B    | 446021.73 | 325027.32 | 10.00  | 270.62 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 74 | B    | 445824.75 | 324975.59 | 10.00  | 90.07  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 75 | B    | 445864.56 | 324975.64 | 10.00  | 90.07  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 76 | B    | 445904.37 | 324975.68 | 10.00  | 90.07  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 77 | B    | 445944.18 | 324975.73 | 10.00  | 90.07  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 78 | B    | 445983.99 | 324975.78 | 10.00  | 90.07  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 79 | B    | 446062.90 | 325031.51 | 10.00  | 292.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 80 | B    | 446016.51 | 324988.63 | 10.00  | 112.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 81 | B    | 446053.21 | 325004.58 | 10.00  | 112.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 82 | B    | 445942.79 | 324837.44 | 10.00  | 356.87 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 83 | B    | 445943.99 | 324859.32 | 10.00  | 356.87 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 84 | B    | 445945.18 | 324881.20 | 10.00  | 356.87 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 85 | B    | 446045.35 | 324906.39 | 10.00  | 87.08  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 86 | B    | 445984.44 | 324838.45 | 10.00  | 176.96 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 87 | B    | 445985.64 | 324860.95 | 10.00  | 176.96 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 88 | B    | 445986.83 | 324883.46 | 10.00  | 176.96 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 89 | B    | 446068.81 | 324905.19 | 10.00  | 87.08  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 90 | B    | 446092.28 | 324904.00 | 10.00  | 87.08  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 91 | B    | 446086.49 | 324940.24 | 10.00  | 266.77 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 92 | B    | 446112.82 | 324938.76 | 10.00  | 266.77 | 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 |
|-----|------|-----------|-----------|--------|--------|------|------|-----------|-----------|----------|----------|----------|
| 93  | B    | 446139.16 | 324937.28 | 10.00  | 266.77 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 94  | B    | 445954.13 | 324907.97 | 10.00  | 287.64 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 95  | B    | 445984.39 | 324917.60 | 10.00  | 287.64 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 96  | B    | 446014.65 | 324927.22 | 10.00  | 287.64 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 97  | B    | 446044.92 | 324936.84 | 10.00  | 287.64 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 98  | B    | 446115.74 | 324902.80 | 10.00  | 87.08  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 99  | B    | 446204.53 | 324834.52 | 10.00  | 85.00  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 100 | B    | 446232.76 | 324830.76 | 8.00   | 88.00  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 101 | B    | 446262.09 | 324824.30 | 8.00   | 89.00  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 102 | B    | 446292.32 | 324823.12 | 8.00   | 88.00  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 103 | B    | 446272.66 | 324860.02 | 10.00  | 267.52 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 104 | B    | 446295.44 | 324859.04 | 10.00  | 267.52 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 105 | B    | 446318.21 | 324858.05 | 10.00  | 267.52 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 106 | B    | 446340.99 | 324857.07 | 10.00  | 267.52 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 107 | B    | 446363.76 | 324856.08 | 10.00  | 267.52 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 108 | B    | 446386.54 | 324855.09 | 10.00  | 267.52 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 109 | B    | 446409.31 | 324854.11 | 10.00  | 267.52 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 110 | B    | 446299.79 | 324808.58 | 10.00  | 87.70  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 111 | B    | 446327.55 | 324807.47 | 10.00  | 87.70  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 112 | B    | 446355.30 | 324806.35 | 10.00  | 87.70  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 113 | B    | 446383.06 | 324805.24 | 10.00  | 87.70  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 114 | B    | 446407.75 | 324803.89 | 10.00  | 87.14  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 115 | B    | 446438.01 | 324802.37 | 10.00  | 87.14  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 116 | B    | 446468.27 | 324800.86 | 10.00  | 87.14  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 117 | B    | 446498.54 | 324799.35 | 10.00  | 87.14  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 118 | B    | 446528.80 | 324797.83 | 10.00  | 87.14  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 119 | B    | 446559.06 | 324796.32 | 10.00  | 87.14  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 120 | B    | 446438.02 | 324853.45 | 10.00  | 267.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 121 | B    | 446457.08 | 324852.65 | 10.00  | 267.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 122 | B    | 446476.15 | 324851.84 | 10.00  | 267.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 123 | B    | 446495.21 | 324851.04 | 10.00  | 267.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 124 | B    | 446514.28 | 324850.24 | 10.00  | 267.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 125 | B    | 446533.35 | 324849.43 | 10.00  | 267.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 126 | B    | 446552.41 | 324848.63 | 10.00  | 267.58 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 127 | B    | 446680.23 | 324696.42 | 10.00  | 87.12  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 128 | B    | 446655.93 | 324697.64 | 10.00  | 87.12  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |

## Layout Continued

| ID  | Type | X         | Y         | Height | Angle  | Tilt | Cant | Out-reach | Dimmed to | Target X | Target Y | Target Z |
|-----|------|-----------|-----------|--------|--------|------|------|-----------|-----------|----------|----------|----------|
| 129 | B    | 446631.64 | 324698.86 | 10.00  | 87.12  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 130 | B    | 446607.34 | 324700.08 | 10.00  | 87.12  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 131 | B    | 446583.05 | 324701.30 | 10.00  | 87.12  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 132 | B    | 446558.75 | 324702.52 | 10.00  | 87.12  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 133 | B    | 446534.46 | 324703.74 | 10.00  | 87.12  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 134 | B    | 446289.42 | 324715.86 | 10.00  | 87.14  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 135 | B    | 446313.02 | 324714.69 | 10.00  | 87.14  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 136 | B    | 446336.62 | 324713.51 | 10.00  | 87.14  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 137 | B    | 446360.21 | 324712.33 | 10.00  | 87.14  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 138 | B    | 446383.81 | 324711.15 | 10.00  | 87.14  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 139 | B    | 446407.41 | 324709.98 | 10.00  | 87.14  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 140 | B    | 446431.01 | 324708.80 | 10.00  | 87.14  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 141 | B    | 446454.61 | 324707.62 | 10.00  | 87.14  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 142 | B    | 446478.20 | 324706.44 | 10.00  | 87.14  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 143 | B    | 446501.80 | 324705.27 | 10.00  | 87.14  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 144 | B    | 446292.02 | 324767.60 | 10.00  | 267.12 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 145 | B    | 446332.77 | 324765.55 | 10.00  | 267.12 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 146 | B    | 446373.53 | 324763.50 | 10.00  | 267.12 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 147 | B    | 446414.28 | 324761.45 | 10.00  | 267.12 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 148 | B    | 446455.04 | 324759.40 | 10.00  | 267.12 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 149 | B    | 446495.79 | 324757.34 | 10.00  | 267.12 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 150 | B    | 446536.55 | 324755.29 | 10.00  | 267.12 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 151 | B    | 446577.30 | 324753.24 | 10.00  | 267.12 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 152 | B    | 446618.06 | 324751.19 | 10.00  | 267.12 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 153 | B    | 446658.81 | 324749.14 | 10.00  | 267.12 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 154 | B    | 446699.57 | 324747.09 | 10.00  | 267.12 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 155 | B    | 446740.32 | 324745.04 | 10.00  | 267.12 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 156 | B    | 446675.27 | 324508.54 | 10.00  | 357.19 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 157 | B    | 446677.04 | 324544.62 | 10.00  | 357.19 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 158 | B    | 446678.81 | 324580.71 | 10.00  | 357.19 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 159 | B    | 446680.58 | 324616.79 | 10.00  | 357.19 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 160 | B    | 446682.34 | 324652.87 | 10.00  | 357.19 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 161 | B    | 446684.11 | 324688.95 | 10.00  | 357.19 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 162 | B    | 446755.14 | 324718.91 | 10.00  | 176.46 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 163 | B    | 446753.78 | 324696.91 | 10.00  | 176.46 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 164 | B    | 446752.42 | 324674.90 | 10.00  | 176.46 | 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 |
|-----|------|-----------|-----------|--------|--------|------|------|-----------|-----------|----------|----------|----------|
| 165 | B    | 446751.06 | 324652.90 | 10.00  | 176.46 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 166 | B    | 446749.70 | 324630.90 | 10.00  | 176.46 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 167 | B    | 446741.04 | 324611.70 | 10.00  | 152.31 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 168 | B    | 446725.75 | 324582.57 | 10.00  | 152.31 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 169 | B    | 446710.46 | 324553.43 | 10.00  | 152.31 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 170 | B    | 446733.22 | 324688.33 | 10.00  | 178.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 171 | B    | 446731.01 | 324640.76 | 10.00  | 176.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 172 | B    | 446247.45 | 324755.32 | 10.00  | 270.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 173 | B    | 446221.14 | 324733.23 | 10.00  | 86.00  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 174 | B    | 446194.61 | 324757.89 | 10.00  | 268.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 175 | B    | 446347.85 | 324520.93 | 10.00  | 267.29 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 176 | B    | 446371.71 | 324519.80 | 10.00  | 267.29 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 177 | B    | 446395.57 | 324518.67 | 10.00  | 267.29 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 178 | B    | 446419.44 | 324517.54 | 10.00  | 267.29 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 179 | B    | 446443.30 | 324516.41 | 10.00  | 267.29 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 180 | B    | 446467.16 | 324515.29 | 10.00  | 267.29 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 181 | B    | 446491.02 | 324514.16 | 10.00  | 267.29 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 182 | B    | 446514.96 | 324512.95 | 10.00  | 267.28 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 183 | B    | 446543.50 | 324511.59 | 10.00  | 267.28 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 184 | B    | 446572.04 | 324510.24 | 10.00  | 267.28 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 185 | B    | 446600.58 | 324508.88 | 10.00  | 267.28 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 186 | B    | 446629.11 | 324507.53 | 10.00  | 267.28 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 187 | B    | 446657.65 | 324506.18 | 10.00  | 267.28 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 188 | B    | 446337.69 | 324470.87 | 10.00  | 87.24  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 189 | B    | 446372.26 | 324469.20 | 10.00  | 87.24  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 190 | B    | 446406.83 | 324467.53 | 10.00  | 87.24  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 191 | B    | 446441.40 | 324465.86 | 10.00  | 87.24  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 192 | B    | 446475.97 | 324464.19 | 10.00  | 87.24  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 193 | B    | 446510.54 | 324462.53 | 10.00  | 87.24  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 194 | B    | 446545.12 | 324460.86 | 10.00  | 87.24  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 195 | B    | 446579.69 | 324459.19 | 10.00  | 87.24  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 196 | B    | 446614.26 | 324457.52 | 10.00  | 87.24  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 197 | B    | 446648.83 | 324455.85 | 10.00  | 87.24  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 198 | B    | 446320.22 | 324522.65 | 10.00  | 271.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 199 | B    | 445949.30 | 324642.16 | 10.00  | 266.81 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 200 | B    | 445975.20 | 324640.72 | 10.00  | 266.81 | 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 |
|-----|------|-----------|-----------|--------|--------|------|------|-----------|-----------|----------|----------|----------|
| 201 | B    | 446001.11 | 324639.28 | 10.00  | 266.81 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 202 | B    | 446027.01 | 324637.83 | 10.00  | 266.81 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 203 | B    | 446052.91 | 324636.39 | 10.00  | 266.81 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 204 | B    | 446078.82 | 324634.95 | 10.00  | 266.81 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 205 | B    | 446104.72 | 324633.51 | 10.00  | 266.81 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 206 | B    | 445948.73 | 324591.54 | 10.00  | 86.90  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 207 | B    | 445965.75 | 324590.61 | 10.00  | 86.90  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 208 | B    | 445982.76 | 324589.69 | 10.00  | 86.90  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 209 | B    | 445999.78 | 324588.77 | 10.00  | 86.90  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 210 | B    | 446016.80 | 324587.85 | 10.00  | 86.90  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 211 | B    | 446042.47 | 324586.43 | 10.00  | 86.99  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 212 | B    | 446058.64 | 324585.58 | 10.00  | 86.99  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 213 | B    | 446074.80 | 324584.73 | 10.00  | 86.99  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 214 | B    | 446090.97 | 324583.88 | 10.00  | 86.99  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 215 | B    | 446107.13 | 324583.03 | 10.00  | 86.99  | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 216 | B    | 446119.85 | 324618.03 | 10.00  | 262.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 217 | B    | 445934.37 | 324713.23 | 10.00  | 266.80 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 218 | B    | 445949.12 | 324712.40 | 10.00  | 266.80 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 219 | B    | 445963.88 | 324711.58 | 10.00  | 266.80 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 220 | B    | 445978.63 | 324710.75 | 10.00  | 266.80 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 221 | B    | 445993.38 | 324709.93 | 10.00  | 266.80 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 222 | B    | 446008.14 | 324709.10 | 10.00  | 266.80 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 223 | B    | 446030.98 | 324707.52 | 10.00  | 267.36 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 224 | B    | 446046.49 | 324706.80 | 10.00  | 267.36 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 225 | B    | 446061.99 | 324706.09 | 10.00  | 267.36 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 226 | B    | 446077.50 | 324705.38 | 10.00  | 267.36 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 227 | B    | 446093.01 | 324704.66 | 10.00  | 267.36 | 0.00 | 0.00 | 0.90      | 100%      |          |          |          |
| 228 | B    | 445932.47 | 324663.10 | 10.00  | 86.76  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 229 | B    | 445961.09 | 324661.48 | 10.00  | 86.76  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 230 | B    | 445989.71 | 324659.86 | 10.00  | 86.76  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 231 | B    | 446018.33 | 324658.24 | 10.00  | 86.76  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 232 | B    | 446046.94 | 324656.63 | 10.00  | 86.76  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 233 | B    | 446075.56 | 324655.01 | 10.00  | 86.76  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 234 | B    | 446108.08 | 324650.88 | 10.00  | 90.00  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 235 | C    | 446291.90 | 324523.77 | 8.00   | 270.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 236 | C    | 446265.86 | 324525.05 | 8.00   | 264.00 | 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 |
|-----|------|-----------|-----------|--------|--------|------|------|-----------|-----------|----------|----------|----------|
| 237 | C    | 446263.04 | 324540.83 | 8.00   | 177.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 238 | C    | 446264.45 | 324571.18 | 8.00   | 182.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 239 | C    | 446266.15 | 324602.81 | 8.00   | 180.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 240 | C    | 446267.38 | 324631.23 | 8.00   | 174.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 241 | C    | 446268.96 | 324661.32 | 8.00   | 180.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 242 | C    | 446270.37 | 324690.97 | 8.00   | 181.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 243 | C    | 446271.51 | 324713.93 | 8.00   | 182.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 1   | C    | 446108.54 | 325238.47 | 8.00   | 175.00 | 5.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 2   | C    | 446089.73 | 325220.02 | 8.00   | 6.00   | 5.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 3   | C    | 446108.59 | 325200.97 | 8.00   | 181.00 | 5.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 4   | C    | 446089.80 | 325175.73 | 8.00   | 359.00 | 5.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 5   | C    | 446110.62 | 325150.90 | 8.00   | 188.00 | 5.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 6   | C    | 446154.90 | 325103.44 | 8.00   | 231.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 7   | C    | 446475.70 | 325381.92 | 8.00   | 178.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 8   | C    | 446447.11 | 325382.67 | 8.00   | 352.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 9   | C    | 446473.32 | 325340.89 | 8.00   | 168.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 10  | C    | 446446.18 | 325354.00 | 8.00   | 335.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 11  | C    | 446461.37 | 325301.73 | 8.00   | 158.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 12  | C    | 446434.69 | 325310.16 | 8.00   | 339.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 13  | C    | 446435.89 | 325262.01 | 8.00   | 137.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 14  | C    | 446417.66 | 325280.36 | 8.00   | 322.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 15  | C    | 446408.36 | 325234.43 | 8.00   | 139.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 16  | C    | 446393.72 | 325253.19 | 8.00   | 317.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 17  | C    | 446376.80 | 325202.78 | 8.00   | 136.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 18  | C    | 446362.81 | 325218.64 | 8.00   | 319.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 19  | C    | 446344.32 | 325170.98 | 8.00   | 139.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 20  | C    | 446330.70 | 325183.36 | 8.00   | 317.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 21  | C    | 446312.04 | 325139.04 | 8.00   | 132.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 22  | C    | 446302.49 | 325154.85 | 8.00   | 311.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 23  | C    | 446274.97 | 325111.58 | 8.00   | 123.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 24  | C    | 446271.46 | 325130.49 | 8.00   | 302.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 25  | C    | 446231.29 | 325088.53 | 8.00   | 119.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 26  | C    | 446238.57 | 325111.63 | 8.00   | 293.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 27  | C    | 446155.43 | 325046.35 | 8.00   | 113.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 28  | C    | 446147.32 | 325061.58 | 8.00   | 293.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 29  | C    | 446126.95 | 325037.21 | 8.00   | 118.00 | 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 |
|----|------|-----------|-----------|--------|--------|------|------|-----------|-----------|----------|----------|----------|
| 30 | C    | 446094.69 | 325023.03 | 8.00   | 119.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 31 | C    | 446089.43 | 325044.47 | 8.00   | 285.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 32 | E    | 446177.45 | 325018.69 | 8.00   | 5.00   | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 33 | E    | 446178.92 | 324985.24 | 8.00   | 4.00   | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 34 | E    | 446197.18 | 325003.60 | 8.00   | 180.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 35 | E    | 446196.09 | 325032.36 | 8.00   | 180.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 36 | E    | 446198.85 | 324962.48 | 8.00   | 180.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 37 | E    | 446180.67 | 324944.17 | 8.00   | 4.00   | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 38 | E    | 446199.28 | 324926.27 | 8.00   | 175.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 39 | E    | 446179.17 | 324905.45 | 8.00   | 356.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 40 | E    | 446195.81 | 324885.50 | 8.00   | 180.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 41 | E    | 446175.70 | 324873.91 | 8.00   | 359.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 42 | E    | 446192.97 | 324856.87 | 8.00   | 180.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 43 | E    | 446172.31 | 324834.72 | 8.00   | 0.00   | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 44 | E    | 446189.66 | 324817.60 | 8.00   | 176.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 45 | E    | 446164.29 | 324755.16 | 8.00   | 350.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 46 | E    | 446168.45 | 324797.18 | 8.00   | 359.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 47 | E    | 446185.27 | 324773.06 | 8.00   | 180.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 48 | E    | 446179.96 | 324726.91 | 8.00   | 176.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 49 | E    | 446160.18 | 324712.71 | 8.00   | 356.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 50 | E    | 446177.55 | 324694.67 | 8.00   | 174.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 51 | C    | 446149.46 | 324673.08 | 8.00   | 281.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 52 | C    | 446149.63 | 324646.15 | 8.00   | 75.00  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 53 | C    | 446171.74 | 324650.46 | 8.00   | 180.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 54 | E    | 446153.88 | 324632.21 | 8.00   | 356.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 55 | E    | 446167.90 | 324610.75 | 8.00   | 178.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 56 | E    | 446142.59 | 324616.75 | 8.00   | 266.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 57 | E    | 446144.03 | 324592.69 | 8.00   | 82.00  | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 58 | E    | 446166.43 | 324586.88 | 8.00   | 180.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 59 | E    | 446157.19 | 324680.68 | 8.00   | 359.00 | 0.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 60 | C    | 446102.48 | 325124.01 | 8.00   | 34.00  | 5.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 61 | C    | 446126.20 | 325100.43 | 8.00   | 49.00  | 5.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 62 | C    | 446149.88 | 325076.84 | 8.00   | 359.00 | 5.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 63 | C    | 446170.27 | 325044.41 | 8.00   | 56.00  | 5.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 64 | C    | 446204.58 | 325057.65 | 8.00   | 164.00 | 5.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 65 | C    | 446202.89 | 325101.23 | 8.00   | 276.00 | 5.00 | 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 |
|----|------|-----------|-----------|--------|--------|------|------|-----------|-----------|----------|----------|----------|
| 66 | C    | 446214.54 | 325077.57 | 8.00   | 146.00 | 5.00 | 0.00 | 0.40      | 100%      |          |          |          |
| 67 | C    | 446174.80 | 325103.53 | 8.00   | 284.00 | 5.00 | 0.00 | 0.40      | 100%      |          |          |          |

## Illuminance (lux)

PHAR 001



### Results

|           |      |
|-----------|------|
| Eav       | 0.01 |
| Emin      | 0.00 |
| Emax      | 0.01 |
| Emin/Emax | 0.20 |
| Emin/Eav  | 0.45 |
|           |      |

## Illuminance (lux)

PHAR 004



### Results

|                       |      |
|-----------------------|------|
| Eav                   | 0.00 |
| Emin                  | 0.00 |
| E <sub>max</sub>      | 0.01 |
| Emin/E <sub>max</sub> | 0.00 |
| Emin/Eav              | 0.00 |
|                       |      |

## Illuminance (lux)

PHAR 003

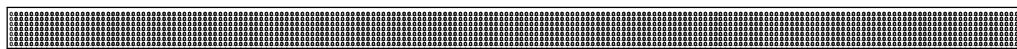


### Results

|           |      |
|-----------|------|
| Eav       | 0.00 |
| Emin      | 0.00 |
| Emax      | 0.00 |
| Emin/Emax | 0.00 |
| Emin/Eav  | 0.00 |
|           |      |

## Illuminance (lux)

PSER 002



### Results

|           |      |
|-----------|------|
| Eav       | 0.01 |
| Emin      | 0.00 |
| Emax      | 0.02 |
| Emin/Emax | 0.08 |
| Emin/Eav  | 0.22 |
|           |      |

## Illuminance (lux)

PSER 002



### Results

|           |      |
|-----------|------|
| Eav       | 0.02 |
| Emin      | 0.00 |
| Emax      | 0.17 |
| Emin/Emax | 0.02 |
| Emin/Eav  | 0.23 |
|           |      |

## Illuminance (lux)

PHAR 002



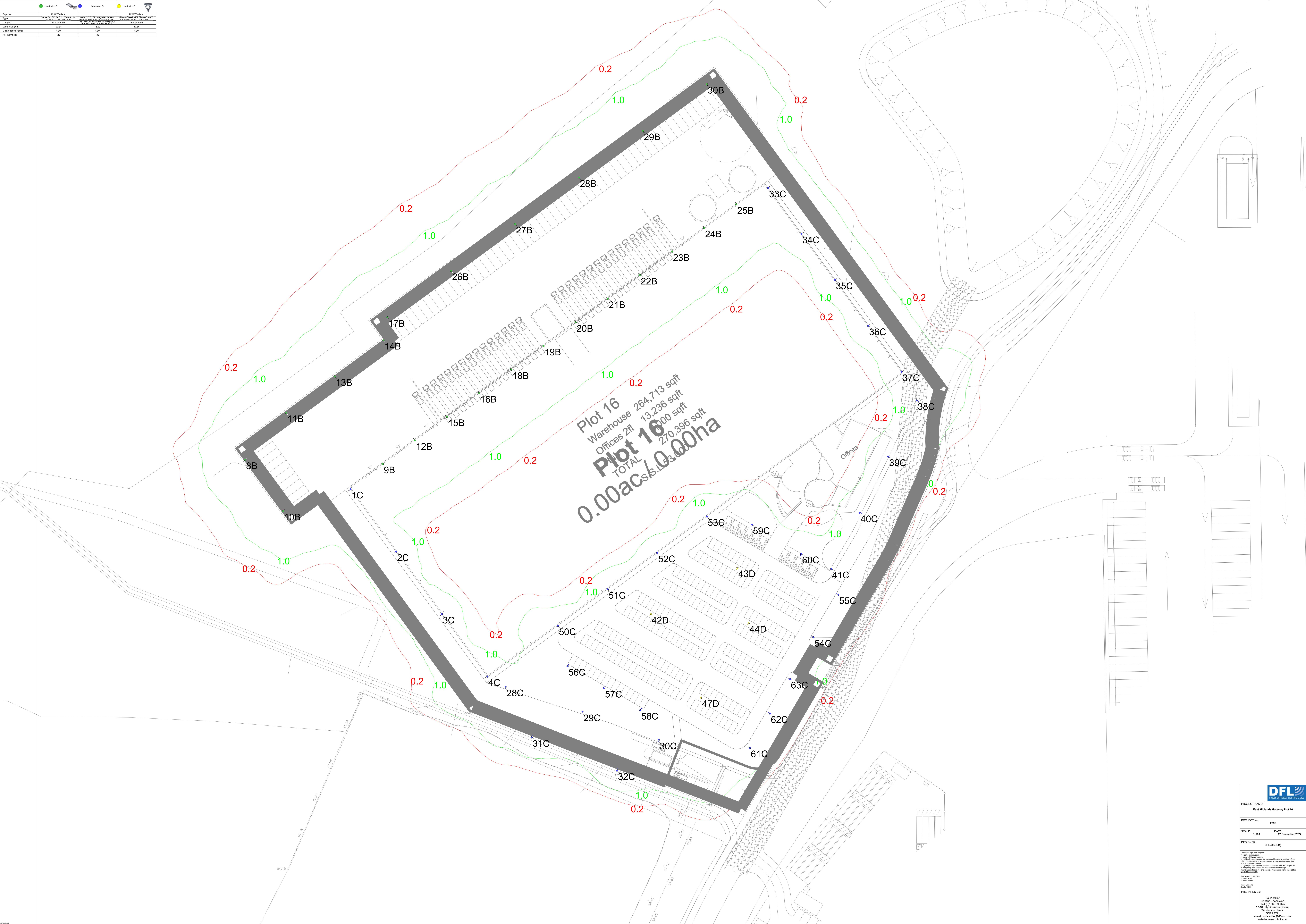
### Results

|           |      |
|-----------|------|
| Eav       | 0.00 |
| Emin      | 0.00 |
| Emax      | 0.01 |
| Emin/Emax | 0.37 |
| Emin/Eav  | 0.55 |
|           |      |

### 3. EMG1 PLOT 16 OBTRUSIVE LIGHT CALCULATIONS

- 3.1.1. The following pages show the results of the obtrusive light calculations for EMG Plot 16.
- 3.1.2. This includes a Light Spill Diagram and Vertical Illuminance Calculations.
- 3.1.3. All obtrusive light calculations have been conducted based on the illustrative masterplans (**Document MCO 2.6**). This plan is subject to change at the detailed design phase. This plan provide a reasonable basis for the assessment of lighting effects from EMG1 PLOT 16.

### 3.2. EMG1 Plot 16 Horizontal Light Spill Diagram

[illegible]

### 3.3. EMG1 Plot 16 Vertical Illuminance Calculations

**DATE:** 17 December 2024  
**DESIGNER:** DFL-UK (LM)  
**PROJECT No:** 2398  
**PROJECT NAME:** East Midlands Gateway Plot 16



This document shows the obtrusive light calculations for the sensitive receptors that have been identified in ES Chapter 11.

This document forms an appendix to ES Chapter 11 and therefore must be read in conjunction with this chapter.

All lighting calculations have been conducted using a maintenance factor of 1 and shows a reasonable worst case at the start of luminaire life.

**2398-DFL-ELG-XX-CA-EO-13002**

**PREPARED BY:** Louis Miller  
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## 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    | 446672.37 | 327162.45 | 560.58    | 440.89    | 2.24       | 1.76       |
| 2  | PSER 004  | 446821.59 | 327276.34 | 150.10    | 12.00     | 1.49       | 1.50       |
| 3  | PSER 005  | 446090.01 | 327385.01 | 1098.18   | 12.00     | 4.39       | 1.50       |
| 4  | PHAR 007  | 446234.90 | 327813.29 | 831.71    | 12.00     | 3.33       | 1.50       |
| 5  | PSER 003  | 447853.84 | 328113.46 | 319.62    | 12.00     | 1.28       | 1.50       |
| 6  | PHAR 008  | 448070.02 | 327152.52 | 503.30    | 12.00     | 2.01       | 1.50       |

### Luminaires



#### Luminaire B Data

|                      |                                                      |
|----------------------|------------------------------------------------------|
| Supplier             | D W Windsor                                          |
| Type                 | Sabre 64LED 3k C2 1000mA UMSUG 42 019 8 0000 100     |
| Lamp(s)              | 64 x 3k LED                                          |
| Lamp Flux (klm)      | 20.34                                                |
| File Name            | Sabre 64LED 3k C2_1000mA UMSUG 42 019 8 0000 100.ies |
| Maintenance Factor   | 1.00                                                 |
| Imax70,80,90(cd/klm) | 853.5, 62.5, 0.0                                     |
| No. in Project       | 23                                                   |

#### Luminaire C Data

|                      |                                                                                |
|----------------------|--------------------------------------------------------------------------------|
| Supplier             |                                                                                |
| Type                 | AXIA 3.3 5267 Integrated lenses Rear louvers 48 OSLO SQUARE                    |
| Lamp(s)              | 48 OSLO SQUARE GIANT@400mA WW 73 0 230V 00-36-649                              |
| LampFlux(klm)/Colour | 6.29 WW 3000K/70                                                               |
| File Name            | AXIA 3.3 5267 48 OSLO SQUARE GIANT 4 00mA WW 730 57W 479482 Integrated lens... |
| Maintenance Factor   | 1.00                                                                           |
| Imax70,80,90(cd/klm) | 1149.7, 130.7, 0.0                                                             |
| No. in Project       | 32                                                                             |



#### Luminaire D Data

|                      |                                                             |
|----------------------|-------------------------------------------------------------|
| Supplier             | D W Windsor                                                 |
| Type                 | Milano Classic-16LED-3k-C3 800mA UMSUG 42 0148 0000 100     |
| Lamp(s)              | 16 x 3k LED                                                 |
| Lamp Flux (klm)      | 17.36                                                       |
| File Name            | Milano Classic-16LED-3k-C3_800mA UMSUG 42 0148 0000 100.ies |
| Maintenance Factor   | 1.00                                                        |
| Imax70,80,90(cd/klm) | 336.0, 30.0, 2.0                                            |
| No. in Project       | 4                                                           |

### Layout

| ID | Type | X         | Y         | Height | Angle  | Tilt | Cant | Out-reach | Target X | Target Y | Target Z |
|----|------|-----------|-----------|--------|--------|------|------|-----------|----------|----------|----------|
| 1  | C    | 446815.02 | 327370.55 | 8.00   | 216.14 | 0.00 | 0.00 | 0.90      |          |          |          |
| 2  | C    | 446835.79 | 327342.11 | 8.00   | 216.14 | 0.00 | 0.00 | 0.90      |          |          |          |
| 3  | C    | 446856.56 | 327313.67 | 8.00   | 216.14 | 0.00 | 0.00 | 0.90      |          |          |          |
| 4  | C    | 446877.33 | 327285.23 | 8.00   | 216.14 | 0.00 | 0.00 | 0.90      |          |          |          |
| 8  | B    | 446767.07 | 327383.87 | 8.00   | 36.51  | 0.00 | 0.00 | 0.90      |          |          |          |

## Layout Continued

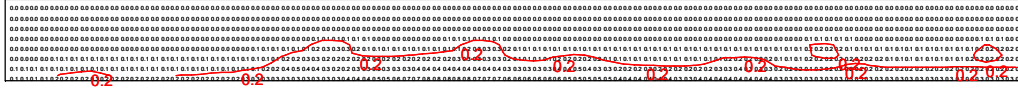
| ID | Type | X         | Y         | Height | Angle  | Tilt | Cant | Out-reach | Target X | Target Y | Target Z |
|----|------|-----------|-----------|--------|--------|------|------|-----------|----------|----------|----------|
| 9  | B    | 446829.71 | 327381.96 | 10.00  | 126.29 | 5.00 | 0.00 | 0.90      |          |          |          |
| 10 | B    | 446784.32 | 327360.56 | 8.00   | 36.51  | 0.00 | 0.00 | 0.90      |          |          |          |
| 11 | B    | 446785.74 | 327405.28 | 8.00   | 306.73 | 0.00 | 0.00 | 0.90      |          |          |          |
| 12 | B    | 446844.34 | 327392.70 | 10.00  | 126.29 | 5.00 | 0.00 | 0.90      |          |          |          |
| 13 | B    | 446807.87 | 327421.79 | 8.00   | 306.73 | 0.00 | 0.00 | 0.90      |          |          |          |
| 14 | B    | 446830.01 | 327438.31 | 8.00   | 306.73 | 0.00 | 0.00 | 0.90      |          |          |          |
| 15 | B    | 446858.97 | 327403.44 | 10.00  | 126.29 | 5.00 | 0.00 | 0.90      |          |          |          |
| 16 | B    | 446873.60 | 327414.19 | 10.00  | 126.29 | 5.00 | 0.00 | 0.90      |          |          |          |
| 17 | B    | 446831.76 | 327448.70 | 8.00   | 306.12 | 0.00 | 0.00 | 0.90      |          |          |          |
| 18 | B    | 446888.23 | 327424.93 | 10.00  | 126.29 | 5.00 | 0.00 | 0.90      |          |          |          |
| 19 | B    | 446902.86 | 327435.67 | 10.00  | 126.29 | 5.00 | 0.00 | 0.90      |          |          |          |
| 20 | B    | 446917.48 | 327446.41 | 10.00  | 126.29 | 5.00 | 0.00 | 0.90      |          |          |          |
| 21 | B    | 446932.11 | 327457.16 | 10.00  | 126.29 | 5.00 | 0.00 | 0.90      |          |          |          |
| 22 | B    | 446946.74 | 327467.90 | 10.00  | 126.29 | 5.00 | 0.00 | 0.90      |          |          |          |
| 23 | B    | 446961.37 | 327478.64 | 10.00  | 126.29 | 5.00 | 0.00 | 0.90      |          |          |          |
| 24 | B    | 446976.00 | 327489.39 | 10.00  | 126.29 | 5.00 | 0.00 | 0.90      |          |          |          |
| 25 | B    | 446990.63 | 327500.13 | 10.00  | 126.29 | 5.00 | 0.00 | 0.90      |          |          |          |
| 26 | B    | 446860.84 | 327469.92 | 8.00   | 306.12 | 0.00 | 0.00 | 0.90      |          |          |          |
| 27 | B    | 446889.92 | 327491.14 | 8.00   | 306.12 | 0.00 | 0.00 | 0.90      |          |          |          |
| 28 | B    | 446919.00 | 327512.37 | 8.00   | 306.12 | 0.00 | 0.00 | 0.90      |          |          |          |
| 29 | B    | 446948.07 | 327533.59 | 8.00   | 306.12 | 0.00 | 0.00 | 0.90      |          |          |          |
| 30 | B    | 446977.15 | 327554.81 | 8.00   | 306.12 | 0.00 | 0.00 | 0.90      |          |          |          |
| 28 | C    | 446885.62 | 327280.51 | 8.00   | 250.50 | 5.00 | 0.00 | 0.40      |          |          |          |
| 29 | C    | 446920.60 | 327269.17 | 8.00   | 250.55 | 0.00 | 0.00 | 0.40      |          |          |          |
| 30 | C    | 446955.30 | 327256.39 | 8.00   | 250.50 | 5.00 | 0.00 | 0.40      |          |          |          |
| 31 | C    | 446897.44 | 327257.53 | 8.00   | 68.60  | 5.00 | 0.00 | 0.40      |          |          |          |
| 32 | C    | 446936.31 | 327242.43 | 8.00   | 68.60  | 5.00 | 0.00 | 0.40      |          |          |          |
| 33 | C    | 447005.09 | 327507.57 | 8.00   | 36.01  | 0.00 | 0.00 | 0.90      |          |          |          |
| 34 | C    | 447020.28 | 327486.66 | 8.00   | 36.01  | 0.00 | 0.00 | 0.90      |          |          |          |
| 35 | C    | 447035.48 | 327465.75 | 8.00   | 36.01  | 0.00 | 0.00 | 0.90      |          |          |          |
| 36 | C    | 447050.67 | 327444.84 | 8.00   | 36.01  | 0.00 | 0.00 | 0.90      |          |          |          |
| 37 | C    | 447065.86 | 327423.94 | 8.00   | 36.01  | 0.00 | 0.00 | 0.90      |          |          |          |
| 38 | C    | 447072.75 | 327410.88 | 8.00   | -26.90 | 0.00 | 0.00 | 0.40      |          |          |          |
| 39 | C    | 447059.78 | 327385.31 | 8.00   | -26.90 | 0.00 | 0.00 | 0.40      |          |          |          |
| 40 | C    | 447046.81 | 327359.74 | 8.00   | -26.90 | 0.00 | 0.00 | 0.40      |          |          |          |
| 41 | C    | 447033.84 | 327334.17 | 8.00   | -26.90 | 0.00 | 0.00 | 0.40      |          |          |          |

### Layout Continued

| ID | Type | X         | Y         | Height | Angle  | Tilt | Cant | Out-reach | Target X | Target Y | Target Z |
|----|------|-----------|-----------|--------|--------|------|------|-----------|----------|----------|----------|
| 42 | D    | 446951.70 | 327313.61 | 8.00   | 237.00 | 0.00 | 0.00 | 0.00      |          |          |          |
| 43 | D    | 446991.13 | 327334.72 | 8.00   | 236.00 | 0.00 | 0.00 | 0.00      |          |          |          |
| 44 | D    | 446996.23 | 327309.49 | 8.00   | 239.00 | 0.00 | 0.00 | 0.00      |          |          |          |
| 47 | D    | 446974.62 | 327275.64 | 8.00   | 65.00  | 0.00 | 0.00 | 0.00      |          |          |          |
| 50 | C    | 446909.44 | 327308.35 | 6.00   | 306.28 | 0.00 | 0.00 | 1.00      |          |          |          |
| 51 | C    | 446932.03 | 327324.94 | 6.00   | 306.28 | 0.00 | 0.00 | 1.00      |          |          |          |
| 52 | C    | 446954.63 | 327341.52 | 6.00   | 306.28 | 0.00 | 0.00 | 1.00      |          |          |          |
| 53 | C    | 446977.22 | 327358.10 | 6.00   | 306.28 | 0.00 | 0.00 | 1.00      |          |          |          |
| 54 | C    | 447025.71 | 327303.09 | 8.00   | 149.76 | 0.00 | 0.00 | 0.40      |          |          |          |
| 55 | C    | 447037.02 | 327322.49 | 8.00   | 149.76 | 0.00 | 0.00 | 0.40      |          |          |          |
| 56 | C    | 446913.81 | 327289.95 | 8.00   | 58.88  | 0.00 | 0.00 | 0.40      |          |          |          |
| 57 | C    | 446930.39 | 327279.94 | 8.00   | 58.88  | 0.00 | 0.00 | 0.40      |          |          |          |
| 58 | C    | 446946.96 | 327269.94 | 8.00   | 58.88  | 0.00 | 0.00 | 0.40      |          |          |          |
| 59 | C    | 446997.73 | 327354.33 | 8.00   | 238.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| 60 | C    | 447020.19 | 327341.05 | 8.00   | 244.00 | 0.00 | 0.00 | 0.40      |          |          |          |
| 61 | C    | 446996.78 | 327252.79 | 8.00   | 149.66 | 0.00 | 0.00 | 0.40      |          |          |          |
| 62 | C    | 447005.93 | 327268.42 | 8.00   | 149.66 | 0.00 | 0.00 | 0.40      |          |          |          |
| 63 | C    | 447015.07 | 327284.05 | 8.00   | 149.66 | 0.00 | 0.00 | 0.40      |          |          |          |

## Illuminance (lux)

PSER 004



### Results

|           |      |
|-----------|------|
| Eav       | 0.11 |
| Emin      | 0.00 |
| Emax      | 0.79 |
| Emin/Emax | 0.00 |
| Emin/Eav  | 0.00 |
|           |      |

## Illuminance (lux)

PSER 005



### Results

|           |      |
|-----------|------|
| Eav       | 0.00 |
| Emin      | 0.00 |
| Emax      | 0.01 |
| Emin/Emax | 0.00 |
| Emin/Eav  | 0.00 |
|           |      |

## Illuminance (lux)

PHAR 007

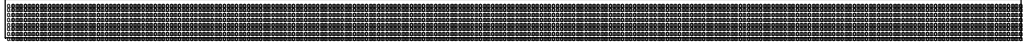


### Results

|           |      |
|-----------|------|
| Eav       | 0.00 |
| Emin      | 0.00 |
| Emax      | 0.01 |
| Emin/Emax | 0.00 |
| Emin/Eav  | 0.00 |
|           |      |

## Illuminance (lux)

PSER 003



### Results

|           |      |
|-----------|------|
| Eav       | 0.00 |
| Emin      | 0.00 |
| Emax      | 0.00 |
| Emin/Emax | 0.00 |
| Emin/Eav  | 0.00 |
|           |      |

## Illuminance (lux)

PHAR 008



### Results

|           |      |
|-----------|------|
| Eav       | 0.00 |
| Emin      | 0.00 |
| Emax      | 0.00 |
| Emin/Emax | 0.00 |
| Emin/Eav  | 0.00 |
|           |      |

## TECHNICAL DESCRIPTIONS, DEFINITIONS & ABBREVIATIONS

**Obtrusive Light:** refers to excessive or bothersome artificial light that goes where it shouldn't, causing discomfort and disruption. *Spill light which because of quantitative, directional or spectral attributes in a given context gives rise to annoyance, discomfort, distraction or reduction in the ability to see essential information.* [CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.](#)

**Sky glow:** When lights are directed upwards or light is scattered by particles in the air, like dust or water droplets, it creates a glow that makes it hard to see stars. *The increase in diffuse illuminance of the night sky above that produced by natural sources such as the moon and visible star.* [CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.](#)

**Vertical Illuminance:** is how much light lands on upright surfaces like walls. It's measured in lux or footcandles and matters for places where the view from a vertical angle is important. *Lighting of vertical surfaces such as walls, windows, statues, sculptures and people's faces.* [CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.](#)

**Correlated colour temperature (CCT):** the appearance of light emitted by a light source measured in Kelvin (K), Lower CCT values such as 2700K represent warmer, more yellowish light, *similar to the light from older incandescent lamps. (Tcp)The temperature of the Planckian radiator whose perceived colour most closely resembles that of a given stimulus at the same brightness and under specified viewing conditions, measured in absolute temperature on the kelvin (K) scale.* [CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.](#)

**Lux:** measures the brightness of light as perceived by the human eye at a specific point on a surface. *The SI derived unit of illuminance, measuring luminous flux per unit area (1 lux = 1 lumen/m<sup>2</sup>).* [CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.](#)

**Lumens:** measure how bright a light appears to our eyes. *The SI derived unit of luminous flux; a measure of the total quantity of visible light emitted by a source or received by a surface (unit: lumen).* [CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.](#)

**Glare:** refers to an excess of bright light that makes you uncomfortable or hinders your vision. It happens when there's a big difference between a bright light and the rest of the surroundings. *Glare: condition of vision in which there is discomfort or a reduction in the ability to see details or objects, caused by an unsuitable distribution or range of luminance, or by extreme contrasts.* [BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.1.8](#)

**Luminous intensity:** is light brightness or how intense the light source is. light intensity is how intense a light source is emitted or received in a particular direction, this is measured candelas and is termed as luminous intensity  $I_v$  <of a source, in a given direction> quotient of the luminous flux,  $d\Phi_v$ , leaving the source and propagated in the element of solid angle  $d\Omega$  containing the given direction, by the element of solid angle (unit:  $cd = lm \cdot sr^{-1}$ ). BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.2.2.

**Candela:** is a measurement for the brightness of a light source, taking into account the direction in which the light is emitted. Base unit of luminous intensity in the International System of Units (SI); the luminous power per unit solid angle emitted by a point light source in a particular direction. CIBSE LG21 Lighting Guide 21: Protecting the night-time environment.

**Uniformity (Uo):** is an explanation for the even distribution of light across an area or surface. The overall uniformity shall be calculated as the ratio of the lowest luminance, occurring at any grid point in the field of calculation, to the average luminance. BS EN 13201-3-2015, Calculation of Performance Section 8.3.

**Luminance:** is how bright a surface appears to our eyes. It considers the light coming from or reflected by an object.  $L_v$  <in a given direction, at a given point of a real or imaginary surface> quantity defined by the formula (unit:  $cd \cdot m^{-2} = lm \cdot m^{-2} \cdot sr^{-1}$ ) BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.2.3.

**Illuminance** is how much light lands on a surface per square meter. It's measured in lux. More lux means a brighter area.  $E_v$  (unit:  $lx = lm \cdot m^{-2}$ ) 1. <at a point of a surface> quotient of the luminous flux  $d\Phi_v$  incident on an element of the surface containing the point, by the area  $dA$  of that element 2. <at a point of a surface> equivalent definition: integral, taken over the hemisphere visible from the given point, of the expression. BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.2.10.

**Luminaire:** a light fixture, this is also sometimes referred to as a lantern or a light fitting, is a product that produces artificial light. apparatus which distributes, filters or transforms the light transmitted from one or more lamps and which includes, except the lamps themselves, all the parts necessary for fixing and protecting the lamps and, where necessary, circuit auxiliaries together with the means for connecting them to the electric supply BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.3.3

**ULOR:** upward light output ratio or ULOR refers to the amount of light the light fixture will produce upwards as a percentage of its total light output.  $RULO$  <of a luminaire> ratio of the upward luminous flux of the luminaire, measured under specified practical conditions with its own lamp(s) and equipment, to the sum of the individual luminous fluxes of the same lamp(s) when operated outside the luminaire with the same equipment, under specified conditions BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.3.12.

**Maintenance factor (MF):** is an allowance for how well the lights keep working overtime. It considers things like dirt on the light fittings and "wear and tear". DEPRECATED: light loss factor ratio of illuminance produced by the lighting installation after a certain period to the illuminance produced by the installation when new Note 1 to entry: The term depreciation factor has been formerly used to designate the reciprocal of the above ratio. Note 2 to entry: The maintenance factor takes into account light losses caused by dirt accumulation on luminaires and room surfaces (in interiors) or other relevant surfaces (in exteriors, where appropriate), and the decrease of the luminous flux of lamps. BS EN 12665-2018, Light and lighting - Basic terms and criteria for specifying lighting requirements, Section 3.5.18.

**Tilt:** is how much the luminaire is lifted based on the fitting facing flat to the ground.

**Outreach:** how far away the fitting is from the column/wall its mounted on to the light source.

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