

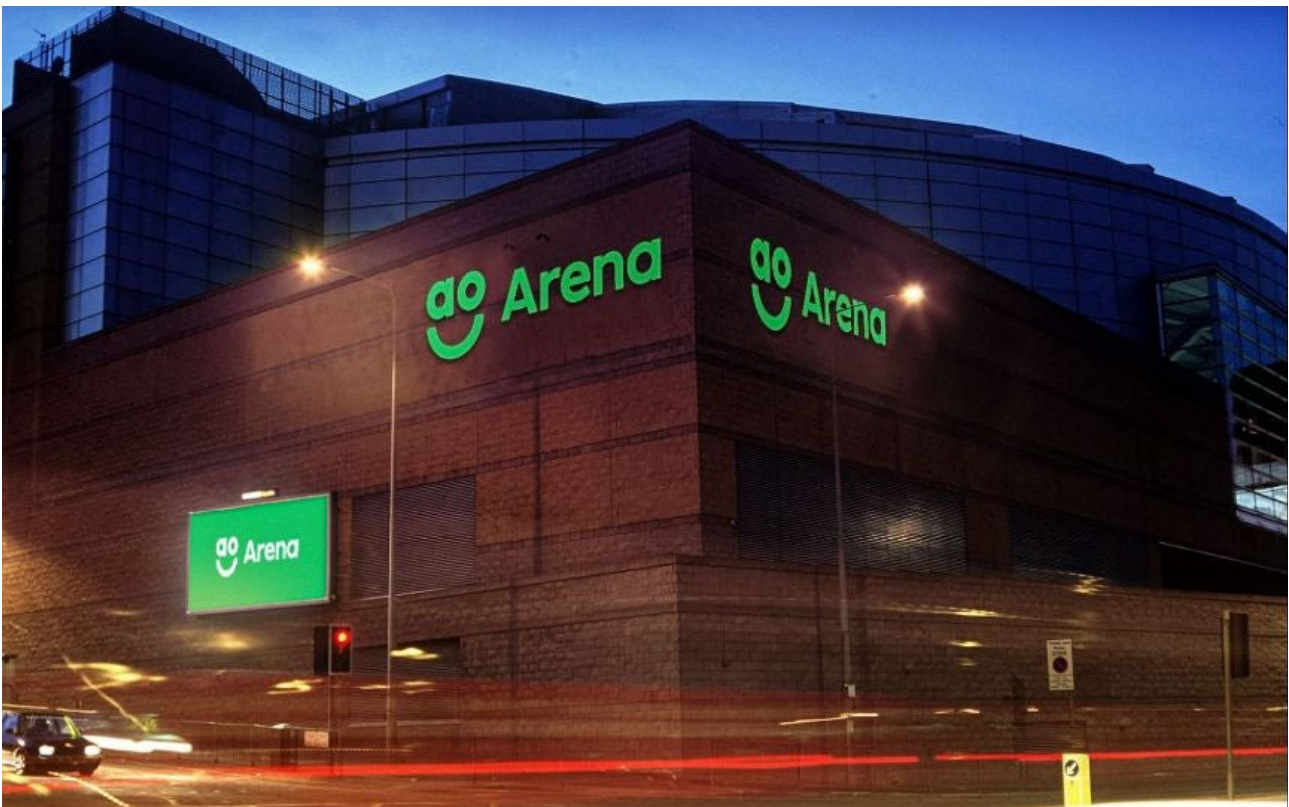
ASM Global

AO Arena Sign Proposal

Light Obtrusion Assessment

Reference: LTG001

Issue 1 | 8 June 2023



This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 273550-32

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1. Introduction

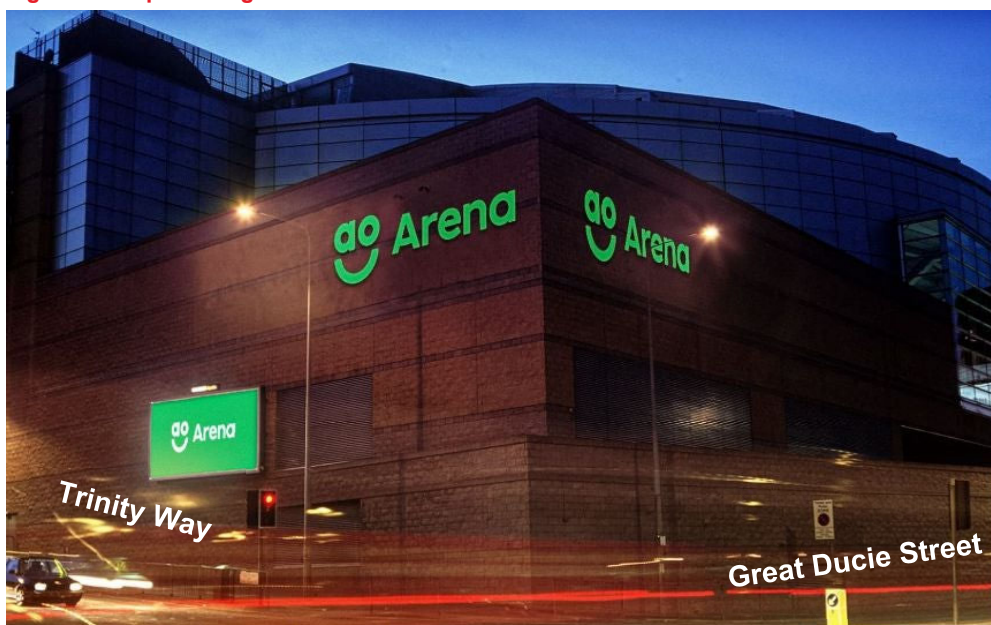
Arup has been appointed by ASM global to report on the likely lighting impact from a new illuminated sign to be mounted on the Great Ducie Street Elevation of the AO Arena in Manchester, in context of Manchester City Council (MCC) planning application reference 136288/AO/2023.

The MCC case officer has requested a lighting assessment which considers the light obtrusion from the proposed sign onto the residential building on the opposite side of Great Ducie Street.

Figure 1: Location



Figure 2: Proposed Sign



his lighting study includes the following elements:

- Survey: gather baseline data on the performance of existing arena illuminated sign.
- Lighting Study: simulate the proposed internally illuminated sign in context with neighbouring properties.

The findings are presented in this report for review by the Manchester City Council planning officer.

2. Guidance

2.1 Policy and Guidance

The following legislation and policy have been considered in this study.

- The Environmental Protection Act 1990 (Part III Statutory Nuisance and Clean Air, Section 79)
- The Clean Neighbourhood and Environmental Act 2005 (Section 102)

These acts give local authorities the power to consider obtrusive artificial light (also referred to as light pollution) as a statutory nuisance.

- The Town and Country Planning Act 1990 provides powers to restrict or regulate the display of advertisements in the interest of public amenity.

The following guidance has been considered in this study.

- ILP GN01, Institute of Lighting Professionals Guidance Note 1 for the reduction of obtrusive light (2021)
- ILP PLG05, Institute of Lighting Professionals Professional Lighting Guide 5 The brightness of illuminated advertisements (2014).

ILP GN01 is the reference guidance for Environmental Health Officers and Planning Authorities when considering light obtrusion effects.

2.2 Recommended Limits

PLG05 and GN01 propose limits on the performance of lighting systems relative to their environmental zone. The city centre is defined as Environmental Zone E4 and is aligned with the highest permitted limits on obtrusive light. The ILP GN01 guidance recommends different maximum lighting performance parameters depending on the time of night; i.e. pre-curfew and post-curfew.

The curfew condition describes a time, typically defined by the local planning authority after which a lower lighting level shall be provided to help reduce the effects of obtrusive light.

In the city centre context of this site, the following is assumed for the purpose of this study.

- Pre-curfew corresponds to the period from dusk to 2300hrs
- Post-curfew corresponds to the period 2300hrs to dawn

GN01 defines limits on illuminance received by residential windows in Zone E4 during these periods. The post-curfew period has the lowest limit.

- Pre-curfew, Zone E4, maximum illuminance at any window 25lux
- Post-curfew Zone E4, maximum illuminance at any window 5lux

GN01 defines limits on source intensity (visible to residential observers as glare) received by residential windows in Zone E4 during these periods. The maximum intensity is dependant on the size of the light source and the distance from the observer. The post-curfew period has the lowest limit.

- Pre-curfew, Zone E4, maximum source intensity for this scenario 25,000cd (candelas)
- Post-curfew Zone E4, maximum source intensity for this scenario 2,500cd

PLG05 and the Town and Country Planning Act note that signage should comply with the following features to comply with ‘deemed consent’:

- Static,
- No intermittent light sources, flashing lights, moving parts or features, exposed cold-cathode tubing, animation or retroreflective material,
- Illumination in a manner responsibly required to fulfil the purpose of advertisement,
- Maximum permitted luminance as defined in Table 1.

Table 1: Maximum Luminance of Signage in Zone 4

Illuminated Area	Maximum Luminance (cd/m2)
More than 10m ²	300
Less than 10m ²	600

The calculation of the area only includes the illuminated parts and not spaces in between.

Lighting calculations are completed based on a maintenance factor of 1 (i.e. 100% output). This means that the sign is initially brighter on day one and will degrade in output over time, to account for degradation of components and dirtying of the sign due to pollution etc.

3. Methodology

3.1 Survey

A nocturnal survey was completed to gather lighting context information on the existing illuminated AO Arena sign on Trinity Way.

This data is a useful reference to the existing conditions for comparison with the new proposal, considering that the proposed sign will be illuminated to the same specification. Photographs and luminance measurements are provided in Appendix A and Appendix B.

3.2 Simulation

To describe the performance of the proposed sign a 3D simulation model of the sign was created in context with the Great Ducie Street residences and Arena.

Technical information the LED equipment used in the sign is included in the Appendix C of this report.

The model was simulated using the luminance measured during the site survey and the maximum luminance permitted by ILP PLG05, to determine the potential illuminance on the residence windows.

The findings were assessed against the relevant guidance ILP GN01 and PLG05 and they are provided in Section 4.3 and Appendix D of this report.

4. Assessment

4.1 Survey

A nocturnal survey was carried out on 31 May 2023. The objective was to photograph the scene and collect luminance data from the existing sign. While PLG05 proposes maximum limits on the luminance of the sign, it is often not necessary to illuminate the sign to this level depending on the competition from other light sources and ambient luminance.

In the case of the existing sign, there are no plans to upgrade the internal light sources and the proposed sign will be built to the same specification. Given the adjacency of the new and proposed signs, it would appear unbalanced to illuminate one sign brighter than the other and therefore the existing sign forms a useful reference for this study.

It is acknowledged that the existing sign is older and that the luminance levels recorded in the survey will likely be around 20% lower now than initially.

4.1.1 Method

The survey used the following equipment:

- Minolta LS-100 calibrated luminance meter
- Canon 6Dii SLR digital camera

The survey was carried out one hour after sunset to avoid the contribution of natural light. Recognising that the luminance will vary depending on the viewing angle, measurements of luminance were taken on the sign from several viewpoints facing it (see Appendix A). The objective was to establish the maximum luminance from each location.

Photographs of the sign and the apartment buildings opposite are provided in Appendix B.

4.1.2 Findings

Observations are recorded below, with reference to Appendix B.

- The existing sign appears uniformly illuminated on all letters/symbols,
- There are significant sources of spill lighting onto the existing apartments due to the highways lighting (e.g. visible in Photograph 4),
- Given the level of light spill onto the apartments, it is likely that the highways lighting is directly visible to the apartment occupants of the first and second floors (Photograph 4),
- The highways lighting is a significant source of intensity towards the residents (Photograph 1)
- The maximum recorded luminance on the existing sign was 130cd/m².

The data from the survey, which captures the performance of the sign is used in the simulation to give a prediction on the likely performance of the proposed sign on the apartment windows. Assuming a maintenance factor of 70%, the simulation will be based on an initial surface luminance of 185cd/m².

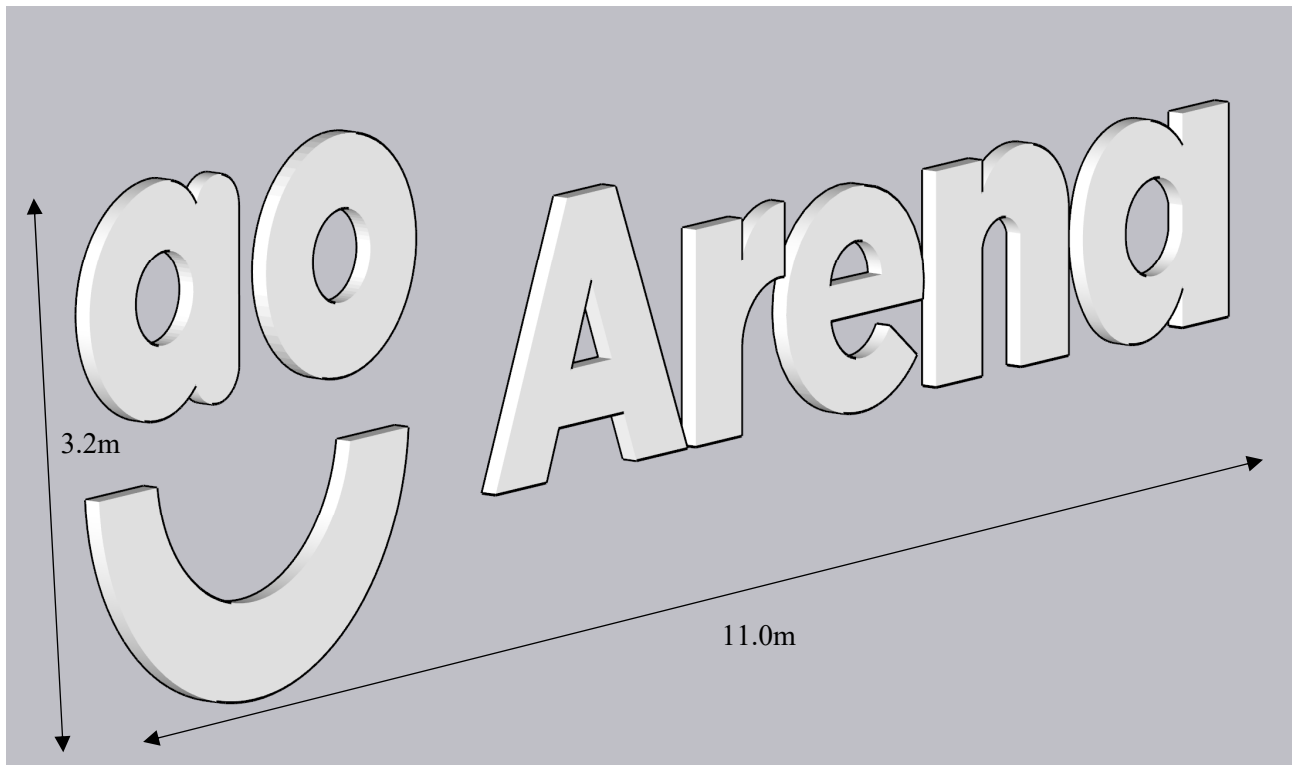
The area of the sign (see 4.2.1) means that the maximum should not exceed 300cd/m² (Table 1). Therefore the existing sign is compliant with the luminance recommendations in GN01 and PLG05.

4.2 Simulation

4.2.1 Method

A three dimensional computer simulation model was created using terrain and massing extracted from the Manchester 3D city model and geometry for the proposed sign based on the information provided from the manufacturer (Appendix C).

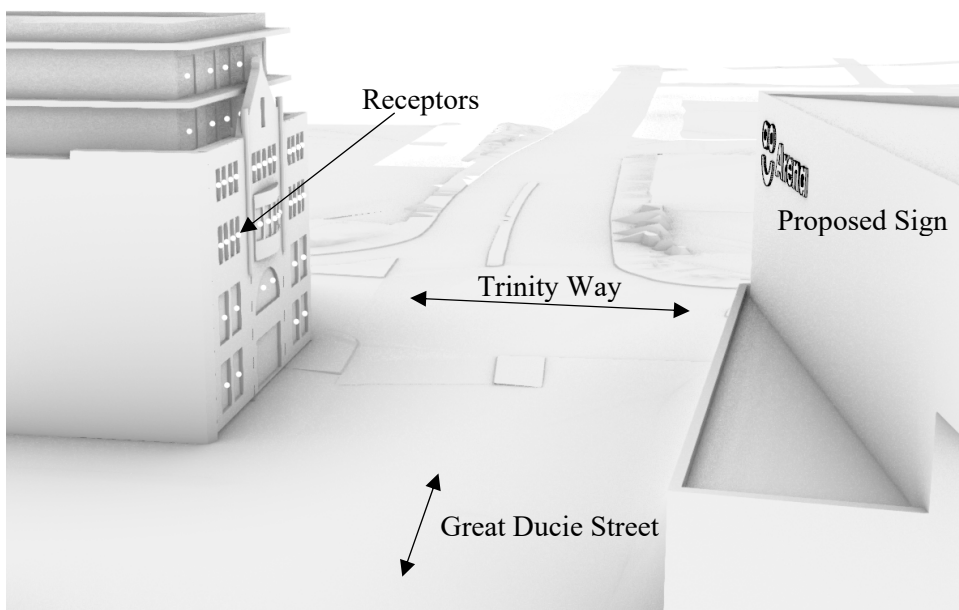
Figure 3: Proposed sign dimensions



The area of the front face of the letters/symbols has been calculated to be 11.23m^2 . Therefore, the maximum permitted luminance is $300\text{cd}/\text{m}^2$ (Table 1).

The sign was combined into the city model and light receptors placed centrally on the residential windows opposite. The existing illuminated sign on Trinity Way sign was also included in the model to account for the cumulative effect of the proposed and existing signs.

Figure 4: Residential windows in context with the proposed sign

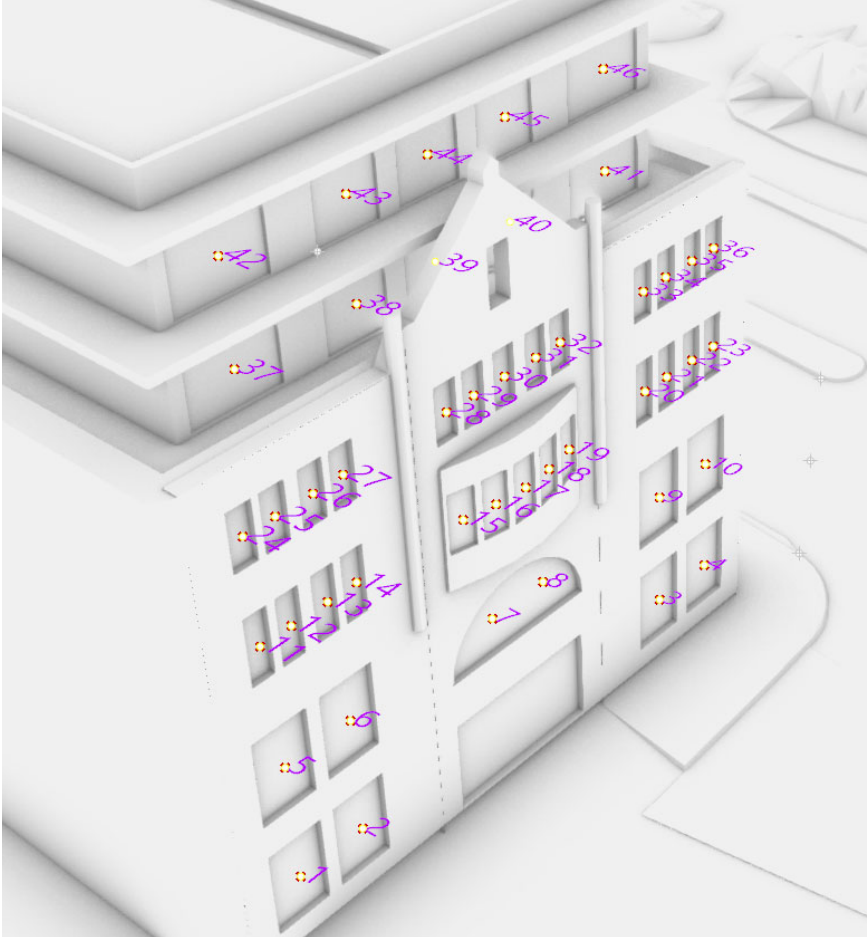


The illuminance at each receptor location (Figure 5) was calculated using Radiance lighting simulation software for the following scenarios:

‘Proposed’: Sign luminance 185cd/m² as per the site survey measurements of the existing sign, with maintenance factor adjusted to 1 (100% output on day one)

‘Maximum’: Sign luminance 300cd/m² the maximum permitted luminance for Zone E4, with maintenance factor of 1 (100%)

Figure 5: Receptor Identification



4.3 Simulation findings

Appendix D contains the complete simulation results.

In summary, the maximum illuminance at any window (Figure 5) is as follows:

- Proposed scenario, 2.7lux on windows 24/25/26
- Maximum scenario, 4.4lux on windows 24/25/26

In summary, the maximum intensity at any window is as follows:

- Proposed scenario, 2397cd on window 36 (average 1989cd)
- Maximum scenario, 3888cd on window 36 (average 3225cd)

Therefore, the following can be summarised:

Scenario	Pre-curfew Illuminance (<25lux)	Post-curfew Illuminance (<5lux)	Pre-curfew Intensity (<25,000cd)	Post-curfew Intensity (<2,500cd)
Proposed	Satisfied	Satisfied	Satisfied	Satisfied
Maximum	Satisfied	Satisfied *	Satisfied	Not Satisfied

* The predicted value of illuminance is 0.6 lux below the threshold, therefore the cumulative effect of other light sources e.g. highways lighting (see Appendix B) will likely result in the threshold being exceeded in the post-curfew scenario.

5. Conclusion

The survey has provided measured data on the likely performance of the proposed sign in the context of the city centre environment, based on it being built to the same specification.

The performance of the proposed sign has been modelled, based on the size and luminous characteristics of the existing sign, including appropriate maintenance factor to upscale output in order to reflect initial lighting performance (the measurement data is divided by the maintenance factor to determine initial output of the system). The simulation predicts that proposed sign will meet ILP GN 01 targets for illuminance and luminous intensity as observed by the windows of the residential properties opposite to it.

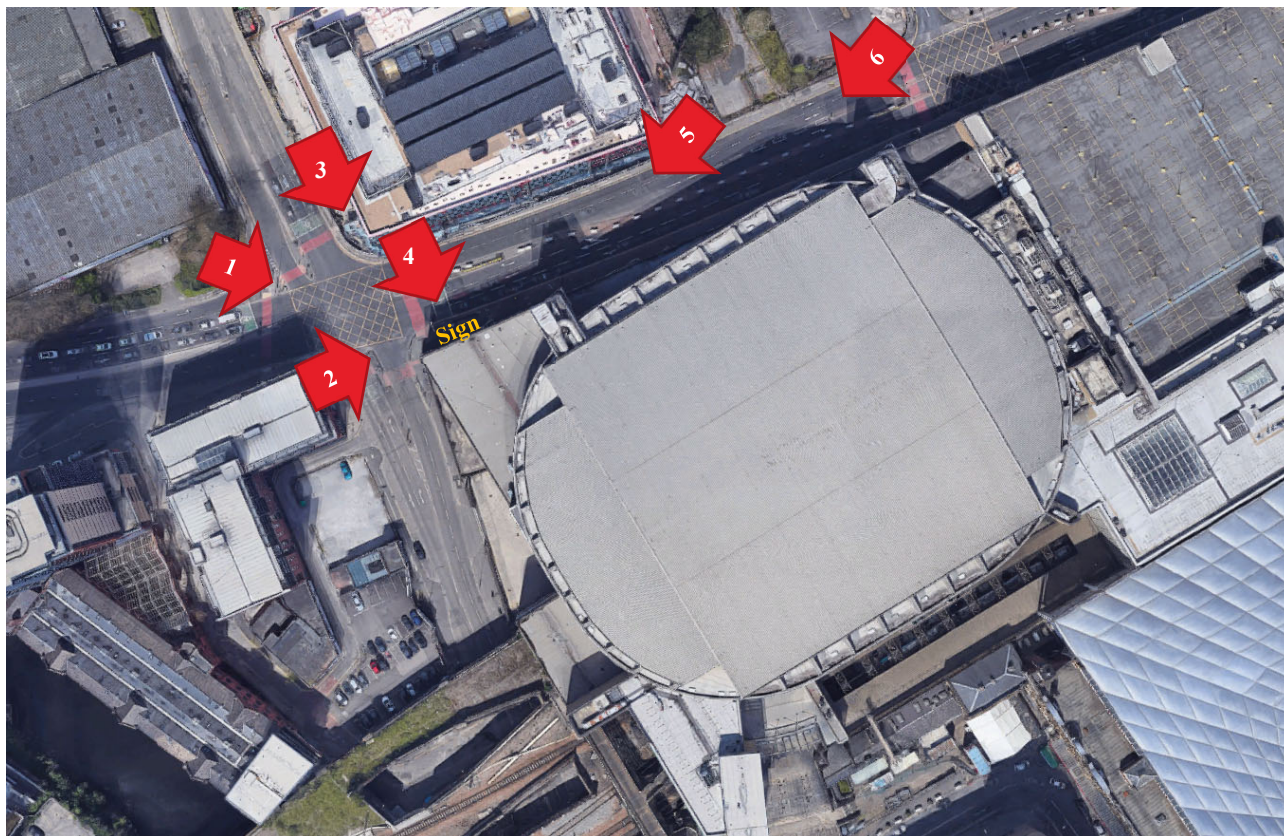
It is therefore concluded that the impact of the sign on the occupants of the surrounding residential properties, opposite to it, will not be significant.

Furthermore, simulations were carried out with the maximum permitted sign luminance (PLG05 suggests an upper limit of 300cd/m²); under such condition the effects are found not to be significant in pre-curfew. However, as the illuminance to the surrounding receptors is just below the upper limit for the post-curfew scenario, it is likely that the cumulative effect of other light sources will exceed the ILP GN 01 target for this scenario. It is therefore recommended that the output of the proposed sign is limited to 185cd/m².

For the purposes of energy savings and reduced environmental impact, it is recommended that automatic controls are fitted to the existing and proposed sign to reduce their output late at night, for example from midnight to dusk.

Appendix A

Site Viewpoints



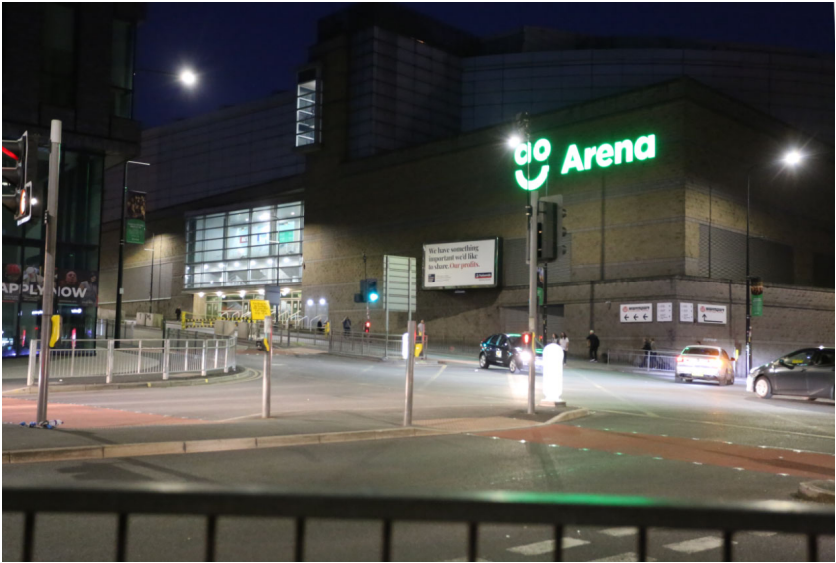
Maximum recorded intensity on existing sign at each viewpoint

1. 96.7
2. 40.3
3. 121.4
4. 130.4
5. 61.3
6. 39.0

Appendix B

Site Photographs

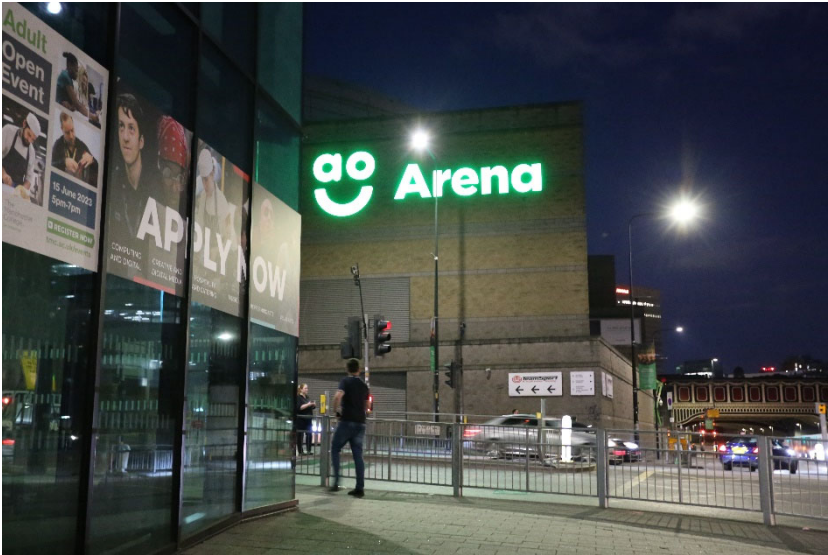
Photograph 1: Viewpoint 1



Photograph 2: Viewpoint 2



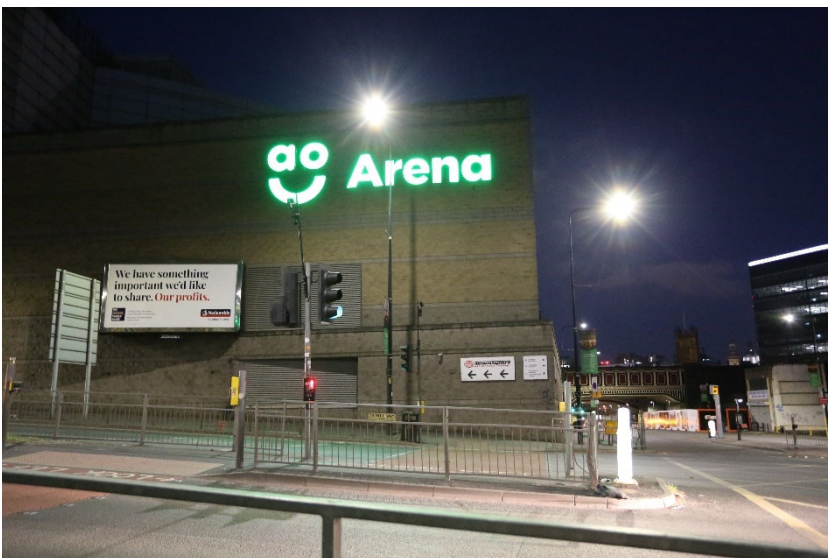
Photograph 3: Viewpoint 3



Photograph 4: Viewpoint 4 – towards apartments



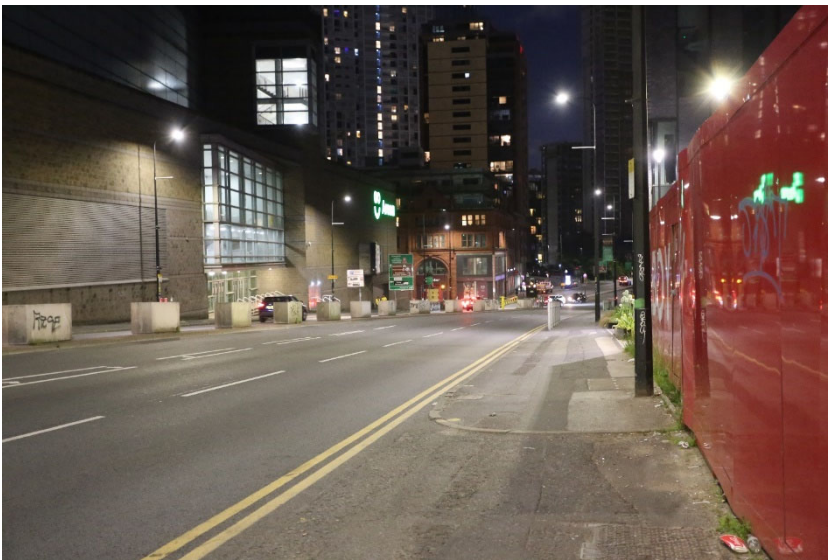
Photograph 5: Viewpoint 4 – towards existing sign



Photograph 6: Viewpoint 5

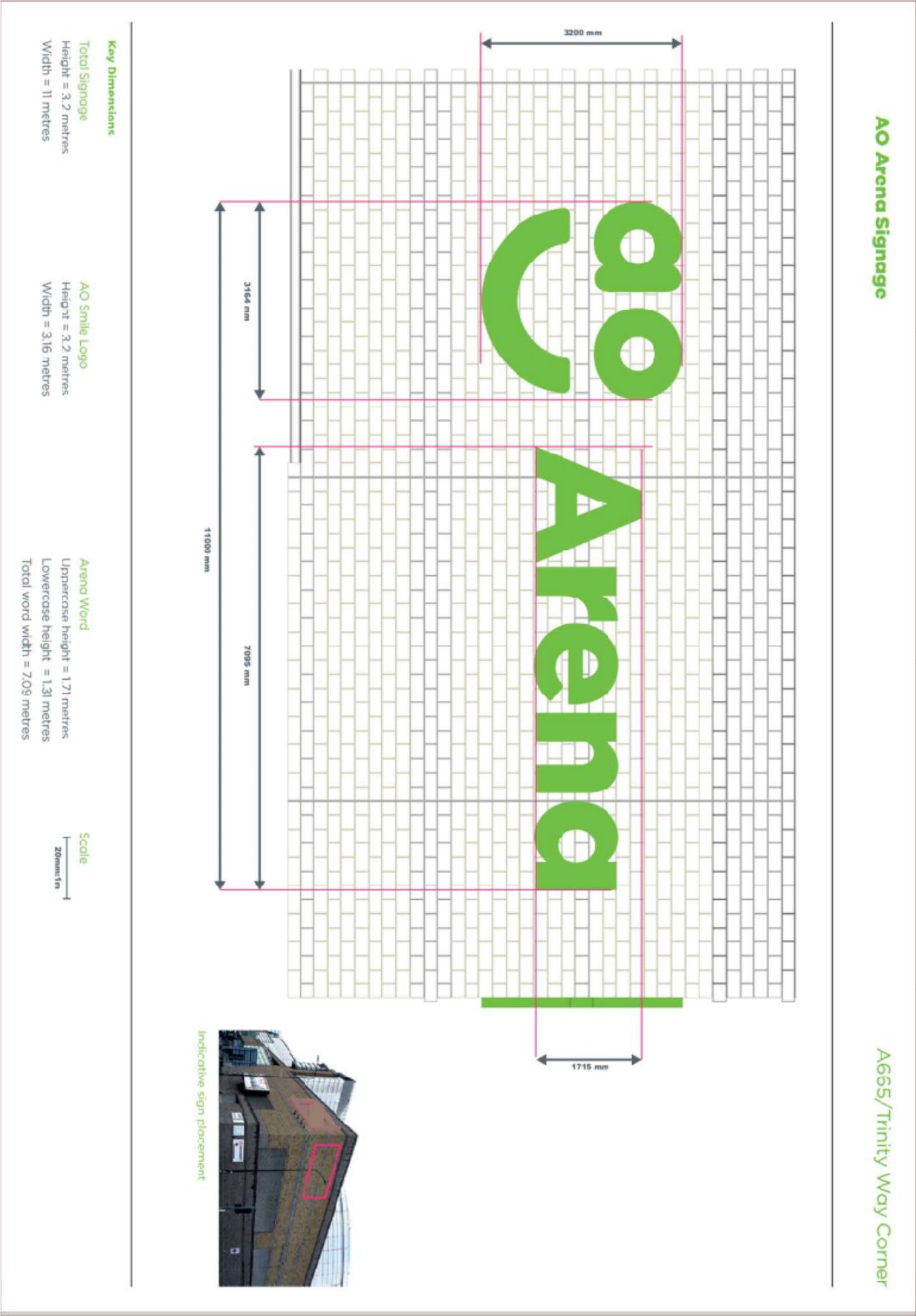


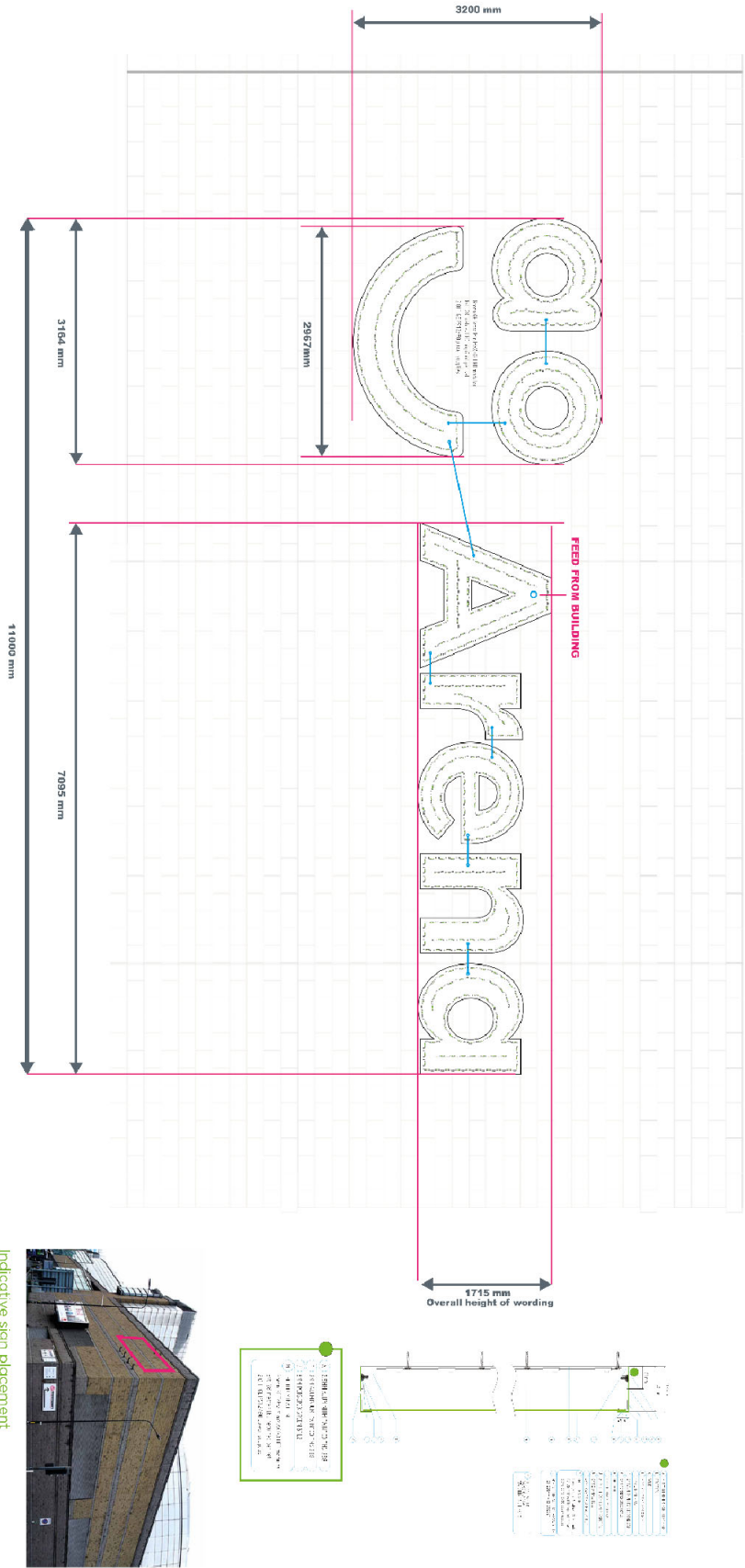
Photograph 7: Viewpoint 6



Appendix C

Manufacturer's Information





Key Dimensions

Total Signage

Height = 3.2 metres
Width = 11 metres

AO Smile Logo

Height = 3.2 metres
Width = 3.16 metres

Arena Word

Uppercase height = 1.68 metres
Lowercase height = 1.31 metres
Total word width = 7.09 metres

Scale



With all-new OptiLens™ X and groundbreaking energy efficiency

Tetra® miniMAX white—the 24V remarkable LED system designed for small and medium channel letters as shallow as 1.5 inches (38mm) in depth delivers incredibly uniform light, installs easily and operates efficiently. Tetra® miniMax is now IP66 and UL wet rated which makes it more robust and reliable than ever, even under wet weather.

Powerful all-new OptiLens™ X

Tetra® miniMAX features all-new OptiLens™ X, our patented technology that allows for an incredible 175° viewing angle. This exclusive technology redirects otherwise wasted light to the sign face, making sure your signs shine.

Best-in-class loading

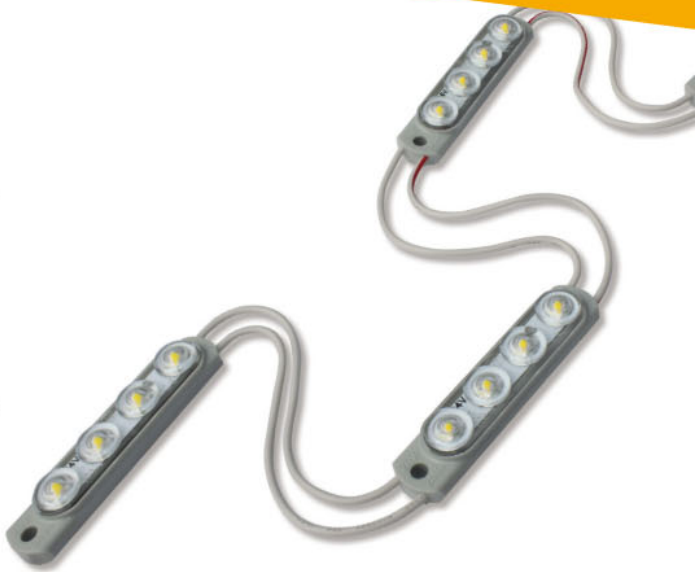
The new 24V Tetra® miniMAX white loading improves 38% from the previous 12V generation. Now load up to 110 feet (33.5 m) or 220 modules of product per GEPS24-100U-GL power supply.

Improved stroke spacing

The new 24V Tetra® miniMAX stroke spacing has improved on average by 30%, thanks to the new OptiLens™ X wide beam angle.

Tetra® miniMAX Features

- Wide 175° beam angle
- Improved luminous intensity
- Efficacy: 157 lm/W for the whites
- 24 Volt DC, Class 2 (UL), Class III (IEC)
- UL Wet Rated & IP66 - no separate enclosure is required
- 10-years limited warranty



Tetra® miniMAX		
	Can Depth	Coverage
Medium	1.5-3" (38-76mm)	3-6.5" (76-165mm)
	3-4" (76-102mm)	5-8" (127-203mm)
Large	4-5" (102-127mm)	8-11" (203-279mm)
	5-6" (127-152mm)	13-15" (330-381mm)

Tetra® miniMAX

Appendix D

Simulation Data

The following table shows the results from the simulation. Maximum values in **red** text.

Table 2: Simulation results

Receptor Reference	Illuminance 'Proposed' (lux)	Illuminance 'Maximum' (lux)	Intensity 'Proposed' (cd)	Intensity 'Maximum' (cd)
1	2.0	3.3	1666	2702
2	2.0	3.2	1632	2646
3	1.8	2.9	1810	2935
4	1.7	2.8	1878	3046
5	2.3	3.8	1950	3162
6	2.3	3.8	1934	3136
7	2.1	3.5	1876	3042
8	2.1	3.5	1930	3130
9	2.0	3.3	2091	3390
10	2.0	3.2	2142	3474
11	2.6	4.2	2142	3473
12	2.6	4.2	2141	3471
13	2.6	4.2	2154	3492
14	2.6	4.2	2160	3502
15	2.5	4.0	2122	3440
16	2.5	4.0	2106	3416
17	2.4	4.0	2126	3448
18	2.4	3.9	2146	3481
19	2.4	3.8	2173	3524
20	2.3	3.7	2287	3709
21	2.2	3.6	2296	3724
22	2.2	3.5	2326	3772
23	2.1	3.4	2326	3771
24	2.7	4.4	2184	3542
25	2.7	4.4	2189	3550
26	2.7	4.4	2207	3580

Receptor Reference	Illuminance 'Proposed' (lux)	Illuminance 'Maximum' (lux)	Intensity 'Proposed' (cd)	Intensity 'Maximum' (cd)
27	2.7	4.3	2207	3579
28	2.6	4.1	2199	3566
29	2.5	4.0	2170	3519
30	2.5	4.0	2191	3553
31	2.4	3.9	2205	3576
32	2.4	3.9	2250	3649
33	2.3	3.8	2372	3847
34	2.3	3.7	2368	3840
35	2.2	3.6	2386	3869
36	2.2	3.5	2397	3888
37	2.3	3.7	2141	3472
38	0.0	0.0	3	5
39	0.9	1.5	940	1525
40	0.0	0.0	2	4
41	2.0	3.2	2299	3732
42	2.2	3.6	2141	3481
43	2.2	3.5	2133	3469
44	0.5	0.8	546	876
45	2.0	3.3	2199	3567
46	2.0	3.2	2338	3782

The same information is presented graphically in Figure 6 to Figure 9 on the following pages.

Figure 6: Window illuminance 'Proposed' Sign

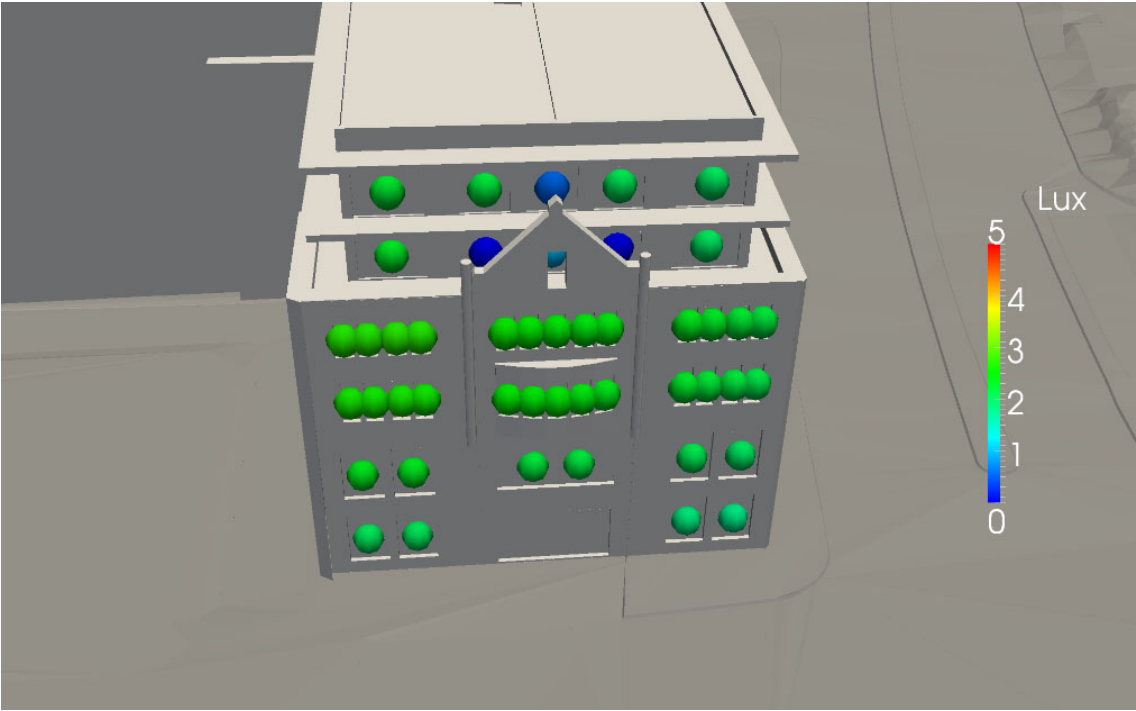


Figure 7: Window illuminance 'Maximum' Sign

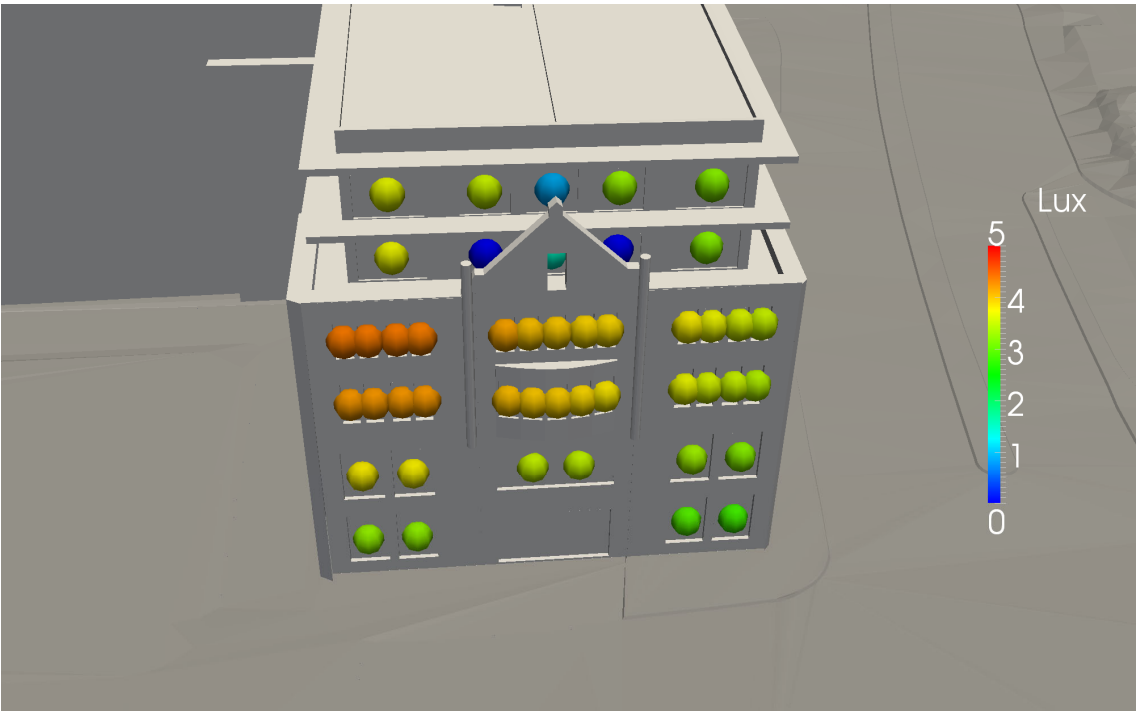


Figure 8: Intensity at windows 'Proposed' sign

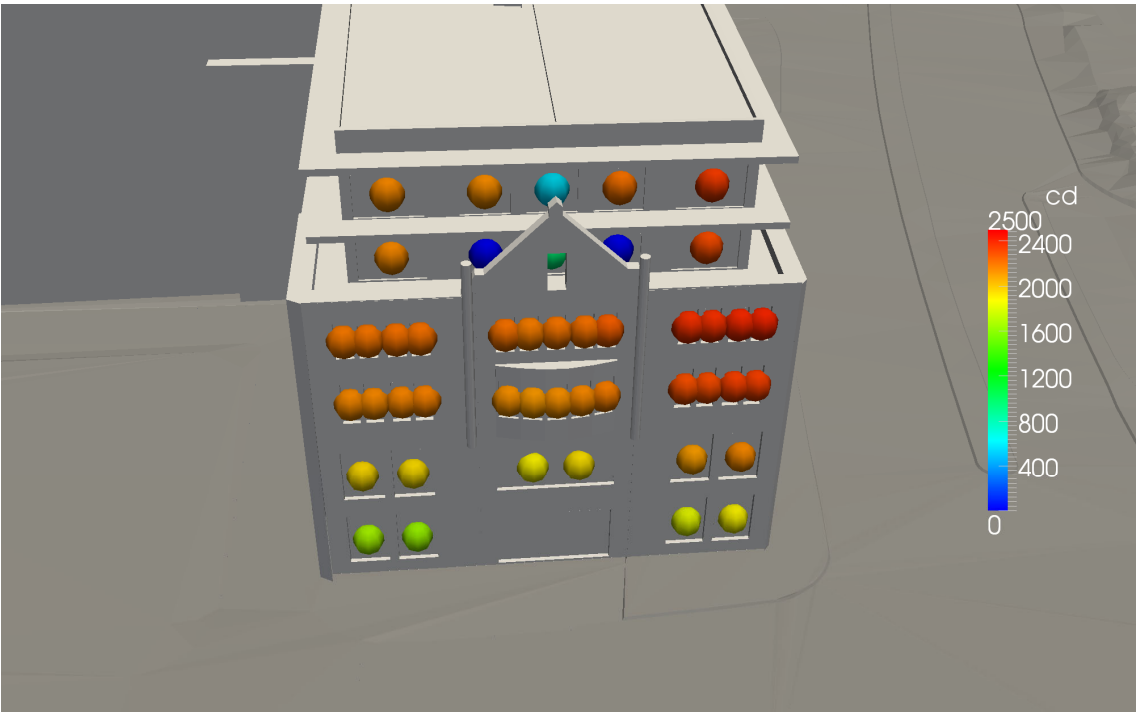


Figure 9: Intensity at windows 'Maximum' sign

