DIGITAL PLACE SOLUTIONS

LIGHTING IMPACT ASSESSMENT -

OUTDOOR SIGNAGE AT IXION ST PEDESTRIAN BRIDGE, WINSTON HILLS (INBOUND)

24th October 2022
Ref: 3214.11

Lighting Impact Assessment

Outdoor Signage at Ixion St Pedestrian Bridge, Winston Hills (Inbound)

DATE	REV	COMMENT	PREPARED BY	CHECKED BY
24/10/22	REV B	For Information	LC	RS

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1. INTRODUCTION

Electrolight have been appointed by Digital Place Solutions to undertake a Lighting Impact Assessment on the proposed digital signage to be installed on the Ixion St pedestrian bridge above M2 Motorway in Winston Hills, NSW (Inbound). The objective of the assessment is to report on compliance with the State Environmental Planning Policy (Industry and Employment) 2021, NSW Transport Corridor Outdoor Advertising and Signage Guidelines, and AS4282-2019 Control of the Obtrusive Effects of Outdoor Lighting.

2. DEFINITIONS

2.1 Illuminance

The physical measure of illumination is illuminance. It is the luminous flux arriving at a surface divided by the area of the illuminated surface. Unit: lux (lx); 1 lx = 1 lm/m2.

(a) Horizontal illuminance (Eh) The value of illuminance on a designated horizontal plane

(b) Vertical illuminance (Ev) The value of illuminance on a designated vertical plane

Where the vertical illuminance is considered in the situation of potentially obtrusive light at a property boundary it is referred to as environmental vertical illuminance (Eve).

2.2 Luminance

The physical quantity corresponding to the brightness of a surface (e.g. a lamp, luminaire or reflecting material such as the road surface) when viewed from a specified direction. SI Unit: candela per square metre (cd/m2) – also referred to as “nits”.

2.3 Luminous Intensity

The concentration of luminous flux emitted in a specified direction. Unit: candela (cd).

2.4 Obtrusive Light

Spill Light which, because of quantitative, directional or spectral attributes in a given context, gives rise to annoyance, discomfort, distraction or a reduction in the ability to see essential information.

2.5 Threshold Increment

The measure of disability glare expressed as the percentage increase in contrast required between a standard object and its background (the carriageway) for it to be seen equally as well with the source of glare present as with it absent, derived in the specified manner. This metric is directly related to Veiling Luminance.

NOTE: The required value is a maximum for compliance of the lighting scheme.

2.6 AGI32 Light Simulation Software

AGI32 (by U.S. company Lighting Analysts) is an industry standard lighting simulation software package that can accurately model and predict the amount of light reaching a designated surface or workplane. AGi32 is a has been independently tested against the International Commission On Illumination (CIE) benchmark, CIE 171:2006, Test Cases to Assess the Accuracy of Lighting Computer Programs.

2.7 Upward Light Ratio (ULR)

The ratio between the luminuous flux emitted above the horizontal plane to the total flux emitted by a light source. The ULR is used as a measure to limit direct spill light to the sky.

3. SITE DESCRIPTION AND SCOPE

The proposed digital signage is located on the Ixion St pedestrian bridge above M2 Motorway in Winston Hills, NSW. The signage is oriented towards the inbound direction of traffic on the M2 Motorway. The total active display (illuminated) area of the proposed digital signage is 39.94 m2. The digital signage is to be in 24 hour operation. Refer to Appendix A for proposed signage location plan and elevations.

The proposed digital signage is illuminated using LEDs installed within the front face. The brightness of the LEDs shall be controlled to provide upper and lower thresholds as required as well as automatically via a local light sensor to adjust to ambient lighting conditions.

For the purpose of this report the proposed manufacturer of the digital signage is noted as Daktronics model type DVX-2200N-10MN-8000-WJ with performance parameters as outlined in Appendix B. The signage includes baffles which mitigate upward waste light, resulting in an Upward Light Ratio (ULR) of less than 50%. Alternative digital sign manufacturers may be used for this installation as long as they have equivalent lighting and performance characteristics and are commissioned as described in this report.

4. DESIGN GUIDELINES AND STANDARDS

The Lighting Impact Assessment will review the proposed digital signage against the following Criteria, Design Guidelines and Standards.

- State Environmental Planning Policy (Industry and Employment) 2021 (Refer Appendix C)
- Transport Corridor Outdoor Advertising & Signage Guidelines 2017
- AS 4282-2019 Control of the Obtrusive Effects of Outdoor Lighting

5. LUMINANCE ASSESSMENT

The maximum permissible night time luminance of the signage is determined by the existing lighting environment of its surroundings. AS4282 outlines maximum average luminances for different Environmental Zones as shown in Table 1 below:

TABLE 1 - MAXIMUM NIGHT TIME AVERAGE LUMINANCE FOR SIGNAGE		
Environmental Zone	Description	Max Average Luminance (cd/m2)
A4	High district brightness e.g. Town and city centres, commercial areas, and residential areas abutting commercial areas	350
A3	Medium district brightness e.g. suburban areas in towns and cities	250
A2	Low district brightness e.g. sparsely inhabited rural and semi-rural areas	150
A1	Dark e.g. relatively uninhabited rural areas. No Road Lighting	0.1
A0	Intrinsically Dark e.g. Major Optical Observatories. No Road Lighting	0.1

Note: Where the signage is viewed against a predominantly dark background (e.g. night sky) then the maximum applicable environmental zone is A2

Based on an assessment of the surrounding environment, the proposed digital signage is located within Environmental Zone A3 under AS4282, therefore the maximum night time luminance is 250 cd/m2.

AS4282 does not include limits for daytime operation of illuminated signage. However, the Transport Corridor Outdoor Advertising & Signage Guidelines outlines maximum permissible luminance limits for various lighting conditions, including daytime. Under the Guidelines, the proposed signage is classified as being within Zone 4, which is described as an area with residential properties located nearby. The maximum night time luminance of a digital signage within Zone 4 is 200 cd/m2.

Table 2 outlines the maximum luminance levels to comply with AS4282 and the Transport Corridor Outdoor Advertising & Signage Guidelines for the various lighting conditions listed below:

TABLE 2 - LUMINANCE LEVELS FOR DIGITAL ADVERTISEMENTS		
Lighting Condition	Max Permissible Luminance (cd/m2) #	Compliant
Full Sun on face of Signage	No Limit	✓
Day Time Luminance (typical sunny day)	6000	✓
Morning and Evening Twilight and Overcast Weather	500	✓
Night Time	97*	✓

The signage is to be dimmed on site to ensure the maximum luminance nominated above is not exceeded.

* The maximum permissible luminance allowable under AS4282 and the Transport Corridor Outdoor Advertising & Signage Guidelines is actually 200 cd/m2. The lower luminance limit shown above is to ensure compliance with other criteria of AS4282 and any additional lighting requirements as described in this report.

The proposed digital signage has a maximum brightness (luminance) of 8000 cd/m2. The screen shall be commissioned on site to yield a maximum screen luminance of 8000 cd/m2 when full sun strikes the face of the sign (maximum brightness), 6000 cd/m2 during normal daytime operation, 500 cd/m2 during twilight and inclement weather and 100 cd/m2 during night time.

6. AS4282 ASSESSMENT

The proposed signage has been assessed against AS 4282-2019 Control of the Obtrusive Effects of Outdoor Lighting as outlined in Section 4.

AS4282 provides limits for different obtrusive factors associated with dark hours (night time) operation of outdoor lighting systems. Two sets of limiting values for spill light are given based on whether the lighting is operating before a curfew (known as "pre-curfew" operation) or operating after a curfew (known as post-curfew or curfewed operation). Pre-curfew spill lighting limits are higher than post-curfew values, on the understanding that spill light is more obtrusive late at night when residents are trying to sleep. Under AS4282, the post-curfew period is taken to be between 11pm and 6am daily. As the signage operates all night, the signage will be assessed against the more stringent post-curfew limits.

Illuminance Assessment

The AS4282 assessment includes a review of nearby residential dwellings and calculation of the amount of illuminance (measured in Lux) that the properties are likely to receive from the signage during night time operation.

The acceptable level of illuminance will in part be determined by the night time lighting environment around the dwellings. AS4282 categorises the night time environment into different zones with maximum lighting limits as shown in Table 3 below:

TABLE 3 - MAXIMUM VALUES OF LIGHT TECHNICAL PARAMETERS

Environmental Zone	Max Vertical Illuminance (lx)		Description
	Pre-curfew	Post-curfew	
A0	0	0	Intrinsically Dark e.g. Major Optical Observatories. No Road Lighting
A1	2	0.1	Dark e.g. relatively uninhabited rural areas. No Road Lighting
A2	5	1	Low district brightness e.g. sparsely inhabited rural and semi-rural areas
A3	10	2	Medium district brightness e.g. suburban areas in towns and cities
A4	25	5	High district brightness e.g. Town and city centres, commercial areas, and residential areas abutting commercial areas

Based on an assessment of the surrounding areas, the nearest dwellings with potential views to the signage are at the following locations:

Address	Zone	Address	Zone
164 Junction Rd	A3	182 Junction Rd	A3
166 Junction Rd	A3	184 Junction Rd	A3
168 Junction Rd	A3	7 Leatherwood Ct	A3
170 Junction Rd	A3	13 Leatherwood Ct	A3
172 Junction Rd	A3	21 Leatherwood Ct	A3
174 Junction Rd	A3	23 Leatherwood Ct	A3
176 Junction Rd	A3		
178 Junction Rd	A3		
180 Junction Rd	A3		

As such, the dwellings above will form the focus of the illuminance assessment. The proposed signage (and surrounding environment) was modelled in lighting calculation program AGI32 to determine the effect (if any) of the light spill from the signage. Photometric data for the screen was provided by the screen manufacturer*, with the maximum luminance corresponding to the night time limit outlined in Section 5. Appendix D shows the lighting model and the results of the calculations.

It should be noted that some of the houses are shielded by mature vegetation and/or barriers which effectively obstructs the spill light of the signage. However calculations were undertaken assuming that there were no barriers or vegetation present.

It can be seen from the lighting model that the maximum illuminance to dwellings in Zone A3 is 0.55lux at 164 Junction Rd and 166 Junction Rd. The illuminance level above complies with the maximum AS4282 limit of 2lux as outlined in Table 3.

Threshold Increment Assessment

The Threshold Increment was also calculated for the traffic approaches on M2 Motorway (North-Eastbound), Junction Rd (North-Eastbound) and Leatherwood Ct (North-Eastbound). The calculation grids were located at 1.5m above ground level for general traffic approaches, with an approach viewing distance of between 10 m to 200 m from the sign. The calculation results show that the Threshold Increment does not exceed 19.62% for any traffic approach (the allowable maximum under the standard is 20%).

Luminous Intensity

The luminous intensity limits nominated in the standard are not applicable for internally illuminated signage.

Additional Requirements:

The signage operator must ensure that the average luminance difference between successive images does not exceed 30% to ensure compliance with AS4282. The dwell time shall be 10 seconds or greater.

Summary

It can therefore be seen that the proposed digital signage complies with all relevant requirements of AS4282-2019 Control of the Obtrusive Effects of Outdoor Lighting.

* Electrolight takes no responsibility for the accuracy of third party provided photometric data.

7. SUMMARY

- The proposed signage to be installed on the Ixion St pedestrian bridge above M2 Motorway in Winston Hills, NSW (Inbound), shall be commissioned on site to yield the following maximum luminances:

LUMINANCE LEVELS FOR DIGITAL ADVERTISEMENTS		
Lighting Condition	Max Permissible Luminance (cd/m2)	Compliant
Full Sun on face of Signage	No Limit	✓
Day Time Luminance (typical sunny day)	6000	✓
Morning and Evening Twilight and Overcast Weather	500	✓
Night Time	97	✓

- The signage operator must ensure that the average luminance difference between successive images does not exceed 30% to ensure compliance with AS4282. The dwell time shall be 10 seconds or greater.
- The proposed signage has been found to comply with all relevant requirements of AS4282-2019 Control of the Obtrusive Effects of Outdoor Lighting.
- In complying with the above requirements, the proposed signage should not result in unacceptable glare nor should it adversely impact the safety of pedestrians, residents or vehicular traffic. Additionally, the signage should not cause any reduction in visual amenity to nearby residences or accommodation.

8. DESIGN CERTIFICATION

The proposed digital signage to be installed on the Ixion St pedestrian bridge above M2 Motorway in Winston Hills, NSW (Inbound), if commissioned according to this report, complies with the following criteria, guidelines and standards:

- State Environmental Planning Policy (Industry and Employment) 2021 (Refer Appendix C)
- Transport Corridor Outdoor Advertising & Signage Guidelines 2017
- AS 4282-2019 Control of the Obtrusive Effects of Outdoor Lighting

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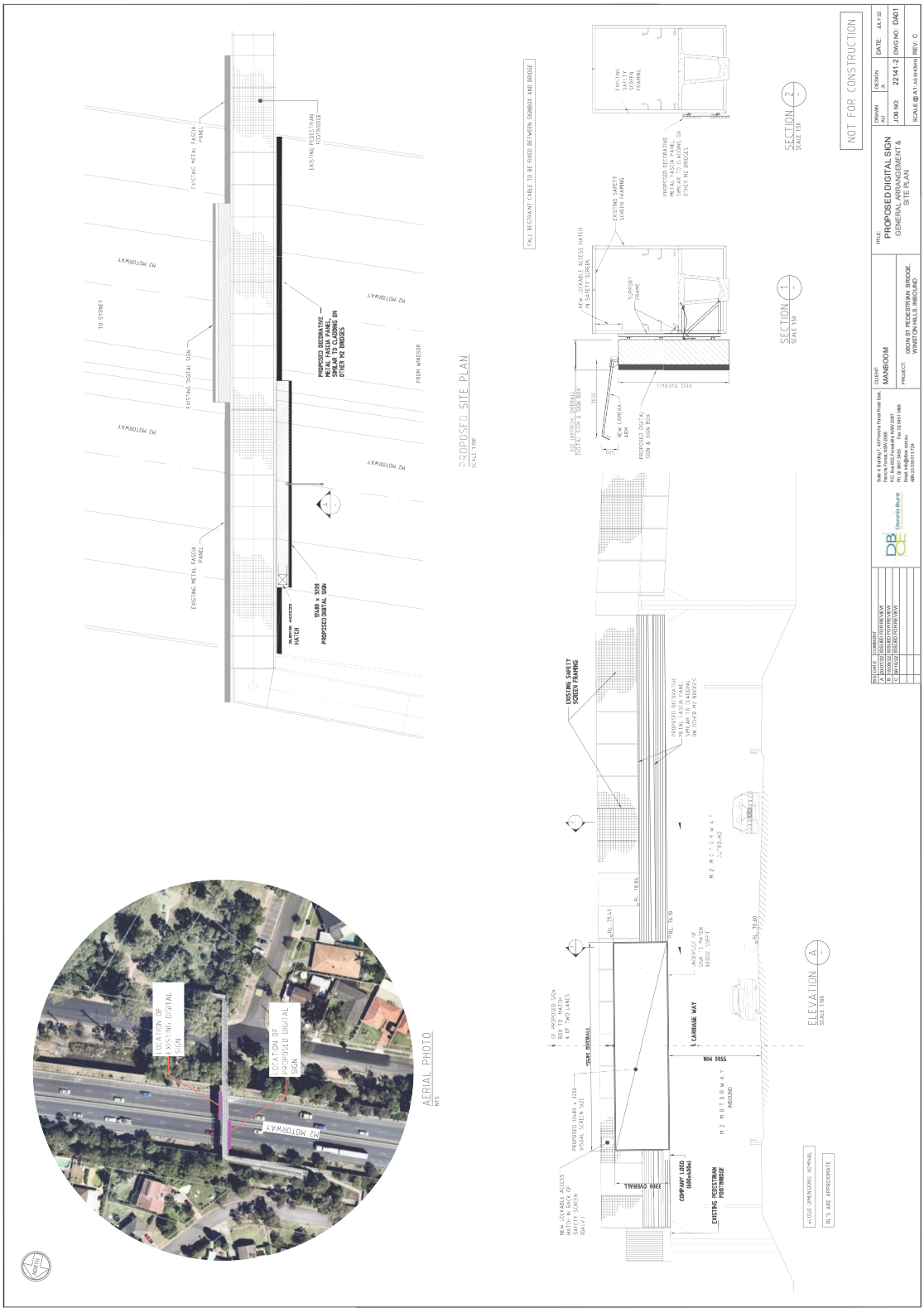
24/10/22

APPENDIX A
SIGNAGE LOCATION



SERIES SPECIFICATION

DVX-2200N-10MN-8000-WJ

Pixel Configuration	RGB 3-in-1 SMD
Line and Column Spacing	0.394 inches - 10 millimeters
Module Configuration - Pixels (RxC)	32 x 32 pixels
Module Dimensions (HxW)	12.598 x 12.598 inches - 320 x 320 mm
Maximum Power per Module	65.35 Watts
Average Power per Module	16.34 Watts
Display Weight per Module	10.2 pounds - 4.63 kilograms
Processing	22 bit Distributed
Color Capacity	281 Trillion Colors
Dimming	256 levels
Color Temperature	3,000º-10,000º kelvin (adjustable)
Calibration	pixel to pixel
LED Refresh Rate	3840 hertz
LED Lifetime	100,000 hrs
Brightness - Typical Nits	8000 nits (cd/sm)
Horizontal Viewing Angle	160º
Vertical Viewing Angle (Up/Down)	+60/-70º
Contrast Ratio	1200:1
Service Access	Front or Rear
Cabinet Depth	3.937 inches - 100 millimeters
Cabinet Construction	Die-Cast Aluminum
Ingress Protection Rating	IP-66 Rated
Working Temperature Rating	-40º to 122º F - -40º to 50º C
Ventilation	None
Data Transmission to Display	Direct: Fiberoptic Cable Remote: Internet/Network (IP)

Note 1: Consistent with Daktronics policy of continuing product improvement, specifications shown on this document are subject to change without notice.

Note 2: See contract specific drawings for customized product weights

APPENDIX C

State Environmental Planning Policy (Industry and Employment) 2021

Schedule 5 Assessment criteria

(Clauses 8, 13 and 17)

1. Character of the area

- Is the proposal compatible with the existing or desired future character of the area or locality in which it is proposed to be located?
- Is the proposal consistent with a particular theme for outdoor advertising in the area or locality?

2. Special areas

- Does the proposal detract from the amenity or visual quality of any environmentally sensitive areas, heritage areas, natural or other conservation areas, open space areas, waterways, rural landscapes or residential areas?

3. Views and vistas

- Does the proposal obscure or compromise important views?
- Does the proposal dominate the skyline and reduce the quality of vistas?
- Does the proposal respect the viewing rights of other advertisers?
-

4. Streetscape, setting or landscape

- Is the scale, proportion and form of the proposal appropriate for the streetscape, setting or landscape?
- Does the proposal contribute to the visual interest of the streetscape, setting or landscape?
- Does the proposal reduce clutter by rationalising and simplifying existing advertising?
- Does the proposal screen unsightliness?
- Does the proposal protrude above buildings, structures or tree canopies in the area or locality?
- Does the proposal require ongoing vegetation management?

5. Site and building

- Is the proposal compatible with the scale, proportion and other characteristics of the site or building, or both, on which the proposed signage is to be located?
- Does the proposal respect important features of the site or building, or both?
- Does the proposal show innovation and imagination in its relationship to the site or building, or both?

6. Associated devices and logos with advertisements and advertising structures

- Have any safety devices, platforms, lighting devices or logos been designed as an integral part of the signage or structure on which it is to be displayed?

7. Illumination

- Would illumination result in unacceptable glare?
- Would illumination affect safety for pedestrians, vehicles or aircraft?
- Would illumination detract from the amenity of any residence or other form of accommodation?
- Can the intensity of the illumination be adjusted, if necessary?
- Is the illumination subject to a curfew?

8. Safety

- Would the proposal reduce the safety for any public road?
- Would the proposal reduce the safety for pedestrians or bicyclists?
- Would the proposal reduce the safety for pedestrians, particularly children, by obscuring sightlines from public areas?

APPENDIX D
OBTRUSIVE LIGHTING CALCULATIONS

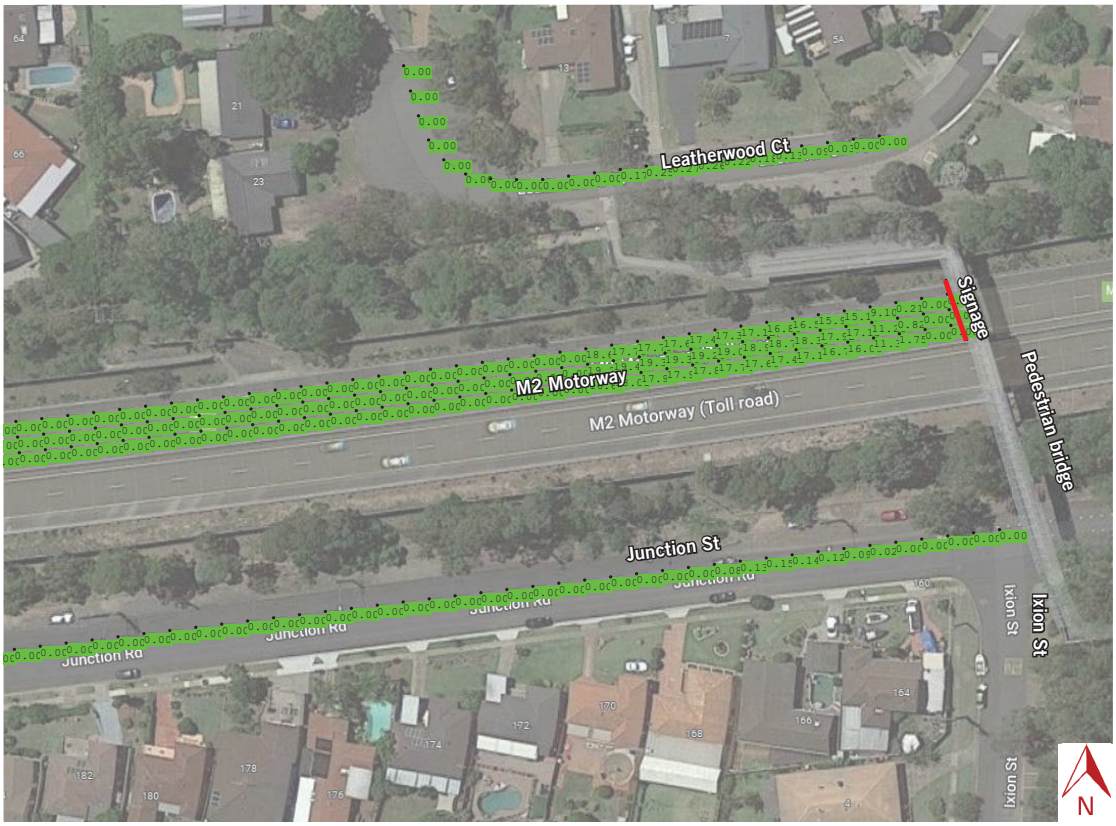
Calculation Summary			
Label	**CalcType**	**Units**	**Max**
13 Leatherwood Ct_III_Seg1	Obtrusive - III	Lux	0.33
164 Junction Rd_III_Seg1	Obtrusive - III	Lux	0.55
166 Junction Rd_III_Seg1	Obtrusive - III	Lux	0.55
168 Junction Rd_III_Seg1	Obtrusive - III	Lux	0.47
170 Junction Rd_III_Seg1	Obtrusive - III	Lux	0.31
172 Junction Rd_III_Seg1	Obtrusive - III	Lux	0.21
174 Junction Rd_III_Seg1	Obtrusive - III	Lux	0.15
176 Junction Rd_III_Seg1	Obtrusive - III	Lux	0.10
178 Junction Rd_III_Seg1	Obtrusive - III	Lux	0.07
180 Junction Rd_III_Seg1	Obtrusive - III	Lux	0.06
182 Junction Rd_III_Seg1	Obtrusive - III	Lux	0.04
184 Junction Rd_III_Seg1	Obtrusive - III	Lux	0.03
21 Leatherwood Ct_III_Seg1	Obtrusive - III	Lux	0.19
23 Leatherwood Ct_III_Seg1	Obtrusive - III	Lux	0.25
23 Leatherwood Ct_III_Seg2	Obtrusive - III	Lux	0.06
7 Leatherwood Ct_III_Seg1	Obtrusive - III	Lux	0.49

Environmental Zone Legend:

- A0
- A1
- A2
- A3
- A4

APPENDIX D
THRESHOLD INCREMENT CALCULATIONS

Calculation Summary			
Label	**CalcType**	**Units**	**Max**
Junction Rd - North-Eastbound	Obtrusive - TI	%	0.45
Leatherwood Ct North-Eastbound	Obtrusive - TI	%	1.11
M2 Motorway - North-Eastbound	Obtrusive - TI	%	19.62



APPENDIX D

OBTRUSIVE LIGHTING AND THRESHOLD INCREMENT CALCULATIONS

Obtrusive Light - Compliance Report

AS/NZS 4282:2019, A3 - Medium District Brightness, Curfew
Filename: 3214.11 RevB
24-Oct-22 3:51:09 PM

Illuminance

Maximum Allowable Value: 2 Lux

Calculations Tested (16):

Calculation Label	Test Results	Max. Illum.
164 Junction Rd_Ill_Seg1	**PASS**	0.55
166 Junction Rd_Ill_Seg1	**PASS**	0.55
168 Junction Rd_Ill_Seg1	**PASS**	0.47
170 Junction Rd_Ill_Seg1	**PASS**	0.31
172 Junction Rd_Ill_Seg1	**PASS**	0.21
174 Junction Rd_Ill_Seg1	**PASS**	0.15
176 Junction Rd_Ill_Seg1	**PASS**	0.10
178 Junction Rd_Ill_Seg1	**PASS**	0.07
180 Junction Rd_Ill_Seg1	**PASS**	0.06
182 Junction Rd_Ill_Seg1	**PASS**	0.04
184 Junction Rd_Ill_Seg1	**PASS**	0.03
7 Leatherwood Ct_Ill_Seg1	**PASS**	0.49
13 Leatherwood Ct_Ill_Seg1	**PASS**	0.33
21 Leatherwood Ct_Ill_Seg1	**PASS**	0.19
23 Leatherwood Ct_Ill_Seg1	**PASS**	0.25
23 Leatherwood Ct_Ill_Seg2	**PASS**	0.06

Threshold Increment (TI)

Maximum Allowable Value: 20 %

Calculations Tested (3):

Calculation Label	Adaptation Luminance	Test Results
M2 Motorway - North-Eastbound	1	**PASS**
Junction Rd - North-Eastbound	1	**PASS**
Leatherwood Ct North-Eastbound	1	**PASS**