JCDecaux

LIGHTING IMPACT ASSESSMENT - OUTDOOR SIGNAGE AT

1 FITZROY ST KILDA, VICTORIA

23rd March 2023
Ref: 1096.120

Lighting Impact Assessment
Outdoor Signage at 1 Fitzroy St Kilda, Victoria

DATE	REV	COMMENT	PREPARED BY	CHECKED BY
23/03/23	REV B	For Information	VG	RS

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CONTENTS

1. INTRODUCTION 3
2. DEFINITIONS 3
    2.1 Illuminance 3
    2.2 Luminance 3
    2.3 Luminous Intensity 3
    2.4 Obtrusive Light 3
    2.5 Threshold Increment 3
    2.6 AGI32 Light Simulation Software 3
    2.7 Upward Light Ratio (ULR) 4
3. SITE DESCRIPTION AND SCOPE 4
4. DESIGN GUIDELINES AND STANDARDS 4
5. LUMINANCE ASSESSMENT 5
6. ILLUMINANCE AND THRESHOLD INCREMENT ASSESSMENT 7
7. SUMMARY 9
8. DESIGN CERTIFICATION 10
APPENDIX A 11
APPENDIX B 12
APPENDIX C 13
APPENDIX D 16

1. INTRODUCTION

Electrolight have been appointed by JCDecaux to undertake a Lighting Impact Assessment for the proposed permit extension of the existing Electronic Major Promotion Sign (**Digital Signage**) installed at 1 Fitzroy St Kilda, Victoria. The objective of the assessment is to report on compliance with the Department of Transport Requirements and Guidelines for Illuminated Outdoor Advertising Signage, 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 digital signage is located on top of the building at 1 Fitzroy St Kilda, Victoria and faces the southbound direction of traffic on Beaconsfield Parade. The total display area of the digital signage is 68m2 and it operates 24 hours a day. Refer to Appendix A for the signage location plan and elevations.

The digital signage is located in a commercial area. The night time lighting conditions are best categorised as “High District Brightness” as defined in the Department of Transport Requirements and Guidelines for Illuminated Outdoor Advertising Signage, equivalent to Environmental Zone “A4” of AS4282:2019.

The digital signage is illuminated using LEDs installed within the front face. The brightness of the LEDs shall be controlled (dimmed) to provide upper and lower thresholds as required as well as automatically via a local light sensor to adjust to ambient lighting conditions. The dwell time of the displayed signage content is 30 seconds, and the transition time between different images is instantaneous (less than 0.1 seconds).

The manufacturer of the digital signage is Daktronics, model number DVX-1800-10MN-WN-HC-360x1656-230BR-MT-MR-CNTLRM, with performance parameters outlined in Appendix B. The digital signage includes baffles which mitigate upward waste light, resulting in an Upward Light Ratio (ULR) of not more than 50%.

4. DESIGN GUIDELINES AND STANDARDS

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

- Department of Transport Requirements and Guidelines for Illuminated Outdoor Advertising Signage 6 May 2022
- AS 4282-2019 Control of the Obtrusive Effects of Outdoor Lighting.

5. LUMINANCE ASSESSMENT

Department of Transport Assessment

The Department of Transport outlines maximum permissible luminance limits for various lighting conditions as per Table 1 below:

TABLE 1 - ILLUMINATED OUTDOOR ADVERTISING SIGNAGE

	CATEGORY A MAXIMUM VALUES OF LIGHT TECHNICAL PARAMETERS			CATEGORY B MAXIMUM VALUES OF LIGHT TECHNICAL PARAMETERS		
Lighting Condition	Max Average Luminance (cd/m2)	Threshold Increment Note 1		Max Average Luminance (cd/m2)	Threshold Increment Note 1	
		Max %	Adaptation Luminance		Max %	Adaptation Luminance
Full sun on face of signage	No limit	-	-	No limit	-	-
Daytime Luminance	6000	-	-	4000	-	-
Morning and evening twilight and overcast weather (see Note 2)	700	-	-	400	-	-
Night Time - High District Brightness (Note 3)	350	20%	5	200	15%	5
Night Time - Medium District Brightness (Note 3)	250	20%	1	150	15%	1
Night Time - Low District Brightness (Note 3)	150	20%	0.25	Not Permitted	N/A	N/A

Note 1: Threshold increment as defined and calculated in AS4282

Note 2: Twilight is a defined as the period when the sun is below the horizon but light from the sun is still indirectly visible. When the sun is 18 degrees or more below the horizon, the amount of visible light is very low and this is defined as Night time.

Note 3: Refer to page 5 for details of equivalent High, Medium and Low district brightness areas

Based on an assessment of the surrounding environment, the digital signage is located within a High District Brightness Area (refer Section 3). The signage is classified as “Category A” illuminated advertising signage, therefore the maximum permissible luminance under the guidelines is unlimited (maximum brightness) when full sun strikes the face of the sign, 6000 cd/m2 during normal daytime operation, 700 cd/m2 during twilight and overcast weather and 350 cd/m2 during night time.

AS4282 Luminance Assessment

AS4282 outlines maximum luminance limits for signage during night time operation only, its scope does not include lighting impacts associated with daytime operation. 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 2 below:

TABLE 2 - 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 signage is located within Environmental Zone A4, Hence, the maximum permissable night time luminance of the signage is 350 cd/m2.

Luminance Assessment Summary

Table 3 outlines the maximum luminance levels for the signage to comply with the Department of Transport Requirements and Guidelines for Illuminated Outdoor Advertising Signage and AS4282 for the various lighting conditions listed below:

TABLE 3 - COMPLYING 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	700	✓
Night Time	193*	✓

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

* The maximum permissible Night time luminance allowable to comply with the Department of Transport Policy and Guidelines for Illuminated Outdoor Advertising Signs and AS4282 is actually 350 cd/m2. The lower luminance limit shown is based on the existing operating luminance limit of the signage, which was measured by Electrolight - refer Measurement Report in Appendix D. It is intended that the night time luminance of the signage remain unchanged for the permit extension.

The digital signage has a maximum brightness (luminance) of 6000 cd/m2. The screen shall be commissioned on site to yield a maximum screen luminance of 6000 cd/m2 when full sun strikes the face of the sign (maximum brightness), 6000 cd/m2 during daytime operation, 700 cd/m2 during twilight and overcast weather, and 193 cd/m2 during night time operation.

6. ILLUMINANCE & THRESHOLD INCREMENT ASSESSMENT

Illuminance Assessment

The digital 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 digital signage will be illuminated 24 hours daily, the assessment will review the signage under the more stringent post-curfew limits.

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 4 below:

TABLE 4 - 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
4 Fitzroy St, St Kilda	A4
368 Beaconsfield Parade, St Kilda	A4
367 Beaconsfield Parade, St Kilda	A4
366 Beaconsfield Parade, St Kilda	A4
364 Beaconsfield Parade, St Kilda	A4
363 Beaconsfield Parade, St Kilda	A4

As such, the dwellings above will form the focus of the illuminance assessment.

The digital 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 was based on a digital sign with similar performance characteristics*, with the maximum luminance corresponding to the night limit as outlined in Table 3 of Section 5. Appendix C shows the lighting model and the results of the calculations.

It can be seen from the lighting model that the maximum illuminance to dwellings in Zone A4 is 0.2 lux. The illuminance level above complies with the maximum AS4282 limits of 5 lux as outlined in Table 4.

Luminous Intensity

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

Threshold Increment Assessment

The Threshold Increment was also calculated for the traffic approaches from Acland St to The Esplanade and for the southbound direction of traffic on Beaconsfield Parade. The calculation grids have been located at 1.5 m above ground level for the general traffic approaches, and 2m above ground level for the tram approach, with a viewing distance of between 2m to 200m from the signage and using a windscreen cutoff angle of 20 degrees. The calculation results show that the Threshold Increment does not exceed 2.69% for any approach (the allowable maximum under AS4282 and the Department of Transport Requirements and Guidelines for Illuminated Outdoor Advertising Signage is 20%). The digital signage therefore complies with the Threshold Increment limits.

Additional AS4282 Requirements:

The signage operator must ensure that the average luminance difference between successive images does not exceed 30% to ensure compliance with AS4282. The minimum dwell time is 30 seconds, which complies with the minimum 10 second dwell time requirement of AS4282.

Summary

It can therefore be seen that the digital signage complies with all relevant illuminance and Threshold Increment requirements of AS 4282-2019 Control of the Obtrusive Effects of Outdoor Lighting, the Department of Transport Requirements and Guidelines for Illuminated Outdoor Advertising Signage.

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

7. SUMMARY

- The existing digital signage at 1 Fitzroy St Kilda, Victoria shall be commissioned on site to yield the following maximum luminances:

COMPLYING 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	700	✓
Night Time	193	✓

- The signage operator must ensure that the average luminance difference between successive images does not exceed 30% to ensure compliance with AS4282.
- The digital signage at 1 Fitzroy St Kilda, Victoria has been assessed and complies with the requirements of the Department of Transport Requirements and Guidelines for Illuminated Outdoor Advertising Signage (when commissioned to the maximum luminance levels above).
- The digital signage has been found to comply with all relevant requirements of AS 4282-2019 Control of the Obtrusive Effects of Outdoor Lighting.
- In complying with the above requirements, the digital signage shall not result in unacceptable glare nor shall it adversely impact the safety of pedestrians, residents or vehicular traffic. Additionally, the signage shall not cause unacceptable amenity impacts to nearby residences or accommodation.

Proposed Lighting Conditions

To ensure that the digital signage complies with the findings of this Lighting Impact Assessment we recommend the following conditions of consent be added to the amended permit:

1. The sign must not exceed a luminance of 193 cd/m2 during night time operation. (Note: this replaces existing Conditions 6 & 7)
2. The sign must at all times comply with the Lighting Criteria of the Department of Transport Requirements and Guidelines for Illuminated Outdoor Advertising Signage 6th May 2022. (Note: this replaces existing Condition 16)

8. DESIGN CERTIFICATION

The existing digital signage at 1 Fitzroy St Kilda, Victoria, if commissioned according to this report, complies with the following criteria, guidelines and standards:

- AS 4282-2019 Control of the Obtrusive Effects of Outdoor Lighting
- Department of Transport Requirements and Guidelines for Illuminated Outdoor Advertising Signage 6 May 2022#

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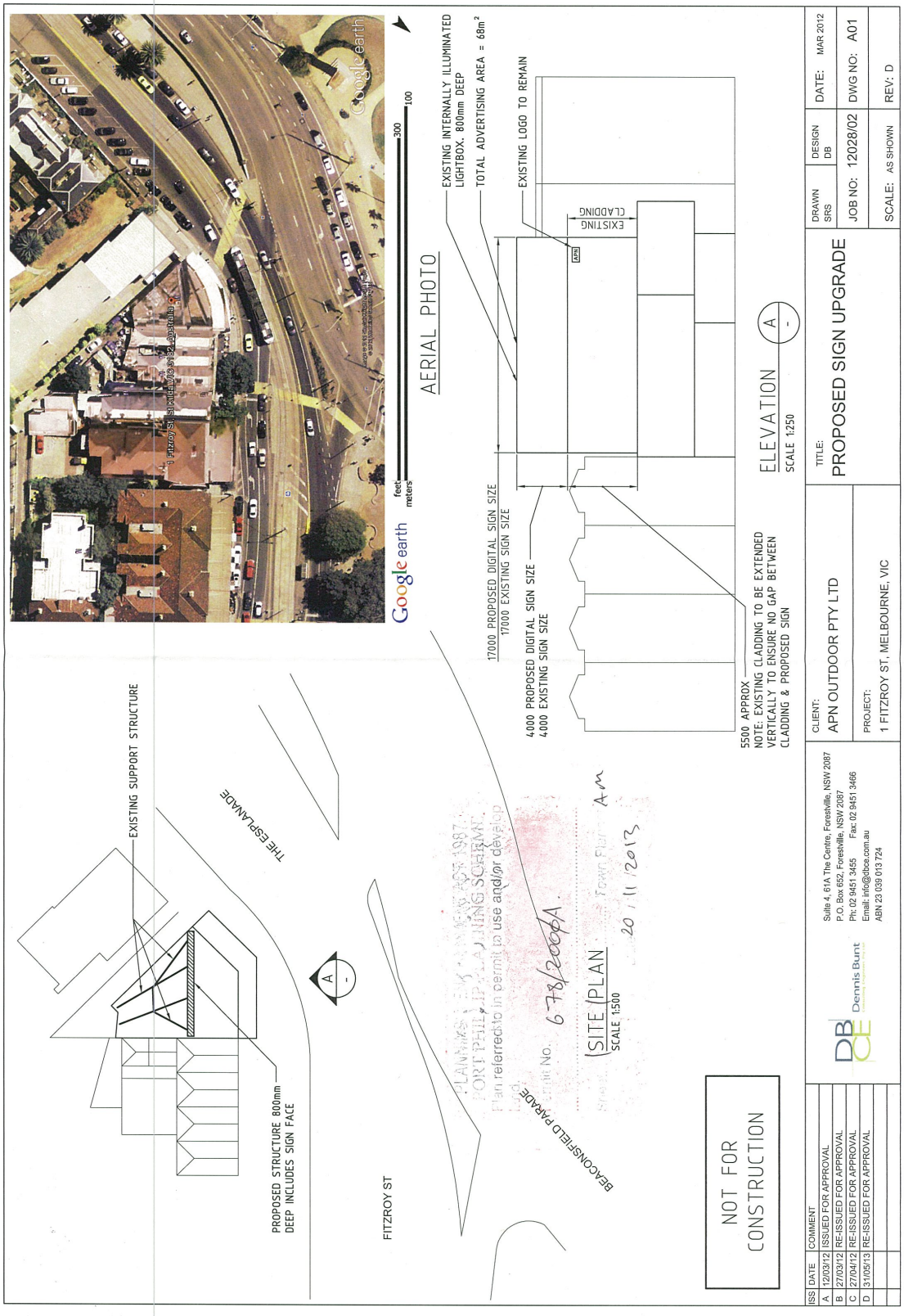
The operator of the signage is responsible for complying with the Department of Transport's ongoing Operational Requirements including providing Compliance Records/Reports upon request.

APPENDIX A
SIGN LOCATION PLAN, ELEVATIONS, & PHOTOMONTAGES



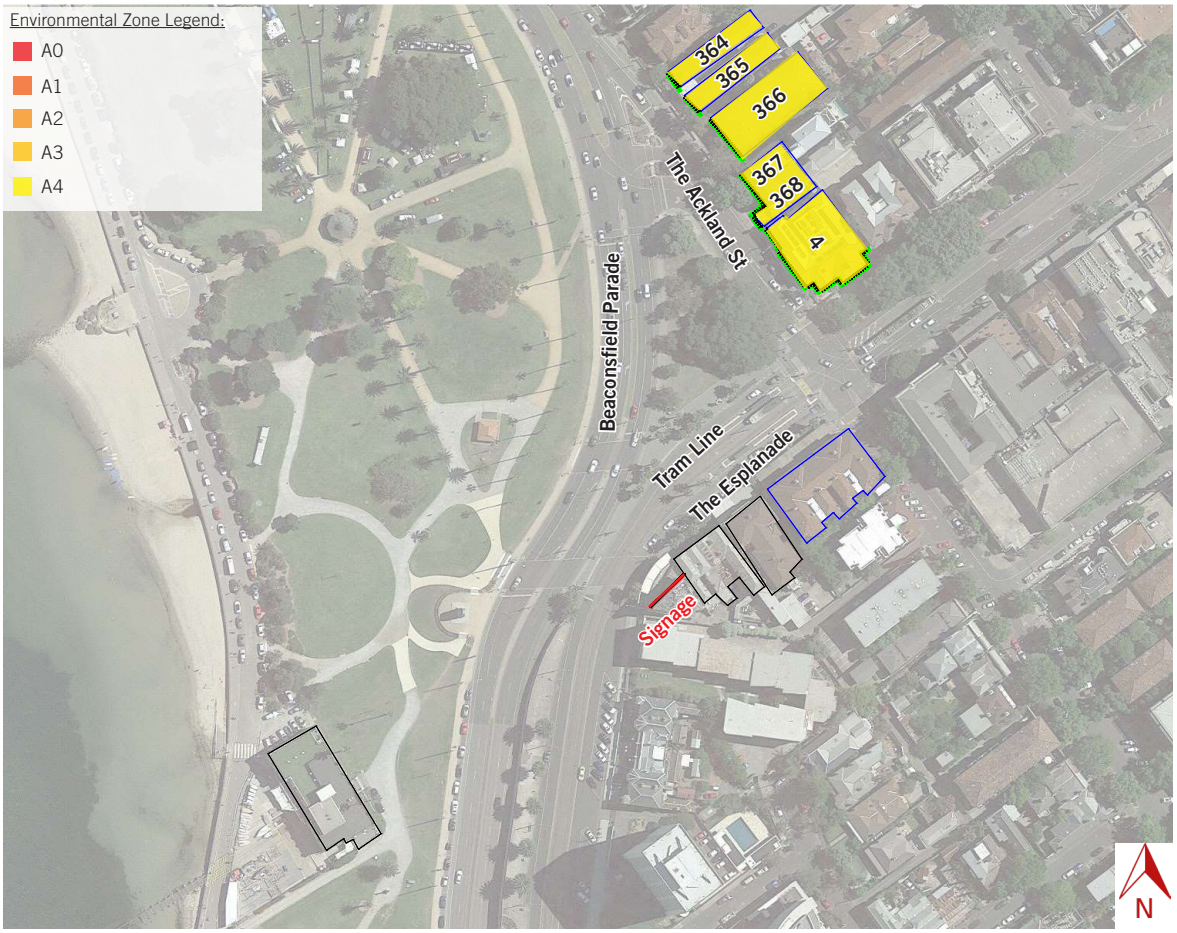
APPENDIX B

DIGITAL SIGNAGE SPECIFICATION

KEY CRITERIA:	DVX-1800-10MN-WN-HC-360x1656-230BR-MT-MR-CNTLRM-None
Size (screen dimensions L x H, including SQM)	3.66 meters x 16.82 meters = 61.56 square meters
Number of modules	1224
Resolution	360x1656
Panel model	DVX-1800-10MN-WN-HC
Manufactured in	Brookings, SD, USA
Pitch – Real	10.16
Pitch – Virtual	5.08
LED configuration	RGB 3-in-1 SMD
IP Rating	IP-65 Components
Air-Conditioned	Not required
Operating Temperatures	-40° C to 50° C
Maintenance Access	Front or rear
Viewing Angle - Horizontal	160
Viewing Angle - Vertical	+25/-45
LED's per m2	9,688
Refresh Rate	4,800 hertz
Brightness	6000 nits
Power Consumption (Max)	36,247 Watts
Power Consumption (Ave)	9,200 Watts
Weight - total	3,643

APPENDIX C
OBTRUSIVE LIGHTING CALCULATIONS

Calculation Summary			
Project: Obtrusive			
Label	CalcType	Units	Max
363 Beaconsfield Parade, St Kild_Ill_Seg1	Obtrusive - Ill	Lux	0.2
364 Beaconsfield Parade, St Kild_Ill_Seg1	Obtrusive - Ill	Lux	0.2
366 Beaconsfield Parade, St Kild_Ill_Seg1	Obtrusive - Ill	Lux	0.2
367 Beaconsfield Parade, St Kild_Ill_Seg1	Obtrusive - Ill	Lux	0.2
368 Beaconsfield Parade, St Kild_Ill_Seg1	Obtrusive - Ill	Lux	0.0
368 Beaconsfield Parade, St Kild_Ill_Seg2	Obtrusive - Ill	Lux	0.0
368 Beaconsfield Parade, St Kild_Ill_Seg3	Obtrusive - Ill	Lux	0.2
4 Fitzroy St, St Kilda_Ill_Seg1	Obtrusive - Ill	Lux	0.2
4 Fitzroy St, St Kilda_Ill_Seg10	Obtrusive - Ill	Lux	0.0
4 Fitzroy St, St Kilda_Ill_Seg2	Obtrusive - Ill	Lux	0.0
4 Fitzroy St, St Kilda_Ill_Seg3	Obtrusive - Ill	Lux	0.2
4 Fitzroy St, St Kilda_Ill_Seg4	Obtrusive - Ill	Lux	0.1
4 Fitzroy St, St Kilda_Ill_Seg5	Obtrusive - Ill	Lux	0.2
4 Fitzroy St, St Kilda_Ill_Seg6	Obtrusive - Ill	Lux	0.1
4 Fitzroy St, St Kilda_Ill_Seg7	Obtrusive - Ill	Lux	0.0
4 Fitzroy St, St Kilda_Ill_Seg8	Obtrusive - Ill	Lux	0.0
4 Fitzroy St, St Kilda_Ill_Seg9	Obtrusive - Ill	Lux	0.0



APPENDIX C

THRESHOLD INCREMENT LIGHTING CALCULATIONS

Calculation Summary			
Project: TI			
Label	CalcType	Units	Max
Acland to the Esplanade (S)	Obtrusive - TI	%	0.13
Beaconsfield Parade (S)	Obtrusive - TI	%	2.69
Tram	Obtrusive - TI	%	0.12

APPENDIX C

THRESHOLD INCREMENT & OBTRUSIVE LIGHTING CALCULATIONS

Obtrusive Light - Compliance Report

AS/NZS 4282:2019, A4 - High District Brightness, Curfew
Filename: 1096.120 1 Fitzroy St. Kilda rev B
22/03/2023 6:11:55 PM

Illuminance

Maximum Allowable Value: 5 Lux

Calculations Tested (17):

Calculation Label	Test Results	Max. Illum.
4 Fitzroy St, St Kilda_Ill_Seg1	**PASS**	0.2
4 Fitzroy St, St Kilda_Ill_Seg2	**PASS**	0.0
4 Fitzroy St, St Kilda_Ill_Seg3	**PASS**	0.2
4 Fitzroy St, St Kilda_Ill_Seg4	**PASS**	0.1
4 Fitzroy St, St Kilda_Ill_Seg5	**PASS**	0.2
4 Fitzroy St, St Kilda_Ill_Seg6	**PASS**	0.1
4 Fitzroy St, St Kilda_Ill_Seg7	**PASS**	0.0
4 Fitzroy St, St Kilda_Ill_Seg8	**PASS**	0.0
4 Fitzroy St, St Kilda_Ill_Seg9	**PASS**	0.0
4 Fitzroy St, St Kilda_Ill_Seg10	**PASS**	0.0
367 Beaconsfield Parade, St Kild_Ill_Seg1	**PASS**	0.2
363 Beaconsfield Parade, St Kild_Ill_Seg1	**PASS**	0.2
364 Beaconsfield Parade, St Kild_Ill_Seg1	**PASS**	0.2
366 Beaconsfield Parade, St Kild_Ill_Seg1	**PASS**	0.2
368 Beaconsfield Parade, St Kild_Ill_Seg1	**PASS**	0.0
368 Beaconsfield Parade, St Kild_Ill_Seg2	**PASS**	0.0
368 Beaconsfield Parade, St Kild_Ill_Seg3	**PASS**	0.2

Threshold Increment (TI)

Maximum Allowable Value: 20 %

Calculations Tested (3):

Calculation Label	Adaptation Luminance	Test Results
Beaconsfield Parade (S)	5	**PASS**
Acland to the Esplanade (S)	5	**PASS**
Tram	5	**PASS**

APPENDIX D

JCDecaux

LIGHTING MEASUREMENT REPORT

EXISTING DIGITAL SIGNAGE AT 1 FITZROY ST, ST KILDA, VICTORIA

24 February 2023

Ref: 1096.125

Lighting Measurement Report

Existing Digital Signage at 1 Fitzroy St, St Kilda, Victoria

DATE	REV	COMMENT	PREPARED BY	CHECKED BY
24/2/23	A	Issued for Information	RS	DS

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CONTENTS

1. INTRODUCTION 3
2. LUMINANCE MEASUREMENTS 4
APPENDIX A – SIGNAGE LUMINANCE MEASUREMENTS 5

1. INTRODUCTION

Electrolight was engaged by JCDecaux to provide night time luminance ("brightness") measurements of the existing digital signage installed on top of the building at 1 Fitzroy St, St Kilda. The signage faces northeast, towards the southbound direction of traffic.

Luminance measurements were taken with the signage displaying a 100% white image (representing worst case brightness) during night time operation. Figure 1 below shows the signage displaying the 100% white image. Further details are provided in Section 2 below.

Figure 1: The signage displaying a 100% white image ready for measurement [1]

1. A small portion of the sign was not operational on the night of testing (see lower right of sign). To ensure an accurate reflection of the average luminance during normal operation, this inoperable area was not measured.

2. LUMINANCE MEASUREMENTS

Luminance Measurements were undertaken on Thursday 23rd February 2023 at 9:00pm using a Gossen Mavo-Spot 2 luminance meter (Serial Number 7C41314). This meter was calibrated on 29th November 2022 by UNSW (Report #22298.2).

The general luminance measurement methodology was as follows:

A minimum of 10 equidistant measurement points were taken across the signage face. All luminance measurements were undertaken with a viewing direction approximately normal to the sign, at a viewing distance of approximately 55m and a height of approximately 1.5m off the ground. Measurements were undertaken ensuring that the signage display was not blocked by any obstructions (such as tree branches).

The average measured luminance for the digital signage was as follows:

Existing Signage– Measurement Summary

SKY CONDITION	AVERAGE SIGN LUMINANCE (CD/M2)	MAX SIGN DIMMING PERCENTAGE (%)
Night-time	193	4

It can be seen from the above measurements that the maximum luminance of the signage during night time operation is 193cd/m2. The maximum sign dimming percentage at this luminance level is 4%.

The detailed results of the luminance measurements are shown in Appendix A.

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24/2/23

APPENDIX A – SIGNAGE LUMINANCE MEASUREMENTS

Signage Measurement values listed below. Note: Drawings are not to scale and point locations indicative only. Refer Section 2 for methodology for measurement.

Nighttime: