QMS Media
Ref: 1597.58

LIGHTING IMPACT ASSESSMENT
DIGITAL SIGNAGE AT
2-4 WARREN AVE, BANKSTOWN, NSW

DATE	REV	COMMENT	PREPARED BY	CHECKED BY
23/10/24	REV A	For Information	AL	RS

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CONTENTS

1. INTRODUCTION

Electrolight have been appointed by QMS Media to undertake a Lighting Impact Assessment on the proposed northbound facing digital signage to be installed on the southern side of the existing signage structure located on top of the building at 2-4 Warren Ave, Bankstown, NSW (**proposed signage**). 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 AS/NZS 4282:2023 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 can be 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 (perceived light power) emitted in a specified direction. Unit: candela (cd).

2.4 Dynamic content

Where the luminous image, pattern, colour or direction of light changes over an interval of less than 60 seconds.
Note: Definition source is AS4282.

2.5 Obtrusive Light

Spill light which, because of quantitative or directional attributes, gives rise to annoyance, discomfort, distraction, or a reduction in ability to see essential information such as transport signals.
Note: Obtrusive light includes the impact on humans and environmental receivers.

2.6 Threshold Increment

The measure of disability glare expressed as the percentage increase in luminance contrast threshold required between an object and its background for it to be seen equally well with a source of glare present.

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

2.7 Environmentally Sensitive Area (ESA)

Area of ecological value including, bushland, waterways and marine and coastal areas.
Note: Definition source is AS4282.

2.8 AGI32 Light Simulation Software

AGI32 (by U.S. company Lighting Analysts/Revalize) 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 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.

2.9 Upward Light Ratio Luminaire (ULR_L)

The ratio of the luminous flux of a luminaire that is emitted, at and above the horizontal, divided by the total luminaire flux when the luminaire is mounted in its designed position, and excluding reflected light from surfaces or obstructions.

Note: Definition source is AS4282.

2.10 Environmental Receiver

Any identified living species (plants, animals and other organisms) and their locations indicated, that may be impacted by the proposed lighting system.

Note: Definition source is AS4282.

2.11 Residential Exclusion Zone

The region in which the illuminance levels to residential properties would exceed the maximum allowable under the Zone limits in AS4282. If no residential properties are located within the Exclusion Zone then the signage will comply with the illuminance limits in the Standard.

3. SITE DESCRIPTION AND SCOPE

The proposed signage is located on top of the building at 2-4 Warren Ave, Bankstown, NSW. The signage is mounted on the southern side of the existing signage structure and faces the northbound traffic on Fairford Road. The total active display (illuminated) area of the signage is 39.94 m2. Refer to Appendix A for the signage location plan, elevations and photomontages.

The proposed 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. The dwell time of the content displayed on the signage is 10 seconds and it is to operate 24 hours per day. As the dwell time of the content displayed on the signage is less than 60 seconds, it is defined as being dynamic content (see Section 2.4).

For the purpose of this report, the specification of the proposed signage is as outlined in Appendix B. The signage includes baffles which mitigate upward waste light, resulting in an Upward Light Ratio (ULR_L) of not more than 0.45*. 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.

Environmental impact assessments, including the management of artificial light for the protection of specific entities protected by environmental legislation, is beyond the scope of this assessment.

*The signage supplier and/or operator is responsible for complying with the Upward Light Ratio. Electrolight take no responsibility for compliance with this requirement.

4. DESIGN GUIDELINES AND STANDARDS

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

- State Environmental Planning Policy (Industry and Employment) 2021 (**SEPP Industry and Employment**)
- Transport Corridor Outdoor Advertising & Signage Guidelines 2017 (**Transport Guidelines**)
- AS/NZS 4282:2023 Control of the Obtrusive Effects of Outdoor Lighting (**AS4282**)

5. LUMINANCE ASSESSMENT

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

TABLE 1 - AS4282 MAXIMUM AVERAGE NIGHT TIME LUMINANCE FOR SIGNAGE		
	Description	Max Average Luminance (cd/m2)
A4	High district brightness e.g. Town and city centres and other commercial areas, residential areas abutting commercial areas, industrial and Port areas and Transport Interchanges	350
A3	Medium district brightness e.g. Suburban areas in towns and cities, generally roadways with streetlighting through suburban, rural or semi-rural areas	250
A2	Low district brightness e.g. Sparsely inhabited rural and semi-rural areas, generally roadways without streetlighting through suburban, rural or semi-rural areas other than intersections	150
A1	Dark e.g. Relatively uninhabited rural areas (including terrestrial, marine, aquatic and coastal areas), generally roadways without streetlighting through rural areas	50
A0	Intrinsically Dark e.g. UNESCO Starlight Reserve, IDA: Dark Sky Parks, Reserves or Sanctuaries, major optical observatories, other accreditations for dark sky places for example astrotourism, heritage value, astronomical importance, wildlife/ ecosystem protection, lighting for safe access may be required	0.1

Based on an assessment of the surrounding environment, the proposed signage is located within Environmental Zone A4 under AS4282, therefore, the maximum night time luminance is 350cd/m2.

AS4282 does not include limits for daytime operation of illuminated signage. However, the Transport Guidelines outlines maximum permissible luminance limits for various lighting conditions, including daytime. Under the Transport Guidelines, the proposed signage is classified as being within which is described as an area Zone 3, which is described as an area with generally medium off-street ambient lighting e.g. small to medium shopping/ commercial centres. The maximum luminance limits of digital signage within Zone 3 are: no limit for full sun on face of sign, 6000cd/m2 during the day, 700cd/m2 for twilight and overcast weather and 350cd/m2 for night time.

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

TABLE 2 - MAXIMUM 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	350	✓

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

6. AS4282 ASSESSMENT

The proposed signage has been assessed against the lighting criteria and requirements outlined in AS4282.

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 proposed signage shall operate all night, it will be assessed against the more stringent post-curfew limits.

Spill light to any adjacent Environmentally Sensitive Areas are also assessed against the more stringent post-curfew limits, as outlined in Clause 3.2.1 of AS4282.

Illuminance Assessment

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

The acceptable level of vertical 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 - AS4282 MAXIMUM VALUES OF VERTICAL ILLUMINANCE

	Max Vertical Illuminance (lx)		Description
	Pre-curfew	Post-curfew	
A4	25	5	High district brightness e.g. Town and city centres and other commercial areas, residential areas abutting commercial areas, industrial and Port areas and Transport Interchanges
A3	10	2	Medium district brightness e.g. Suburban areas in towns and cities, generally roadways with streetlighting through suburban, rural or semi-rural areas
A2	5	1	Low district brightness e.g. Sparsely inhabited rural and semi-rural areas, generally roadways without streetlighting through suburban, rural or semi-rural areas other than intersections
A1	2	0.1	Dark e.g. Relatively uninhabited rural areas (including terrestrial, marine, aquatic and coastal areas), generally roadways without streetlighting through rural areas
A0	0	0	Intrinsically Dark e.g. UNESCO Starlight Reserve, IDA: Dark Sky Parks, Reserves or Sanctuaries, major optical observatories, other accreditations for dark sky places for example astrotourism, heritage value, astronomical importance, wildlife/ecosystem protection, lighting for safe access may be required

Where the signage displays dynamic content (a dwell time less than 60 seconds) and is located within 100m of residential dwelling/s with potential views to the signage, then the maximum allowable vertical illuminance limits to the impacted dwellings are 50% of those outlined in Table 3 above. Where the dwellings are further than 100m from the signage, the maximum vertical limits are those values shown in Table 3.

Residential Dwellings

The signage (and surrounding environment) was modeled in lighting calculation program AGI32 to determine the effect (if any) of the light spill from the proposed signage. Photometric data for the signage was provided by the manufacturer* with the maximum luminance corresponding to the night time limit outlined in Section 5. Appendix C shows the lighting model and the results of the calculations. A detailed description of the calculation results is outlined below.

As there are no nearby residential dwellings in view of the signage, a Residential Exclusion Zone was calculated in order to demonstrate compliance with AS4282 - refer Appendix C. The Residential Exclusive Zone is defined as the region in which the vertical illuminance levels to residential properties may exceed the maximum allowable under AS4282.

It can be seen that no residential dwellings fall within the exclusion zone. The signage therefore complies with the maximum post-curfew vertical illiuminance limits for Zone A4.

Environmentally Sensitive Areas

No Environmentally Sensitive Areas were identified in the vicinity of the proposed signage. The limits in AS4282 therefore do not apply.

Threshold Increment Assessment

The Threshold Increment was also calculated for the northbound traffic approach on Fairford Road, the eastbound traffic approach on Canterbury Road, the northbound traffic approach on Warren Ave and the westbound traffic approach on Short Street. The calculation grids were located at 1.5m above ground level, with a viewing distance of between 10m to 200m from the signage and a windscreen cutoff angle of 20 degrees (as outlined in AS1158). The calculation results show that the Threshold Increment does not exceed 1.22% for any traffic approach (the allowable maximum under AS4282 is 20%).

Upward Waste Light Assessment

In order to reduce light pollution and associated environmental impacts, AS4282 includes requirements that limit upward waste light into the night sky from signage. Clause 3.3.3.b) of AS4282 states that digital signage shall have an Upward Waste Light Ratio (ULR_L) of not more than 0.45. The ULR_L of the specified signage is not more than 0.405. The signage therefore complies with this requirement.

Luminous Intensity

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

AS4282 Assessment Summary

It can therefore be seen that the proposed signage complies with all relevant requirements of AS4282.

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

7. SEPP ASSESSMENT

Table 4 below outlines the illumination assessment criteria from the SEPP Industry and Employment Schedule 5 - Clause 7 Illumination. While the SEPP only applies to sites located on classified roads, this assessment references the guidelines for all sites as a best practice document in New South Wales. In addition to the criteria, responses have been included demonstrating that the proposed signage is in compliance.

TABLE 4 - ILLUMINATION ASSESSMENT CRITERIA		
Assessment Criteria	Response	Compliant?
Would illumination result in unacceptable glare?	The proposed signage complies with the Threshold Increment limits of AS4282, demonstrating that the illumination will not cause unacceptable glare.	✓
Would illumination affect safety for pedestrians, vehicles or aircraft?	The proposed signage complies with the Threshold Increment limits of AS4282, demonstrating that the illumination will not cause unacceptable glare. The small size of the signage and its relatively low intensity limits the risk to pedestrians, vehicles or aircraft.	✓
Would illumination detract from the amenity of any residence or other form of accommodation?	The proposed signage, when installed according to this report, complies with the illuminance (spill lighting) limits of AS4282, demonstrating that the illumination will not detract form the amenity of any residence or other form of accommodation	✓
Can the intensity of the illumination be adjusted, if necessary?	The proposed signage is dimmable and when designed according to this report, includes a light sensor that automatically adjusts the brightness of the advertising display to prevailing light conditions.	✓
Is the illumination subject to a curfew?	The proposed advertising signage, when installed according to this report, complies with the limits required during curfewed operation under AS4282 (nominally between the hours of 11pm and 6am). This means that a curfew is not required.	N/A

8. SUMMARY

- The proposed signage to be installed at 2-4 Warren Ave, Bankstown, NSW, shall be commissioned on site to yield the following maximum luminances:

COMPLYING LUMINANCE LEVELS FOR DIGITAL SIGNAGE		
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	350	✓

- The proposed signage has been found to comply with all relevant requirements of AS4282, the Transport Guidelines and SEPP Industry and Employment.
- In complying with the above requirements, the proposed 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 any unacceptable amenity impacts to nearby residential dwellings or accommodation or environmental receivers.

9. DESIGN CERTIFICATION

The proposed signage to be installed at 2-4 Warren Ave, Bankstown, NSW, if commissioned according to this report, complies with the following criteria, guidelines and standards:

- State Environmental Planning Policy (Industry and Employment) 2021
- Transport Corridor Outdoor Advertising & Signage Guidelines 2017
- AS/NZS 4282:2023 Control of the Obtrusive Effects of Outdoor Lighting

Ryan Shamier MIES

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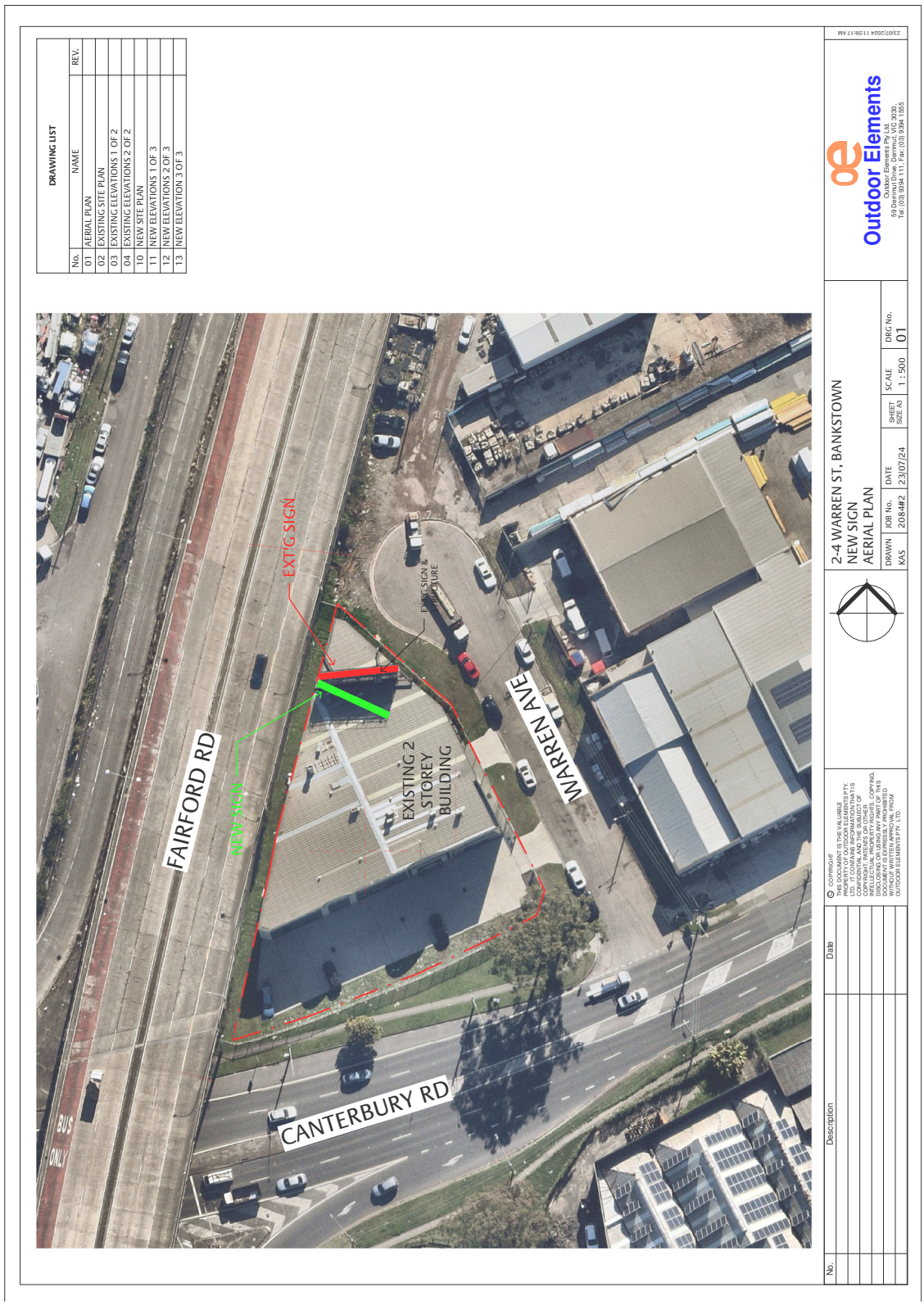
Registered Professional Engineer - New South Wales (PRE0000868)

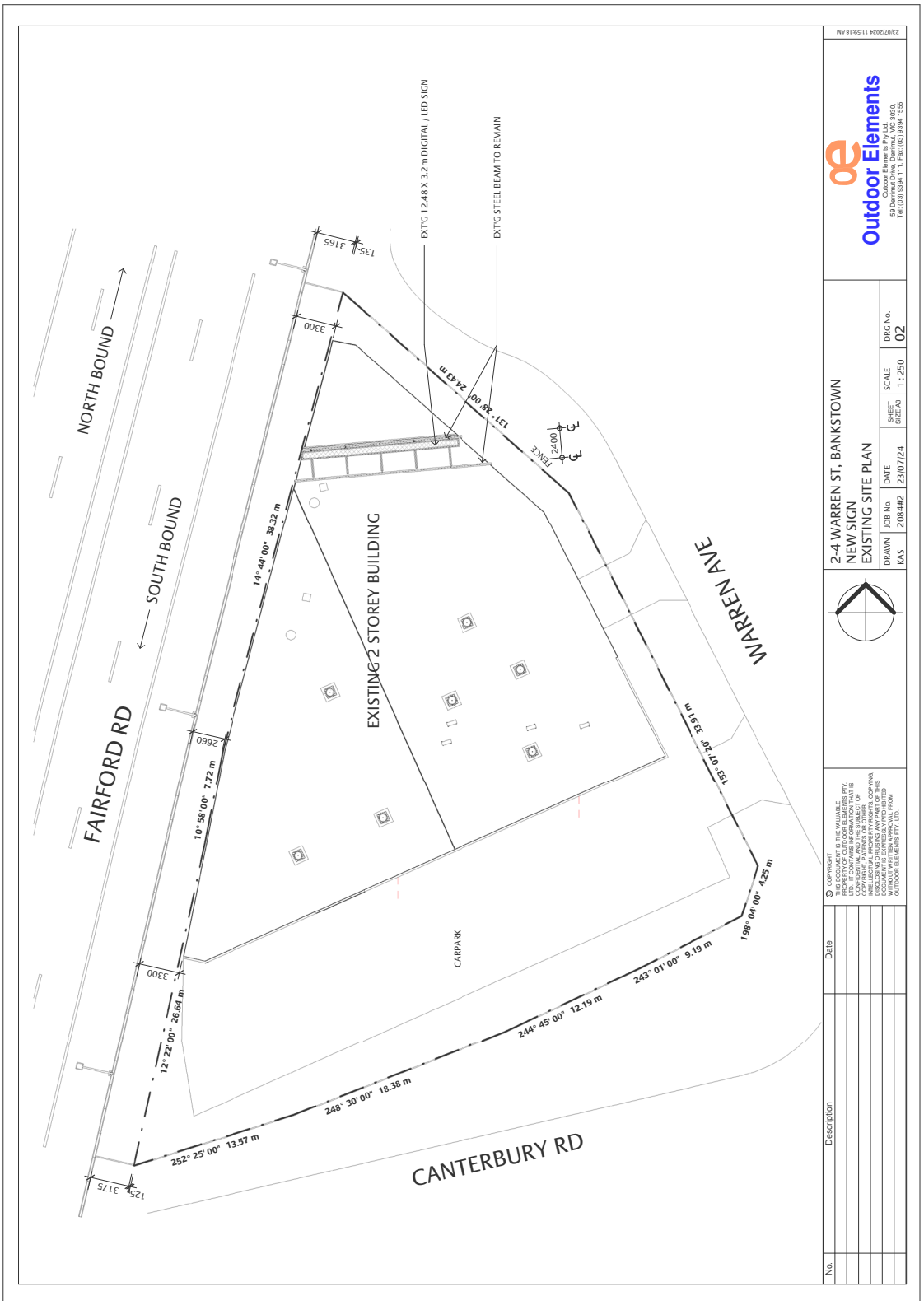
Senior Lighting Designer
Electrolight Sydney
23/10/24

APPENDIX A

PROPOSED SIGNAGE LOCATION, ELEVATIONS & PHOTOMONTAGES



APPENDIX A
PROPOSED SIGNAGE LOCATION, ELEVATIONS & PHOTOMONTAGES



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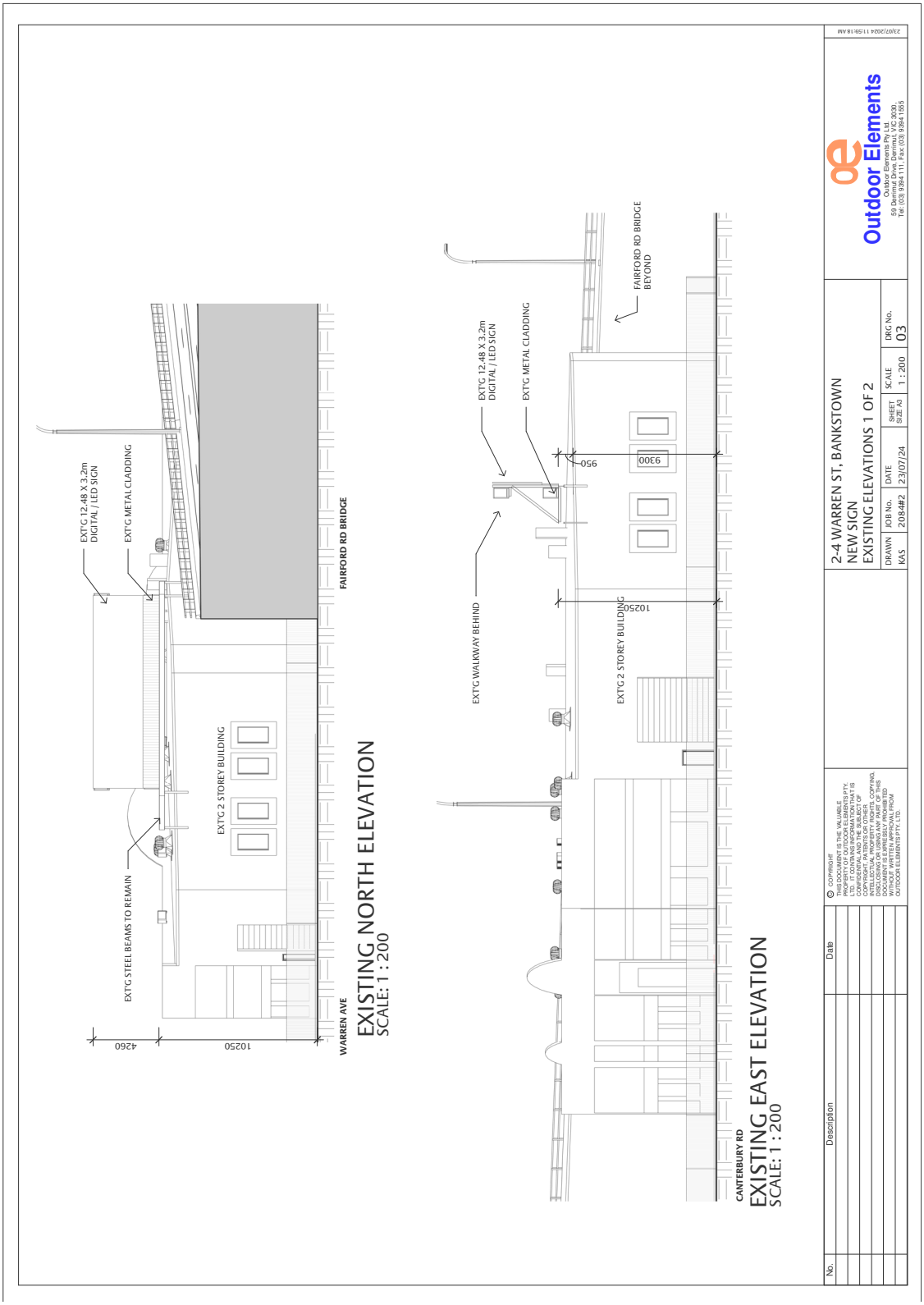

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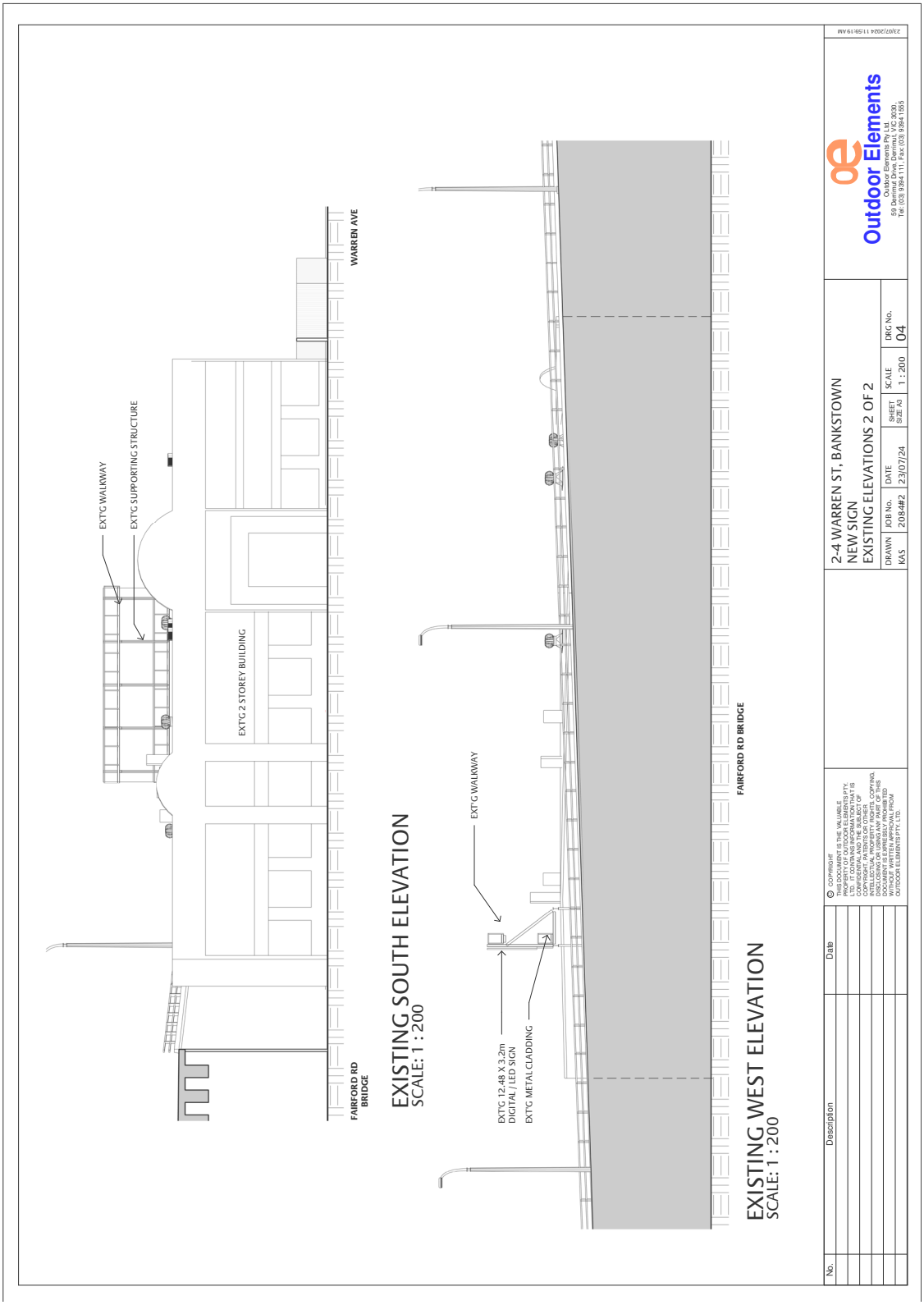

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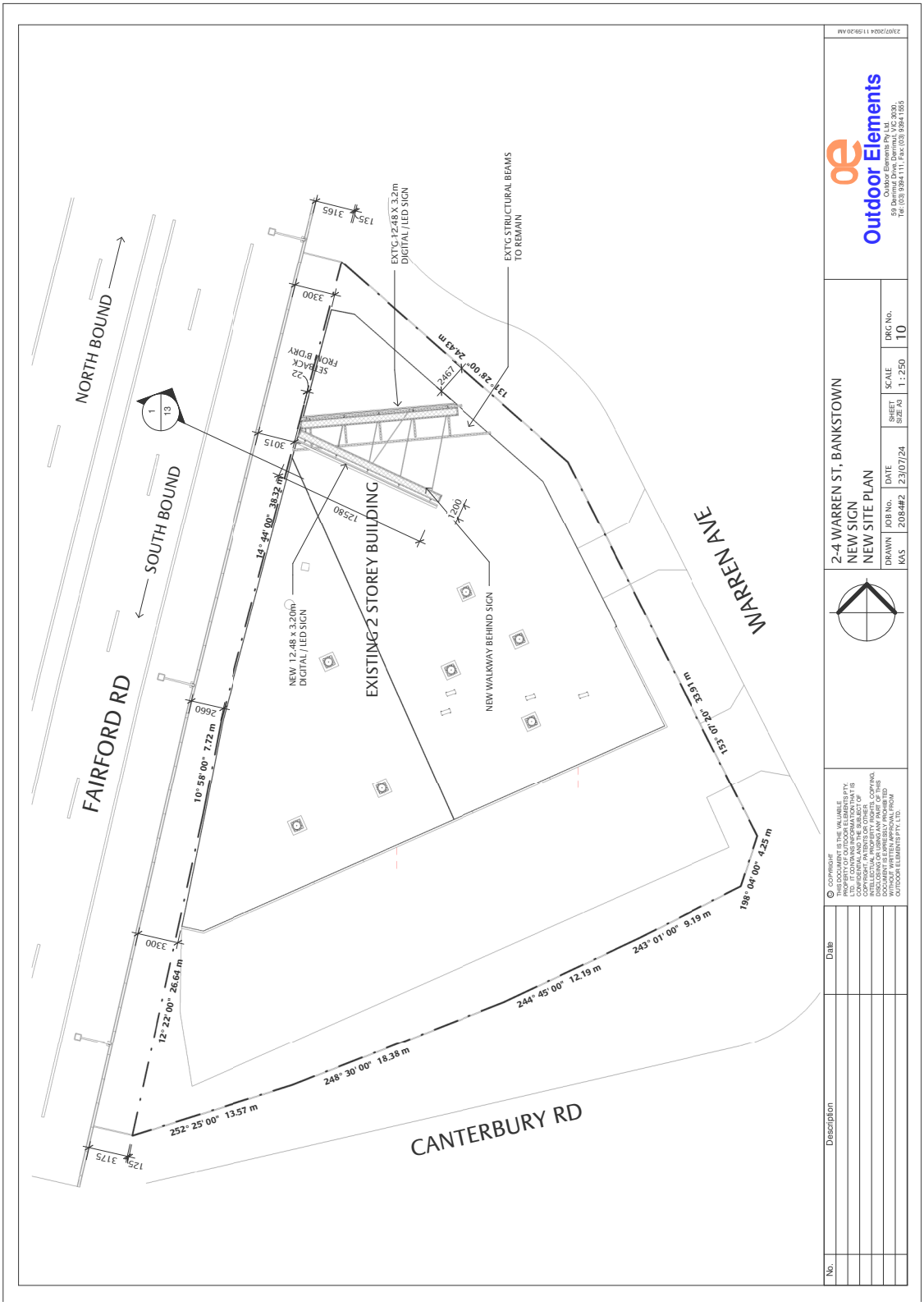

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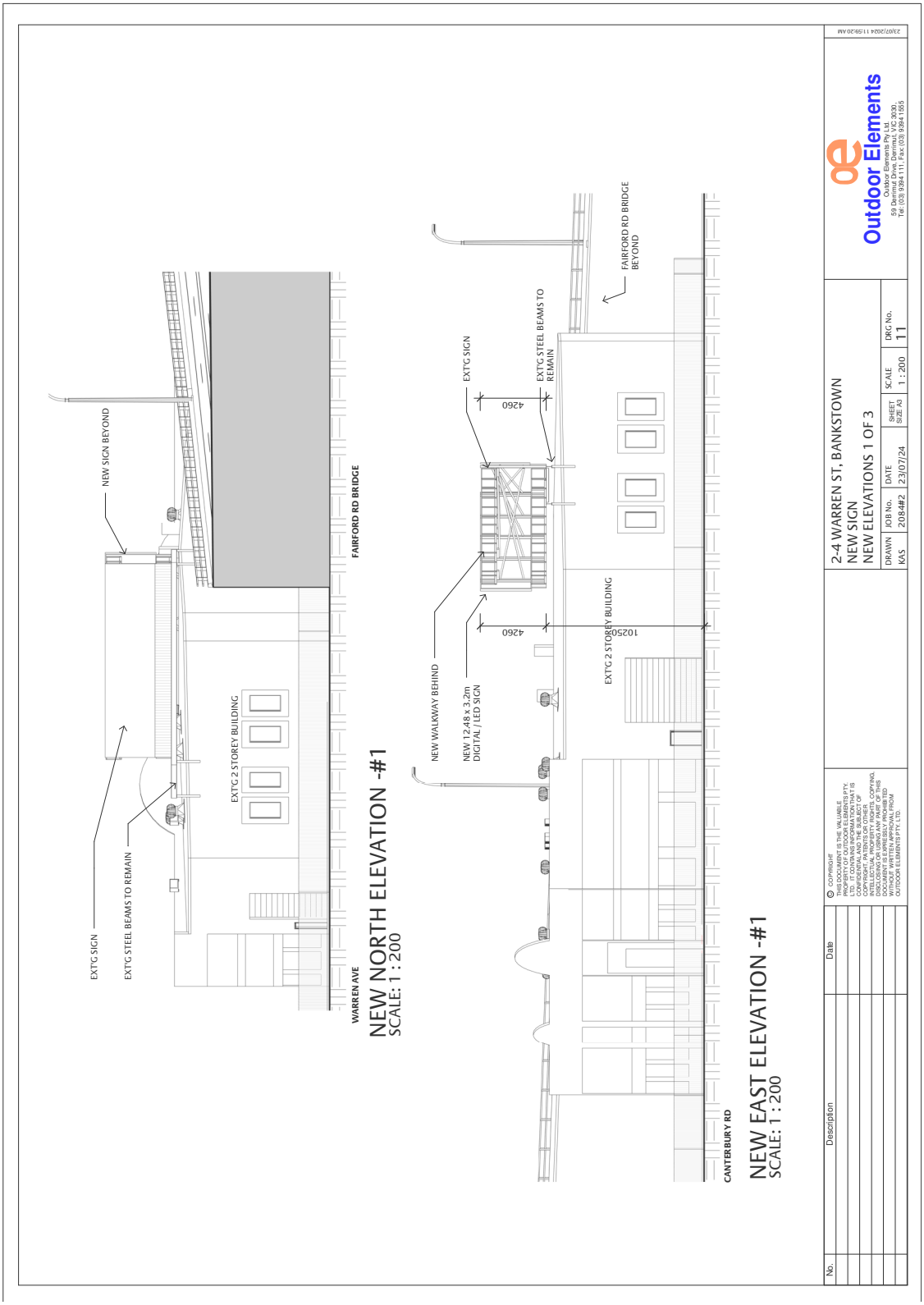

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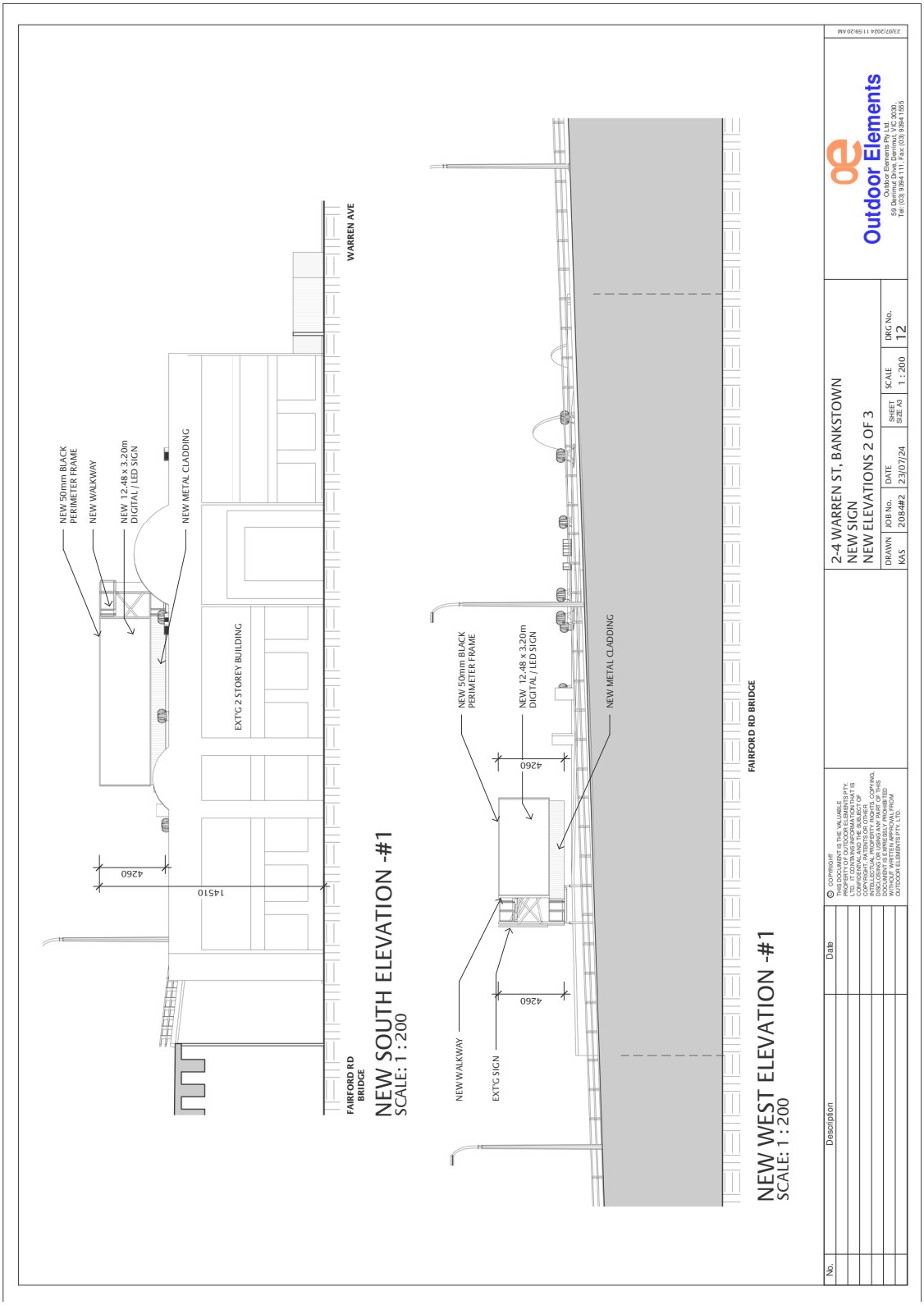

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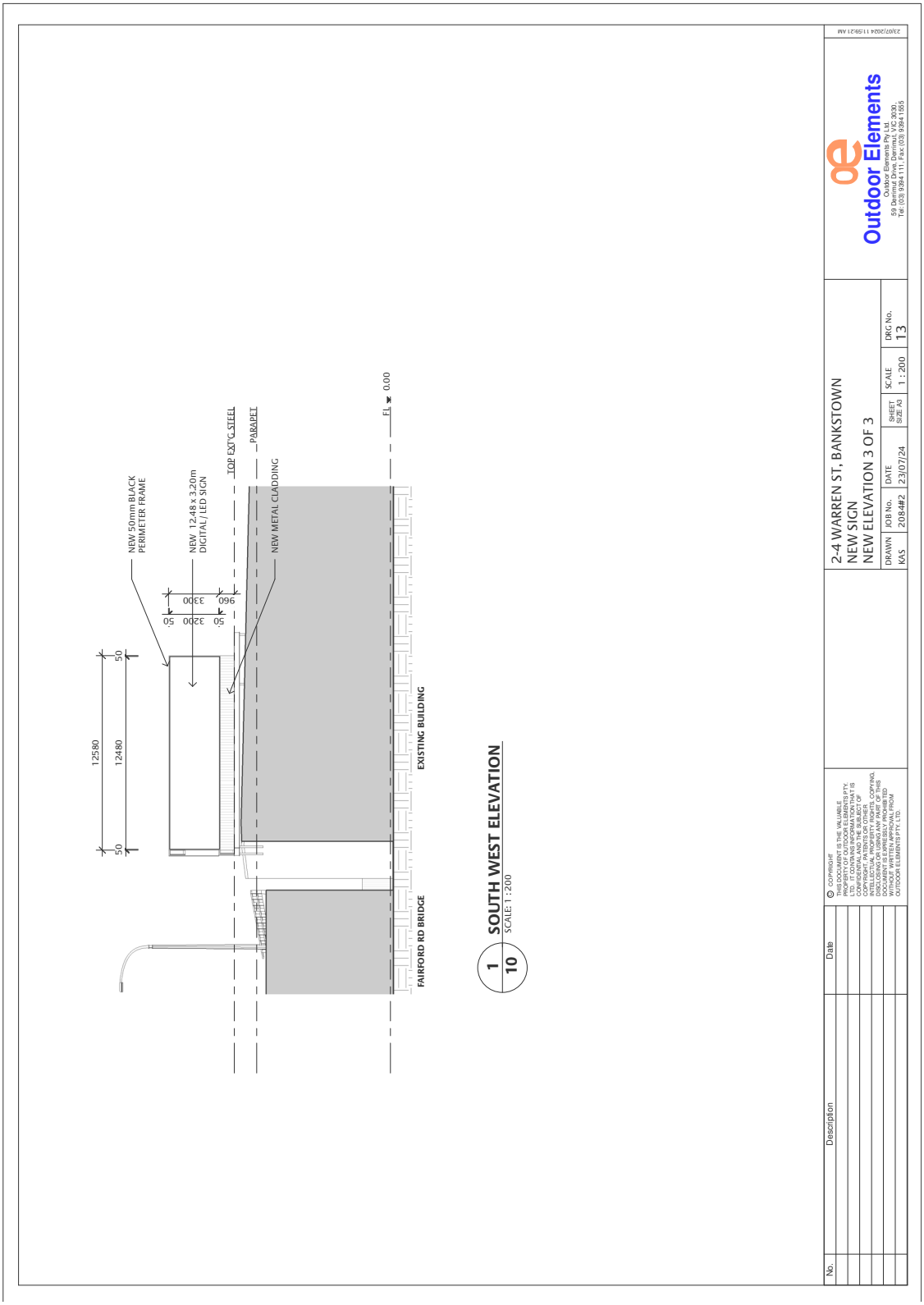

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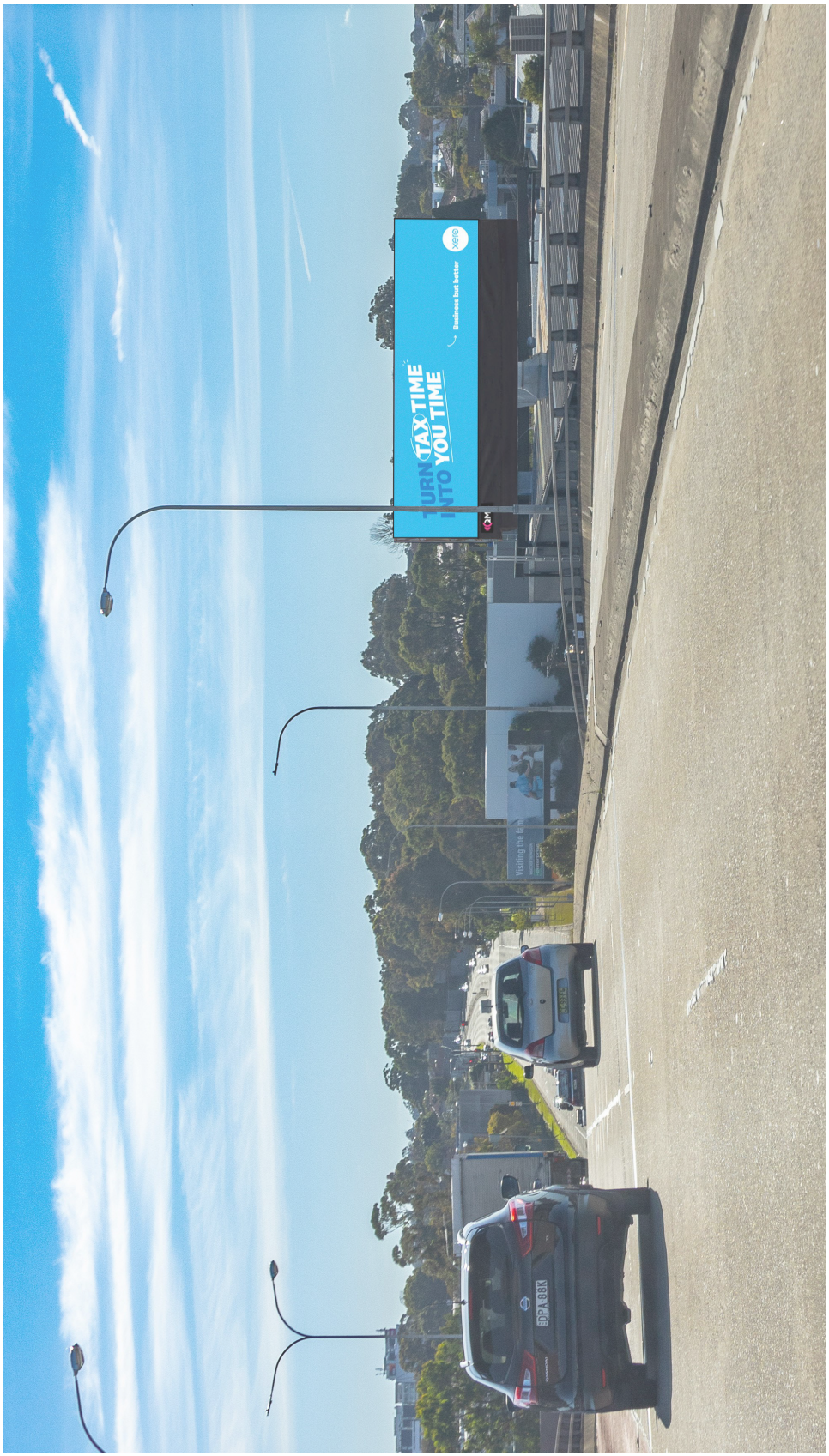


APPENDIX B

DIGITAL SIGNAGE SPECIFICATION

DAKTRONICS PRODUCT SPECIFICATION

SERIES SPECIFICATION

DVX-2220-10MN-8000-WJ

Pixel Configuration	RGB 3-in-1 SMD
Line and Column Spacing	0.39 inches - 10 millimeters
Module Configuration - Pixels (RxC)	32 x 32 pixels
Module Dimensions (HxW)	12.6 x 12.6 inches - 320 x 320 mm
Max Power per Square Dimension	65 W/sq. ft - 702W/sq. m
Average Power per Square Dimension	16 W/sq. ft - 176W/sq. m
Max Heat Output per Sq. Dim	222 BTU/sq. ft/hr - 2395BTU/sq. m/hr
Avg. Heat Output per Sq. Dim	56 BTU/sq. ft/hr - 599BTU/sq. m/hr
Display Weight per Square Dimension	8.1 lb/sq. ft - 39.4 kg/sq. m
Processing	22 bit Distributed
Color Capacity	16 bit (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)	+30/-60º
Contrast Ratio	1200:1
Service Access	Front or Rear
Cabinet Depth	4.9 inches - 125.4 millimeters
Cabinet Construction	Sheetmetal
Ingress Protection Rating	IP-66 Front/ IP-65 Rear Rated Components
Working Temperature Rating[3]	-40º to 122º F - -40º to 50º C
Ventilation	Fan
Data Transmission to Display	Direct: Fiberoptic Cable Remote: Internet/Network (IP)
Storage & Operating Humidity	NA
Certifications	Reach out for Certifications

Note 1: Power draw varies depending on display ventilation. Information not intended for construction use.

Note 2: Display weight includes module, cabinet, and required interconnect hardware and cables. Does not include structure or peripherals.

Note 3: Temperature range is based on typical usage (100% daytime brightness, 50% content, 250W/m2 solar, no wind). Display will operate above listed temp range but will see greater rates of dimming. Range is based on low-temp configuration.

Note 4: Ventilation solution may require external supplemental A/C in some areas of the world. Please consult your Daktronics representative regarding your area.

Note 5: Consistent with Daktronics policy of continuing product improvement, specifications shown on this document are subject to change without notice.

Note 6: See contract specific drawings for customized product weights

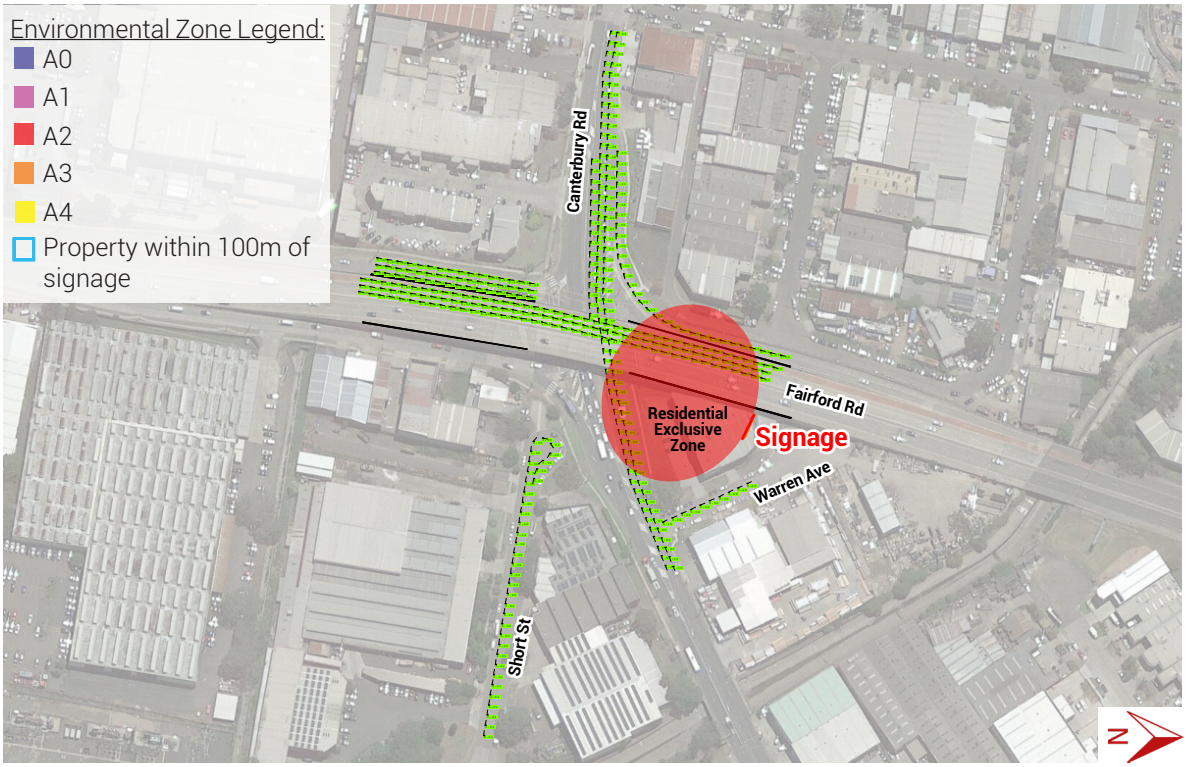
DISPLAY SPECIFICATION

DVX-2220-10MN-8000-WJ-HC-320x1248-AUTOBR-LT-SR-FOR-SBB-CRMP

Active Screen Size (HxW)	10.5 feet x 40.94 feet - 3.2 meters x 12.48 meters
Active Screen Size (Square Dimensions)	430 square feet - 39.94 square meters
Number of Modules (HxW)	10 Modules x 39 Modules
Total Modules	390 Modules
Matrix Size (HxW)	320 pixels x 1248 pixels
Aspect Ratio	0.26 (Reference - 16:9 = .5625 and 4:3 = .75)
Display Weight[6]	3469 lb - 1572 kg
Total Maximum Power Consumed	28040 Watts
Total Average Power Consumed	7020 Watts
Total Maximum Heat Output	95630 BTU/hr
Total Average Heat Output	23910 BTU/hr
Current Draw	122 amps @ 230v 1P 41 amps @ 230/400v 3P 117 amps @ 120/240v 78 amps @ 208Y/120v 3P
Control Method	Prolink Based Rack Mount Control System

201 Daktronics Drive PO Box 5128 Brookings, SD 57006-5128
800-325-8766 605-692-0200 fax 605-697-4700
www.daktronics.com email sales@daktronics.com

APPENDIX C
OBTRUSIVE LIGHT AND THRESHOLD INCREMENT CALCULATIONS



Calculation Summary			
Project: TI			
Label	CalcType	Units	Max
Canterbury Rd_EB	Obtrusive - TI	%	0.10
Canterbury Rd_EB RT	Obtrusive - TI	%	0.07
Canterbury Rd_On Ramp	Obtrusive - TI	%	0.10
Fairford Rd_Off Ramp	Obtrusive - TI	%	0.27
Fairford Road_NB	Obtrusive - TI	%	1.22
Short Street	Obtrusive - TI	%	0.90
Warren Ave_NB	Obtrusive - TI	%	0.16

Image: Light Model - Plan showing residential exclusion zone.

"Residential Exclusion Zone" is defined as the region in which the illuminance levels to residential properties would exceed the maximum allowable under the Zone limits in AS4282. If no residential properties are located within the Exclusion Zone then the signage will comply with the illuminance limits in the Standard.

The Zone limit shown is for A4, dynamic content within 100m (2.5 lux maximum).

APPENDIX C
OBTRUSIVE LIGHT AND THRESHOLD INCREMENT CALCULATIONS

Zone A4 - High District Brightness, Curfew

Threshold Increment (TI)
Maximum Allowable Value: 20 %

Calculations Tested (7):

Calculation Label	Adaptation Luminance	Test Results
Fairford Road_NB	5	**PASS**
Canterbury Rd_EB	5	**PASS**
Canterbury Rd_On Ramp	5	**PASS**
Fairford Rd_Off Ramp	5	**PASS**
Short Street	5	**PASS**
Canterbury Rd_EB RT	5	**PASS**
Warren Ave_NB	5	**PASS**