EXTERNAL LIGHTING MANAGEMENT PLAN

14th of June 2022

SUBJECT PREMISES: HARBOURSIDE (PIRRAMA ROAD), EXISTING HOTEL & APARTMENT, THEATRES, LIFTS, AND PROPOSED SIGNAGES

Project: The Star Sydney

Prepared by: FPOV

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- Lighting calculation of entrance awning down-lights type XI
- Level 3 service provider calculation for Harborside External
- Handrail lighting calculation - level 3 harbourside types XH1.
- Lyric & sports theatres. Type XXD & XXE.

Drawings

Harbourside, Existing Hotel & Apartment, Theatres, Lifts, and proposed signages

- 106679-E0000 [A] - ELECTRICAL SERV ICES - LE GEND AND NOTES
- 106679-E0100 [C] - ELECTRICA L SERVICES - LEVEL 3 - LIGHTING LAYOUT
- 106679-E0101 [C] - ELECTRICA L SERVICES - ROOF - LIGHTING LAYOUT
- 106679-E0102 [A] - ELECTRICAL SERV ICES - ROOF - LIGHTING LAY OUT
- 106679-E0200 [A] - ELECTRICAL SERV ICES - LIGHTING LAYOUT - EXISTING HOTEL
- 106679-E0201 [A] - ELECTRICA L SERVICES - LIGHTING LAYOUT - E XIS TING APARTME NT
- 106679 - PRELIMINARY SPECIFICATION

Appendix 2

Signage alternations evaluation of lighting impact prepared by Lighting, Art Science

1. Executive Summary

FPOV has been engaged by The Star to update the external lighting management plan, previously prepared by Meinhardt for The Star Sydney, and incorporate existing evaluation lighting impact from Lighting, Art + Science to the main exterior lighting management plan. The purpose of this management plan is to provide and update all necessary information for the management of the light fittings in and around the public domain.

This External Lighting Management plan includes:
1) Luminaire types and related technical details e.g., LED, wattage, etc.
2) Lighting lux diagrams of proposed fittings (see appendix for calculations).
3) Hours of operation.
4) Potential traffic and navigation hazards.
5) Potential amenity impacts on surrounding properties.
6) Pedestrian safety, security, and amenity.

In accordance with the City of Sydney Exterior Lighting Strategy, the lighting design scheme has been designed to comply with the following Australian Standards (see appendix for calculations):

- Compliance with the Australian Standards AS 4248 - 'Control of the Obtrusive Effects of Outdoor Lighting;

-Wherever possible, energy-efficient, dimmable, and adjustable fixtures complete with glare guards and louvers are selected. This is to control the effect of obtrusive lighting to properties surrounding The Star Sydney.

2. Technical Details of External Luminaires (Public Domain)

Harbor Side External, Existing Hotel & Apartment, Theatres, Lifts

Type	Description	Source	Wattage	Light output	Colour temperature
Harbour Side (Pirrama Road)					
XA	Street lighting	Metal halide	400W	4000 lumens	As per level 3 service provide specification
XA1	Pedestrian lighting	Metal halide	70W	6600 lumens	As per level 3 service provide specification
XB	In ground up-lights - Palm trees	Metal halide	70W	7100 lumens	3000K colour temperature (warm white)
XQ	In ground up-lights - Trees	Metal halide	70W	7100 lumens	3000K colour temperature (warm white)
XF	Backlighting to escalator	LED	12W	527 lumens	2700K colour temperature (warm white)
XF1	Backlighting to escalator	LED	12W	527 lumens	2700K colour temperature (warm white)
XG	Awning recessed – general lighting	LED	12W	850 lumens	2700K colour temperature (warm white)
XI	Awning recessed – general lighting	LED	20W	900 lumens	2700K colour temperature (warm white)
XJ	Awning recessed – Glass back-lighting	LED	12W	900 lumens	Mid Red Blue
Existing Hotel & Apartments					
XXA	FAÇADE LED RGBW Sparkle	LED	5W		RGBW colour
XXB	Roof Canopy – Uplighting	LED	12W	-	5500K colour temperature (cool white)
XXC	Roof Canopy – Wash lighting (4ft)	LED	70W	1086 lumens	To match Rosco34600 MEDRED BLUE FILTER
Lyric Theatre & Sports Theatre					
XXD	Theatre Rooftop – Wash lighting	LED	70W	-	To match Rosco34600 MEDRED BLUE FILTER
XXE	Theatre Facades – Wash lighting	Metal Halide	70W	6900 lumens	4000K colour temperature (cool white)
Lifts					
XK1	Ceiling & Floor Backlighting	LED	12W	-	5500K colour temperature (cool white) RGB
XL1	Backlighting to top & bottom vertical surfaces	LED	12W	-	colour
XM1	Lift Car – Down lighting	LED	28W	2100 lumens	3000K colour temperature (warm
XN1	Lift Car – Exterior Circular Pattern	LED	12W	-	white) RGB colour
Signage					
	Signage – Existing Hotel/Apartment	LED	Signage Spec		3000K colour temperature (warm white)
					5500K colour temperature (cool white)

3. Illumination Levels of Proposed Light Fittings

See below for calculations for the Harbourside External, Existing Hotel & Apartment, Theatres and Lifts

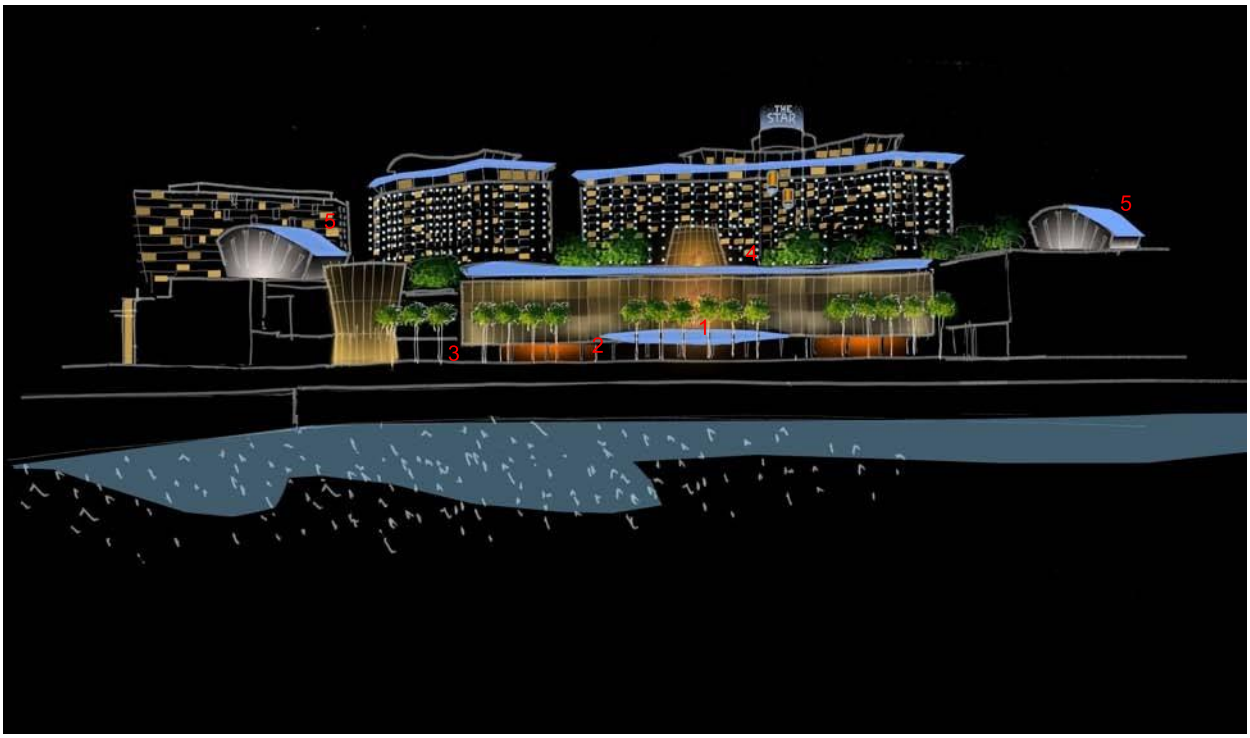
The Star Sydney - Lighting Layout

Habourside (Pirrama Road)

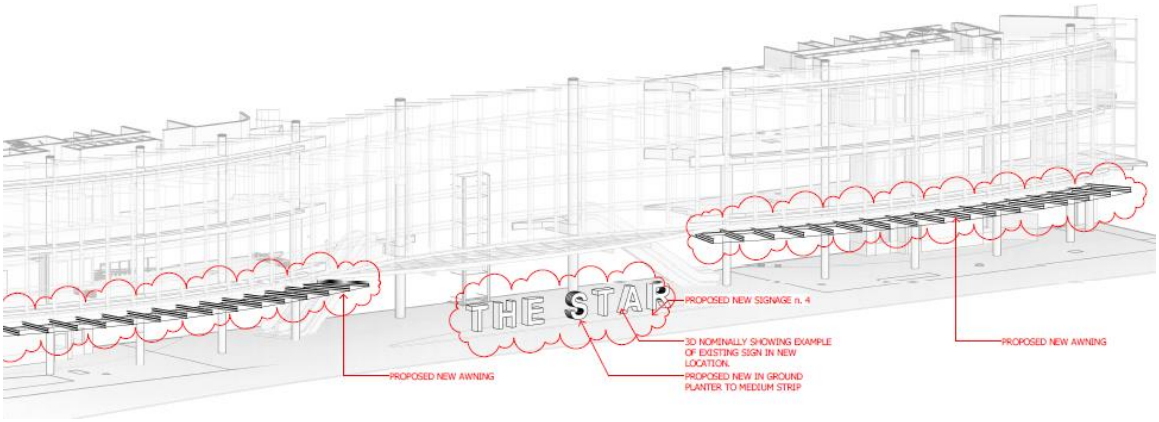
1. New under canopy lighting calculation, Down-lights XG.
2. Entrance awning calculation. Down-lights type XI.
3. Street & pedestrian lighting to Pirrama Road Types XA & XA1.

Existing Hotel & Apartment, Theatres and Lift

4. Handrail lighting calculation - level 3 harbour side.
5. Lyric & sports theatres.



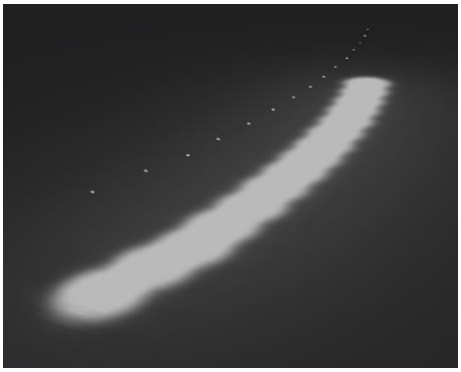
Harbour side – computer simulation



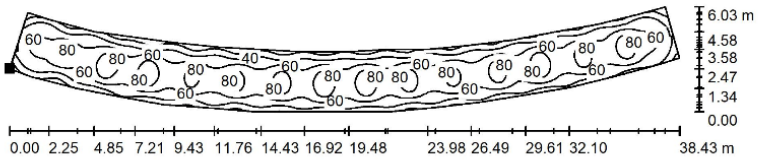
Harbourside entrance (Pirrama Road) – drawing from Amended MOD 15

Harbourside (Pirrama Road)

1. New under awning lighting calculation. Downlight types XG

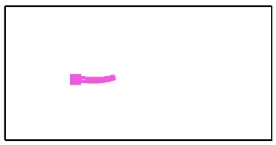


New Awning Lighting / Calculation Surface 1 / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 275

Position of surface in room:
Marked point: (34.452 m, 55.465 m, 0.100 m)



Grid: 128 x 128 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
57	6.58	99	0.115	0.066

(a) Fully dimmable luminaires and a central lighting control system have been specified, enabling future adjustment of lighting intensity and hours of illumination as required. Fixed warm white 2700K light source (no colored light) has been specified.

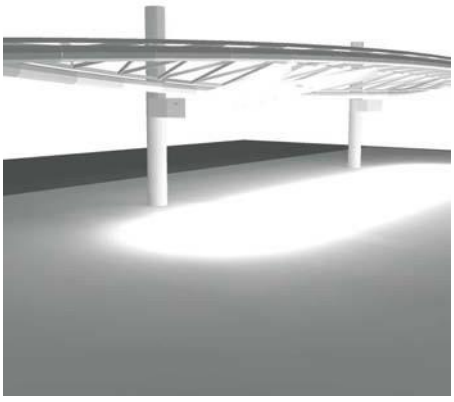
(b) There is no under awning lighting which is directed upwards.

(c) Luminaires with LED source are specified for under-awning.

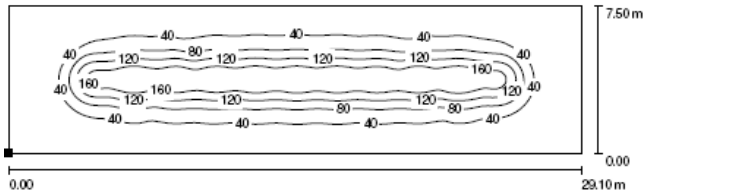
(d) Luminaires to be integrated into the awning structure

Harbourside (Pirrama Road)

2. Lighting calculation. Down-light Type XI Fitting.

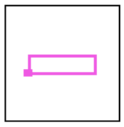


15.5 W LED 30 degree new / Calculation Surface 1 / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 209

Position of surface in external scene:
Marked point:
(10.400 m, 20.500 m, 0.024 m)



Grid: 128 x 128 Points

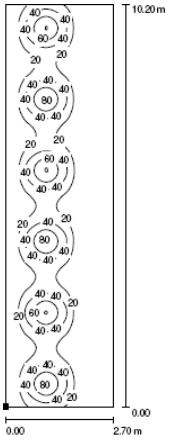
E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
61	1.13	197	0.019	0.006

Harbourside (Pirrama Road)

3. Street & Pedestrian lighting to Pirrama Road Types XA & XA1.

See Appendix Page 17 – " Harbour side works electrical services External lighting layout "

4. Hand rail lighting calculation - Level 3 Harbourside, Type XH1.



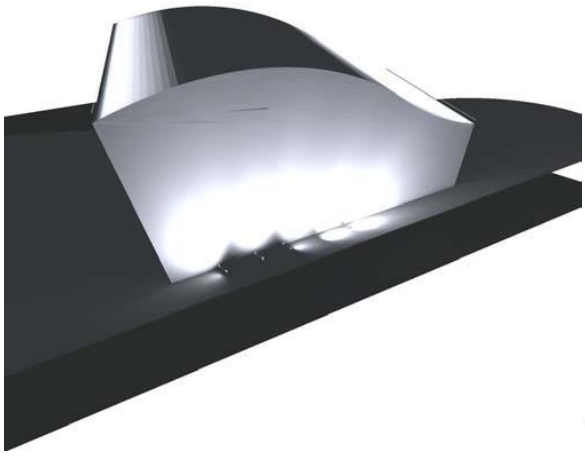
Values in Lux, Scale 1 : 80

Position of surface in external scene:
Marked point:
(11.900 m, 21.300 m, 0.000 m)

Grid: 128 x 128 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
20	0.33	82	0.017	0.004

5. Lyric & sports theatres. Type XXD & XXE.



4. Evaluation of lighting impact of proposed signages

There are several standards that may have relevance to this site:

- AS/NZS4282: Control of obtrusive effects of outdoor lighting, gives control for the levels of spill light that can be reasonably expected in an urban environment. This is not called up in any NSW legislation, however, conformance is commonly required in LEPs (Local Environmental Plans). The standard's main concentration is on the impact on residents.

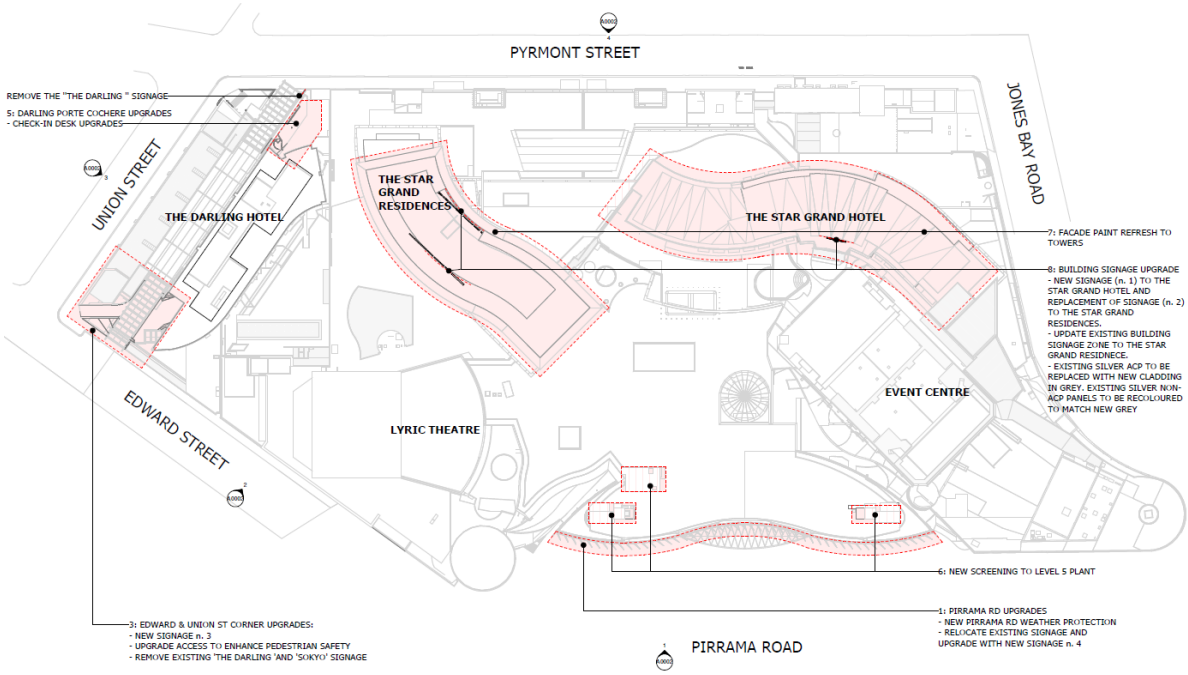
- NSW Transport Corridor Advertising and Signage Guidelines (NSWTAG) specifies luminance limits on signs by day and night concentrating on the impact on traffic.

- CASA Manual of Standards Part 139-Aerodromes- section 9.21 (CASA MoS Pt 139)

- State Environmental Planning Policy No.64 Advertising and Signage Controls

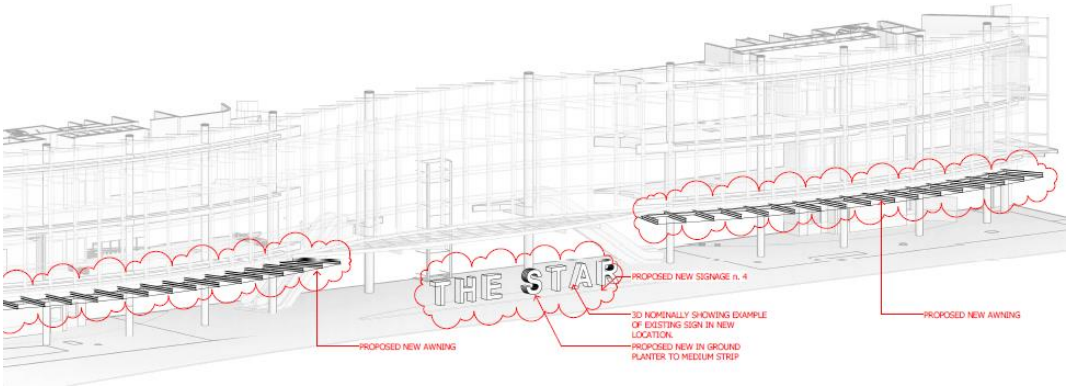
- Sydney Development Control Plan 2012

The proposed signage package comprises several signs in different locations around the building. Key maps as below:



4.1. "THE STAR" 3D block letters at ground level facing Pirrama Road.

There are internally lit signs with possible variable content, so they have been assessed as white signs. The sign has been assessed for luminance and threshold increment, due to the proximity of the road. The sign has negligible illuminance impacts as there are no residences within a close enough distance to be affected. The impact is included however in the combined assessment of all the signs.

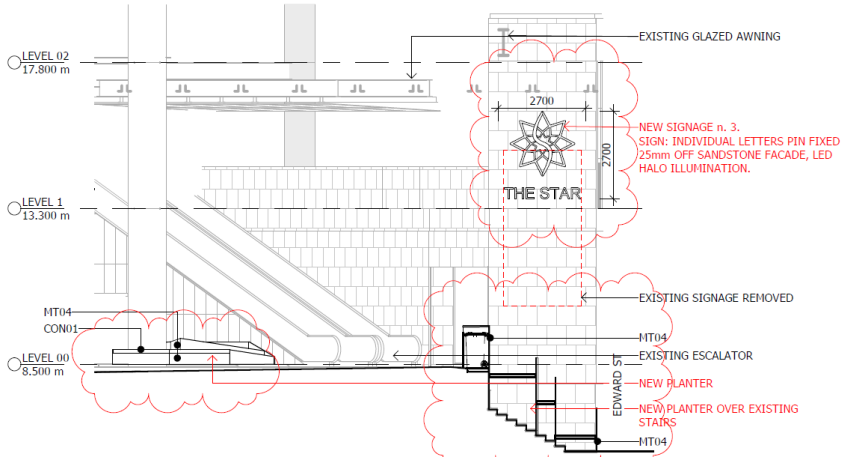


Summary conformance “THE STAR” Sign

Light Technical Parameter	Required Limit	Calculated Result	Conformance	Conformance
Sydney Development Control Plan (SDC)	300 cd/m²	Level set to comply	Conformance level	YES
Maximum Average Luminance as per AS/NZS 4282 table 3.5 Non-Curfew L1	350 cd/m²	Level set to comply with SDC Luminance		YES
Maximum Average Luminance Curfew	350 cd/m²	Level set to comply with SDC Luminance		YES
Maximum Vertical illuminance Non-Curfew L1	25 lux	Level set to comply with SDC Luminance	N/A	N/A
Maximum Vertical illuminance Curfew	5 lux	Level set to comply with SDC Luminance	N/A	N/A
Maximum Threshold Increment Result Non-Curfew L1 (Annexure C)	20% at L_{ad}=5	Level set to comply with SDC Luminance	0%	YES
Maximum Threshold Increment Result Curfew (Annexure C)	20% at L_{ad}=5	Level set to comply with SDC Luminance	0%	YES
CASA MoS Pt 139	Not Applicable in this location	N/A	N/A	N/A
Upward Waste Light Ratio	50%		50%	YES

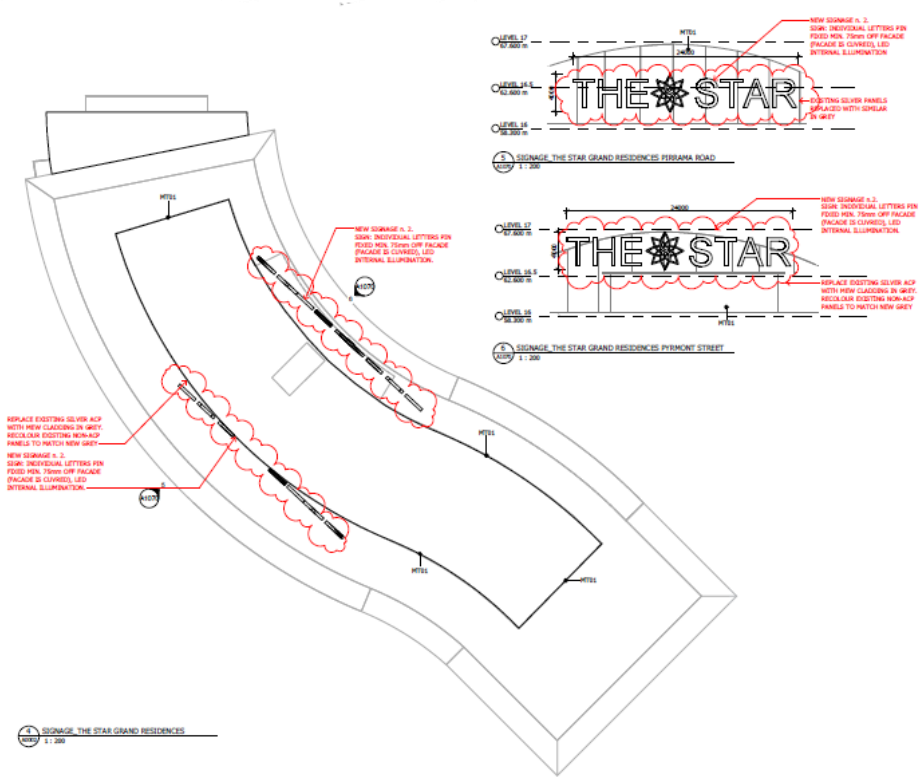
4.2. Corner of Edward St and Union St.

There is a new letter sign with pin mounted letters on sandstone with halo illumination. There is also a LED sign zone with variable content approximately 17000 x 600mm. It has therefore been assessed as a white sign. The pin mounted sign has not been assessed due to the minimal impact.



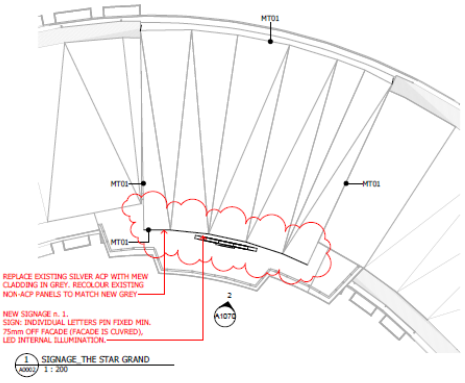
4.3. Rooftop signs.

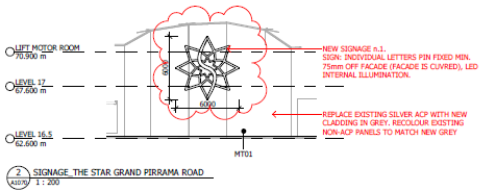
Signs on the eastern and western elevations of The Star Grand Residences are a combination of a logo and discrete letters. All elements are internally lit.



The new sign on the eastern elevation of The Star Grand Hotel is a logo only of discrete elements, internally lit.

The signs will be a constant white color. The roof signs have been assessed for luminance and illuminance at those residences that have a view of the sign. Threshold increment is irrelevant due to the viewing distance from any road.





Summary conformance Roof Top Sign

Light Technical Parameter	Required Limit	Calculated Result	Conformance	Conformance
Sydney Development Control Plan (SDC)	300 cd/m²	Level set to comply	Conformance level	YES
Maximum Average Luminance as per AS/NZS 4282 table 3.5 Non-Curfew L1	350 cd/m²	Level set to comply with SDC Luminance		YES
Maximum Average Luminance Curfew	350 cd/m²	Level set to comply with SDC Luminance		YES
Maximum Vertical illuminance Non-Curfew L1	25 lux	Level set to comply with SDC Luminance	0.1 lux	YES
Maximum Vertical illuminance Curfew	5 lux	Level set to comply with SDC Luminance	0.1 lux	YES
Maximum Threshold Increment Result Non-Curfew L1 (Annexure C)	20% at L_{ad}=5	Level set to comply with SDC Luminance	N/A	N/A
Maximum Threshold Increment Result Curfew (Annexure C)	20% at L_{ad}=5	Level set to comply with SDC Luminance	N/A	N/A
CASA MoS Pt 139	Not Applicable in this location	N/A	N/A	N/A
Upward Waste Light Ratio	50%		50%	YES

Conclusion:

At the maximum luminance of 300cd/m2 nominated in the Sydney Development Control Plan 2012, all the proposed signage meets the limits of AS/NZS4282: 2019 for 24-hour operation for an environmental zone of A4.

5. Hours of Operation

Habourside (Pirrama Road):

From Dawn to Dusk
All pedestrian lighting, canopies, floodlighting, cove lighting, in-ground recessed up-lights, and decorative lighting are to be switched off.
All general lighting including the down lighting to Level 3 dome canopy located on drawing 106679-E0100 (see attached) to be switched on for safety.

From Dusk to Dawn
All pedestrian lighting, canopies, floodlighting, cove lighting, in-ground recessed up-lights, decorative lighting, and down lighting are to be switched on.

Existing Hotel & Apartment buildings:

From Dawn to Dusk
All Façade sparkle lighting, roof canopy wash lighting, and canopy support up lighting are to be switched off.

From Dusk to Dawn
All Façade sparkle lighting, roof canopy wash lighting, and canopy support up lighting are to be switched on.

Lyric Theatre & Sports Theatre:

From Dawn to Dusk
All rooftop canopy wash lights and wash lights to façades are to be switched off.

From Dusk to Dawn
All rooftop canopy wash lights and wash lights to façades are to be switched on.

Exterior Lifts:

From Dawn to Dusk
All exterior lift feature lights are to be switched off.

From Dusk to Dawn
All exterior lift feature lights are to be switched off.

Signage:

From Dawn to Dusk

All signage lights are to be switched ON

From Dusk to Dawn

All signage lights are to be switched ON.

Type	Description	Dawn till Dusk	Dusk till Dawn
Harbourside (Pirrama Road)			
XA	Street lighting	-	X
XA1	Pedestrian lighting	-	X
XB	In-ground uplight – Palm Trees	-	X
XQ	In-ground uplight – Trees	-	X
XF	Backlighting to Escalator	-	X
XF1	Backlighting to Escalator	-	X
XG	Ceiling recessed - General lighting	X	X
XP	Ceiling recessed - General lighting	X	X
XI	Awning recessed - General lighting	-	X
XJ	Awning recessed – Glass back-lighting	-	X
Existing Hotel & Apartments			
XXA	FAÇADE LED RGBW Sparkle	-	X
XXB	Roof Canopy – Up lighting	-	X
XXC	Roof Canopy – Wash lighting	-	X
Lyric Theatre & Sports Theatre			
XXD	Theatre Rooftop – Wash lighting	-	X
XXE	Theatre Facades – Wash lighting	-	X
Signage:			
	Signage Lighting	X	X
Exterior Lifts			
XK1	Ceiling & Floor Backlighting	X	X
XL1	Backlighting to top & bottom vertical surfaces	-	X
XM1	Lift Car – Down lighting	X	X
XN1	Lift Car – Exterior Circular Pattern	-	X

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6. Potential Traffic and Navigation Hazard

The proposed lighting design for The Star Sydney, Existing Hotel & Apartment, Theatres and Lifts has no potential traffic or navigation hazard impacts.

– Compliance with the Australian Standards AS 4248 - ‘Control of the Obtrusive Effects of Outdoor Lighting’

Type	Description	No Potential	Potential
Harbourside (Pirrama Road)			
XA	Street lighting	X	-
XA1	Pedestrian lighting	X	-
XB	In-ground uplight – Palm Trees	X	-
XQ	In-ground uplight – Trees	X	-
XF	Backlighting to Escalator	X	-
XF1	Backlighting to Escalator	X	-
XG	Ceiling recessed - General lighting	X	-
XP	Ceiling recessed - General lighting	X	-
XI	Awning recessed - General lighting	X	-
XJ	Awning recessed – Glass back-lighting		
Existing Hotel & Apartments			
XXA	FAÇADE LED RGBW Sparkle	X	-
XXB	Roof Canopy – Up lighting	X	-
XXC	Roof Canopy – Wash lighting	X	-
Lyric Theatre & Sports Theatre			
XXD	Theatre Rooftop – Wash lighting	X	-
XXE	Theatre Facades – Wash lighting	X	-
Lift Car			
XK1	Ceiling & Floor Backlighting	X	-
XL1	Backlighting to top & bottom vertical surfaces	X	-
XM1	Lift Car – Down lighting	X	-
XN1	Lift Car – Exterior Circular Pattern	X	-
Signage			
	Signage Lighting	X	-
			-

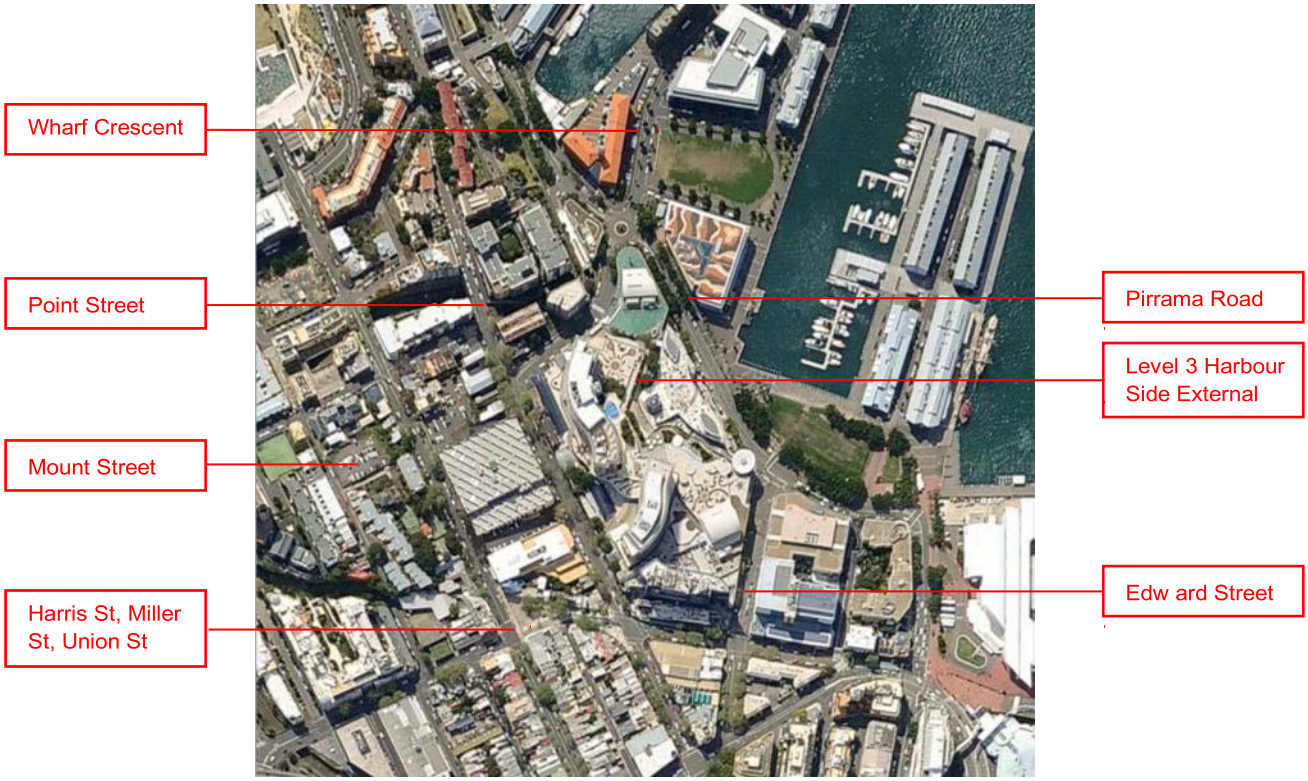
7. Potential Impact on Surrounding Properties

Implementing a new lighting scheme to the external areas of a building and its facades can have a huge impact on the surrounding buildings and properties. The Star Sydney's lighting scheme has been designed to prevent glare and spill light to the surrounding properties while also adopting the latest energy-efficient technologies available today.

See below for a graphical representation of the new lighting and the effect it will have on the surrounding properties. This shows a complete 360-degree picture of the new lighting layout for The Star Sydney. Where possible, energy-efficient, dimmable, adjustable fixtures with glare guards and louvers have been chosen to control the effect of obtrusive lighting to surrounding properties.

The exterior lighting to The Star Sydney's Harbourside External, Existing Hotel & Apartment Buildings, Theatres, Lifts, and proposed signages

– Compliance with the Australian Standards AS 4248 - 'Control of the Obtrusive Effects of Outdoor Lighting.

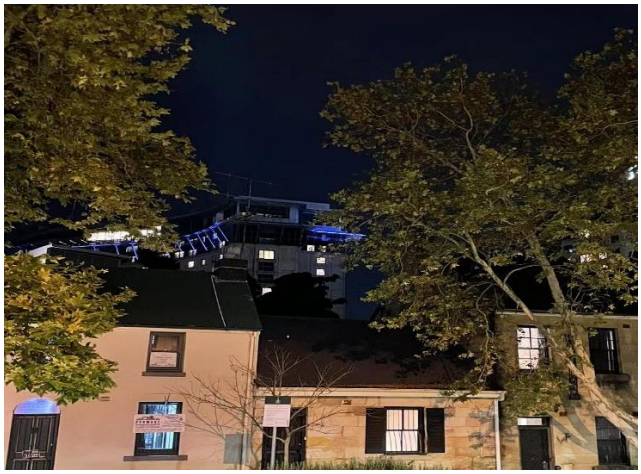


Overall lighting design to The Star Sydney

View from Pirrama Road: This view is the main view from the CBD. It has been designed specifically using energy efficient, dimmable, adjustable fixtures with glare guards and louvers preventing unwanted glare and spill light

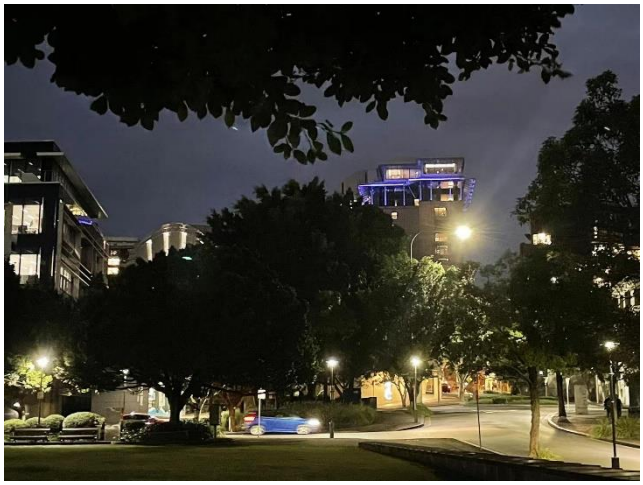
Harbour Side Entrance view from Pirrama Road

View from Mount Street: This view has been designed specifically using of energy efficient, dimmable, adjustable fixtures with glare guards and louvers preventing unwanted glare and spill light.



View from Harris Street, Miller Street and Union Street: This view has been designed specifically using energy efficient, dimmable, adjustable fixtures with glare guards and louvers preventing unwanted glare and spill light.

View from Point Street: This view has been designed specifically using energy efficient, dimmable, adjustable fixtures with glare guards and louvers preventing unwanted glare and spill light.



View from Wharf Street: This view has been designed specifically using energy efficient, dimmable, adjustable fixtures with glare guards and louvers preventing unwanted glare and spill light.

Type	Description	No Potential	Potential
Harbour Side (Pirrama Road)			
XA	Street lighting	X	-
XA1	Pedestrian lighting	X	-
XB	In-ground uplight – Palm trees	X	-
XQ	In-ground uplight – Trees	X	-
XF	Backlighting to Escalator	X	-
XF1	Backlighting to Escalator	X	-
XG	Ceiling recessed - General lighting	X	-
XP	Ceiling recessed - General lighting	X	-
XI	Awning recessed - General lighting	X	-
XJ	Aw ning recessed – Glass back-lighting	X	-
Existing Hotel & Apartments			
XXA	FAÇADE LED RGBW Sparkle	X	X
XXB	Roof Canopy – Up lighting	X	X
XXC	Roof Canopy – Wash lighting	X	X
Lyric Theatre & Sports Theatre			
XXD	Theatre Roof top – Wash lighting	X	-
XXE	Theatre Facades – Wash lighting	X	-
Lifts			
XK1	Ceiling & Floor Backlighting	X	-
XL1	Backlighting to top & bottom vertical surfaces	X	-
XM1	Lift Car – Dow n lighting	X	-
XN1	Lift Car – Exterior Circular Pattern	X	-
Signage			
	Signage lighting	X	-

8. Pedestrian Safety, Security and Amenity

The current lighting design for The Star Sydney, Existing Hotel & Apartment, Theatres, MUEF and Lift Cars has been designed to assist pedestrians to orient themselves and detect potential hazards. The lighting design discourages crime and reduces the fear of crime, while protecting the integrity of the night environment through the control of light spill. The design enhances the prestige and amenity of the location.

Wherever possible energy efficient, dimmable, and adjustable fixtures were chosen to control the effect of obtrusive lighting to surrounding properties.

- Compliance with the Australian Standards AS 4248 - 'Control of the Obtrusive Effects of Outdoor Lighting'.

Type	Description	No Potential	Potential
Harbourside (Pirrama Road)			
XA	Street lighting	X	-
XA1	Pedestrian lighting	X	-
XB	In-ground uplight – Palm Trees	X	-
XQ	In-ground uplight – Trees	X	-
XF	Backlighting to Escalator	X	-
XF1	Backlighting to Escalator	X	-
XG	Ceiling recessed - General lighting	X	-
XP	Ceiling recessed - General lighting	X	-
XI	Awning recessed - General lighting	X	-
XJ	Awning recessed – Glass back-lighting		
Existing Hotel & Apartments			
XXA	FAÇADE LED RGBW Sparkle	X	-
XXB	Roof Canopy – Up lighting	X	-
XXC	Roof Canopy – Wash lighting	X	-
Lyric Theatre & Sports Theatre			
XXD	Theatre Roof top – Wash lighting	X	-
XXE	Theatre Facades – Wash lighting	X	-
Lift Car			
XK1	Ceiling & Floor Backlighting	X	-
XL1	Backlighting to top & bottom vertical surfaces	X	-
XM1	Lift Car – Down lighting	X	-
XN1	Lift Car – Exterior Circular Pattern	X	-
Signage			
	Signage lighting	X	-

9. Control of Decorative lighting

The light levels of all decorative lighting will be dimmed down gradually w here possible.

The Star Sydnvey Harbourside Entrance (Pirrama Road), Exis ting Hotel & Apartment, Theatres and Lifts

Exterior **Decorative Lighting - Dimming schedule:**
Monday to Thursday dimming level from dusk - 11:00 pm = 100 %; from 11:00 pm - 12:30 pm =70%; from 12:30 pm - dawn = 50 %
Friday to Sunday and Public Holidays, dimming le vel from dusk to 11:00 pm = 100 %; from 11:00 pm - 12:30 pm = 80%; from 12:30 pm - dawn = 65 %

If it is found that the lighting is disruptive to residents in the vicinity, the specifically disruptive luminaries may be further dimmed down to 25% during curfew hours. These luminaries s hall be provided with a dimming control capable of dimming down to 25%.

The interior lighting in the areas behind the new glazed Harbourside entrance façade should be controlled to maintain an average vertical l illuminance of less than Ev-a v = 120 lx and an average horizontal illumina nce of Eh-a v= 160 lx. If any further changes require higher lux levels, blinds or other control options will be investigated and installed.

Appendix