



# WEST CIRCULAR QUAY EXTERNAL LIGHTING

Investigation and Concept Design

**Client**

Sydney Harbour Foreshore Authority

**Compliance with Standards**

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## 1. Background

The area in question is the open space at West Circular Quay which is bound by Alfred Street, George Street and Argyle Street. It is proposed to upgrade this area in order to:

- Create a simplified and unified park space
- Create clear and generous pedestrian links to adjacent areas
- Create a square/forecourt in front of the MCA
- Retain and locate landmark trees to preserve views and provide shade
- Create a generous provision of formal and informal seating
- Create a unified and coherent ground plane
- Provide well lit pedestrian paths at night
- Create a layout that accommodates temporary events and festivals

To achieve the above, it is anticipated that the external lighting in the area may need to be upgraded.

## **2. Objective**

The first task of this investigation is to determine what lighting standards are applicable to an area such as this.

Secondly, it is intended to survey the lighting in the area to check how it compares to the relevant standards.

Thirdly, it is intended to propose a method of lighting that will comply with the relevant standards whilst achieving other design goals.

Finally, estimates of costs for this work will be provided.

### **3. Technical Requirements of Lighting**

Australian Standard AS1158.3.1:2005 sets out performance and design requirements for Pedestrian area lighting, having regard to the degree of activity (of pedestrians and vehicles), the risk of crime and the need to enhance the prestige of the locality. It describes a number of lighting categories, known collectively as Category P lighting, for application to various types of usage.

Category P lighting is acknowledged to be an effective counter both to the occurrence of crime and to the fear of crime. It has been demonstrated in studies that the relevant Category P lighting can provide significant community benefits and that the cost involved in providing the lighting can be offset by the financial returns from the reduction in crime.

The nearest applicable category is included in Table 2.2 (Refer Appendix A) for "Pedestrian or cycle oriented pathway, e.g. footpaths..., walkways, lanes, park paths, cycleways" with high pedestrian/cycle activity, medium risk of crime and high need to enhance prestige. For such areas, the standard designates a lighting category P2 which in Table 2.6 (Refer Appendix A) requires a minimum average horizontal illuminance of 3.5 lux and absolute minimum horizontal and vertical illuminances at any point of 0.7 lux. Vertical illuminance is critical because it aids facial recognition. It also requires a uniformity of no more than 10, where uniformity is defined as the ratio between maximum illuminance to average illuminance within the specified area.

For steps and stairways, the applicable category is included in Table 2.4 which designates a category P9. Table 2.8 indicates that the lighting performance should be the same as for the general area as described above.

## **4. Methodology**

The site was visited on the evening of 31 August 2010. Light levels were taken using a Yokogawa Model 51002 illuminance meter. Note was also taken of the positions and types of the existing luminaires.

## 5. Findings

### 5.1 Luminaires

The locations of the pole-mounted light fittings are as indicated on the survey plan. The existing light fittings comprise the following:

- A line of pole-mounted sphere luminaires along the water's edge on 3m poles and generally at 9.8m spacings. These light fittings are manufactured by Sylvania Lighting and are their 'Macquarie' model. These fittings were originally designed, manufactured and installed in 1987 along Macquarie Street and around Circular Quay and intended to complement the similar spheres on bronze poles around the Sydney Opera House. In around 2000, the lamps and reflectors of these fittings were modified in an attempt to improve the light output. Recently the fittings around the Opera House have again been modified and Sylvania Lighting now markets these as a new model, the 'Bennelong'. The fittings in the subject area have not been converted to 'Bennelong' fittings. Originally the light poles were powdercoat painted a 'claret' colour. Subsequently these poles have been painted black.



- Along the footpath in front of the MCA building and parallel to the promenade and also in First Fleet Park, lighting is provided by twin metal halide luminaires mounted at about 6 metres above ground level on Sydney City Council standard Smartpoles. The light fittings and poles are similar to those used in the nearby Customs House forecourt.



- On the underside of the structure supporting the railway line above, there are mounted on purpose built rails a large number of floodlights. Approximately 20 of these are white metal halide aimed downwards to provide direct illumination to the ground, and 96 are aimed upwards to illuminate the structure and provide violet light.



- Directly in front of the eastern façade of the MCA building are floodlights mounted on the ground within steel cages and aimed upwards to graze the façade of the building.



## **5.2 Light Levels**

The light readings taken are shown on the attached drawing.

The areas that are lit by the pole-mounted spheres and which complied with Category P2 of AS1158.1 are shown by the use of shading. Generally, the complying areas extended about 6 to 7 metres from the line of poles, except for those areas where the spacing between poles exceeds the usual 9.8m due to physical obstructions such as steps. These fittings provide a low level of light but appeared dim compared to identical fittings at Circular Quay East. This may be due to a lack of maintenance and improvement could be gained with a clean and re-lamp.

The similar 'Bennelong' fittings in the Opera House forecourt achieved Category P2 to a distance of about 8.5 metres with poles at 12 metre spacings.

The areas presently lit by the twin fittings on Smartpoles will be substantially changed under the proposed plans with footpaths being removed. It is anticipated that all of these fittings would be removed and therefore detailed light readings were not taken. Generally these areas were lit from 3 to 40 lux in First Fleet Park and from 5 to 40 lux along the main footpath running north-south in front of MCA. This far exceeds the requirements of Category P2 and makes it difficult to achieve the required uniformity of no more than 10.

The areas under the railway lines are evenly lit at 5 to 8 lux. This exceeds the requirements of Category P2 but is not considered excessive. The violet indirect lights have little effect and their value is questionable. Their ineffectiveness is exacerbated by the fact that they aimed towards very dark surfaces with low reflectivities.

The floodlights in front of MCA are not all operational due to construction work in the area. Their sole purpose is to graze light along the façade of the building and the effect could be considered a little severe due to the acute angles involved.

## 6. Recommendations

The following recommendations are made for the lighting of the upgraded areas:

1. The pole-mounted spheres extend all around Circular Quay and the Opera House and have become somewhat iconic, providing a motif for the area, in particular at night. It is recommended that the fittings be retained, but upgraded to the more effective 'Bennelong' fittings (refer to the data sheet included in the Appendix). These fittings, if located along the centreline of a path, could adequately light a path 17 metres wide.
2. The lighting under the railway line is perfectly adequate and can be retained. Consideration may be given to removing or switching off the violet lights given the energy consumption and minimal effectiveness.
3. The new Market Wharf footpath from George Street to the promenade on the south side of the MCA will need to be lit to Category P2 of AS1158.3.1. Included in this is the requirement for some vertical illumination at face level. This will require the use of some pole-mounted light fittings. This could be achieved by the use of more 'Bennelong' fittings or some other fitting to be selected. In addition, it is recommended that consideration be given to using LED lights located within handrails to provide illumination of footpaths and in particular ramps and steps (refer to the data sheet for the ledpod50 system included in the Appendix)
4. The above items are necessary to comply with the standards. Consideration should be given to additional lighting to enhance the overall appearance of the area. With a stated aim being to improve the views of the Opera House and harbour, and additional lighting should be selected with an aim of minimising glare, i.e. the actual light source should not be visible. Recommended measures include inground uplighting of significant trees. This has the dual benefit of highlighting the trees at night but also removing potentially oppressive shadows. This has been done to good effect at circular Quay East and other nearby areas. Concealed lighting within the new seats to be provided is also a recommended measure. This will have the effect of drawing people to the seats and present them as refuges.
5. If archaeological digs are to be included in the area, these can be sealed and lit using fibre optic lighting whereby the light sources are installed outside the protected area and light is transmitted to the areas via fibre optic tubes.
6. It should be noted that the type of lighting proposed above involves tightly controlled lighting with minimal light spill. Compliance with *AS4282 – Control of the obtrusive effects of outdoor lighting* will be achieved and there will be no interference with the navigational requirements of vessels on the harbour/quay.
7. It is further noted that the City of Sydney Council is currently undertaking trials of LED outdoor light fittings and it is possible to incorporate any recommendations of this trial into the final design for this project.

## 7. Estimates

1. Convert 'Macquarie' to 'Bennelong' lights	\$16,000
2. New post-top fittings	\$40,000
3. Handrail lights	\$40,000
4. Inground uplights	\$25,000
5. Seat lights	<u>\$30,000</u>
Total	\$151,000

These figures are excluding GST.

APPENDIX A



**TABLE 2.2**  
**LIGHTING CATEGORIES FOR PATHWAYS (INCLUDING CYCLEWAYS)**

1	2	3	4	5	6
Type of pathway		Selection criteria <sup>a,b)</sup>			Applicable lighting subcategory
General description	Basic operating characteristics	Pedestrian/cycle activity	Risk of crime <sup>d)</sup>	Need to enhance prestige	
Pedestrian or cycle orientated pathway, e.g. footpaths, including those along local roads <sup>d)</sup> and arterial roads <sup>e)</sup> , walkways, lanes, park paths, cycleways	Pedestrian/cycle traffic only	N/A	High	N/A	P1 <sup>e)</sup>
		High	Medium	High	P2 <sup>e)</sup>
		Medium	Low	Medium	P3
		Low	Low	N/A	P4

- <sup>a)</sup> The selection criteria of Columns 3 to 5 should be separately evaluated. The highest level of any of the selection criteria that is deemed appropriate for the pathway will determine the applicable lighting subcategory.
- <sup>b)</sup> Refer to Appendix C for guidance on choosing the applicable level of each selection criteria for the environment and purpose of a lighting scheme.
- <sup>c)</sup> Where there are vertical surfaces of high reflectance (e.g. light coloured walls bordering on an alleyway) alongside the pathway, the next lower lighting subcategory may be selected.
- <sup>d)</sup> Where the footpath is along a local road and subcategory P1 or P2 is selected, the light technical parameters for that subcategory only apply to the formed footpath. Where subcategory P3 or P4 is selected, the light technical parameters apply to the whole road reserve width, including the footpath.
- <sup>e)</sup> Footpaths associated with arterial roads are deemed not to require separate lighting provided that—
- (i) the road is lit to at least the applicable level of Category V lighting complying with AS/NZS 1158.1.1; and
- (ii) the footpath is unshaded, e.g. there are no substantially continuous building awnings, and the footpath is contiguous with the roadway.
- If the footpath is shaded, or is separated from the roadway by an extensive nature strip or a service road, it shall be provided with lighting to at least subcategory P4.
- <sup>f)</sup> The risk levels 'High', 'Medium' and 'Low' correspond to the classifications of the same names in HB 436.

**TABLE 2.6**  
**VALUES OF LIGHT TECHNICAL PARAMETERS AND PERMISSIBLE**  
**LUMINAIRE TYPES FOR ROADS IN LOCAL AREAS AND FOR PATHWAYS**

1	2	3	4	5	6
Lighting subcategory	Light technical parameters				Permissible luminaire type (see Table 2.10)
	Average horizontal illuminance <sup>a,b)</sup> ( $\bar{E}_h$ ) lux	Point horizontal illuminance <sup>a,b)</sup> ( $E_{ph}$ ) lux	Illuminance (horizontal) uniformity <sup>c)</sup> Cat. P ( $U_{E2}$ )	Point vertical illuminance <sup>a,b)</sup> ( $E_{pv}$ ) lux	
P1	7	2	10	2	Type 4 where part of a road reserve or Types 2, 3, 4 or 6 elsewhere
P2	3.5	0.7	10	0.7	
P3 <sup>e)</sup>	1.75	0.3	10	0.3 <sup>d)</sup>	
P4 <sup>e)</sup>	0.85	0.14	10	N/A	
P5 <sup>e)</sup>	0.5	0.07	10	N/A	

a) These values are maintained.

b) Compliance is achieved by being greater than or equal to the applicable table value.

c) Compliance is achieved by being less than or equal to the applicable table value.

d) The vertical illuminance requirement only applies when subcategory P3 is selected for application to pathways, i.e. it does not apply for local roads.

e) The values for New Zealand for subcategories P3 and P3R are also subject to the lamp source lumen derating values as per Clause 2.6. The New Zealand values are as per the table below. In New Zealand, when the luminaires are to be supported on existing reticulation poles, the subcategories P3R and P4R may be designated and the following reduced levels applied:

Subcategory	$\bar{E}_h$	$E_{ph}$	$E_{pv}$
P3 (NZ)	1.3	0.22	0.22
P3R	0.9	0.11	N/A
P4R	0.7	0.07	N/A

Subcategory P5 lighting shall not be chosen for this situation.

**NOTES:**

- Validation of the values in Columns 2 to 5 is by calculation, not field measurement. This is particularly relevant to small values in Columns 2, 3 and 5, which will typically be difficult to validate by field measurements.
- See Section 3 for the design methods and requirements for use in assessing compliance with the specified light technical parameters.

# Bennelong



## Decorative Sphere

The Bennelong Series allows the end user to maximise the aesthetic elegance of sphere lighting without the upward waste levels which hinder conventional systems. The luminaire features a seamless light stabilised 600mm clear acrylic sphere combined with a unique reflector system design, which maximises distribution in a symmetrical downward direction.



Sydney Opera House, Sydney, New South Wales

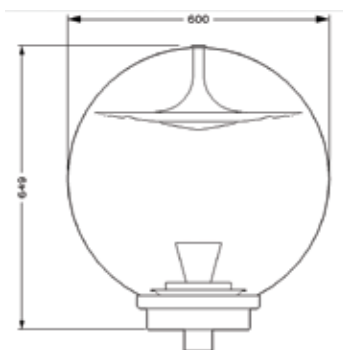
## Luminaire Construction

- Die-cast aluminium base
- Black polyester powdercoat finish as standard
- 600mm seamless UV stabilised acrylic sphere
- G12 lamp contained in a glare free anodised aluminium shrouding system offering optimised and precise beam control
- Highly tooled anodised 99.8% circular aluminium reflector disc offering minimised upward spill light whilst maximising downward distribution

## Features

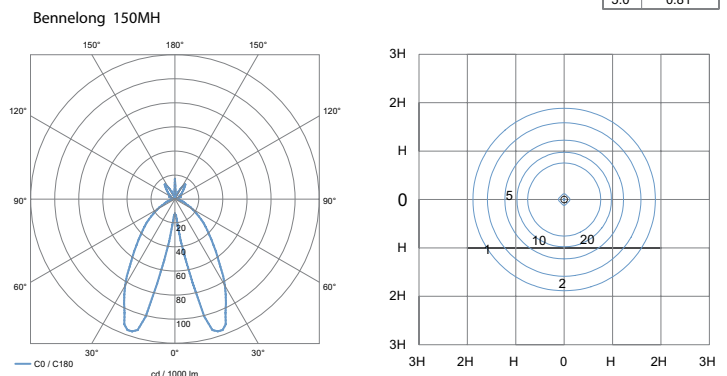
- To fit Pole spigot 65 n.b. Heavy Section 67mm I.D.
- Note: Pole spigot requires (3) 6.25mm counter sunk holes equally spaced 25mm from top edge
- Remote control gear c/w timed ignitor
- Minimised upward waste light
- Ceramic lamps as standard

## Applications



Bennelong 150MH  
H = 4.5m

H	Multiplier
4.0	1.27
4.5	1.00
5.0	0.81



DESCRIPTION	TYPE	BASE	LAMP	WEIGHT
BENNELONG 70W MH	Metal Halide	G12	CMIT70W	6.7kg
BENNELONG 150W MH	Metal Halide	G12	CMIT150W	6.7kg

Options Available:



For relevant start and run currents, please refer to SLA website.