# SYDNEY CRICKET & SPORTS GROUND TRUST

# NOBLE BRADMAN REDEVELOPMENT PROJECT
# SPORTS LIGHTING

# ENVIRONMENTAL IMPACT REPORT

PREPARED BY:

**WEBB AUSTRALIA GROUP (NSW) PTY LTD** ABN 48 050 056 712 sydney@webbaustralia.com.au www.webbaustralia.com.au
LEVEL 4 828 PACIFIC HIGHWAY GORDON NSW 2072 AUSTRALIA T +61 2 9418 1444 F +61 2 9418 1191
**CONSULTING ENGINEERS** ELECTRICAL LIGHTING MECHANICAL SECURITY COMMUNICATIONS AUDIO VISUAL
BRISBANE CANBERRA GOLD COAST MELBOURNE SUNSHINE COAST SYDNEY

Friday, 29 August 2008 E044MREP001

## TABLE OF CONTENTS

# 1 INTRODUCTION

This report has been prepared by Webb Australia Group for MI Associates for the assessment of proposed relocation of existing lighting towers at the Sydney Cricket Ground due to the Noble Bradman Stand Redevelopment.

The report covers the outcomes in regard to compliance with AS4282 (Control of the obtrusive effects of outdoor lighting). No existing lighting was taken into account for the purpose of this report. None of the site boundaries directly adjoin any residential properties, hospitals or the like.

AGI32 is recognized as one of the leading lighting design and modelling programs. The potential lighting impact of the Sydney Cricket Ground was simulated through computer modelling which predicts compliance with AS/NZS 4282, in particular vertical illuminance in the adjacent environment & threshold increment (veiling illuminance or glare) for road users.

On the basis of zoning; 10lux was warranted as the design target for pre-curfew hours. All vertical spill calculations have been carried out on the relevant road boundaries. At this distance the proposed lighting installation is compliant to all requirements of the standard.

a) STANDARDS

- Australian Standard AS 4282 - 1997
- Australian Standard AS 3665

b) RELEVANT DEFINITIONS

- 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 e.g. signal lights.
- Spill Light (stray light) - Light emitted by a lighting installation which falls outside the boundaries of the property on which the installation is sited.
- Threshold Increment (TI) - The measure of disability glare expressed as a percentage in contrast required between an object and its background for it to be seen equally well with a source of glare present (note – higher levels of 'TI' correspond to greater disability glare.

# 2 NEW TOWER LOCATIONS

The development of the new Noble & Bradman stands impact on the location of lighting towers Nos 1 & 6. Tower 6 will be pulled down and relocated on the new lift shaft. Tower 1 will be pulled down and relocated behind the new stand in the service loading area.

Tower 6 is approximately 9m further back from the field of play than the current pole location & Tower 1 is approximately 21m further back from the field of play than the current pole location. The overall height of the towers and appearance of the headframes will not change.

The remaining 4 existing poles at the SCG will remain at their current locations.

## 3 OBTRUSIVE LIGHTING

The new sports lighting arrangements will not change the current levels of spill lighting emanating from the SCG by a huge amount and will still be below the levels required by the standards. The threshold increment criteria on the adjacent trafficable roads will also remain mostly unaffected and below the levels required by the standards.

Australian Standard AS 4282-1997 "Control of obtrusive effects of outdoor lighting" outlines the specific requirements applicable to items; with particular emphasis on training modes but not full international TV coverage.

The new lighting arrangements have been calculated and provide the following results for each switching mode of operation. These figures indicate compliance with standards:

These calculations were carried out for Compliance with AS4282 only and no conformity to AS2560 has been assessed. These detailed calculations will have be carried out during the design stage and compliance to AS4282 re-assessed.

| **Non Televised Training – 250 Lux Mode** | **Standards** | **Calculated** |
|---|---|---|
| Maximum Vertical Illuminance (spill) Moore Park Rd | 10 lux | 0.375 lux |
| Maximum Vertical Illuminance (spill) South Dowling Street | 10 lux | 0.125 lux |
| Maximum Vertical Illuminance (spill) Cook Rd | 10 lux | 0.25 lux |
| Maximum Threshold Increment Anzac Parade Bus Carriageway | 20% | 0% |
| Maximum Threshold Increment Driver Avenue | 20% | 0.5% |

| **Non Televised Match (M1) – 500 Lux Mode** | **Standards** | **Calculated** |
|---|---|---|
| Maximum Vertical Illuminance (spill) Moore Park Rd | 10 lux | 0.75 lux |
| Maximum Vertical Illuminance (spill) South Dowling Street | 10 lux | 0.125 lux |
| Maximum Vertical Illuminance (spill) Cook Rd | 10 lux | 0.50 lux |
| Maximum Threshold Increment Anzac Parade Bus Carriageway | 20% | 0% |
| Maximum Threshold Increment Driver Avenue | 20% | 0.875% |

| **Non Televised Match (M2) – 700 Lux Mode** | **Standards** | **Calculated** |
|---|---|---|
| Maximum Vertical Illuminance (spill) Moore Park Rd | 10 lux | 1.0 lux |
| Maximum Vertical Illuminance (spill) South Dowling Street | 10 lux | 0.25 lux |
| Maximum Vertical Illuminance (spill) Cook Rd | 10 lux | 0.75 lux |
| Maximum Threshold Increment Anzac Parade Bus Carriageway | 20% | 0% |
| Maximum Threshold Increment Driver Avenue | 20% | 1.125% |

| **Televised 1400 Lux Mode** | **Standards** | **Calculated** |
|---|---|---|
| Maximum Vertical Illuminance (spill) Moore Park Rd | EXEMPT | 14.375 lux |
| Maximum Vertical Illuminance (spill) South Dowling Street | EXEMPT | 1.75 lux |
| Maximum Vertical Illuminance (spill) Cook Rd | EXEMPT | 8.625 lux |
| Maximum Threshold Increment Anzac Parade Bus Carriageway | 20% | 0.375% |
| Maximum Threshold Increment Driver Avenue | 20% | 9.25% |

A map of the SCG area is provided in Appendix 1 for reference to the above table.

The Standards relate only to light from a proposed installation and refers only to the direct component of light from luminaries, not the reflected component from building surfaces.
The calculated direct illuminance from the site would be additional to the values from any existing lighting.

Lighting Calculations were carried out with the following assumptions:

A) Significant reductions in the light technical parameters occur in service, primarily as a result of a gradual depreciation in lamp light output and an accumulation of dirt on the transmitting or reflecting surfaces of the luminaires. In order to replicate a worst case scenario a maintenance factor of 0.8 was assumed for the calculations.
B) Classification Of Road Surfaces For Luminance Calculations was assumed as R3 which has the following characteristics (a) Asphaltic concrete (cold, mastic asphalt) with gravel sizes up to 10 mm but with harsh texture (sandpaper) & (b) Surface dressings with coarse texture but polished (Characteristics as defined in CIE Publication No. 30.2)
C) For the purposes of calculations the streets were considered free of trees, vehicles, buildings and any other obstructions.
D) All calculations are subject to accuracies and tolerances nominated in Australian and New Zealand Standards AS/NZS 3827.1:1998 and AS/NZS 3827.2:1998.

## 4 LUMINAIRE LUMINOUS INTENSITY

The luminous intensity of the luminaire within the new installation is calculated to comply with **Level 2 Control** as set out in Table 2.2 of AS 4282-1997 (Appendix 2).

| | | | |
|---|---|---|---|
| At Max Tilt - 60° | Training Mode | : 9,000 cd | |
| | Match 1 | : 9,000 cd | Type 2, 3, 4 luminaires used |
| | Match 2 | : 9,000 cd | |
| At Max Tilt - 70° | T.V. Mode | :100,000 cd on selected luminaires on the 65° - 70° | As above plus Type 1 |

As can be seen under the training and match modes 1 & 2, the lighting criteria of level 1 in table 2.2 (Appendix 2) is close to being complied with, despite this not being a requirement of this development. The requirement of this development, being Level 2, has been complied with as indicated.

## 5 SKY GLOW/SPILL LIGHT

AS4282 defines Sky Glow and spill light as the following:

Sky glow as "the brightening of the night sky that results from the reflection of radiation (visible and non-visible), scattered from the constituents of the atmosphere (gaseous, molecules, aerosols, and particulate matter), in the direction of observation. It comprises two separate components as follows:

> **Natural sky glow** – that part of the sky glow, which is attributable to radiation from celestial sources and luminescent processes in the Earth's upper atmosphere.
>
> **Artificial sky glow** – that part of the sky glow which is attributable to man-made sources of radiation (eg outdoor electrical lighting), including radiation that is emitted directly upwards and radiation that is reflected from the surface of the Earth.

Spill lighting is defined as light emitted by a lighting installation, which falls outside the boundaries of the property on which the installation is sited. Our assessment is based on an area extending 500m, in each direction, from the centre of the SCG pitch.
Covering the above area we have assessed the 250/500 lux training modes and 1400 lux TV mode for UWLR (Upward Waste Light Ratio).

At 250/500 lux we calculate an UWLR of only 1.1%. At the 1400 lux mode we calculate an UWLR of only 1.4%.

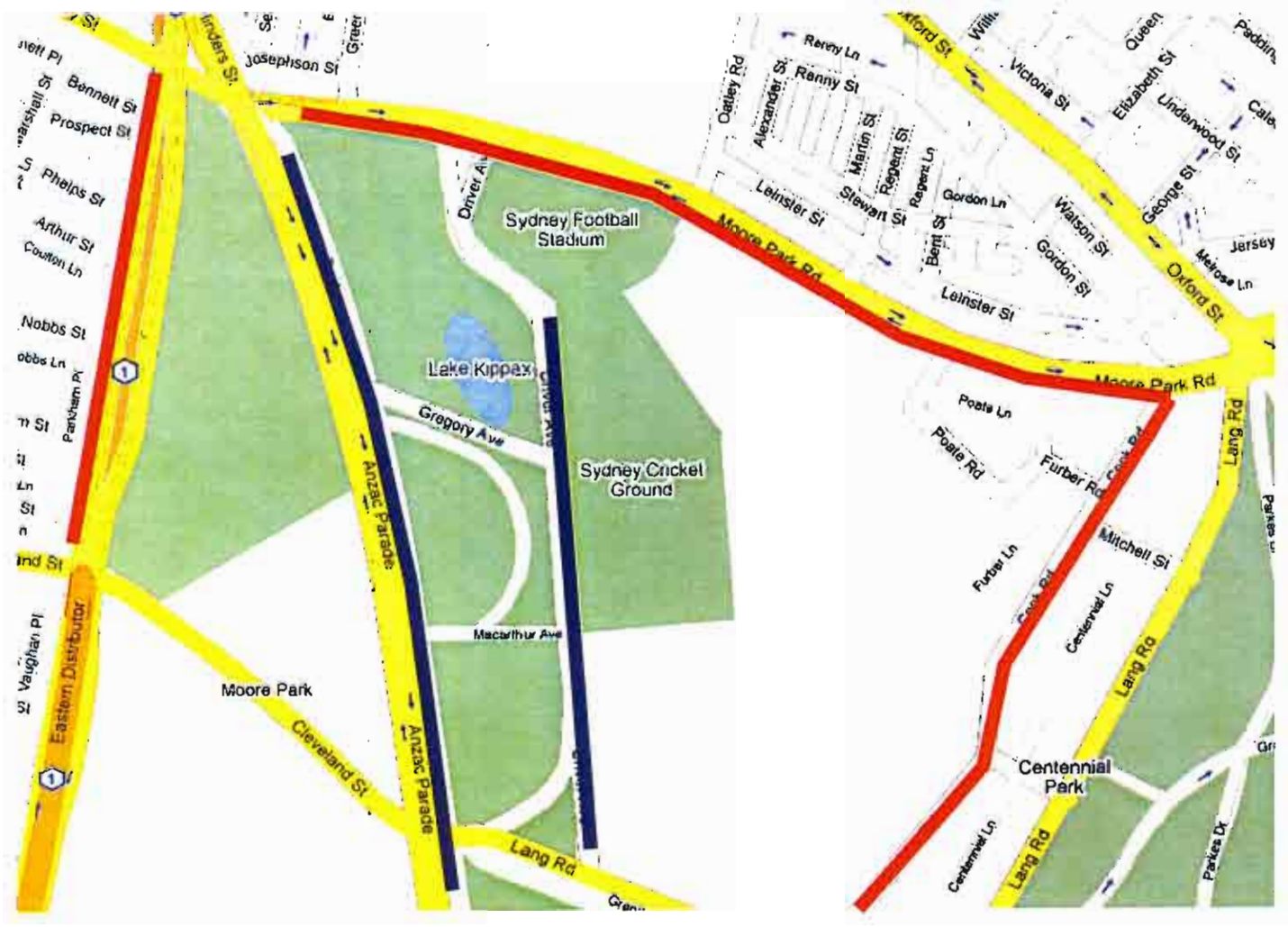
These values are direct from the floodlight with no contribution from inter-reflection.

The percentage of light (energy) being wasted is minimal due to the precisely controlled distribution of this type of floodlight. Although there are 5 beam widths luminaires used on the project they are all symmetric type distributions. The use of an internal baffle within the floodlight adjusts the symmetric distribution slightly, but more importantly reduces the direct component skyward and secondly increases the utilisation factor by directing more light towards the field of play.

The new installation therefore complies with this part of the standard.

WEBB

## APPENDIX 1 - OBTRUSIVE LIGHT – CALCULATED AREAS




- Red blocks
  - South Dowling Street, Moore Park Road, Cook Road
  - Spill light calculation area
- Blue Blocks
  - Anzac Parade bus lane, Driver Avenue
  - Threshold Increment calculation area

# APPENDIX 2 - TABLE 2.1 & TABLE 2.2 OF AS4282-1997

## TABLE 2.1

## RECOMMENDED MAXIMUM VALUES OF LIGHT TECHNICAL PARAMETERS FOR THE CONTROL OF OBTRUSIVE LIGHT

(See Clause 2.7)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Light technical parameter | Application or calculation conditions (see also Figure 2.1 and Section 5) | Recommended maximum values | | |
| | | In commercial areas or at boundary of commercial and residential areas* | Residential areas | |
| | | | Light surrouuds† | Dark surrounds‡ |
| Illuminance in vertical plane ($E_v$) | *Pre-curfew:* Limits apply at relevant boundaries of nearby residential properties. in a vertical plane parallel to the relevant boundary. to a height commensurate with the height of the potentially affected dwellings. Values given are for the direct component of illuminance | 25 lx | 10 lx | 10 lx |
| | *Curfewed hours:* Limits apply in the plane of the windows of habitable rooms of dwellings on nearby residential properties. In the absence of development (i.e. vacant allotment). the limits apply on the potentially affected property. in a vertical plane parallel to the relevant boundary. at the minimum setback permitted for a dwelling. to a height commensurate with land use zoning provisions. Values given are for the direct component of illuminance | 4 lx | 2 lx | 1 lx |
| Luminous intensity emitted by luminaires ($I$) | *Pre-curfew:* Limits apply to each luminaire (irrespective of the number on a head frame) in the principal plane. for all angles at and above the control direction. when aimed in accordance with the installation design | Limits as determined from Table 2.2. Alternatively. the limits and method of assessment associated with curfewed hours may be applied. at the discretion of the designer (see Clauses 2.7.1 and 2.7.2) | | |
| | *Curfewed hours:* Limits apply in directions where views of bright surfaces of luminaires are likely to be troublesome to residents. from positions where such views are likely to be maintained. i.e. not where momentary or short-term viewing is involved | 2 500 cd | 1 000 cd | 500 cd |
| Threshold increment ($TI$) | Limits apply at all times where users of transport systems are subject to a reduction in the ability to see essential information. Values given are for relevant positions and viewing directions in the path of travel | 20% based on adaptation luminance ($\bar{L}$) of 10 cd·m$^{-2}$ | 20% based on adaptation luminance ($\bar{L}$) of 1 cd·m$^{-2}$ | 20% based on adaptation luminance ($\bar{L}$) of 0.1 cd·m$^{-2}$ |

* Applies to residential accommodation in commercial areas or at the boundary between commercial and residential areas. The term 'commercial' is used as a generic description for zoning which provides for urban uses other than residential.

† Where the affected property abuts roads that are lit to Category V5 or higher in accordance with AS/NZS 1158.1.1.

‡ Where the affected property abuts roads that are lit to Category B1 or lower in accordance with AS 1158.1, or where there is no lighting.

## TABLE 2.2

## MAXIMUM LUMINOUS INTENSITY PER LUMINAIRE FOR PRE-CURFEW OPERATING TIMES

(See Table 2.1)

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| Area description | | Maximum luminous intensity from each luminaire* | |
| Size of area | Controlling dimension (Figure 5.1) | Level 1 control (Note 1) | Level 2 control (Note 2) |
| Large | >75 m | 7 500 cd | 100 000 cd |
| Medium | ≥25 m ≤75 m | 7 500 cd | 50 000 cd |
| Small | <25 m | 2 500 cd | 25 000 cd |

* Limits apply to each luminaire (irrespective of the number on a head frame) in the principle plane, for all angles at and above the control direction, when aimed in accordance with the installation design (see Clause 5.3.2.1).

NOTES:

1 Level 1 control is appropriate for development control of environmentally sensitive areas, i.e. where the existing environment is of high quality, where abutting properties are close to the installation, where they are residential in nature, where the existing ambient light levels are low and where the community requires the best available environmental safeguards to be applied.

As the use of Type C cut-off luminaires† is likely to be necessary for Level 1 control, the implementation of this level of control will normally be possible only for lighting applications that require relatively high illuminances over areas that are small to medium in size, e.g. lighting for tennis courts or hockey fields. However, Level 1 control may also be suitable for larger areas where lower illuminances are appropriate, e.g. for car parks and outdoor storage areas.

2 Level 2 control will permit the use of a wide range of currently used lighting techniques but will limit intensities in the control direction to what might reasonably be expected by careful attention to design and the selection and aiming of luminaires, especially for applications involving Type A luminaires†.