

11 OPERATIONAL LIGHTING

Operational lighting throughout the project generally falls across five categories:

- Street lighting for all surface works
- Cycleway and footpath lighting
- General external areas lighting for all service facilities
- Tunnel lighting
- Tunnel portals feature lighting.

Light spill mitigation is also assessed within this section.

The general design approach for each of the above general lighting categories is described below.

11.1 Lighting types

Street Lighting

Street lighting across the project has been designed in accordance with AS/NZS 1158 Series - Lighting for Public Roads and Spaces which requires a Category V3 lighting system for all street lighting.

Poles and luminaires are required to be in accordance with RMS standard specifications and generally consistent with existing street lighting in the area. Poles are of the galvanised steel impact absorbing type with heights and outreach arms to RMS specifications. Poles and outreach arms have been selected to achieve a typical luminaire mounting height of 10.5m. Outreach arms lengths are limited to a maximum length of 4.5m in order to maintain the required overhang for the various locations.

Where possible poles will be positioned outside of the clear zone. In some circumstances poles may be mounted on or behind retaining walls and barriers. On bridges, poles will be aligned behind the bridge rail.

Roadway luminaires are to RMS specifications, incorporating high pressure sodium lamps, high power factor control gear and active reactor.

Street light locations are shown on the landscape design drawings in Section 9.

Cycleway and Footpath Lighting

Cycleways have been provided with lighting to the performance requirements of Table 4.5 in Austroads Guide to Road Design Part 6B: Roadside Environment. This level of lighting also achieves compliance with the requirements of Category P2 lighting as defined in AS/NZS 1158 Series - Lighting for Public Roads and Spaces.

Where cycleways are located directly adjacent to lit Category V roadways no separate lighting system has been provided for the cycleway.

Cycleway and footpath light locations are shown on the landscape design drawings in Section 9.

General external area lighting for all service facilities

General external area lighting will be provided where necessary for safety and security at the various motorway service facilities including:

- Motorway control centre and maintenance facility
- Underwood Road ventilation facility
- Ismay Ave 33 kv substation facility
- Concord Road substation
- Cintra Park Facilities
- Parramatta Road ventilation facility

Tunnel Lighting

Tunnel lighting is a specialist activity that is required to be implemented for the safe and effective operation of the motorway in accordance with various technical standards and performance requirements including:

- AS/NZS 1158.5:2014 Lighting for roads and public spaces - Tunnels and underpasses
- RMS Specification – R158 Road Tunnel and Underpass Lighting

Tunnel lighting has no impact on any areas outside the tunnel environment and so there is no further consideration required of potential impacts in relation to light spill.

Tunnel Portals Feature Lighting

Each tunnel portal will also include subtle feature lighting to each entry and exit. They will provide night time interest and present a memorable experience that will brand the WestConnex motorway within the wider Sydney road network.

The lighting consists of LED strip lights that are concealed in a shallow rebate within the tunnel dive approach walls.

Note : Operation of outdoor operational lighting that would impact the facade of residents properties is currently not approved by Department of Planning and Environment

11.2 Operational lighting impacts

The operational lighting design for the M4 East project was assessed to determine impacts of lighting on residents in the vicinity of the project.

The Condition of Approval B50 requires the project construct and operate a lighting which minimises light spillage at residential properties and is generally consistent with the requirements of Australian Standard 4282-1997 Control of the obtrusive effects of outdoor lighting.

Section 1.4.10 of AS4282:1997 excludes public lighting (including lighting provided for the purposes of all-night safety and security on public roads) from the light spill requirements of AS4282 as such lighting is provided to facilitate all-night safety and security for the public at large. Based on this the Project lighting is deemed consistent with the requirements of Australian Standard 4282-1997 Control of the obtrusive effects of outdoor lighting.

The lighting design for the Homebush Bay Drive, Concord Road, Wattle Street and Parramatta Road zones was initially reviewed against the location of potentially affected residential properties. It was found that there are no residential properties that front onto project roads in the Homebush Bay Drive zone, therefore no further assessment was completed. Further assessment was completed for the Concord Road, Wattle Street and Parramatta Road zones and is outlined below.

Assessment of lighting fittings

The Project assessed the light spill properties of six varieties of light fittings which met Roads and Maritime specifications, selecting fitting that provides the lowest level of light spill whilst still providing the required level of luminance at the roads.

An assessment of the raw light distribution from standard inventory Sylvania Roadster luminaires (Aeroscreen, Semi cut-off, Semi cut-off plus glare shield, Forward throw) and the Rexel Optispan luminaire was undertaken. The assessment found that the glare shield and forward throw optic Sylvania Roadster luminaire options provided the greatest level of light spill minimisation at residential properties due to their reduced backward light distribution in comparison to both standard semi cut-off and aeroscreen luminaires.

Although AS4282 excludes public light, the AS4284 light spill calculation assessment was then completed for all types of luminaires, based on a typical section of Wattle Street between Parramatta Road and Ramsay Street where existing residences front onto Wattle Street. This location was selected due to the close proximity of residents to the project road. The spacing of luminaires modelled was typical for the lighting system required for the project (Category V3 in accordance with AS1158) and an average property line setback for Wattle Street was considered.

The assessment confirmed that luminaires incorporating the glare shield or forward throw optic produce the least amount of illuminance on the vertical façade of properties based on the calculation methods of AS4282.

Mitigation Measure

Following the assessment of lighting fittings, the project elected to mitigate and minimise light spill by utilising the Sylvania Roadster Semi cut-off luminaire incorporating the glare shield optic in areas of the design where residences front onto and/or border the new project works in close proximity.

Light distribution illuminance contour diagrams

The first two following figures indicate two light distribution illuminance contour diagrams indicative of Sylvania Roadster and Rexel Optispan semi cut-off and aeroscreen luminaires. Both exhibit a significant light distribution in the backwards direction.

The third figure indicates the light distribution illuminance contour diagram indicative of the Sylvania Roadster semi cut-off luminaire incorporating glare shield. An image of the luminaire incorporating the glare shield with an internal thermal paint finish is also indicated below. The glare shield provides a reduced backward light distribution.

The final figure indicates the light distribution illuminance contour diagram indicative of the Sylvania Roadster semi cut-off luminaire incorporating a forward throw optic for light distribution. The forward throw optic provides a reduced backward light distribution similar to the glare shield option.

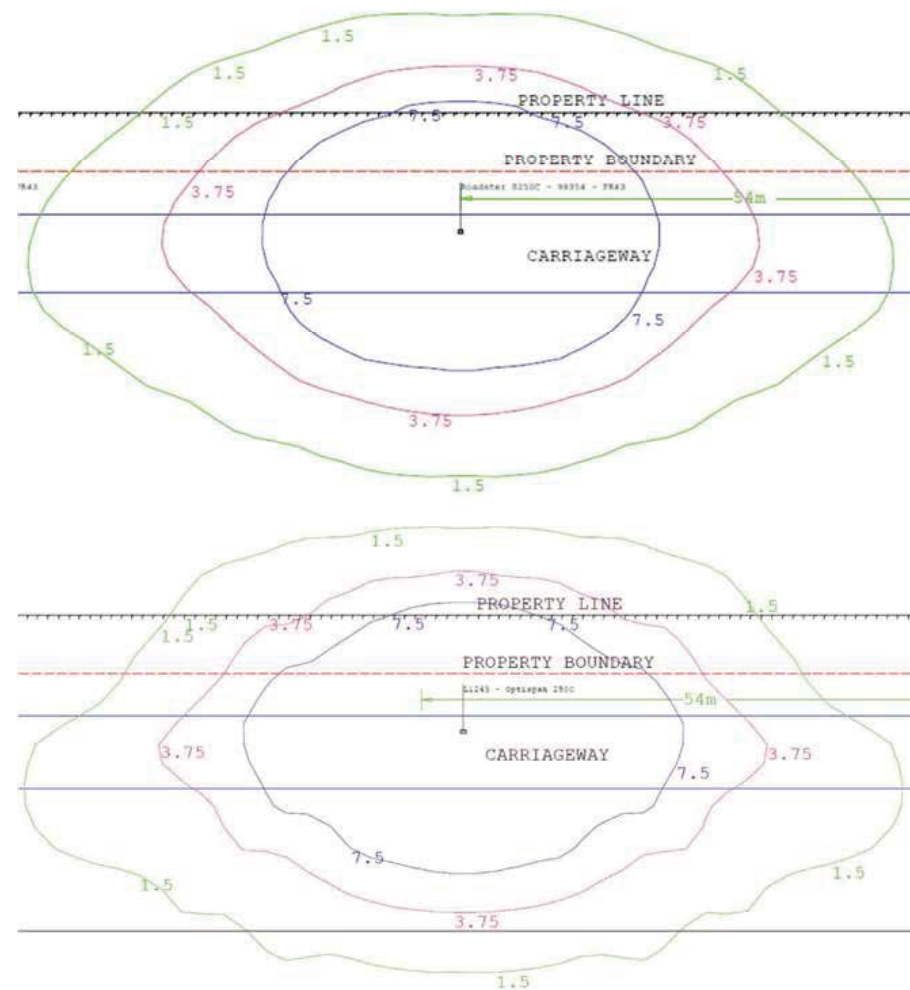


Figure 11-1 - Light distribution illuminance contour diagrams are indicative of Sylvania Roadster and Rexel Optispan semi cut-off luminaires

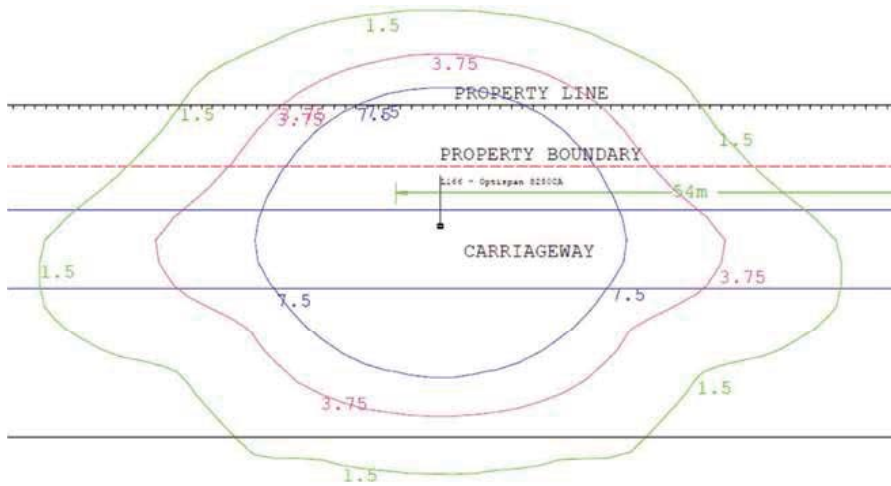
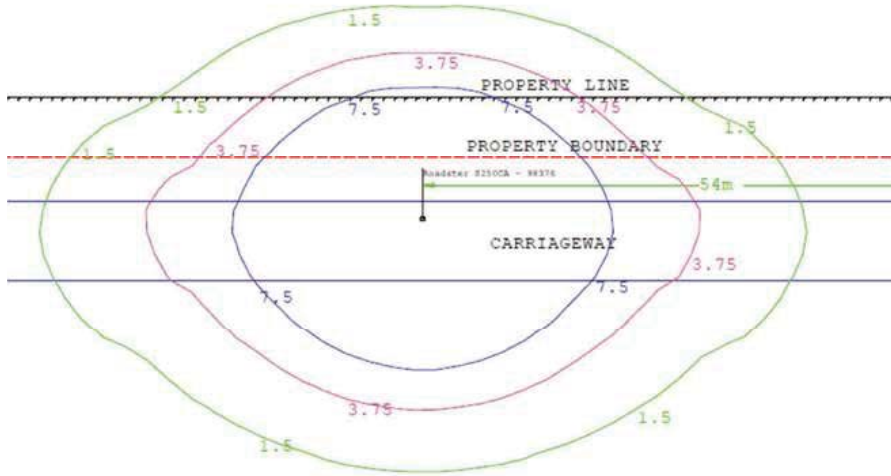


Figure 11-2 - Light distribution illuminance contour diagrams are indicative of Sylvania Roadster and Rexel Optispan aeroscreen luminaires

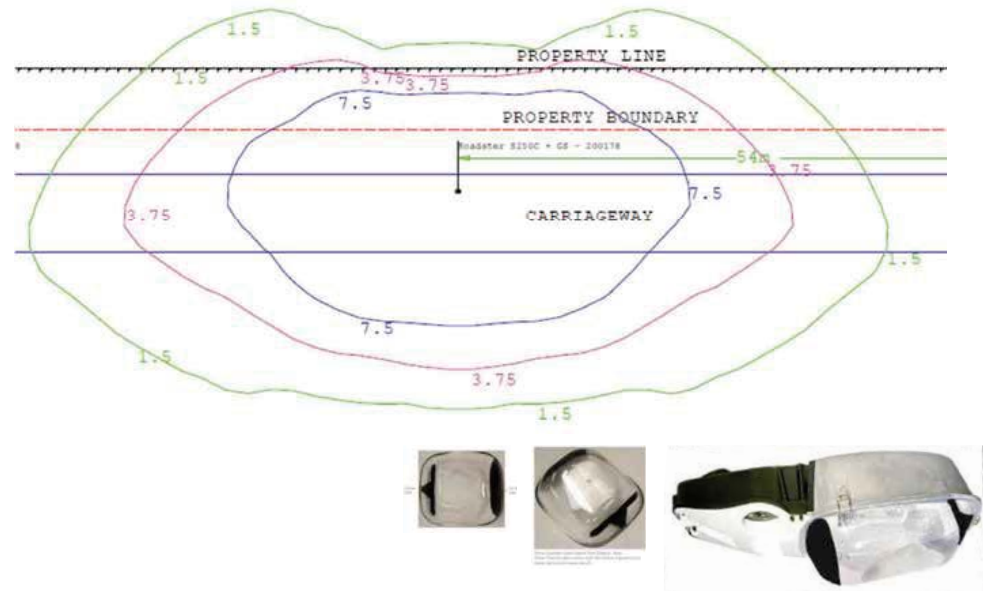


Figure 11-3 - Light distribution illuminance contour diagram indicative of Sylvania Roadster with glare shield visor

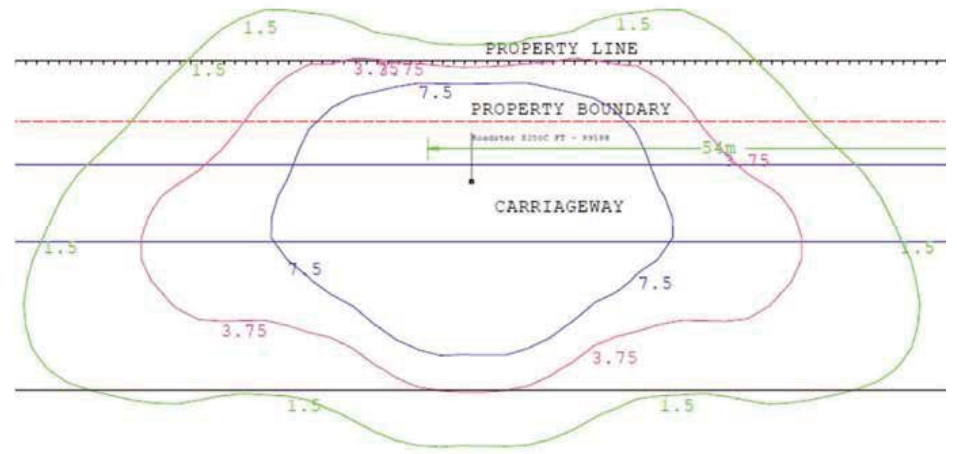


Figure 11-4 - Light distribution illuminance contour diagram indicative of Sylvania Roadster with forward throw light distribution

11.3 Assessment of light spill

The project further assessed light spill associated with the Sylvania Roadster Semi cut-off luminaire (incorporating the glare shield optic) at representative locations within the Concord Road, Wattle Street and Parramatta Road Project Zone.

As AS4282 excludes public lighting provided for the purposes of all-night safety and security on public roads, the impacts of operational lighting were assessed by comparing the illuminance of existing lighting along project roads and the proposed lighting design. The exact location of light poles on project roads has shifted to ensure the lighting system is compliant with Category V3, in accordance with AS1158. As a result of these changes some residents will experience greater illuminance and some less illuminance, therefore changes in illuminance have been averaged within sections of project road.

The assessment calculations are for the direct component of illuminance and do not consider existing obstacle and shielding elements within residential properties. Where the existing luminaire model and lamp data cannot be obtained from visual inspection, the supply authority GIS data has been consulted for lamp data and a luminaire of the same type (eg. Aeroscreen or semi cut-off) has been used in the assessment.

The results of this assessment for Concord Road, Wattle Street and Parramatta Road are provided below. Through the installation of Sylvania Roadster Semi cut-off luminaire (incorporating the glare shield optic) the assessment demonstrates that illuminance levels within the Concord Road, Wattle Street and Parramatta Road zones do not significantly increase and therefore lighting impacts are minimised.

Comparison between light spill performance between existing installation and proposed design, on representative properties at the Concord Road Interchange.

Residence	Existing Lighting Max Illuminance (lux)	Glare Shield Luminaires Max Illuminance (lux)
74 Concord Road	8.1	8.9
76 Concord Road	4.7	3.2
78 Concord Road	5.8	7.7
80-82 Concord Road	11.8	13.4
84-86 Concord Road	2.1	3.9
20 Edward Street	0.7	7.0
18 Edward Street	0.4	4.1
29 Sydney Street	9.2	3.6
27 Sydney Street	12.3	5.3
Average	6.1	6.3
Average Difference (Lux)		+0.2

Please note that the residence at 22 Edward Street was also assessed and found to have an existing maximum illuminance of 1.6 lux and a proposed maximum illuminance of 14.7 lux. However, as this property has been acquired by RMS, it has not been included in the comparison table.

Comparison between light spill performance between existing installation and proposed design, on abutting properties at the Wattle street Interchange.

Residence	Existing Lighting Max Illuminance (lux)	Glare Shield Luminaires Max Illuminance (lux)
261 Ramsay Street	40	24.1
166 Ramsay Street (From Ramsay Street)	8.3	19.4
166 Ramsay Street (From Wattle street)	27.2	13.3
56 Wattle Street	6.8	5.3
50-52 Wattle Street	5.8	7.2
46-48 Wattle Street	7.9	7.1
44 Wattle Street	5.8	5.2
42 Wattle Street	4.6	5.5
40 Wattle Street	3.3	5.6
20 Wattle Street	4.4	4.9
18 Wattle Street	9.2	8.5
64 Wattle Street	7.5	12.7
34 Walker Avenue	0.1	2.4
44 Walker Avenue	0.1	2.1
50 Walker Avenue	0.2	2.2
154 Ramsay Street	1.3	6.8
Average	8.3	8.3
Average Difference (Lux)		0.0

Comparison between light spill performance between existing installation and proposed design, on representative properties at the Parramatta Road Interchange

Residence	Existing Lighting Max Illuminance (lux)	Glare Shield Luminaires Max Illuminance (lux)
7 Loftus Street	0.2	2.4
13 – 17 Loftus Street	0.1	2.3
19 Loftus Street	0.1	2.4
77 – 79 Chandos Street	0.1	4.0
98 Chandos Street	0.2	4.5
179 Parramatta Road	11.9	5.7
Average	2.1	3.6
Average Difference (Lux)		+1.5



Aerial view over Wattle Street portals (Artists impression only)