

Australian/New Zealand Standard™

Lighting for roads and public spaces

Part 3.1: Pedestrian area (Category P) lighting—Performance and design requirements



AS/NZS 1158.3.1:2020

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Australian Local Government Association
Centre for Pavement Engineering Education
CIE Australia
Consumers Federation of Australia
Department of Planning, Transport and Infrastructure, SA
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This Standard was issued in draft form for comment as DR AS/NZS 1158.3.1:2018.

Australian/New Zealand Standard™

Lighting for roads and public spaces

Part 3.1: Pedestrian area (Category P) lighting—Performance and design requirements

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee LG-002, Lighting for Roads and Public Spaces, to supersede AS/NZS 1158.3.1:2005, *Lighting for roads and public spaces, Part 3.1: Pedestrian area (Category P) lighting—Performance and design requirements*.

This Standard forms Part 3.1 of the AS/NZS 1158 series, which covers lighting schemes for the generality of roads and outdoor public areas.

The AS/NZS 1158 series consists of the following:

AS/NZS

- 1158 Lighting for roads and public spaces
- 1158.0 Part 0: Introduction
- 1158.1.1 Part 1.1: Vehicular traffic (Category V) lighting—Performance and design requirements
- 1158.1.2 Part 1.2: Vehicular traffic (Category V) lighting—Guide to design, installation, operation and maintenance
- 1158.2 Part 2: Computer procedures for the calculation of light technical parameters for Category V and Category P lighting
- 1158.3.1 Part 3.1: Pedestrian area (Category P) lighting—Performance and design requirements (this Standard)
- 1158.4 Part 4: Lighting of pedestrian crossings
- 1158.5 Part 5: Tunnels and underpasses
- 60598 Luminaires
- 60598.2.3 Part 2.3: Particular requirements—Luminaires for road and street lighting (IEC 60598-2-3, Ed.3.1 (2011) MOD)

SA/SNZ TS

- 1158 Lighting for roads and public spaces
- 1158.6 Part 6: Luminaires—Performance

The significant technical changes that have been made in this Standard in relation to the 2005 edition include the following:

- (a) Separation of previous Table 2.6 into the differing requirements for lighting of ‘local roads’ and ‘cyclist paths’.
- (b) Clarification of glare requirements for high intensity discharge luminaires and new requirements for SSL light sources.
- (b) Additional and revised layout rules for typical road layouts.
- (d) Additional information relating to SSL light sources.
- (e) Additional requirements for surround illuminance.
- (f) Updated data on the specification of minimum ingress protection requirements for various maintenance factors and requirements regarding assumed and actual maintenance regimes and maintenance intervals.
- (g) Additional lighting level for lighting of external car parking areas.
- (h) New requirements relating to energy measures if required.
- (i) Additional option for specifying minimum environmental spill levels for local roads.

This joint Standard is intended to be applied in its entirety in Australia and New Zealand; however, a number of differences exist with respect to the requirements that apply in each country. These are indicated by the qualification 'In Australia' or 'In New Zealand', or similar.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a Standard, whereas an 'informative' appendix is only for information and guidance.

Statements expressed in mandatory terms in footnotes to tables are deemed to be requirements of this Standard.

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FOREWORD

The performance criteria for road and public space lighting schemes can include any or all of the three basic aims of—

- (a) facilitation of safe movement;
- (b) reduction of the fear of crime at night; and
- (c) contributing to the amenity of an area through increased aesthetic appeal.

However, as the most common primary aim of a scheme is that of safe movement of people, the series divides road and public space lighting into two broad categories — Category V lighting and Category P lighting, as defined in AS/NZS 1158.0.

This Standard sets out performance and design requirements for Category P lighting schemes having regard to the safe movement of pedestrians, degree of activity (of pedestrians and vehicles), the fear of crime and the need to enhance the amenity of the locality. It should be read in conjunction with AS/NZS 1158.2, which sets out calculation procedures.

Category P lighting is acknowledged to be an effective counter measure to the fear of crime.

The effects that blue light can have on human melatonin suppression and circadian rhythm disruption have begun to be explored extensively in the literature. However, there seems to be no definitive levels of amount, duration and timing which would give guidance to this document.

For each lighting subcategory described in this Standard, the light technical parameters (LTPs) and their prescribed values are both necessary and sufficient for the particular application. Conformance to this Standard will be achieved by meeting all the required values of the LTPs for the designated subcategory. A higher quality of lighting scheme can be achieved within a subcategory by, for example, increasing the minimum level of uniformity or reducing the glare allowable, or both.

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Australian/New Zealand Standard
Lighting for roads and public spaces

Part 3.1: Pedestrian area (Category P) lighting—Performance and design requirements

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE AND APPLICATION**1.1.1 Scope**

This Standard specifies performance and design requirements for Category P lighting schemes as described in AS/NZS 1158.0. It also specifies the luminaire data and other data that is needed to facilitate the lighting design and the assessment of conformance to the requirements of this Standard.

This Standard assigns various levels of required performance based on an assessment of degree of activity, fear of crime and the required aesthetic appeal (i.e. ‘amenity’). In achieving the required performance, attention is paid to minimizing adverse effects on the night time environment.

This Standard does not apply to roads in which one or a number of luminaires may be installed at irregular intervals on an otherwise unlit road, nor to additional luminaires installed in lit roads for reasons of increased security, including instances where such luminaires are typical of those used in Category P lighting schemes.

This Standard does not cover lighting intended specifically as security lighting for building exteriors, nor does it cover lighting for video surveillance. However, where video surveillance is provided, the lighting principles and performance requirements expressed in this Standard still apply.

This Standard does not cover lighting requirements for ‘wayfinding’ or ‘waypoint’ lighting where lights are intended to provide a guide rather than to provide a particular level of illumination.

This Standard does not apply in Australia to public transport areas where the mandatory requirements of the *Disability Discrimination Act 1992 (Cth)* and subordinate instruments including the *Disability Standards for Accessible Public Transport 2002 (Cth)* (DSAPT) and the *Disability (Access to Premises – Buildings) Standards 2010 (Cth)* (Premises Standards) are applicable. See Clause 2.1.

This Standard is intended to be read in conjunction with AS/NZS 1158.0, AS/NZS 1158.2, AS/NZS 1158.1.1, AS/NZS 60598.2.3 and SA/SNZ TS 1158.6, which specify related provisions that may require consideration.

1.1.2 Application

Subject to the requirements of applicable laws, the choice of whether to install a scheme of road or public space lighting in conformance to this Standard and, if so, which subcategory of lighting is appropriate, rests with the client (usually the applicable road controlling authority). This decision is typically based on factors such as night-time pedestrian traffic flows and other patterns of use.

1.2 NORMATIVE REFERENCES

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document.

NOTE: Documents for informative purposes are listed in the Bibliography. Following the informative referenced documents, related documents that are considered useful sources of information on the subject of this Standard are provided.

AS

- 1742 Manual of uniform traffic control devices
- 1742.13 Part 13: Local area traffic management

AS ISO/IEC

- 17025 General requirements for the competence of testing and calibration laboratories

AS/NZS

- 1158 Lighting for roads and public spaces
- 1158.0 Part 0: Introduction
- 1158.1.1 Part 1.1: Vehicular traffic (Category V) lighting—Performance and design requirements
- 1158.1.2 Part 1.2: Vehicular traffic (Category V) lighting—Guide to design, installation, operation and maintenance
- 1158.2 Part 2: Computer procedures for the calculation of light technical parameters for Category V and Category P lighting

CIE*

- S 025/E Test Method for LED Lamps, LED Luminaires and LED Modules

IESNA

- LM-79-19 Electrical and Photometric Measurements of Solid-State Lighting Products
- LM-80-15 IES Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules
- LM-84-14 Approved Method for Measuring Luminous Flux and Color for Maintenance of LED Lamps, Light Engines and Luminaires
- TM-21-11 Projecting Long Term Lumen Maintenance of LED Light Sources

NEW ZEALAND TRANSPORT AGENCY

Traffic Control Devices Manual

1.3 DEFINITIONS

For the purpose of this Standard, the definitions given in AS/NZS 1158.0 and the following apply.

1.3.1 Competent person

A person who has acquired, through education, training, qualification or experience or a combination of these, the knowledge and skill enabling that person to perform the task required as determined by the client.

1.3.2 Initial lamp lumens (for non-SSL luminaires)

The total luminous flux emitted by a light source after 100 h of operation.

1.3.3 Initial luminaire lumens (for SSL luminaires)

The total luminous flux emitted by the SSL luminaire as photometered according to CIE S 025/E or IESNA LM-79-19.

* International Commission on Illumination, Vienna.

1.3.4 Solid state lighting (SSL)

A group of devices that embody p-n junctions that emit visible radiation when excited by an electric current. They can be further defined by the type of technology used, i.e. light-emitting diodes (LEDs), organic light-emitting diodes (OLEDs) or polymer light-emitting diodes (PLEDs).

1.4 SYMBOLS AND ABBREVIATIONS

For the purpose of this Standard, the symbols and abbreviations given in AS/NZS 1158.0 apply.

SECTION 2 OBJECTIVES AND DETERMINATION OF LIGHTING SUBCATEGORIES

2.1 ROAD AND PUBLIC SPACE CLASSIFICATION

Figure 2.1 shows representative land use types and associated road and public space classifications together with the applicable lighting categories and subcategories.

NOTE: Selection of the appropriate lighting subcategory for a road or public space is governed by Tables 2.1 to 2.5 for Category P areas and AS/NZS 1158.1.1 for Category V areas.

The exact names of the various road types and their associated operating characteristics may vary between relevant authorities. In addition, the layout of roads in older suburbs may not conform to the schematic layout shown in Figure 2.1. In particular, the local roads and some arterials might coalesce into a grid arrangement of roads. It is therefore important that the documentation for the lighting design clearly states the road or public space type and associated lighting subcategory that have been assigned.

When determining the applicable lighting category and subcategory each separate element needs to be assessed by considering its own particular operational characteristic. Special attention should be given to the likely night time usage. This may differ with respect to traffic density or the presence of pedestrians to that existing during the day. For example, a neighbourhood collector road may have relatively low traffic volumes with pedestrian activity during the day, but at night be used by heavy vehicles servicing industrial or retail precincts.

Public spaces within public transport boundaries (including, but not limited to, walkways, pedestrian crossings, disability car parking spaces) are subject to Commonwealth Legislation. Designers should refer to the DSAPT and the Premises Standards, which contain specific illumination requirements, and to AS 1428.2—1992. Further information on the implementation on both of the DSAPT and the Premises Standards is available from their guidelines. Otherwise public spaces surrounding public transport boundaries shall be classified in accordance with this Standard.

2.2 GENERAL OBJECTIVES

The major purposes of the lighting covered in this Standard are to assist pedestrians to orientate themselves and detect potential hazards, and to reduce fear of crime while protecting the integrity of the night time environment through control of obtrusive light and glare. The lighting may also be used to enhance the amenity of the location and should be designed to minimize any obtrusive effects.

The lighting, with certain exceptions, is not designed to provide drivers with enhanced and adequate visibility if motor vehicle traffic is present at the location. Drivers need to use the vehicle headlights for visibility. The exceptions are LATM devices and where there is interactive pedestrian and vehicular activity present in designated areas, e.g. transport interchanges, car parks.

The provision of road lighting should not compromise other road safety objectives, e.g. by creating a potential collision hazard through the use of road lighting poles/columns that are of an inappropriate type or that are inappropriately placed.

NOTE: Refer to appropriate appendix of AS/NZS 1158.1.2 for guidance on the selection and locations of road lighting columns and poles.

2.3 DESIGN OBJECTIVES

2.3.1 Principal objectives

The principal design objectives for Category P lighting are to provide the following:

- (a) Illuminance and uniformity of illuminance over the designated area to a specified level.
- (b) Glare control to a specified level.
- (c) Limitation of upward light from luminaires to a specified level.
- (d) Limitation to a specified level of the obtrusive light into properties that abut the lit area.
- (e) A lighting scheme that conforms to this Standard at all times during each maintenance cycle over the life of an installation.
- (f) Minimization of energy consumption.

The specified levels of illuminance depend on the particular lighting subcategory involved (see Tables 2.1 to 2.5 inclusive).

These objectives are realized by a combination of the choice of relevant lighting subcategory and appropriate design procedure, leading to luminaire light output distribution and lighting scheme geometry appropriate to the configuration and dimensions of the location being lit.

Road surface reflection properties are not taken into account in the design of Category P lighting for roads.

2.3.2 Other considerations

Other aspects of a road or public space lighting scheme will affect the initial and long-term performance quality. These include the following:

- (a) Reliability and maintainability over the service life of the selected hardware components.
- (b) Energy efficiency.
- (c) Ability to complement or enhance the visual amenity of the illuminated route or area by the aesthetics of the installation, including the use of light with good colour rendering properties (see Clause 3.3).
- (d) Life cycle costs of the scheme.

2.4 LIGHTING SUBCATEGORIES AND THEIR APPLICATION

For the purpose of this Standard the lighting subcategories set out in the following tables are:

- (a) For roads in local areas (PR)—Table 2.1.
- (b) For pathways (PP)—Table 2.2.
- (c) For public activity areas (excluding car parks) (PA)—Table 2.3.
- (d) For connecting elements (PE)—Table 2.4.
- (e) For outdoor car parks (including roof-top car parks) (PC)—Table 2.5.

Tables 2.1 to 2.5 set out the general application and operating characteristics of the roads or public spaces to which the lighting subcategories apply. Figure 2.1 illustrates indicative lighting subcategories for a range of road and public space types on a schematic locality plan.

The concept of using relative terms is employed since it would be both unrealistic and impractical to apply one numerical set of values, for each of the selection criteria, to the lighting level hierarchy to accommodate the relevant requirements of each town, city, etc., across both Australia and New Zealand.

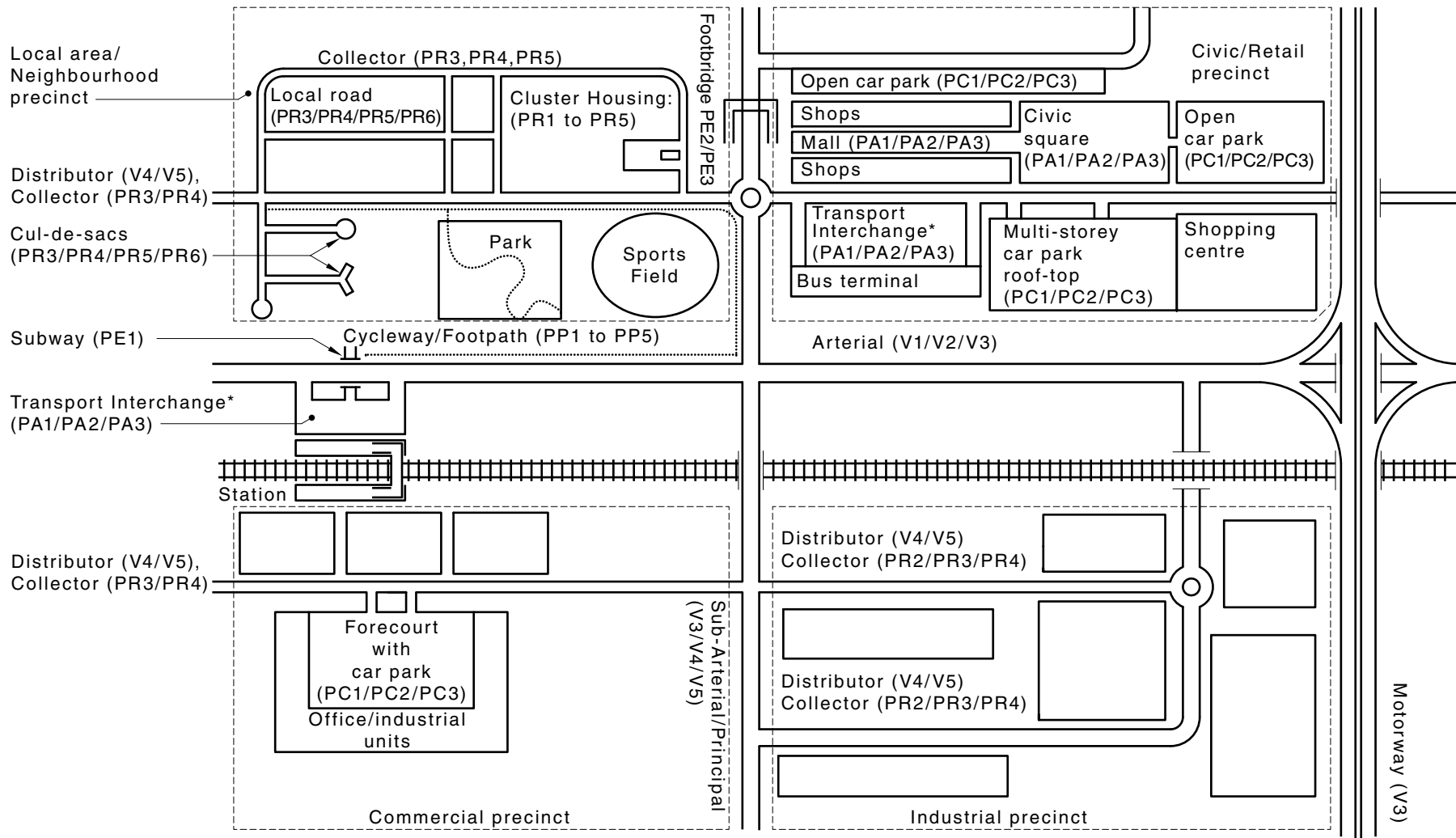
The terms 'mixed', 'low', 'medium', 'high', 'very high' and 'moderate' are provided to enable individual road authorities to develop their own specific lighting hierarchy.

The appropriate subcategory for a particular road or public space should be a matter for determination in consultation with the client (usually the applicable road controlling authority). When a geographically specific road lighting scheme incorporates road or roads controlled by more than one road authority, then it will be necessary to consult those authorities in order to confirm the subcategory of road lighting which is to be specified for the road lighting scheme.

As the operating characteristics of a road or public space are not always constant throughout the operating period due to changes in vehicle volume or pedestrian/cycle activity it is appropriate for a lighting scheme to have more than one applicable lighting subcategory during normal operation.

NOTES:

- 1 Appendix A provides information on the criteria used in Tables 2.1 to 2.3 to determine the applicable lighting subcategory, based on the fear of crime or the need to enhance the amenity of the locality. The appendix also includes an example of the selection procedure.
- 2 See Appendix B for a sample design brief.



* See Clause 1.1 regarding Disability Discrimination Act 1992 (Cth) otherwise (PA1/PA2/PA3)

FIGURE 2.1 EXAMPLE OF ROAD AND PUBLIC SPACE TYPES AND INDICATIVE LIGHTING CATEGORIES AND SUBCATEGORIES

TABLE 2.1
LIGHTING SUBCATEGORIES FOR ROAD RESERVES IN LOCAL AREAS

1	2	3	4	5	6
Type of road or pathway		Selection criteria ^{a,b}			Applicable lighting subcategory ^{c,d}
General description	Basic operating characteristics	Pedestrian/cycle activity	Fear of crime	Need to enhance amenity	
Collector roads or non-arterial roads which collect and distribute traffic in an area, as well as serving abutting properties	Mixed vehicle and pedestrian traffic	N/A	High	N/A	PR1
		High	Medium	High	PR2
		Medium	Low	Medium	PR3 ^f or PR4 ^f
		Low	Low	Low	PR5
Local roads or streets used primarily for access to abutting properties, including residential, commercial and industrial precincts		N/A	High	N/A	PR1
		High	Medium	High	PR2
		Medium	Low	Medium	PR3 ^f or PR4 ^f
		Low	Low	Low	PR5
		N/A	N/A	N/A	PR6 ^e
Common area, forecourts of cluster housing		N/A	High	N/A	PR1
		High	Medium	High	PR2
		Medium	Low	Medium	PR3 ^f or PR4 ^f
		Low	Low	Low	PR5

^a 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 road will determine the applicable lighting subcategory.

^b See Appendix A for guidance on choosing the applicable level of each selection criteria for the environment and purpose of a lighting scheme.

^c All lighting subcategories apply across the whole of the road reserve width, including the footpath.

^d Where there is a significant fear of crime or where required by the relevant authority, then, for enhanced lighting of the formed pathways, see Table 2.2.

^e Use of subcategory PR6 shall be discretionary.

Generally, subcategory PR6 is only applied to the replacement of existing luminaires installed on existing electricity distribution poles or for the initial application of a lighting scheme where the cost to re-configure these poles limits or precludes conformance to subcategory PR4 and PR5 respectively.

NOTE: It is also appropriate to use one subcategory lower to take advantage of the cost reductions available when utilizing electricity distribution poles rather than dedicated lighting columns, i.e. if the desired subcategory is PR3, PR4 or PR5 and if electricity distribution poles are used then levels PR4, PR5 or PR6 respectively, may be used.

However, it is recognized that, for some authorities, there may be some specific lighting tasks where subcategory PR5 could be deemed to be excessive in terms of providing adequate level of service and meeting with community expectations. In this case subcategory PR6 may be used.

^f Category PR3 is generally used in Australia and Category PR4 is generally used in New Zealand.

TABLE 2.2
LIGHTING SUBCATEGORIES FOR PEDESTRIAN AND CYCLIST PATHS

1	2	3	4	5
Type of pathway		Selection criteria ^{a,b,c}		Applicable lighting subcategory
General description	Basic operating characteristics	Pedestrian/cycle activity	Fear of crime	
Pedestrian or cycle orientated pathway, e.g. footpaths, including those along local roads ^d and arterial roads ^e , walkways, lanes, park paths, cyclist paths	Pedestrian and or cycle traffic only	N/A	High	PP1 ^c
		High	Medium	PP2 ^c
		Medium	Medium	PP3
		Medium	Low	PP4
		Low	Low	PP5

^a The selection criteria of Columns 3 to 4 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.

^b See Appendix A for guidance on choosing the applicable level of each selection criteria for the environment and purpose of a lighting scheme.

^c 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.

^d Where the footpath is along a local road and subcategory PP1 or PP2 is selected, the light technical parameters for that subcategory should only apply to the formed footpath.

^e Footpaths associated with arterial roads are deemed not to require separate lighting provided that—

(a) the road is lit to at least the applicable level of Category V lighting conforming to AS/NZS 1158.1.1; and

(b) the footpath is unshaded, e.g. there are no substantially continuous building awnings, trees (refer to AS/NZS 1158.1.2) and the footpath is contiguous with the roadway.

TABLE 2.3
LIGHTING SUBCATEGORIES FOR PUBLIC ACTIVITY AREAS (EXCLUDING CAR PARKS)

1	2	3	4	5	6
Type of area or activity		Selection criteria ^{a,b}			Applicable lighting subcategory
General description	Basic operating characteristics	Night time vehicle movements	Fear of crime	Need to enhance amenity	
Areas primarily for pedestrian use, e.g. city, town, suburban centres, including outdoor shopping precincts, malls, open arcades, town squares, civic centres	Generally pedestrian movement only	N/A	High	High	PA1
		Medium	Medium	Medium	PA2
		Low	Low	N/A	PA3
Transport terminals and interchanges, service areas ^c	Mixed pedestrian and vehicle movement	High	High	High	PA1
		Medium	Medium	Medium	PA2
		Low	Low	N/A	PA3

^a 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 area type will determine the applicable lighting subcategory.

^b See Appendix A for guidance on choosing the applicable level of each selection criteria for the environment and purpose of the lighting scheme.

^c See Clause 1.1.1.

NOTE: See Table 2.5 for lighting subcategories applicable to outdoor car parks, including roof-top car parks.

TABLE 2.4
LIGHTING SUBCATEGORIES
FOR CONNECTING ELEMENTS

Type of area	Applicable lighting subcategory
Subways, including associated ramps or stairways	PE1
Steps and stairways, ramps, footbridges, pedestrian ways	PE2
Ramps and footbridges associated with low use pathways (e.g. in parks and reserves)	PE3

NOTE: Subways are listed as a separate subcategory because of a fear of crime.

TABLE 2.5
LIGHTING SUBCATEGORIES FOR OUTDOOR CAR PARKS
(INCLUDING ROOF-TOP CAR PARKS)

1	2	3	4
Type of area	Selection criteria ^{a,c}		
	Night time vehicle and/or pedestrian movements	Fear of crime	Applicable lighting subcategory ^b
Parking spaces, aisles and circulation roadways	High	High	PC1
	Medium	Medium	PC2
	Low	Low	PC3
Designated parking spaces specifically intended for people with disabilities	N/A	N/A	PCD
For any designated areas for pedestrians to cross	N/A	N/A	PCX

^a The selection criteria of Columns 2 to 4 should be separately evaluated. The highest level of any of the selection criteria that is deemed appropriate for the area type will determine the applicable lighting subcategory.

^b Providing a lighting scheme that meets the requirements of more than one subcategory by the use of switching is permitted.

^c Consider the use of adaptive lighting controls for variable night time utilization.

SECTION 3 LIGHT TECHNICAL PARAMETERS FOR EACH LIGHTING SUBCATEGORY

3.1 LIGHT TECHNICAL PARAMETERS

3.1.1 General

The design objectives outlined in Clause 2.3 are formally specified in terms of various light technical parameters. These parameters are divided as follows:

- (a) Parameters that relate to the attainment of the required level of lighting performance.
- (b) Parameters that limit the adverse effects of the lighting on—
 - (i) users of the lit space, e.g. pedestrians, vehicle drivers (i.e. by the control of glare);
 - (ii) night sky viewing conditions (i.e. by reducing consequent sky glow); and
 - (iii) occupants of properties that abut the lit area (i.e. by the control of obtrusive light).

Details of the applicable parameters are set out in Clauses 3.1.2 and 3.1.3 [the mathematical definitions of these light technical parameters (LTPs) are set out in AS/NZS 1158.2].

The values for these parameters shall be as specified in Tables 3.3 to 3.7 and are the minimum permissible, except for the parameter U_{E2} for which the values given are the maximum permissible. These requirements apply throughout each maintenance cycle over the life of the installation.

When adaptive lighting is used, each dimming level shall be such that it complies with all the requirements of a relevant lighting category. The control system shall be failsafe in that on a failure of any element of the control system, the luminaires shall revert back to their initial undimmed level.

The design procedures necessary to determine conformance to the required values of the light technical parameters shall be as specified in Section 4.

3.1.2 Lighting performance parameters

The performance of Category P lighting shall be assessed in terms of the light technical parameters in Table 3.1:

TABLE 3.1
LIGHT TECHNICAL PARAMETERS (LTP)

Parameter	Symbol
Average horizontal illuminance	$\bar{E}_h$
Point horizontal illuminance	E_{ph}
Illuminance uniformity Category P	U_{E2}
Point vertical illuminance	E_{pv}

The applicable values for these four parameters shall be as set out in Tables 3.3 to 3.7 for the lighting subcategories established in accordance with Clause 2.4.

3.1.3 Adverse effects of lighting

3.1.3.1 General

The adverse effects of the lighting system shall be controlled by application of the light technical parameters set out in Clauses 3.1.3.2 to 3.1.3.4.

3.1.3.2 Glare

Glare from the luminaires shall be mitigated by the specification of maximum values of the luminous intensity or of the average controlled luminance in specified directions, appropriate to the luminaire type (see Clause 3.7).

3.1.3.3 Upward waste light

The amount of light emitted by the luminaires in directions above the horizontal shall be controlled by the specification of maximum values for the upward waste light ratio (*UWLR*).

The type of luminaires used and the way that they are installed shall ensure conformance to the requirements of Table 3.10. The limiting value of *UWLR* in Table 3.10 shall not be exceeded for the selected luminaire when mounted with the tilt angle, where applicable, specified in the design.

NOTES:

- 1 Section 5 requires that luminaire manufacturers state the maximum tilt angle at which the luminaire satisfies the requirement in Table 3.10.
- 2 The *UWLR* typically increases with tilt.

3.1.3.4 Spill light into abutting properties

For local roads provided with lighting subcategories PR3 to PR6 spill light can be advantageous in lighting the surrounds. If deemed beneficial, a minimum level of 50% of E_{ph} at a distance of 3 m inside abutting properties should prevent any undesirable sharp reduction in illumination immediately inside the property boundaries.

However, if it is deemed necessary by the relevant authority that a limit is required on the amount of spill light, refer to AS/NZS 4282.

NOTE: For the control of spill light for outdoor car parks, refer to AS/NZS 4282.

3.1.3.5 Impact on wildlife

Spill light from roads and pathways may have negative impacts upon wildlife species sensitive to light. In some cases where environmental habitat or migratory pathways of these species is adjacent or nearby, relevant regulation and regulatory authorities may require that spill light be limited in order to avoid or minimize negative impacts.

In Australia, this, in particular, relates to instances where threatened or migratory species or threatened ecological communities listed under the Australian Government, Department of Environment and Energy — *Environment Protection and Biodiversity Conservation Act 1999 (Cth)*, for which light is listed as a threat, occur in the vicinity of the lighting.

New Zealand users will find relevant details at the following link:

<https://www.doc.govt.nz/nature/biodiversity/biodiversity-new-zealand-resources/biodiversity-references/laws-and-regulations>

Further guidance on addressing the impact of spill light upon wildlife is available in AS/NZS 4282.

3.2 DESIGN LUMINOUS FLUX

3.2.1 Non-SSL luminaires

The design luminous flux is the initial lamp lumens, which shall be used in calculations except that, for subcategories PR3 to PR6 and PP3 to PP5, the lamp lumens for high pressure sodium (HPS) lamps shall be derated to 0.75 of their quoted value.

NOTE: This requirement is included to compensate for the decreased sensitivity of the eye to 'yellow' light at low light levels. The low brightness of the scene will be further exacerbated by the low reflectance of any surrounding foliage to yellow light.

3.2.2 SSL luminaires

For installation designs that use a maintenance factor, the design luminous flux is the luminaire luminous flux determined from the luminaire's CIE S 025/E report or the IESNA LM-79-19 report obtained from the luminaire manufacturer.

For installation designs that use a constant light output technology, the design luminous flux is the maintained luminous flux, i.e. the luminous flux required at the end of the maintenance cycle to achieve compliance with the nominated lighting category. Then the light source lumen depreciation (LLD) is 1.0 (one) and the luminaire dirt depreciation factor (LDD) is given in Table 3.2.

3.3 LIGHT SOURCE REQUIREMENTS

The choice of light source should be based on an analysis of all the factors relevant to the particular application, including aesthetics, environmental factors, light source mortality, lumen depreciation, cost and energy use.

NOTE: For correlated colour temperature (CCT) and colour rendering index (CRI) for light sources, refer to SA/SNZ TS 1158.6. The performance and characteristics of a light source are not fully defined by CCT and CRI metrics and consideration should be taken of the spectral power distribution (SPD) of a light source.

3.4 ENERGY PERFORMANCE ASSESSMENT AND REPORTING

Where energy performance assessment and reporting is required by road authorities the methods shall be as set out in Appendix F.

The methods outlined in Appendix F align with the principles in EN 13201-5 which define international practice.

The energy performance of a lighting scheme is determined by the interaction and combined effects of the—

- (a) luminous efficacy and photometric distribution of the selected luminaire;
- (b) appropriateness of the lighting design for the scheme layout and geometry; and
- (c) operation of the lighting system in practice.

The ability to objectively quantify and compare the total systemic energy impacts of road lighting scheme scenarios at the planning stages provides the facility for the lighting designer to undertake tuning and optimization of various options to evaluate the energy use of a proposed lighting scheme while meeting the required light technical parameters.

The methods in Appendix F accommodate lighting levels as dynamic and changing parameters rather than only as fixed values. A variable light level and timing facility allows for the application of adaptive lighting techniques such as constant light output (CLO), scheduled control and real-time control enabled by smart control devices and internet based central management systems (CMS).

The methods in Appendix F provide rules for the structured description, calculation and presentation of annualized energy performance indicators for road, pathway and public space lighting schemes.

NOTE: This will facilitate optimization at the design stage and for ongoing periodic auditing purposes. This will allow for structured and harmonized comparisons of the energy performance implications of—

- (a) various equipment technologies;
- (b) design approaches such as luminaire optics and column layouts;
- (c) adapting at times of low pedestrian use, e.g. after midnight, using sensors to adapt between lighting categories on approach of pedestrians; and
- (d) operating of dimming/brightening adaptive control schedules or sensing.

Application of the methods in Appendix F will provide a standardized framework to design, calculate, benchmark or audit the energy performance of both existing and proposed lighting schemes in a systemic and objective manner for the purposes of benchmarking, continuous improvement or as part of progressive infrastructure procurement processes.

Appendix F introduces the measures of—

- (i) the power density indicator (PDI); and
- (ii) the annual energy consumption indicator (AECI).

3.5 MAINTENANCE OF LIGHT TECHNICAL PARAMETERS

3.5.1 General

Significant reductions from the initial values of the light technical parameters will occur in service, primarily as a result of a gradual depreciation in light source lumen output, an accumulation of dirt and ageing of the optical transmitting materials and/or reflecting surfaces of the luminaire. Recognizing that this depreciation occurs, Tables 3.3 to 3.7 require conformance to maintained values of $\bar{E}_h$, E_{ph} and E_{pv} by the application of a maintenance factor, see Clauses 3.5.2 to 3.5.5.

An appropriate maintenance regime shall be developed and documented for the design which will ensure that the values of $\bar{E}_h$, E_{ph} and E_{pv} will not fall below the applicable values for these parameters throughout any maintenance cycle in the life of the installation.

3.5.2 Luminaire dirt depreciation factor (LDD)

The value of the luminaire optical degradation factor associated with the pollution category and cleaning interval to be assumed for the calculation of maintained values $\bar{E}_h$, E_{ph} and E_{pv} , shall not exceed the applicable value in this Clause. The IP rating of the luminaire shall not be less than IP65. If the control gear is IP65, the control gear/wiring connection chamber may be IP24.

Table 3.2 gives values of luminaire maintenance factors for luminaires with IP ratings of IP65 and above by environmental zone and cleaning interval. These values shall be used in Category P lighting system design. The effects of light source lumen depreciation are not included in the luminaire dirt depreciation (LDD) factor.

NOTE: Some additional information is given in AS/NZS 1158.1.2, however Table 3.2 supersedes the LDD factors for IP6X luminaires in AS/NZS 1158.1.2:2010 Table 14.4. The LDD factors for IP54 luminaires are given in AS/NZS 1158.1.2:2010 Table 14.4.