

Australian/New Zealand Standard™

Lighting for roads and public spaces

Part 4: Lighting of pedestrian crossings



AS/NZS 1158.4:2015

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The following are represented on Committee LG-002:

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Australian Industry Group
Australian Local Government Association
Centre for Pavement Engineering Education
CIE Australia
Department of Transport and Main Roads, Qld
Energy Efficiency and Conservation Authority of New Zealand
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Part 4: Lighting of pedestrian crossings

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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 1158.4:2009.

The objective of this Standard is to specify performance requirements for designers of pedestrian crossings and manufacturers of luminaires in order to enhance the visibility and safety of pedestrians.

The purpose of the pedestrian crossing is to time separate pedestrians and vehicular traffic by assigning priority to pedestrians using the crossings. The existence of a pedestrian on the crossing imposes a legal requirement on vehicular traffic to give way to the pedestrian. Therefore, during the hours of darkness, the safe operation of a pedestrian crossing is dependent upon the driver being able to see both a pedestrian on or about to use the crossing, and the signs and markings associated with the crossing, in time for the vehicle to be stopped, if necessary, to give way to the pedestrian.

The function of lighting at pedestrian crossings is to illuminate the crossing, the immediate verge, and any pedestrian at or on the crossing, so that the crossing and pedestrian are highly conspicuous to approaching vehicular traffic. The lighting design will, by necessity, involve relatively higher values of both horizontal and vertical illuminance over the design area than that of the general roadway lighting scheme in the vicinity. Accident studies have shown that specifically lighting pedestrian crossings can significantly reduce the night accidents associated with them.

NOTE: See CIE 093, *Road lighting as an accident countermeasure*, for a technical report on the analysis of lighting and accident studies.

Considering the safety benefits for pedestrians, it would be preferable that lighting be provided at all crossings on Category V and P roads unless there are specific reasons not to install lighting. Nevertheless, whether a particular crossing, normally not controlled by traffic signals and generally of the type known and marked as a zebra crossing, will or will not be lit, will be determined by the road controlling authority.

In Australia, there will be instances where the pedestrian crossing is located on the threshold of an intersection or within the intersection itself, in which case special treatment of the installation may be warranted.

The following Standards have been issued in the AS/NZS 1158 series:

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
1158.4	Part 4: Lighting of pedestrian crossings (this Standard)
1158.5	Part 5: Tunnels and underpasses
1158.6	Part 6: Luminaires

A number of significant changes have been made to the previous edition of this Standard as follows:

- (i) The maximum permissible glare control at 90 degrees as specified in Table 3.2 (column 3) has been increased from 0 cd to 250 cd for PX1 and PX2 subcategories and to 170 cd for subcategory PX3.
- (ii) Provisions have been added for pedestrian crossings at intersections and where left-hand turning movements bring vehicles directly onto a pedestrian crossing.
- (iii) Provisions have been added for unsignalized pedestrian crossings over left and right turn slip lanes at otherwise signalized intersections.

In New Zealand, the principal difference is that provision has been made for a safety assessment to determine whether pedestrian crossing luminaires are needed where the existing street lighting already meets the light technical parameters for pedestrian crossing lighting.

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 notes to tables and figures are deemed to be requirements of this Standard.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard Lighting for roads and public spaces

Part 4: Lighting of pedestrian crossings

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies performance requirements for the lighting of pedestrian crossings.

The requirements apply primarily to pedestrian crossings located on roads with two-way traffic; however, unless otherwise stated, they also apply to pedestrian crossings on one-way roads. For roads with two-way traffic, the requirements for each half of the crossing (from kerb to the carriageway centre) are considered separately according to the direction of traffic flow. For one-way roads, the requirements apply from kerb to kerb in the particular direction of traffic flow.

1.2 APPLICATION

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 a qualification such as 'In Australia' or 'In New Zealand'.

Subject to the requirements of applicable laws, the choice of whether to install supplementary lighting at a pedestrian crossing in compliance with this Standard and, if so relevant, which lighting sub-category is appropriate, rests with the client (usually the applicable road controlling authority).

1.3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

- | | |
|------|--|
| 1742 | Manual of uniform traffic control devices (series) |
| 1743 | Road signs—Specifications |
| 4282 | Control of the obtrusive effects of outdoor lighting |

AS/NZS

- | | |
|----------|--|
| 1158 | Lighting for roads and public spaces |
| 1158.0 | Part 0: Introduction |
| 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 |
| 1158.6 | Part 6: Luminaires |

ANSI	
ANSLG	
C78.377-2011	Specifications for the chromaticity of solid state lighting products
IESNA	Standard file format for electronic transfer of photometric data and related information (R2008)
LM-63-02	
BS	
5489	Code of practice for the design of road lighting
5489-1	Part 1: Lighting of roads and public amenity areas
CIE	
121	The photometry and goniophotometry of luminaires
1924	Photopic spectral luminous efficiency function $V'(\lambda)$
NZ Government	
Rule 54002	Land Transport Rule: Traffic Control Devices 2004 (TCD Rule)

1.4 DEFINITIONS

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

1.4.1 Aiming angle

The angle, in the vertical plane, typically parallel to the road centreline, between the beam axis and the downward vertical axis through the centre of the pedestrian crossing luminaire.

1.4.2 Aiming point

A specified point on the carriageway at which the pedestrian crossing luminaire(s) is required to be aimed in order to achieve compliance with the requirements of Section 3.

1.4.3 Beam axis

The line through the centre of the pedestrian crossing luminaire in the mean direction of the beam. The beam axis normally coincides with the direction of maximum intensity.

NOTE: This term is illustrated in Figure 3.1.

1.4.4 Beam spread (in a particular plane)

The angular subtense of the pedestrian crossing luminaire beam in a specified plane containing the axis of the beam.

1.4.5 Crossing width

The horizontal distance, measured parallel to the centreline of the carriageway, between the extremities of the marked crossing.

NOTE: This term is illustrated in Figure 3.1.

1.4.6 Crossing zone

A space bounded by the extremities of the pedestrian crossing along and across the carriageway, up to a height of 1.5 m, and extending—

- (a) for two-way undivided roads, from the nearside kerb or pavement edge to the carriageway centreline (in each direction);
- (b) for one-way undivided roads, from kerb to kerb or pavement edge to pavement edge; and
- (c) for divided roads, from the kerb or pavement edge to the median.

1.4.7 Initial lamp lumen

The total luminous flux emitted by a light source after 100 hours of operation as conventionally evaluated using the CIE 1924 Standard Observer (i.e. V_λ function).

1.4.8 Lighting design

A lighting configuration for a specific element of roadway, supported by engineering analysis against prescribed light technical parameters.

1.4.9 Lighting scheme

A composite lighting layout inclusive of various components of a roadway, sufficiently documented with material and electrical reticulation details so as to facilitate construction and efficient operation.

1.4.10 Relevant authority

A reference to either the local government authority or the road controlling authority, whichever authority whose interests are to be managed by the road lighting requirements, be that the impact that the lighting has on properties abutting the roadway or the lighting requirements of the road users.

1.4.11 Road controlling authority

The authority that owns and manages the roadway and related infrastructure, be that local government or, in the case of an arterial road, a state or regional authority, such as a department of transport or main roads.

1.4.12 Pedestrian crossing (otherwise commonly marked and referred to as a 'zebra' crossing), at grade (pavement level) crossings and raised (section of pavement) crossings

A portion of carriageway marked by a series of longitudinal bars parallel with the road centre-line over an area where vehicular traffic is required to give way to pedestrian traffic. Does not include those areas controlled by traffic signals or shared pedestrian-vehicle areas where legal obligations are more general.

NOTE: For details of the road markings and the signage, see the relevant requirements of AS 1742 and AS 1743 (for Australia) and the Land Transport Rule, Traffic Control Devices (for New Zealand).

1.4.13 Surround zone

That area delineated by the dimensions 3 m back from the kerb and the same width (parallel with the road axis) as the pedestrian crossing.

NOTE: This term is illustrated in Figure 3.1.

1.5 SYMBOLS AND ABBREVIATIONS

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

SECTION 2 DESIGN OBJECTIVES AND LIGHT TECHNICAL PARAMETERS

2.1 DESIGN OBJECTIVES

The principal design objectives in the lighting of pedestrian crossings are to—

- (a) provide advance warning to vehicular traffic of the presence of the crossing; and
- (b) use direct illumination to make pedestrians more conspicuous in areas where spill light from surrounding conventional road lighting is deemed inadequate by the road controlling authority.

2.2 LIGHT TECHNICAL PARAMETERS

2.2.1 General

The design objectives outlined in Clause 2.1 are formally specified in terms of various light technical parameters. These parameters are divided as follows:

- (a) *Performance parameters*—relate to the attainment of the required level of lighting performance.
- (b) *Environmental parameters*—limit the adverse effects of the lighting on—
 - (i) users of the lit space, e.g. pedestrians, vehicular traffic (i.e. by the control of glare);
 - (ii) night sky viewing conditions, (i.e. by reducing consequent sky glow); and
 - (iii) occupants of adjacent premises (i.e. by the control of spill light).

Details of the applicable light technical parameters (LTP) are set out in Clause 2.2.2 (the mathematical definitions of these LTPs are given in AS/NZS 1158.2).

The required values for these parameters are specified in Clause 3.2 (Australia) and Clause 3.3 (New Zealand) and are the minimum permissible, except for the parameters glare control and upward waste light ratio (UWLR), for which the values given are the maximum permissible. These requirements shall be met throughout each maintenance cycle over the life of the scheme.

The design procedures necessary to determine compliance with the required values of the LTPs shall be as specified in Section 3.

2.2.2 Performance parameters

The performance of pedestrian crossing lighting design shall be assessed in terms of the LTPs set out in Table 2.1.

TABLE 2.1
LIGHT TECHNICAL PARAMETERS (LTPs)

Parameter	Symbol	Max./Min.
Point vertical illuminance	E_{pv}	Min.
Point horizontal illuminance	E_{ph}	Min.
Point horizontal illuminance (surrounds)	E_{phs}	Min.
Upward waste light	UWLR	Max.
Glare control	Angular intensity limits	Max.
Obtrusive light	E_{pv}	Max.

2.2.3 Environmental parameters

2.2.3.1 General

The adverse effects of the lighting scheme shall be controlled by the application of the LTPs in Table 2.1 and Clauses 2.2.3.2 to 2.2.3.4.

2.2.3.2 Glare

Glare from the pedestrian crossing luminaires shall be controlled by the specification of maximum values of initial intensities (100 h) at given angles.

2.2.3.3 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 UWLR.

The type of luminaires used and the way that they are installed shall ensure compliance with the requirements in Section 3. The limiting value of UWLR in Section 3 shall not be exceeded for the selected luminaire when mounted with the aiming angle specified in the design.

NOTES: (For Australia)

- 1 Section 4 requires the maximum aiming angle at which the luminaire, if aimable (Type 5), satisfies the requirement of Section 3 to be stated in the luminaire data.
- 2 The UWLR typically increases with aiming angle.
- 3 If the luminaire is of the non-aimable type (Type 6), the aiming angle is fixed as determined by the luminaire optical system, and the luminaire should be mounted with the light emitting face horizontal.

2.2.3.4 Light spilled onto abutting properties

Where required by the relevant authority, the lighting scheme shall limit the light spilled onto properties abutting the crossing so as to minimize the obtrusive light (E_{PV}) in accordance with AS 4282.

2.3 DESIGN LAMP LUMEN VALUE

The initial lamp lumens shall be used to determine glare as well as in calculations to determine maintained illuminance values. No re-rating lumen multipliers, such as those based on either the changing sensitivity of the eye at low light levels, or the enhanced receptiveness of the eye to 'white' light shall be used in pedestrian crossing lighting designs.

2.4 COLOUR RENDERING

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

Compatible with the operational and economical requirements of the lighting scheme, the type of light source used should have the highest Colour Rendering Index (CRI) practicable.

Where white light sources are used, the recommended correlated colour temperature should be in the range 4000 ± 275 K, unless otherwise specified by the road controlling authority.

NOTE: In New Zealand, refer also to the recommendations contained in Clause 3.3.3. For guidance see the ANSI Table ANSLG C78.377-2011.

2.5 ENERGY AUDIT

2.5.1 General

An inherent part of the design of any lighting scheme is the minimization of life cycle energy consumption. To this end it is recommended that the energy audit described in this Clause (2.5) be conducted and documented.

NOTE: Poorly specified schemes are often unreliable and consequently require proportionally higher maintenance. Maintenance is a significant consumer of energy, as bulk and spot replacement of lamps in public lighting schemes consume large amounts of fuel. A good public lighting scheme is one that is reliable, energy efficient and cost effective.

2.5.2 Purpose

The purpose of the energy audit is to demonstrate that the designer of the lighting scheme has minimized the life cycle energy of the scheme, commensurate with reliability and cost.

Where the lighting is being refurbished, the audit should contain a comparison of the energy consumption of both the existing and proposed schemes and their relative compliance with the current lighting standard.

2.5.3 Parts

If an energy audit is conducted, it shall contain the following three parts:

- (a) Hardware used (with a view to minimizing the use of capital equipment which requires high energy inputs during manufacture).
- (b) Electricity use in the lamp and control gear.
- (c) Energy (electricity and other) used in the maintenance of the scheme commensurate with ensuring reliability and the efficiency of the scheme.

Should an energy audit be requested, information on the required documentation is given in Appendix D, Paragraph D2.

2.6 MAINTENANCE OF LIGHT TECHNICAL PARAMETERS

2.6.1 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 lamp lumen output, and accumulation of dirt on the transmitting or reflecting surfaces of the luminaires, and ageing of those surfaces; because this depreciation occurs, the maintained values of E_{pv} and E_{ph} defined in Section 3 are required for compliance. Therefore, it is essential that a realistic maintenance regime be determined in conjunction with the client (usually the applicable road controlling authority) as part of the lighting design, and that this regime is applied throughout the life of the scheme so that the scheme continues to comply with this Standard for the full duration of each maintenance period.

2.6.2 Luminaire maintenance factor

The value of the luminaire maintenance factor associated with the pollution category and cleaning interval, to be assumed for the calculation of maintained values of E_{pv} and E_{ph} , shall not exceed the applicable value in Table E1 of Appendix E.

2.6.3 Light source lumen maintenance factor

The value of the light source lumen maintenance factor associated with the lamp replacement interval to be assumed for the calculation of E_{pv} and E_{ph} shall be obtained from data applicable to the specific lamp type chosen.