

AS/NZS 1158.5:2014

Australian/New Zealand Standard

Lighting for roads and public spaces

Part 5: Tunnels and underpasses

Superseding AS/NZS 1158.5:2007



AS/NZS 1158.5:2014



This joint Australian/New Zealand standard was prepared by Joint Technical Committee LG-002, Lighting for Roads and Public Spaces. It was approved on behalf of the Council of Standards Australia on 22 October 2014 and on behalf of the Council of Standards New Zealand on 31 October 2014.

This standard was published on 14 November 2014.

The following are represented on Committee LG-002:

Astronomical Society of Australia
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
Energy Networks Association
Equipment Energy Efficiency Committee
IES: The Lighting Society
Institute of Public Works Engineering Australia
Lighting Council New Zealand
Lighting Council of Australia
Local Government and Shires Associations of New South Wales
Main Roads Western Australia
Municipal Association of Victoria
New Zealand Transport Agency
Roads and Maritime Services

Keeping standards up to date

Standards are living documents which reflect progress in science, technology, and systems. To maintain their currency, all standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current standard, which should include any amendments which may have been published since the standard was purchased.

Detailed information about joint Australian/New Zealand standards can be found by visiting the standards webshop in Australia at www.saiglobal.com.au or Standards New Zealand's website at www.standards.co.nz.

Alternatively, Standards Australia publishes an annual printed catalogue with full details of all current standards. For more frequent listings or notification of revisions, amendments, and withdrawals, Standards Australia and Standards New Zealand offer a number of update options. For information about these services, users should contact their respective national standards organisation.

We also welcome suggestions for improvement in our standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of either Standards Australia or Standards New Zealand at the address shown on the title page.

This standard was issued in draft form for comment as DR AS/NZS 1158.5.

Australian/New Zealand Standard

Lighting for roads and public spaces

Part 5: Tunnels and underpasses

Originated as AS/NZS 1158.5:2007.
Second edition 2014.

COPYRIGHT

© Standards Australia Limited/Standards New Zealand

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Australia) or the Copyright Act 1994 (New Zealand).

Jointly published by SAI Global Limited under licence from Standards Australia Limited, GPO Box 476, Sydney, NSW 2001 and by Standards New Zealand, Private Bag 2439, Wellington 6140.

ISBN (Print) 978-1-77551-559-3
ISBN (PDF) 978-1-77551-560-9

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 1158.5:2007, and provide performance and design requirements for lighting schemes for tunnels and underpasses.

This Standard is for the use of designers, consultants, owners and operators of lighting schemes for tunnels and underpasses. The design of tunnel lighting schemes is complex and involves the use of specialist computer software and should be undertaken only by experienced designers.

This revision provides more explanatory information. It also recognizes that in some situations daylight penetration into an underpass can be significant and that software is readily available to determine the daylight luminance contribution, which may be used to offset some or all of the electric lighting requirements.

Requirements for the tunnel interior lighting are now based on operating speed and in very long tunnels, interior sub zones have been introduced.

A flow diagram has been introduced in Appendix L detailing lighting design steps.

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.

CONTENTS

	<i>Page</i>
FOREWORD.....	5
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE.....	6
1.2 APPLICATION	6
1.3 REFERENCED DOCUMENTS.....	6
1.4 DEFINITIONS.....	6
1.5 SYMBOLS AND ABBREVIATIONS.....	9
SECTION 2 OBJECTIVES AND LIGHT TECHNICAL PARAMETERS	
2.1 ROAD ELEMENT CLASSIFICATION	10
2.2 GENERAL OBJECTIVE.....	11
2.3 DESIGN OBJECTIVES.....	12
2.4 LIGHTING CATEGORIES AND THEIR APPLICATION	13
2.5 LIGHT TECHNICAL PARAMETERS.....	15
2.6 DESIGN LAMP LUMEN VALUE.....	15
2.7 COLOUR RENDERING	15
2.8 ENERGY AUDIT	16
2.9 MAINTENANCE OF LIGHT TECHNICAL PARAMETERS	16
2.10 BASIS OF COMPLIANCE	17
SECTION 3 DESIGN OBJECTIVES AND LIGHT TECHNICAL PARAMETERS	
3.1 GENERAL.....	19
3.2 TUNNEL LIGHTING CATEGORIES.....	19
3.3 LIGHTING OF THE TUNNEL ZONES.....	19
SECTION 4 DESIGN OF LIGHTING SCHEMES FOR UNDERPASSES	
4.1 GENERAL.....	26
4.2 UNDERPASS LIGHTING CATEGORIES	26
4.3 LIGHTING OF UNDERPASSES	26
SECTION 5 ELECTRICITY SUPPLY, OTHER LIGHTING REQUIREMENTS AND SIGNAGE	
5.1 MAINS FAILURE LIGHTING	28
5.2 EMERGENCY LIGHTING AND EXIT SIGNS FOR ESCAPE PASSAGES	29
5.3 TUNNEL SIGNAGE	29
APPENDICES	
A REFERENCED DOCUMENTS.....	30
B BIBLIOGRAPHY	31
C MOTORIST PERCEPTIONS AND TUNNEL DESIGN AND OPERATION.....	32
D DAYTIME LIGHTING OF UNDERPASSES	35
E TUNNEL LIGHTING DESIGN CALCULATIONS PROCEDURES.....	40
F MAINTENANCE OF TUNNEL LIGHTING	43
G CONTROLLING OF TUNNEL LIGHTING TO ACCOMMODATE CHANGING AMBIENT DAYLIGHT	45
H DETERMINATION OF THE ACCESS ZONE LUMINANCE L_{20}	46

	<i>Page</i>
I TUNNEL LIGHTING SCHEME DESIGN BRIEF	49
J DOCUMENTATION REQUIRED FOR DEMONSTRATING COMPLIANCE OF THE DESIGN WITH THIS STANDARD	50
K MEASUREMENT OF ROAD AND WALL LUMINANCE.....	52
L TUNNEL LIGHTING DESIGN FLOW DIAGRAM FOR TU1 AND TU2 TUNNELS	53

FOREWORD

Tunnels and underpasses, including underbridges, are road elements where simple accidents can have a serious effect on the smooth operation of the associated road network. Lighting design for these elements is essentially to overcome the daylight problems of the 'black hole' seen on the approach to a tunnel portal on the one hand and on the other, shadowing of objects within an underpass. These potential effects result from the, often, high light adaptation of the motorist's vision and then may only be overcome by the application of very high levels of lighting in the relevant zones of the structures.

Since the structures in question are mainly located on heavily trafficked urban roads, the specific lighting categories are based on the structural design details, i.e. length for tunnels and the degree of 'see-through' for underpasses, and not on traffic characteristics.

For the design of lighting schemes for tunnels, reference was made to CIE 88, *Guide for the lighting of road tunnels and underpasses*, and is also based on considerable national experience. However, the method of determining the light adaptation level of the motorist approaching the tunnel portal (L20) is retained from the first edition (1990) rather than the method of the second edition (2004). This is because the 2004 method is complex, whereas the more simple method of the first edition has given very satisfactory results in practice.

The day lighting for much of the tunnel is predicated on the L20 value in the particular situation. Therefore, the luminances of the various elements, in particular that of the sky, making up the relevant field of view of the motorist must be known with accuracy. The Standard contains indicative values based on a program of sky measurements and more abbreviated measurements of other structural elements taken in Australia, together with those in CIE 88.

For the design of lighting schemes for underpasses, reference was made to BS 5489-2 (2003), *Code of practice for the design of road lighting, Part 2: Lighting of tunnels*. The method of determining the degree of 'see-through' is based on national experience.

The compliance values of the light technical parameters are the minimum to be maintained through the life of the installation; an effective maintenance regime for the lighting scheme is essential, particularly in the case of tunnels. The values given are the minimum necessary to ensure sufficient safety and comfort.

In general, the light technical parameters for the various zones in the structures are based on the following:

- (a) The luminance level of the road and walls.
- (b) The uniformity of luminance of the road and walls.
- (c) Limitation of glare from the luminaires.
- (d) Limitation of the flicker effect from luminaires.

Other requirements, such as luminaire IP ratings and maximum acceptable maintenance factor (MF) need to be considered.

Information is given on how motorist's perceptions are influenced by tunnel design and operation, on mains failure lighting, tunnel signage, tunnel lighting maintenance and on the design brief and compliance documentation.

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard
Lighting for roads and public spaces**Part 5: Tunnels and underpasses**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies performance and design requirements for lighting schemes for tunnels and underpasses. It also specifies the luminaire data and other design data that is needed to facilitate the lighting design and the assessment of compliance with the requirements of this Standard.

NOTE: The basic steps of the design process are set out in a flow diagram in Appendix L.

This Standard does not deal with lighting schemes for underpasses catering solely for pedestrians/cyclists, which are covered by AS/NZS 1158.3.1. Underpasses and shorter tunnels are often designed to carry a mixture of motorized traffic, cyclists and pedestrians but long tunnels typically exclude all but motorized traffic. Current practice for underpasses within roads designated Category P is not to provide daytime lighting, and no recommendations are offered.

This Standard is intended to be read in conjunction with AS/NZS 1158.0, AS/NZS 1158.1.1, AS/NZS 1158.2, AS/NZS 1158.1.2 and AS/NZS 1158.6.

NOTE: Computer based design calculation procedures are given in AS/NZS 1158.0, AS/NZS 1158.2 and Appendices E and H of this Standard. Guidance on the design, installation, operation and maintenance of lighting schemes is given in AS/NZS 1158.1.2.

1.2 APPLICATION

Subject to the requirements of applicable laws, the choice of whether to install a lighting scheme in compliance with this Standard, and if so which category of lighting is appropriate, rests with the client (usually the applicable road controlling authority). In the application of this particular Standard, the decision is based solely on the structural characteristics of the road element.

1.3 REFERENCED DOCUMENTS

A list of the Standards and other documents referred to in this Standard is given in Appendix A.

NOTE: A number of additional documents, which are considered useful sources of information, are listed in Appendix B.

1.4 DEFINITIONS

For the purpose of this Standard the definitions given in AS/NZS 1158.0 plus those in the supplementary list below apply.

1.4.1 Access zone

Part of the road immediately outside (in front of) an entrance portal, covering the distance over which an approaching driver should be able to see into a tunnel.



AS/NZS 1158.5:2014 Lighting for roads and public spaces - Part 5: Tunnels and underpasses

This is a free sample only.

Purchase the full publication here:

<https://shop.standards.govt.nz/catalog/1158.5%3A2014%28AS%7CNZS%29/view>

Or contact Standards New Zealand using one of the following methods.

Freephone: 0800 782 632 (New Zealand)
Phone: +64 3 943 4259
Email: enquiries@standards.govt.nz