
**VOLUME 8 TRAFFIC SIGNS AND
LIGHTING**
SECTION 3 LIGHTING

TD 34/07

**DESIGN OF ROAD LIGHTING FOR THE
STRATEGIC MOTORWAY AND ALL
PURPOSE TRUNK ROAD NETWORK**

SUMMARY

This document sets out the design standards applicable to road lighting on the strategic motorway and all purpose trunk road network.

INSTRUCTIONS FOR USE

1. Remove contents pages from Volume 8 and insert new contents pages dated August 2007.
2. Insert new Advice Note TD 34/07 into Volume 8, Section 3.
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LLYWODRAETH CYNULLIAD CYMRU**



**THE DEPARTMENT FOR REGIONAL DEVELOPMENT
NORTHERN IRELAND**

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REGISTRATION OF AMENDMENTS

Amend No	Page No	Signature & Date of incorporation of amendments	Amend No	Page No	Signature & Date of incorporation of amendments

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1. INTRODUCTION

General

1.1 This Standard contains requirements and guidance for the design of road lighting on the strategic motorway and all purpose trunk road network, referred to hereafter as the strategic road network.

1.2 The publication of the new European and British Standards BS EN 13201 Road Lighting and BS 5489 Code of Practice for the Design of Road Lighting in 2003 introduced significant changes to road lighting design criteria. This has necessitated the revision of TD 30/87 Design of Road Lighting for All-Purpose Trunk Roads and TD 34/91 Design of Road Lighting for Motorway Trunk Roads. These covered similar topics and this revised Standard consolidates them into one standard for the design of road lighting on the strategic road network.

1.3 BS 5489 contains guidance and recommendations to support BS EN 13201 and to enable designers of road lighting schemes to comply with it. This Standard describes how to apply BS EN 13201 and BS 5489 to the design of road lighting for the strategic road network.

1.4 This Standard should be read in conjunction with TA 96 Whole Life Cycle Code of Practice for Lighting on the Strategic Motorway and All Purpose Trunk Road Network.

Scope

1.5 This Standard sets out the design objectives and procedures that shall be adopted for the design of road lighting for the strategic road network.

1.6 The following aspects of road lighting are not included in this Standard:

- i. the decision whether or not to provide road lighting (refer to TA 49 Appraisal of New and Replacement Lighting on the Strategic Motorway and All Purpose Trunk Road Network);
- ii. the design of lighting for long and short road tunnels (refer to BS 5489-2 Code of Practice for the Design of Road Lighting – Part 2: Lighting of Tunnels and BD 78 Design of Road Tunnels);

- iii. variable lighting levels and hours of operation (further advice on this subject will be available from the Highways Agency from 2008);
- iv. equipment specification that is not directly related to photometric performance (refer to other Standards and the relevant clauses from MCHW-1); and
- v. road lighting power distribution networks.

Implementation

1.7 This Standard shall be used forthwith for the design of road lighting for the strategic road network. It shall be applied to both new lighting schemes and renewals where lighting columns are to be replaced. Where a scheme is already under construction or currently being prepared and application of this Standard would result in significant additional cost or delay, the advice of the Overseeing Organisation shall be sought.

Definitions

1.8 For this Standard the definitions in the following standards shall apply:

- i. BS EN 13201-2 Road Lighting – Part 2: Performance Requirements; and
- ii. BS 5489-1 Code of Practice for the Design of Road Lighting – Part 1: Lighting of Roads and Public Amenity Areas.

2. PERFORMANCE REQUIREMENTS

General

2.1 The road lighting shall be designed in accordance with the recommendations of BS 5489-1 Code of Practice for the Design of Road Lighting – Part 1: Lighting of Roads and Public Amenity Areas, together with the additional requirements set out in this Standard.

2.2 All road lighting shall be designed and installed such that the installation will emit no direct light above the horizontal.

2.3 The criterion for lighting main carriageways on the strategic road network is luminance based. The aim is to achieve a bright background (the road surface), with acceptable uniformity and glare, against which objects appear in silhouette. The lighting shall comply with the quantifiable system performance requirements set out in paragraphs 2.7 and 2.9 to 2.11.

2.4 The criterion for lighting conflict areas on the strategic road network, such as junctions, complex road intersections, roundabouts and queuing areas, is illuminance based. The lighting shall comply with the quantifiable system performance requirements set out in paragraphs 2.8 to 2.11.

2.5 All road lighting should comply with the subjective performance requirements set out in paragraphs 2.12 to 2.15, so far as is reasonably practicable.

2.6 Lighting arrangements for the strategic road network should generally be as described in Sub-Clause 5.2.3.6 of BS 5489-1, subject to the following:

- i. safety both in use and during maintenance is of paramount importance (see Chapter 3 of this Standard); and
- ii. catenary lighting is only permitted in exceptional circumstances where it can be demonstrated that it is the only practical solution.

Quantifiable System Performance Requirements

2.7 Main Carriageways (strategic road network)

- i. The lighting design shall be in accordance with the recommendations of Clause 7 and Annex B of BS 5489-1. The design objectives for the lighting of main carriageways are expressed in performance terms using the five calculated photometric measures of maintained average luminance, overall uniformity, longitudinal uniformity, threshold increment and surround ratio.
- ii. The design shall be based on dry road conditions and shall use the ME-series of lighting classes given in Table 1a of BS EN 13201-2. The wet road MEW-series of lighting classes given in Table 1b of BS EN 13201-2 should not be used unless specified by the Overseeing Organisation.
- iii. Main carriageways include:
 - a. main carriageways of motorways, dual carriageway roads and single carriageway roads;
 - b. slip roads and free flow link roads at grade-separated junctions and interchanges, provided horizontal and vertical alignment complies with TD 9, including permitted relaxations; and
 - c. hard shoulders where the Overseeing Organisation foresees hard shoulder running in the near future.
- iv. Hard shoulders (emergency lanes) shall be designed in accordance with Sub-Clause 4.2.3 of BS 5489-1. Where the hard shoulder is part carriageway and part hardened verge this applies to the carriageway part only, the hardened verge being covered by the surround ratio.
- v. Hardstrips that are no wider than one metre may be ignored as they should be covered by the surround ratio.

vi. Where a portion of the carriageway is provided with hatchings and other road markings the design should nevertheless include the whole carriageway.

2.8 Conflict Areas

i. The lighting design shall comply with Clause 11 and Annex B of BS 5489-1. The design objectives for the lighting of conflict areas are expressed in performance terms using the three calculated photometric measures of maintained average horizontal illuminance, overall uniformity and glare limitation.

ii. The design shall use the CE-series of lighting classes given in Table 2 of BS EN 13201-2.

iii. Conflict areas include:

- a. single level junctions, including approaches;
- b. circulatory carriageways and approaches of roundabouts and gyratories;
- c. grade-separated junctions and interchanges, except those elements covered by paragraph 2.7;
- d. toll plazas, between the points where the carriageway is widened;
- e. crossing points for non-motorized users; and
- f. any other areas of potential conflict as agreed with the Overseeing Organisation.

iv. Where a lit slip road or link road joins a lit mainline, the resulting conflict point should be treated as described in paragraph 3.16.

2.9 Lighting on the strategic road network should normally comply with luminous intensity class G6 as given in Table A.1 of BS EN 13201-2 in order to limit environmental impact. However, in rare instances environmental significance may be less important than other considerations, in which case the constraints on luminous intensity for angles below the horizontal may be relaxed, subject to the agreement of the Overseeing Organisation.

2.10 The lighting of bridges and elevated roads shall be in accordance with Clause 8 of BS 5489-1.

2.11 Road lighting close to other modes of transport shall be in accordance with Clause 12 of BS 5489-1.

Non-quantifiable Performance Requirements

2.12 The design of road lighting should follow the recommendations in Clauses 4 and 5 of BS 5489-1.

2.13 The lighting arrangement should be coordinated with any bridges, gantries, traffic signing, signalling and surveillance installations so as to minimize shadows and visual impact.

2.14 Appearance will be influenced by the colour and brightness of light sources at night and by the scale, form and disposition of luminaires and their supports in the daytime. Views from surrounding areas may be as important as views for road users.

2.15 Bracket projections should comply with the recommendations of Sub-Clause 5.2.3.3 of BS 5489-1 and additionally should not exceed 1.5 metres for mounting heights up to and including 8 metres, and 2 metres for all other mounting heights. Brackets should be inclined slightly upwards at an angle not exceeding 5° and the spigot should be designed to enable compliance with paragraph 2.2.

Equipment Performance Requirements

2.16 The ingress protection rating for luminaire optical compartments should preferably be IP 6X as defined in BS EN 60529, but shall in any case comply with the minimum requirements given in CI 1407.2 in MCHW-1 Series 1400 Electrical Work for Road Lighting and Traffic Signs.

2.17 Luminaire control gear shall be of the dimmable electronic type wherever possible.

3. DECISIONS PRIOR TO DESIGN

General

3.1 The decisions that need to be made prior to design are set out in Clauses 4, 5 and 6 of BS 5489 1. This chapter of the Standard sets out the additional requirements applicable to the strategic road network.

Light Sources

3.2 Light sources shall have a colour rendering index (Ra) greater than or equal to 20 and shall be selected to minimise whole life cost and energy consumption.

Lighting Arrangement and Column Location

3.3 The lighting arrangement shall ensure that access for maintenance is as safe as reasonably practicable. The recommendations in IAN 69 Designing for Maintenance should be followed.

3.4 For roads with a mandatory speed limit of 50 mph or more the distance of lighting columns from the carriageway shall be determined in accordance with TD 19 Requirement for Road Restraint Systems. For other roads the distance from the carriageway shall be no less than specified in Table 2 of BS 5489-1 and the guidance given in TD 19 for such roads shall be followed.

3.5 Where passively safe lighting columns are proposed (as an alternative to providing a dedicated road restraint system), the distance from the carriageway shall be in accordance with the recommendations of Chapter 5 of TA 89 Use of Passively Safe Signposts, Lighting Columns and Traffic Signal Posts to BS EN 12767.

Selection of Lighting Class

3.6 Selection of the applicable lighting class from Table B.2 of BS 5489-1 shall be made using the following criteria:

- i. The average daily traffic flow (ADT) is the opening year ADT (ADT is defined as the total traffic in both directions during a given period, in whole days, divided by the number of days in the given period).

- ii. For motorways, the distance between junctions is measured from the end of the entry slip road taper to the beginning of the next exit slip road taper.

Road Surface

3.7 The road surface luminance, used in designing the lighting for the main carriageway, is dependent on the reflection properties of the road surface. The road surface obtains its luminance by the process of illumination and reflection and therefore the road surface becomes a component of the road lighting system.

3.8 Advice on selection of the appropriate road surface reflection data is given in Sub-Clause 7.2 of BS 5489-1.

Maintenance Factor

3.9 Maintenance factors shall be determined in accordance with Sub-Clause 6.4.4 of BS 5489-1. Luminaire maintenance factors shall be selected from Table D.1 of BS 5489-1.

3.10 The requirements for lamp changing and luminaire cleaning are set out in TD 23 Trunk Roads and Trunk Road Motorways Inspection and Maintenance of Road Lighting.

Overhead Electricity Supply Lines

3.11 Safe working clearance shall be ensured on all road lighting near overhead electricity supply lines. The operator of the line shall be consulted regarding safe working clearances and to establish the accurate position and height of the line.

3.12 The design should seek to minimise the number of affected lighting columns. Lower mounting heights should be used as needed and columns should normally be hinged in order to provide safe access for maintenance in the vicinity of the overhead line.

Extent of Lighting

3.13 When a section of road is lit, any single level junctions, grade separated junctions and interchanges occurring within or at either end should also be lit.

3.14 Grade-separated junctions where the mainline is unlit may:

- i. remain unlit;
- ii. be partially lit, with only the off-line conflict points lit (see paragraph 3.18); or
- iii. be fully lit, with lighting provided on the mainline through the junction and on the slip roads (see paragraph 3.16).

3.15 Grade-separated junctions situated at the end of a lit section of mainline may either:

- i. be partially lit, with mainline lighting terminated just beyond the back of nose of the slip roads connecting to the lit section, lighting continuing along the full length of those slip roads, and the slip roads connecting to the unlit side of the junction remaining unlit; or
- ii. be fully lit, with lighting on the mainline extended through the junction and on the slip roads.

3.16 Lighting on slip roads, link roads and auxiliary lanes should extend to the end of the taper, and the mainline lighting should continue for a further distance no less than 1.5 times the Desirable Minimum Stopping Sight Distance as defined in TD 9.

3.17 Lighting on the leaving or joining lane of a lane drop/lane gain junction should extend to the point where the mainline carriageway width becomes constant, and the mainline lighting should continue for a further distance no less than 1.5 times the Desirable Minimum Stopping Sight Distance.

3.18 For single level junctions of any type, including off-line elements of partially lit grade-separated junctions, lighting should not terminate closer to the conflict point than indicated as follows:

- i. 1.5 times the Desirable Minimum Stopping Sight Distance on the major road at a major/minor priority junction;

- ii. the peak traffic queuing distance on the approach to a give way or stop line;
- iii. the distance required to illuminate any bend at the end of an exit slip road or the beginning of an entry slip road.

3.19 There should not be an unlit gap of less than four times the stopping sight distance between lit sections.

3.20 For motorway service areas (MSA) where the main carriageway is lit the MSA slip roads should also be lit. For MSAs where the main carriageway is not lit the MSA slip roads may be lit but, if so, this lighting should commence as far as possible after the diverge and terminate as far as possible before the merge.

4. DESIGN PROCESS

General

4.1 The lighting design process should follow the recommendations of Annex E (non-motorway roads) and Annex F (motorways) of BS 5489-1.

4.2 Designs should be as energy efficient as possible, taking into account the other requirements of this Standard, including paragraph 2.2. If necessary, alternative designs should be developed in order to ensure that this requirement is met.

Consultations

4.3 Consultations shall be undertaken as necessary during the design process in order to:

- i. eliminate any possible confusion with air or water navigation lights, railway signals or the safe operation of other services;
- ii. identify the most appropriate and acceptable methods of lighting for environmentally sensitive areas and/or conservation areas.

4.4 For those situations where consultation is considered necessary, a typical list of consultees is given in Appendix A. This may vary to suit local circumstances.

Lighting Design Checklist

4.5 A checklist that could assist in completing a strategic road network lighting design is shown in Appendix B.

Design Documentation

4.6 A full record of the decisions, consultations and design shall be compiled by the Overseeing Organisation's design agent in a Technical File and retained for inspection by the Overseeing Organisation's representative. Further details are given in TA 96.

5. REFERENCES

1. Design Manual for Roads and Bridges (DMRB)

BD 78: Design of Road Tunnels (DMRB 2.2.9).

IAN 69/05: Designing for Maintenance.

TA 49: Appraisal of New and Replacement Lighting on the Strategic Motorway and All Purpose Trunk Road Network (DMRB 8.3) (due to be published late 2007).

TA 89: Use of Passively Safe Signposts, Lighting Columns and Traffic Signal Posts to BS EN 12767 (DMRB 8.2.2).

TA 96: Whole Life Cycle Code of Practice for Lighting on the Strategic Motorway and All Purpose Trunk Road Network (DMRB 8.3) (due to be published late 2007).

TD 9: Highway Link Design (DMRB 6.1.1).

TD 19: Requirement for Road Restraint Systems (DMRB 2.2.8).

TD 23: Trunk Roads and Trunk Road Motorways Inspection and Maintenance of Road Lighting (DMRB 8.3).

2. Manual of Contract Documents for Highway Works (MCHW)

MCHW-1: Manual of Contract Documents for Highway Works, Volume 1, Specification for Highway Works.

3. British Standards and BS EN Standards

BS EN 12767: Passive safety of support structures for road equipment – requirements and test methods.

BS EN 13201-2: Road lighting – Part 2: Performance requirements.

BS 5489-1: Code of practice for the design of road lighting – Part 1: Lighting of roads and public amenity areas.

BS 5489-2: Code of practice for the design of road lighting – Part 2: Lighting of tunnels.

BS EN 60529: Specification for degrees of protection provided by enclosures (IP code).

6. ENQUIRIES

All technical enquiries or comments on this Standard should be sent in writing as appropriate to:

Chief Highway Engineer
The Highways Agency
123 Buckingham Palace Road
London
SW1W 9HA

G CLARKE
Chief Highway Engineer

Director of Trunk Roads: Infrastructure and
Professional Services
Transport Scotland
Trunk Road Network Management
8th Floor, Buchanan House
58 Port Dundas Road
Glasgow
G4 0HF

A C McLAUGHLIN
Director of Trunk Roads: Infrastructure
and Professional Services

Chief Highway Engineer
Transport Wales
Welsh Assembly Government
Cathays Parks
Cardiff
CF10 3NQ

M J A PARKER
Chief Highway Engineer
Transport Wales

Director of Engineering
The Department for Regional Development
Roads Service
Clarence Court
10-18 Adelaide Street
Belfast BT2 8GB

R J M CAIRNS
Director of Engineering

APPENDIX A LIST OF CONSULTEES

Note: This is not an exhaustive list. The choice of consultees depends on local issues, as described in paragraph 4.3.

A.1 Air, Rail and Water Navigation and Signal Issues

Civil Aviation Authority (CAA) – Civil Airfields
Ministry of Defence (MOD) – Military Airfields
Trinity House – Coastal Waters and Harbours
British Waterways
Association of Inland Navigation Authorities
(AINA) – Navigable Waters
Railway Track Authority

A.2 Environmental Issues

Highways Agency Environmental Advisor, SSR
Environment and Sustainable Development
Group
Regional Highways Agency Landscape Advisor
Environment Agency
Commission for Architecture and the Built
Environment (CABE)
English Heritage
The Civic Trust
Natural England
Local Planning Authority
Local Conservation and Environmental Groups
Campaign to Protect Rural England (CPRE)
British Astronomical Association (BAA)
Campaign for Dark Skies (CfDS)
Professional Astronomers

APPENDIX B LIGHTING DESIGN CHECKLIST

The diagram in Figure B.1 is based on Table 1a of BS EN 13201-2 and Table B.2 of BS 5489-1 and is provided for information only. It may be used to determine the appropriate ME lighting class and design criteria for a road. The schedules below may then be used to record lighting design inputs and results.

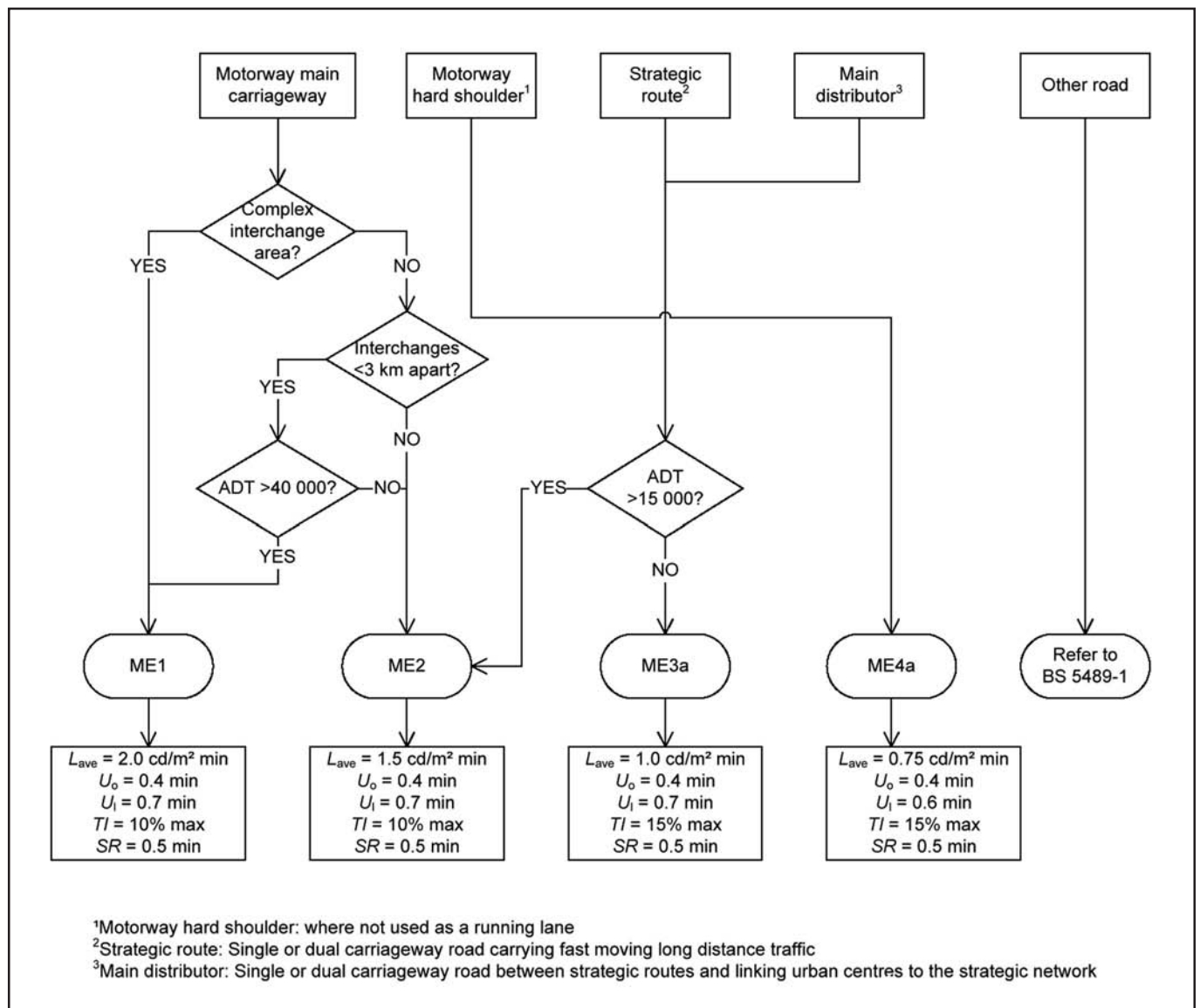


Figure B.1 – Lighting Design Criteria for the Strategic Road Network

Road Details		Value	
Location			
Road Category	Motorway/Strategic Route/Main Distributor/Other	MW/SR/MD/OR	
	Motorways only:	Complex junction area	Y/N
		Junctions less than 3 km apart	Y/N
	Traffic Flow ADT		
	Lighting Class	ME	
Luminous Intensity Class	G		
Geometry	Number of Carriageways		
	Number of Lanes		
	Lane Width	m	
	Hard Shoulder Width	m	
	Central Reservation Width	m	
Surface	CIE Road Surface Type		
	Average Luminance Coefficient Q_0		

Lighting Scheme Details		Value
Configuration	Singled sided/Opposite/Staggered/Twin central	SS/OP/SG/TC
Column	Height	m
	Tilt	deg
	Bracket Projection	m
	Setback	m
Luminaire	Manufacturer	
	Model	
	Optical setting/matrix	
	Ingress Protection of Optical Compartment	IP
	Cleaning Interval	months
	Pollution category	HIGH/MEDIUM/LOW
Luminaire Maintenance Factor	%	
Lamp	Type	
	Nominal Rating	W
	Initial Luminous Flux	klm
	Lamp Replacement Interval	months
	Lamp Flux Maintenance Factor	%
Maintenance Factor	Luminaire MF × Lamp Flux MF	%

Design Results	Main Carriageway	Hard Shoulder ¹
Inter-column Spacing	m	—
Average Luminance – L_{ave}	cd/m ²	cd/m ²
Overall Uniformity – U_o		
Longitudinal Uniformity – U_l		
Threshold Increment – TI	%	%
Surround Ratio – SR		

¹where applicable