

Road lighting —

Part 2: Code of practice for lighting for traffic routes

Committees responsible for this British Standard

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- Automobile Association
- British Lighting Association for the Preparation of Standards (Britlaps)
- British Precast Concrete Federation Ltd.
- Chartered Institution of Building Services Engineers
- Council for the Protection of Rural England
- County Surveyors' Society
- Department of Transport
- Institution of Civil Engineering Surveyors
- Institution of Civil Engineers
- Institution of Electrical Engineers
- Institution of Lighting Engineers
- Institution of Mechanical Engineers
- Lighting Industry Federation Ltd.
- Royal Fine Art Commission
- Scottish Office (Building Directorate)

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Foreword

This Part of BS 5489 has been prepared under the direction of the Electrical Illumination Standards Policy Committee and is a new edition of BS 5489-2:1987 which is withdrawn.

In the 1987 edition a new design procedure was formulated to calculate specific standards of uniformity and levels of luminance on the dry road surface. Disability and discomfort glare were controlled by limiting threshold increment rather than by limiting luminaire intensities. These concepts are discussed in BS 5489-1, the reading of which is essential for the understanding of this Part 2. Furthermore, a new method was introduced for designing installations on bends in the 1987 edition.

The lighting levels and glare control achieved by the 1987 edition were similar to those of the 1974 edition to ensure continuity of practice.

This edition introduces a revised definition of maintenance factor and incorporates editorial improvements but it does not reflect a full review or revision of the standard, which will be undertaken in due course.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 28, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This Part of BS 5489 gives recommendations for the lighting of all-purpose traffic routes up to 15 m in width for single carriageways and up to 2×11 m in width for dual carriageways. Motorways are not included.

A step by step illustration of the use of this code is given in Appendix A.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

NOTE A checklist of abbreviations and symbols used in this Part of BS 5489 is given in Table 7.

For the purposes of this Part of BS 5489 the definitions given in BS 5489-1, BS 6100-2.4.1 and BS 5225-1 apply, together with the following.

2.1

bracket projection

the horizontal distance from the point of entry to the luminaire to a vertical line passing through the centre of the cross section of the column at the ground level

NOTE See Figure 1.

2.2

spacing index (SI)

the product of the calculated average road luminance (in cd/m^2) produced by an installation of luminaires in their clean state and the spacing (in m) divided by the lamp flux (in klm)

2.3

veil factor (VF)

the equivalent veiling luminance per kilolumen of lamp output, multiplied by 650

2.4

width of carriageway (WK)

the distance between kerb lines, measured at right angles to the length of the carriageway

NOTE See Figure 1.

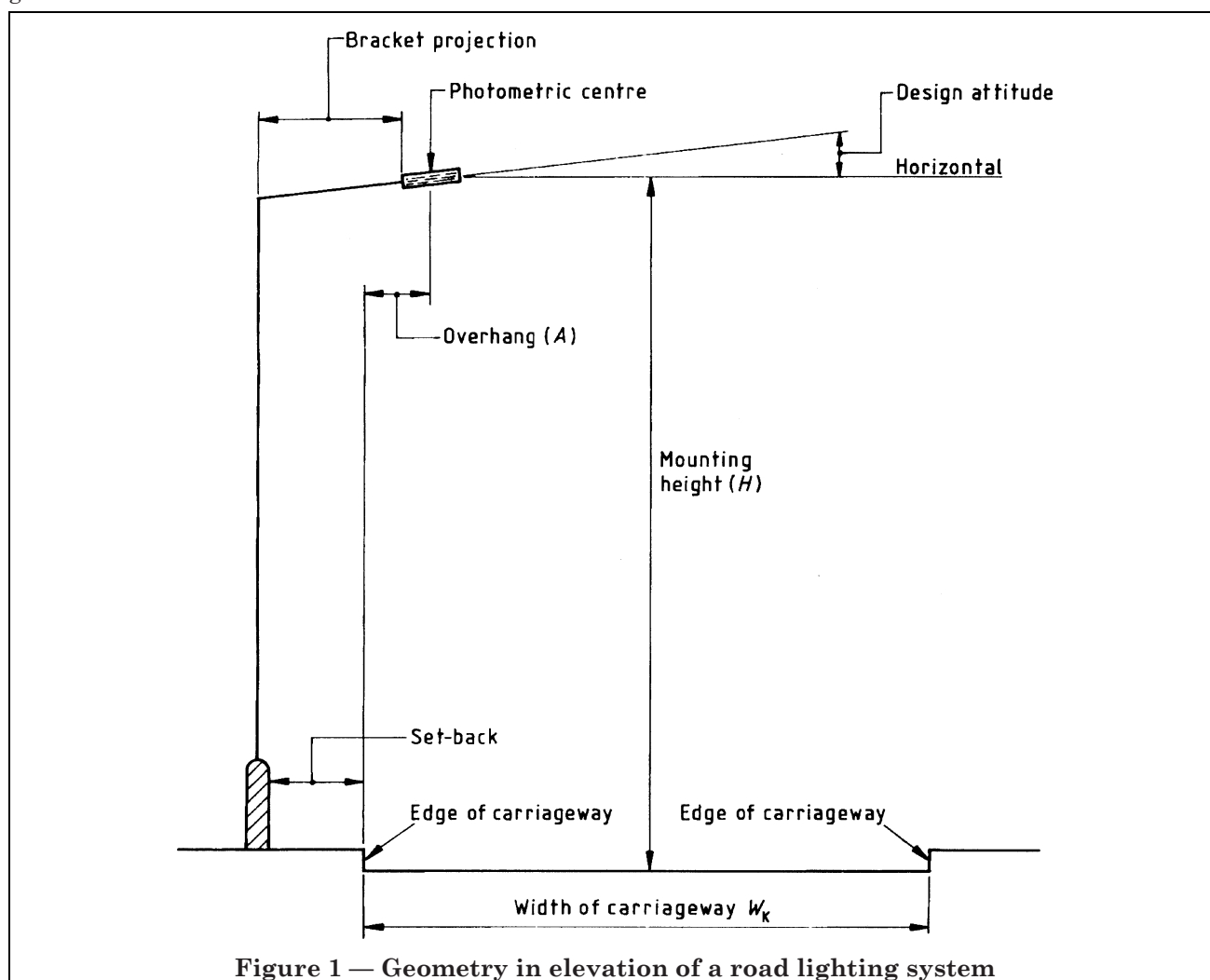


Figure 1 — Geometry in elevation of a road lighting system

3 Mounting height

3.1 General

The mounting heights to be adopted should be 8 m, 10 m or 12 m, except in special situations, e.g. where the appearance of the installation is particularly important. In these circumstances consideration may be given to other systems and mounting heights but it is essential to ensure that the lighting performance is not inferior to that recommended in this standard.

3.2 8 m mounting height

8 m is the recommended mounting height for:

- a) urban traffic routes where, owing to the multiplicity of road junctions, no reduction in the number of lighting points is to be gained by the use of a higher mounting height;
- b) traffic routes where higher mounting heights would be out of scale with the adjacent buildings;
- c) relatively narrow roads such as local distributor and access roads to residential areas in which a mounting height between 10 m or 12 m and 5 m or 6 m is desirable.

3.3 10 m mounting height

10 m is the recommended mounting height for lighting for:

- a) the majority of urban traffic routes;
- b) lighting for traffic routes in which a mounting height of 12 m would be of an undesirable appearance;
- c) lighting for wide heavily used routes where a large number of intersections, bends, etc., could lead to a short spacing making the use of 12 m mounting height uneconomical.

3.4 12 m mounting height

12 m is the recommended mounting height for lighting for wide or heavily used routes where advantage can be taken of a longer spacing of luminaires.

4 Limitation of glare

4.1 Disability glare

Disability glare, defined and discussed in BS 5489-1, reduces the contrast between objects and their background, so that their visibility is decreased. An object that is just visible (that is at the threshold of visibility) when there is no disability glare will, in the presence of disability glare, merge into the background. The percentage by which the background luminance has to be increased to render the object just visible again is known as the threshold increment (TI). This provides a notional measure of disability glare from installations.

The value of the TI depends on the light distribution from the lantern between 70° and 90° in elevation in the vertical plane at which the luminance is observed, usually within 10° of azimuth of the transverse axis of the luminaire. It also depends on the road luminance, the layout of the luminaires, the mounting height and the observer position.

4.2 Discomfort glare

Control of the TI within the limits recommended in 4.3 will generally ensure that discomfort glare, defined in BS 5489-1, will be adequately controlled.

4.3 Recommended threshold increment

Recommended limits for the TI are for the luminaire operated in a clean state with a lamp emitting its initial luminous flux, as in this state the maximum disability glare will be produced.

A value of the TI not exceeding 15 % is recommended where it is necessary to minimize glare, e.g. on high speed roads. It is of particular advantage in rural areas, where the absence of a reflecting background, such as buildings bordering the road, may increase the effect of glare.

In all other installations the value of the TI should not exceed 30 %. The light distribution for this less stringent glare control generally permits more scope for the siting of individual columns and longer spacing between luminaires, leading to lower capital and running costs.

NOTE Other special requirements may be imposed in the neighbourhood of aerodromes, where the luminous intensity above the horizontal may need to be limited (see BS 5489-8) and in environmentally sensitive areas, where spill light may be regarded as being visually intrusive (see BS 5489-1).

4.4 Selection of luminaires

As an aid to their selection according to the recommendations in 4.3, luminaires are divided into two classes: low threshold increment (LTI) and moderate threshold increment (MTI). An LTI luminaire will generally be capable of meeting the recommendation for the TI being not more than 15 % and an MTI luminaire will generally meet the recommendation for the TI being not more than 30 %.

On straight roads, the TI should be checked in the manner described in 8.2 g), when the luminaire has been selected. This is necessary because in certain installations the TI may exceed the recommended limits, even though the luminaire classification may indicate otherwise. In practice this will occur rarely. On bends it may be assumed that the limits hold according to the class of the luminaire.

NOTE The classification of a luminaire will depend, to a small extent, on the luminous flux of the lamp used for calculating the TI. For increases (or decreases) of flux up to 50 %, the TI will increase (or decrease) by approximately 0.2 % for every 1 % increase (or decrease) in flux. For larger changes of flux the equation for the TI given in 8.2 g) may be used.

5 Choice of lamps

5.1 Preferred sources

The preferred sources, on grounds of efficacy and life, are low pressure sodium and high pressure sodium lamps. The low pressure sodium lamp has the greater efficacy and emits a monochromatic yellow light. The high pressure sodium lamp has a longer life and renders colours. The use of other sources may be considered for special applications.

5.2 Use of lamps giving light of different colour

A change of colour of the light of the installation, by the use of different types of lamps, may be advantageous if used with discretion, the change being intentional and consistent; haphazard changes are distracting. There may be an advantage (where, for example, low pressure sodium lamps are used on the approach roads) in using high pressure sodium lamps in shopping areas, civic centres and other areas where better colour rendering is desirable.

6 Lighting of surrounds

Adequate lighting of the surrounds to the carriageway is necessary to serve the needs of the driver and the pedestrian.

For the driver, it helps to reveal objects on the carriageway that are only partly seen against the background of the carriageway, as is often the case on bends, or where there are stationary vehicles or bicycles near the margin of the carriageway. Moreover, it is needed to reveal pedestrians about to step into the carriageway and vehicles emerging from side roads.

For the pedestrian, it reveals the footway surface, obstructions and other pedestrians.

The surround lighting is quantified by the surround ratio (SR), defined in BS 5489-1.

For the chosen arrangement, the luminaire should give a value of the SR which is not less than 0.5; otherwise the surround lighting may be inadequate.

7 Lighting of road surface

To be visually satisfactory, the value and uniformity of road luminance should be in accordance with the recommendations given in Table 1.

The recommended maintained average luminance ensures that the road is sufficiently bright to reveal objects adequately. The recommended overall uniformity ratio (UO) ensures that no part of the road surface is so dark that it becomes ineffective as a background for revealing objects, whilst the recommended longitudinal uniformity ratio (UL) ensures that pronounced visual patchiness of the lighted road surface is avoided.

The geometry required to obtain these recommended values can be found by interrelating the light distribution from the luminaire and the reflection properties of the road surface, as described in clause 8 for straight roads and in clause 9 for bends. The results are valid for the assumed photometric conditions, e.g. no atmospheric attenuation, road surface of the stated reflection properties, clean luminaires correctly mounted, etc. In practice there will be departures from these conditions and, therefore, it may be difficult to substantiate the values in the actual installation by measurement. Nevertheless, the mathematical procedures described will provide a good representation of the absolute installation performance, as well as enabling valid comparisons between luminaires to be made.

Table 1 — Lighting requirements for traffic routes

Category	Maintained average luminance $\bar{L}$ cd/m ²	Overall uniformity ratio U_O	Longitudinal uniformity ratio U_L	Examples
2/1	1.5	0.4	0.7	High speed roads. Dual carriageway roads
2/2	1.0	0.4	0.5	Important rural and urban traffic routes. Radial roads. District distributor roads (see BS 6100)
2/3	0.5	0.4	0.5	Connecting, less important roads. Local distributor roads (see BS 6100). Residential area major access roads

8 Design spacings

8.1 For day-to-day installation design, spacings are determined from design tables prepared from the photometric quantities determined in accordance with Appendix B for each luminaire, and normally available from the manufacturer.

An example is shown in Table 2 for a mounting height of 10 m. If the luminaire can be used at 8 m or 12 m, tables for these mounting heights can be produced as appropriate.

NOTE On some computers it is not possible to print the second letter of a symbol as a subscript. In these cases it is recommended that the corresponding abbreviation is used, e.g. VF for V_F .

As well as enabling the user to determine the design spacing needed to achieve a desired maintained average luminance, the design table enables the UO, UL and SR to be checked, and the TI to be calculated.

Data for four arrangements are tabulated:

- a) staggered (see Figure 2);
- b) opposite (see Figure 3);
- c) single side (see Figure 4);
- d) twin central on dual carriageway (see Figure 5).

These tables are calculated for zero overhang ($A = 0$) but they may be used to a good accuracy for a positive or negative overhang not exceeding 1 m by applying the following rules.

- 1) Find the WE by using the appropriate relationships in Figure 2 to Figure 5.
- 2) Find the SR, SI, UL, and VF corresponding to the WE.
- 3) Use the isoluminance templates described in clause 9 to check the UO and adjust the spacing as necessary.

Designs for geometries not included in the table can be calculated by following the methods given in Appendix B.

The road surface for which the design tables are prepared is designated the “representative British road surface”, and is typical of the great majority of road surfaces used in Great Britain. The average luminance coefficient for this surface is 0.07 and the full reflection data are given in Table 3 (see **B.2**).

8.2 The calculation procedure using the design tables is as follows.

- a) Consult Table 1 to establish photometric requirements.
- b) Decide on mounting height and degree of glare limitation.
- c) Consult design tables for the chosen luminaires at their design attitude and for the mounting height to be used.

d) For the luminaire arrangement to be used, and the WE, check that the SR is equal to or greater than 0.5.

e) Calculate the design spacing, S (in m), required to give the desired maintained average luminance. This is done by using the spacing index, S_I , obtained from the design table, in the following equation:

$$S = \frac{S_I \varphi M_F}{\bar{L}}$$

where

φ is the initial luminous flux of the lamp (in klm) as quoted by the manufacturer;

M_F is the maintenance factor, which is the product of the lamp flux maintenance factor and the luminance maintenance factor. Values for the latter are given in Table 4;

$\bar{L}$ is the maintained average road luminance (in cd/m^2) as selected from Table 1.

f) Use the calculated value of S to enter the design table and check whether the UL and UO recommendations given in Table 1 are satisfied. If they are not, select the maximum spacing at which they are satisfied and determine the new average road luminance, $\bar{L}$ (in cd/m^2), from the equation:

$$\bar{L} = \frac{S_I \varphi M_F}{S}$$

where the symbols are as defined in 8.2 e).

g) Check that the design limit for the threshold increment T_I (expressed as a percentage) is not exceeded. This is done by substituting the appropriate value of the veil factor, V_F from the design table into the equation:

$$T_I = \frac{V_F \varphi}{10 (\bar{L}/M_F)^{0.8}}$$

where

φ is as defined in 8.2 e);
 $10 (\bar{L}/M_F)^{0.8}$ can be evaluated by using Table 5.

If the design limit is exceeded it will be necessary to select a different luminaire, or a different installation geometry.

Table 2 — Design table: standard presentation

Luminaire: Full light			Lamp: 150 W SON-T			Design attitude: Spigot entry elevated 5°			Mounting height: 10 m																			
Luminaire classification: MTI																												
S (m)	Staggered																											
	W _E 6 m			W _E 7 m			W _E 8 m			W _E 9 m			W _E 10 m			W _E 11 m			W _E 12 m			W _E 13 m			W _E 14 m			
	S _I 3.78	S _R 0.83		S _I 3.58	S _R 0.84		S _I 3.38	S _R 0.85		S _I 3.19	S _R 0.85		S _I 3.02	S _R 0.86		S _I 2.84	S _R 0.88		S _I 2.71	S _R 0.90		S _I 2.62	S _R 0.92		S _I 2.48	S _R 0.95		
20	.68	.81	29	.68	.80	29	.67	.81	27	.66	.83	27	.66	.83	26	.65	.82	26	.65	.82	25	.65	.82	24	.64	.82	24	
22	.66	.81	27	.65	.80	26	.65	.80	26	.65	.82	25	.65	.82	25	.65	.82	24	.65	.81	22	.65	.81	23	.65	.81	22	
24	.65	.82	25	.64	.81	24	.65	.81	24	.65	.81	24	.66	.84	23	.66	.83	23	.66	.82	22	.65	.83	21	.66	.83	21	
26	.62	.73	24	.62	.73	23	.62	.72	23	.63	.73	23	.63	.74	22	.63	.74	21	.62	.74	21	.61	.74	21	.61	.72	18	
28	.63	.75	22	.62	.74	22	.63	.71	22	.64	.70	22	.63	.70	21	.62	.70	21	.62	.70	20	.60	.69	19	.60	.69	18	
30	.63	.73	21	.63	.73	21	.63	.71	21	.61	.71	20	.59	.71	20	.58	.70	19	.58	.69	19	.58	.69	18	.57	.68	18	
32	.63	.67	21	.63	.65	20	.61	.63	20	.58	.62	19	.57	.62	19	.55	.62	19	.53	.62	18	.51	.61	18	.50	.62	17	
34	.63	.67	19	.60	.63	19	.58	.61	19	.56	.58	18	.54	.58	18	.52	.58	18	.51	.57	17	.48	.56	17	.48	.56	16	
36	.61	.67	19	.56	.63	18	.54	.58	18	.50	.56	18	.49	.55	18	.46	.53	17	.45	.54	16	.44	.54	16	.44	.53	16	
38	.59	.64	18	.58	.61	18	.54	.58	18	.49	.56	17	.47	.53	17	.45	.51	16	.43	.50	16	.41	.49	16	.40	.49	16	
40	.55	.58	17	.53	.56	17	.51	.54	17	.50	.52	16	.48	.50	16	.44	.49	16	.42	.48	16	.40	.47	15	.40	.45	15	
42	.54	.57	17	.52	.54	17	.51	.52	16	.50	.50	16	.47	.48	16	.45	.47	16	.43	.46	15	.42	.45	15	.41	.44	15	
44	.56	.56	16	.53	.53	16	.51	.51	16	.49	.49	16	.46	.48	15	.44	.46	15	.43	.45	15	.42	.44	14	.40	.43	14	
46	.55	.56	16	.52	.52	16	.50	.50	15	.48	.49	15	.46	.47	15	.44	.47	14	.43	.45	14	.40	.44	14	.40	.44	14	
48	.53	.55	16	.50	.51	15	.47	.49	15	.46	.47	15	.45	.45	14	.43	.44	14	.40	.43	14	.37	.42	14	.37	.42	13	
50	.52	.50	15	.49	.46	15	.46	.44	14	.45	.42	14	.44	.40	14	.42	.39	14	.39	.38	13	.36	.38	13	.34	.38	13	
S (m)	Opposite																											
	W _E 15 m			W _E 16 m			W _E 17 m			W _E 18 m			W _E 19 m			W _E 20 m												
	S _I 3.95	S _R 0.95		S _I 3.78	S _R 0.96		S _I 3.66	S _R 0.96		S _I 3.50	S _R 0.97		S _I 3.35	S _R 0.97		S _I 3.35	S _R 0.97											
20	.73	.93	36	.71	.93	36	.69	.92	34	.68	.92	33	.67	.91	32	.64	.91	31										
22	.74	.92	34	.71	.92	33	.70	.93	32	.69	.92	31	.67	.94	30	.65	.94	29										
24	.73	.93	32	.72	.91	32	.71	.91	30	.69	.91	29	.66	.90	28	.65	.90	27										
26	.71	.90	31	.71	.89	30	.69	.89	29	.68	.88	28	.65	.88	27	.63	.88	26										
28	.69	.90	29	.67	.89	28	.67	.88	27	.65	.91	26	.63	.90	26	.63	.89	25										
30	.71	.93	28	.70	.92	27	.68	.94	26	.67	.94	25	.63	.92	25	.60	.92	24										
32	.70	.87	28	.69	.86	26	.69	.87	25	.67	.87	24	.65	.86	24	.64	.86	23										
34	.69	.86	26	.69	.85	25	.68	.85	24	.66	.85	23	.63	.86	23	.62	.86	22										
36	.66	.84	25	.64	.83	24	.63	.83	24	.60	.83	23	.59	.83	22	.57	.81	22										
38	.68	.89	25	.64	.88	23	.63	.88	23	.61	.88	22	.59	.87	21	.57	.86	21										
40	.68	.88	23	.66	.89	23	.64	.88	22	.62	.88	21	.61	.87	21	.60	.86	20										
42	.68	.88	23	.68	.87	22	.66	.87	22	.64	.87	21	.63	.86	20	.61	.86	20										
44	.68	.86	22	.67	.86	21	.67	.86	21	.66	.86	20	.64	.87	19	.63	.87	19										
46	.66	.84	22	.65	.83	21	.64	.84	21	.63	.84	20	.61	.84	19	.60	.83	18										
48	.64	.84	21	.64	.84	20	.63	.85	20	.63	.86	19	.61	.85	18	.60	.84	18										
50	.62	.75	21	.61	.76	20	.62	.76	19	.62	.77	19	.60	.77	18	.59	.78	18										
S (m)	Single sided														Twin central on dual carriageway													
	W _E 5 m			W _E 6 m			W _E 7 m			W _E 8 m			W _E 9 m			W _E 7 m			W _E 8 m			W _E 9 m						
	S _I 3.20	S _R 0.74		S _I 2.98	S _R 0.83		S _I 2.78	S _R 0.84		S _I 2.61	S _R 0.85		S _I 2.48	S _R 0.85		S _I 4.72	S _R 0.60		S _I 4.49	S _R 0.61		S _I 4.24	S _R 0.61					
20	.57	.88	28	.52	.88	28	.48	.89	28	.43	.90	28	.41	.90	28	.46	.91	33	.40	.92	31	.36	.93	29				
22	.56	.86	26	.52	.87	26	.49	.88	26	.45	.89	26	.42	.89	26	.45	.91	30	.41	.92	29	.38	.92	27				
24	.56	.85	25	.51	.85	24	.47	.86	24	.44	.87	25	.41	.87	25	.46	.91	29	.41	.91	27	.37	.92	25				
26	.55	.84	23	.50	.85	24	.46	.86	23	.45	.87	23	.42	.88	23	.46	.91	28	.43	.92	26	.38	.92	24				
28	.55	.88	23	.50	.88	22	.45	.89	23	.43	.90	23	.41	.90	23	.43	.88	26	.40	.86	25	.38	.85	23				
30	.57	.85	21	.51	.86	21	.47	.88	21	.45	.88	21	.40	.90	21	.44	.88	26	.41	.91	24	.37	.90	23				
32	.56	.81	21	.51	.82	20	.48	.83	21	.45	.84	21	.43	.84	21	.45	.82	25	.41	.87	23	.38	.90	21				
34	.56	.84	20	.51	.84	20	.46	.85	20	.44	.87	20	.41	.87	15	.44	.79	24	.41	.83	22	.37	.86	21				
36	.53	.86	19	.47	.86	19	.43	.87	19	.40	.88	19	.37	.90	19	.41	.77	23	.38	.77	21	.35	.80	20				
38	.54	.79	18	.49	.80	18	.44	.82	18	.41	.84	18	.38	.85	16	.41	.80	22	.38	.80	21	.35	.82	28				
40	.53	.72	18	.47	.73	18	.43	.75	18	.40	.76	18	.38	.78	16	.42	.83	21	.39	.84	20	.36	.84	19				
42	.53	.71	17	.47	.72	17	.43	.73	17	.40	.75	17	.39	.76	17	.43	.83	21	.39	.85	19	.37	.86	18				
44	.52	.69	16	.48	.71	16	.44	.72	16	.41	.74	16	.38	.75	16	.43	.81	20	.39	.82	19	.35	.85	18				
46	.52	.69	16	.47	.70	16	.42	.72	16	.40	.74	16	.38	.75	16	.41	.76	20	.38	.76	18	.35	.78	18				
48	.51	.67	16	.47	.69	16	.43	.61	16	.41	.73	16	.39	.74	16	.41	.75	19	.39	.75	18	.35	.77	17				
50	.50	.58	16	.48	.60	16	.44	.61	16	.41	.63	15	.38	.65	15	.41	.70	19	.38	.72	18	.35	.74	16				

Table 3 — *r*-table for representative British road surface CIE type C2^a

β°	0	2	5	10	15	20	25	30	35	40	45	60	75	90	105	120	135	150	165	180
$\tan \gamma$																				
0	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329
0.25	362	358	371	364	371	369	362	357	351	349	348	340	328	312	299	294	298	288	292	281
0.5	379	368	375	373	367	359	350	340	328	317	306	280	266	249	237	237	231	231	227	235
0.75	380	375	378	365	351	334	315	295	275	256	239	218	198	178	175	176	176	169	175	176
1	372	375	372	354	315	277	243	221	205	192	181	152	134	130	125	124	125	129	128	128
1.25	375	373	352	318	265	221	189	166	150	136	125	107	91	93	91	91	88	94	97	97
1.5	354	352	336	271	213	170	140	121	109	97	87	76	67	65	66	66	67	68	71	71
1.75	333	327	302	222	166	129	104	90	75	68	63	53	51	49	49	47	52	51	53	54
2	318	310	266	180	121	90	75	62	54	50	48	40	40	38	38	38	41	41	43	45
2.5	268	262	205	119	72	50	41	36	33	29	26	25	23	24	25	24	26	27	29	28
3	227	217	147	74	42	29	25	23	21	19	18	16	16	17	18	17	19	21	21	23
3.5	194	168	106	47	30	22	17	14	13	12	12	11	10	11	12	13	15	14	15	14
4	168	136	76	34	19	14	13	11	10	10	10	8	8	9	10	9	11	12	11	13
4.5	141	111	54	21	14	11	9	8	8	8	8	7	7	8	8	8	8	10	10	11
5	126	90	43	17	10	8	8	7	6	6	7	6	7	6	6	7	8	8	8	9
5.5	107	79	32	12	8	7	7	7	6	5										
6	94	65	26	10	7	6	6	6	5											
6.5	86	56	21	8	7	6	5	5												
7	78	50	17	7	5	5	5	5												
7.5	70	41	14	7	4	3	4													
8	63	37	11	5	4	4	4													
8.5	60	37	10	5	4	4	4													
9	56	32	9	5	4	3														
9.5	53	28	9	4	4	4														
10	52	27	7	5	4	3														
10.5	45	23	7	4	3	3														
11	43	22	7	3	3	3														
11.5	44	22	7	3	3															
12	42	20	7	4	3															

NOTE All the figures in this table relate to a road surface having an average luminance coefficient of 0.07. See "Calculation and measurement of luminance and illuminance in road light", CIE Publication No. 30-2 (TC-4.6).

^a See "Road surfaces and lighting", CIE Publication No. 66 (1984).

Table 4 — Luminaire maintenance factors

Cleaning interval months	Ingress protection number of lamp housing								
	IP2 minimum ^a			IP5 minimum ^a			IP6 minimum ^a		
	Pollution category			Pollution category			Pollution category		
	High	Medium	Low	High	Medium	Low	High	Medium	Low
12	0.53	0.62	0.82	0.89	0.90	0.92	0.91	0.92	0.93
18	0.48	0.58	0.80	0.87	0.88	0.91	0.90	0.91	0.92
24	0.45	0.56	0.79	0.84	0.86	0.90	0.88	0.89	0.91
36	0.42	0.53	0.78	0.76	0.82	0.88	0.83	0.87	0.90

NOTE 1 High pollution occurs in the centre of large urban areas and in heavy industrial areas.

NOTE 2 Medium pollution occurs in semi-urban, residential, and light industrial areas.

NOTE 3 Low pollution occurs in rural areas.

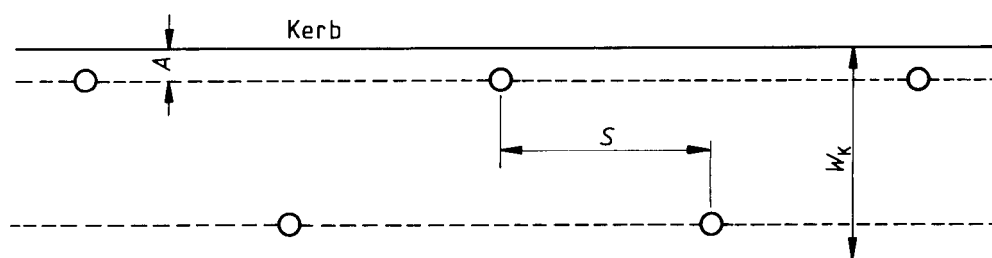
^a See BS 5490.NOTE Effective width (W_E) is $W_K - 2A$ for luminaires over the carriageway and $W_K + 2A$ for luminaires behind the edge of the carriageway.

Figure 2 — Staggered arrangement of luminaires

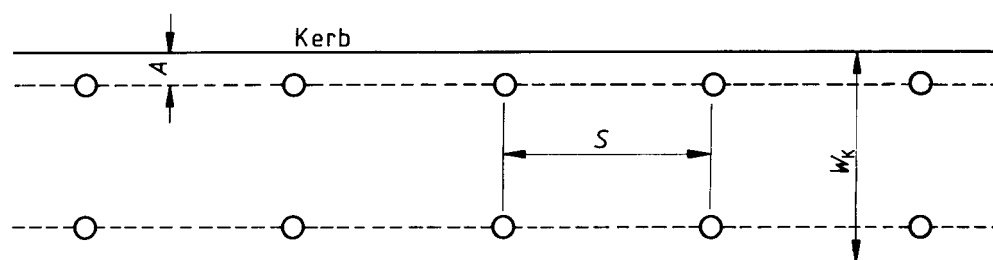
NOTE Effective width (W_E) is $W_K - 2A$ for luminaires over the carriageway and $W_K + 2A$ for luminaires behind the edge of the carriageway.

Figure 3 — Opposite arrangement of luminaires