THE HIGHWAYS AGENCY TA 19/81

THE SCOTTISH OFFICE DEVELOPMENT DEPARTMENT

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Reflectorisation of Traffic Signs

Summary: This Advice Note describes the functions and performance requirements of retro-reflective traffic signs and supersedes TA/1/78, TD/1/78 and Appendix 1 to Chapter 11 of the Traffic Signs Manual.

(Clauses 7.6 and 7.7 are superseded by Ch.8 of TSM.)

VOLUME 8	TRAFFIC SIGNS AND LIGHTING
SECTION 2	TRAFFIC SIGNS AND ROAD MARKINGS

TA 19/81

REFLECTORISATION OF TRAFFIC SIGNS

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1. INTRODUCTION

1.1 This Advice Note describes the functions and performance requirements of retro-reflective traffic signs and supersedes TA/1/78 and TD/1/78. It also supersedes Appendix 1 to Chapter 11 of the Traffic Signs Manual.

NOTE: In the remainder of this document references to reflective signs or reflective materials shall be taken to mean retro-reflective signs or materials.

1.2 The recommendations will be applied to new and replacement signs as regards Trunk Roads and Trunk Road Motorways. It is strongly recommended that the advice be applied to signs on other roads.

1.3 The diagram numbers referred to in this Advice Note are those in the Traffic Signs Regulations and General Directions 1981 9 (S.I. 1981 No 859), except for diagrams 1 to 4 which are contained in the Traffic Signs (Speed Limits) Regulations and General Directions 1969 (S.I. 1969 No 1487).

2. REQUIREMENTS OF THE REGULATIONS

2.1 The Traffic Signs Regulations and General Directions 1981 prescribe the Statutory Requirements for the illumination of signs (other than speed limit signs) by means of direct lighting or reflectorisation. Regulations 15 to 19 inclusive refer and the requirements are summarised in Annex A.

2.2 The illumination requirements for speed limit signs are prescribed in the Traffic Signs (Speed Limits) Regulations and General Directions 1969 and these are summarised in Annex B.

3. FUNCTIONS OF SIGNS

3.1 Traffic Signs must convey their messages to road users clearly and at the correct time. To enable signs to be detected and read by night as well as by day it is necessary for them to be illuminated either by direct lighting or reflectorisation. Annex A details the signs which are required to be illuminated by direct lighting and also lists those which may be reflectorised.

3.2 The target value of a sign is its inherent ability to attract a driver's attention. Increasing the target value of a sign means increasing the distance at which it is detected and recognised as a traffic sign. Early detection means that a driver has more time to decide then to direct his attention to the sign to read and interpret its message. The target value of all reflectorised signs is increased by using a material having a higher reflective property.

3.3 The legibility distance of a sign is the distance at which it can be read by a driver having average visual acuity. Improving the legibility means that a driver will have more time to react and carry out any braking or direction changing involved.

3.4 Trials of permanent directional signs with legends in white reflective material having the photometric properties shown in Table 1 of Annex C have shown an average increase in legibility of 15% compared with legends in white material having the photometric properties shown in Table 2 of Annex C. Reflectorisation of coloured backgrounds had been expected to show a reduction in legibility, but this did not occur. The trials also showed that for green and blue backgrounds, identification of colour was more positive when material to Table 1 of Annex C was used. Reflectorisation of white or red background worded signs in material to Table 1 of Annex C showed no reduction in legibility. It should be noted however, that where black symbols having fine detail are displayed on white backgrounds, eg on some warning and regulatory signs, a gain in target value may be achieved at the expense of a loss in definition of the symbol when materials to Table 1 of Annex C are used for the white background.

3.5 Most signs which are directly lit may also be reflectorised as a safeguard in the event of a power failure. See Annex A paragraph A2.1.

3.6 All advance direction signs shown in Annex A with the Code B which are erected within a system of street lighting (as defined in Annex A at Code A) should be located so as to obtain maximum illumination from the street lighting, as detailed in the Traffic Signs Manual, Chapter 11, paragraphs 11.56 to 11.59 and Fig 11:4.

4. PERFORMANCE REQUIREMENTS OF DIFFERENT TYPES OF REFLECTORISED SIGNS

4.1 The basic requirement of most reflectorised signs will be satisfied by using reflective materials having a photometric performance complying with the requirements set out in Table 2 of Annex C.

4.2 Any sign for which greater target value is desirable and/or any sign with a green or blue background which needs greater legibility distance may be reflectorised with materials having a photometric performance complying with the requirements set out in Table 1 or 1A of Annex C, provided it is mounted in a situation where the entrance angle is not likely to exceed 15 degrees (see Annex C paragraphs C1 and C2).

4.3 Signs similar to those described in paragraph 4.2 but mounted in situations where the entrance angle is likely to exceed 15 degrees (see Annex C paragraphs C1 and C2) should be reflectorised with materials having a photometric performance complying with the requirements set out in Table 1 of Annex C. Examples of situations where this is likely to occur are:-

(a) at roundabouts

(b) where signs cannot be orientated to face directly towards traffic (eg. NO ENTRY signs at a side road junction)

4.4 Signs similar to those described in paragraph 4.2 but used in the following situations:-

(a) where signs must be placed at an unusually large distance from the edge of the carriageway

(b) where carriageways are unusually wide

(c) at road works

(d) overhead signs in unlit areas (NB All overhead signs in lit areas must be directly illuminated)

should be reflectorised with materials having a photometric performance complying with the requirements set out in Table 1 of Annex C even though the entrance angle may not exceed 15 degrees.

4.5 Signs mostly used during daylight, which have limited life or are of a temporary nature, eg certain roadworks signs (as described in paragraph 7.6) and signs giving information about special events, may be reflectorised with material having a photometric performance complying with the requirements set out in Table 3 of Annex C.

4.6 Signs which are not lit but reflectorised in either materials to Tables 2 or 3 of Annex C when viewed under street lighting with or without care headlights are generally not satisfactory because they are not bright enough to compete with the lit background. However, the Department now accepts that certain large, white background, reflectorised signs in material conforming with Table 1 or 1A of Annex C do not need to be directly illuminated in lit areas because they will be sufficiently bright provided that they are located so as to obtain the maximum illumination from the street lighting and that they are positioned correctly (see para 7.2.6).

4.7 Fully reflectorised signs mounted over the carriageway in unlit areas and faced entirely in reflective materials to Table 1 of Annex C have been demonstrated to provide adequate legibility and target value and are

unlikely to need to be directly lit in an unlit area in normal circumstances (see para 7.2.8). All overhead signs in lit areas must be directly illuminated.

4.8 Materials to Table 1 or 1A of Annex C reflect 3 to 4 times more light than materials to Table 2 of Annex C and these materials reflect 2 or 3 times more light than materials to Table 3 of Annex C given the same light source.

4.9 The actual effective life of traffic sign reflective material may be expected to exceed the lift "guaranteed" by the manufacturer and will very according to factor such as:

(a) the extent of compliance with the reflective sheeting manufacturer's processing recommendations;

(b) the materials used in the manufacture of the sign;

(c) the conditions of storage of the sign prior to erection;

(d) the location and orientation of the sign;

(e) the atmospheric and other environmental conditions to which the sign is exposed;

(f) the care and frequency of regular cleaning and maintenance; and

(g) the handling and storage of the sign in the case of a portable sign.

A sign should be considered ineffective when it can no longer be detected or easily read by day and night from a vehicle travelling at the average speed of traffic on the road on which the sign is place.

5. FINANCIAL CONSIDERATIONS

5.1 Materials providing greater reflectivity are generally more expensive than those with lower reflectivity. Some return can be expected from the additional initial cost of using material to Table 1 or 1A of Annex C in the form of improved target value and/or legibility (based on studies of dark background worded signs) which could lead to greater driver comfort and to accident savings, though these benefits cannot be evaluated. There will be actual cash savings, however, wherever the use of material to Table 1 or 1A of Annex C enables the use of direct lighting to be dispensed with in situations where the Traffic Signs Regulations and General Directions do not specifically require that they be so illuminated, eg the final Advance Direction Sign on Motorways and Trunk Roads which has traditionally been lit on unlit roads. Cash benefits will also be derived from the reduction in sign replacement costs if materials are used which have a longer effective life.

5.2 The low cost of road works signs in materials to Table 3 of Annex C justifies their use for short duration works mostly conducted in daylight. These signs generally have a short life because of the excessive amount of handling they receive.

6. BRITISH STANDARDS 873 ROAD TRAFFIC SIGNS AND INTERNALLY ILLUMINATED BOLLARDS

6.1 BS 873: Part 1 : 1970 is being totally revised and will provide amongst other things detailed specifications for the minimum reflective qualities of Class 1, Class 2 and Class 3 materials and their durability.

6.2 It is expected that the requirements shown in Table 1 of Annex C will be equivalent to the minimum photometric qualities of Class 1 material, the requirements shown in Table 2 of Annex C will be equivalent to the minimum photometric qualities of Class 2 material and the requirements shown in Table 3 of Annex C will be equivalent to the minimum photometric qualities of Class 3 material in the revised BS 873. Until the revised BS is issued, users should specify the material they require by using the description "material having a photometric performance complying with the requirements set out in Table 1, 1A, 2 or 3 of Annex C of the Department of Transport Advice Note TA/19/81".

7. RECOMMENDATIONS

7.1 GENERAL

The following advice about the uses of the various types of reflective material will be reviewed as further experience is gained. The decision about which grade of reflective material to use in any particular case should be based on the performance and financial considerations given above. Attention is drawn to paragraph 4.2, 4.3 and 4.4 relating to the requirements, applications and photometric properties of materials having different properties of reflection at the wider entrance angles.

7.2 DIRECTIONAL AND OTHER INFORMATORY SIGNS

GREEN OR BLUE BACKGROUND SIGNS

7.2.1 All new or replacement directional signs on unlit Motorways and Primary Routes must be fully reflectorised (ie reflective materials must be applied to all parts of the sign except any coloured black) as now required by the 1981 Regulations.

7.2.2 Materials to Table 2 of Annex C are suitable for many applications but where greater target value and/or legibility distance is required materials to Table 1 or 1A of Annex C are recommended. However, there is at present no material to Table 2 of Annex C available in Middle Brunswich Green (BS 381c : 1980, No 226) for the background of Primary Route signs (ie colour Green (1)), therefore material having higher reflective and of the correct colour must be used for the backgrounds and the same grade used for the legends of these signs.

7.2.3 New or replacement Final Advance Direction signs and signs at the bifurcation of grade separated junctions on Motorways and Primary Routes in unlit areas should not be provided with direct illumination, but should be reflectorised with materials to Table 1 or 1A of Annex C. The signs covered by this paragraph are those in diagrams 703, 714, 907, 910 and 910.1.

LIGHT BACKGROUND SIGNS

7.2.4 Reflectorising the backgrounds of white or yellow background signs with materials to Table 1 or 1A of Annex C produces enhanced target value.

7.2.5 The blue borders of local direction signs and the red borders and chevrons of MOD direction signs may be in materials to Table 1 or 1A of Annex C.

7.2.6 Signs to diagrams 718, 718.1, 719 to 723, 727, 728.1, 729 to 730, 760, 761 and 812, do not require to be directly illuminated when they are within 50 metres of a street light forming part of a system of street lighting as they will be sufficiently bright provided they are:

i. reflectorised in materials to Table 1 or 1A of Annex C.

ii. located so as to obtain the maximum illumination from the street lighting - see Traffic Signs Manual, Chapter 11, paragraphs 11.56 to 11.59 and Fig 11:4;

iii. positioned correctly, taking particular care with orientation to avoid the risk of specular reflection - see TSM, Chapter 1 (1977), Section 6, para 1.51.

NOTE: If a reflectorised only sign at a particular location does not perform adequately, it may be directly illuminated.

SIGNS MOUNTED OVER THE CARRIAGEWAY

7.2.7 All overhead signs in lit areas must be directly illuminated.

7.2.8 Overhead signs in unlit areas may themselves be unlit provided they are fully reflectorised in materials to Table 1 of Annex C if for example:-

i. there is no lit background to the sign;

ii. there are no sharp bends on the approach;

iii. sign mounting is not unusually high; or

iv. the area is not prone to fog or mist.

If any of these or any other disabling condition applies, the sign must be directly illuminated and may also be fully reflectorised in materials to Table 1 of Annex C.

7.3 WARNING SIGNS

7.3.1 Materials to Table 2 of Annex C are suitable for many applications but the target value of all of these signs, whether triangular or rectangular, will be improved by the use of materials to Table 1 or 1A of Annex C.

7.3.2 However, there is some evidence that the legibility of symbols having fine details is reduced if the background is in materials to Table 1 or 1A of Annex C. Therefore, in these cases (eg diagram 529.1), materials to Table 2 of Annex C are recommended unless target value is considered to be of overriding importance, such as in the following circumstances:

(a) when the clear visibility distance is at or near the minimum laid down in Circular Roads No 7/75, Appendix 1;

(b) when a sign must be placed at an unusually large distance from the edge of the carriageway;

(c) when a sign is set against a non-contrasting background;

(d) when there is a history of accidents at a particular location.

7.4 REGULATORY SIGNS

7.4.1 Materials to Table 2 of Annex C are suitable for many applications, but the target value of all of these signs will be improved by the use of materials to Table 1 or 1A of Annex C.

7.4.2 As in the case of some warning signs, the legibility of symbols having the detail is reduced if the background is in materials to Table 1 or 1A of Annex C and in these cases (eg diagram 621) materials to Table 2 of Annex C are recommended unless target value is considered to be of overriding importance, such as in the circumstances given 7.3.2 above. In addition, where signs cannot be orientated to face directly* towards oncoming traffic, materials to Table 1 of Annex C should be used (eg NO ENTRY signs in a side-road entrance).

7.4.3 Signs to Diagrams 606, 609 to 611 and 616 when mounted in an internally illuminated bollard must be internally illuminated throughout the hours of darkness. Exceptionally, in rural areas where there is no local electricity supply nor any street light forming part of a system of street lighting within 50m, a reflective only sign may be used in a reflective only bollard. In this case, reflective materials to Table 1 or 1A of Annex C must be used for the sign and bollard panels.

NOTE: The general appearance and size of reflective only bollards should be similar in all respects to internally illuminated bollards (those to BS 873 : Part 3 : 1980.

7.5 SPEED LIMIT SIGNS

Speed limit signs to Diagrams 1 to 4 of the Traffic Signs (Speed Limits) Regulations and General Directions 1969 (S.I. 1969 No 1487) when erected on unlit roads, will be more effective if reflectorised in materials to Table 1 or 1A of Annex C.

7.6 SIGNS AT ROADWORKS (except Traffic Cones and Cylinders)

All roadworks signs should be reflectorised as recommended in the Traffic Signs Manual, Chapter 8. Because these signs are used in situations where drivers do not normally expect to see them, their after-dark target value is extremely important (see Traffic Signs Manual, Chapter 8, para 8.126). However, many short duration jobs, such as described in TA/6/80, 'Traffic Signs for Minor works on Minor Roads', are started and completed during daylight and do not normally need to continue after dark. For this kind of work carried out on roads where traffic speeds are unlikely to exceed 50mph, signs in materials to Table 3 of Annex C may be used. For all other works the signs should be in materials to Table 2 of Annex C or even Table 1 of Annex C.

7.7 TRAFFIC CONES AND CYLINDERS

The reflective material used on cones and cylinders should conform at least with the requirements of Table 3 of Annex C.

*see TSM Chapter 1 (1977), Section 6, about the avoidance of specular reflection.

8. SPECIAL CASES

There are certain signs for which a high target value is desirable for maximum effectiveness in unlit areas and all of these will be improved by being fully reflectorised* in materials to Table 1 or 1A of Annex C always bearing in mind the requirements of Regulation 15 of the Traffic Signs Regulations and General Directions 1981 and paragraph 4.2, 4.3 and 4..4. These signs are:

501	560	611.1
515	561	615
532.1	564	616
539-541	569	617
542	569.1	634
542.1	601.1	635
542.2	602	652
544	606	727.2
544.1	609	728.3
544.2	610	822
545	611	823-825

*except any part coloured black.

9. ENQUIRIES

GENERAL GUIDANCE ON THE STATUTORY REQUIREMENTS FOR THE ILLUMINATION OF TRAFFIC SIGNS (OTHER THAN SPEED LIMIT SIGNS)

A1. The requirements for the illumination of traffic signs are codified by letters in the Schedule below. Tables 1 to 4 in this Annex list the illumination requirements for individual signs in code form. Reference to the Common Requirements given below, the Tables and the Schedule enables the illumination requirements for any sign (other than a speed limit sign) to be readily ascertained.

NOTE: Appendix 1, to Chapter 11 of the Traffic Signs Manual, is hereby cancelled.

A.2. COMMON REQUIREMENTS ADDITIONAL TO THOSE GIVEN IN THE TABLES

A2.1 Any of the signs in the tables, except signs to diagrams 560 and 561 may be lit and any sign, except those to diagrams 536, 605.1 and 828.1, may be fully reflectorised by the application of reflective material.

NOTE: All signs which are to be reflectorised must be fully reflectorised except that no reflective material shall be applied to any part of the signs coloured black. See also Regulation 18(3) and (4) of the Traffic Signs Regulations and General Directions 1981.

A2.2 Where the message given by a sign does not apply at all times, the sign shall be illuminated in accordance with the Tables and Schedule, but only when the message applies.

SCHEDULE

Code	Method of Illumination
A	When erected within 50 m of any electric lamp forming part of a system of street lighting (at least 3 such lamps not more than 183 m apart),* the sign SHALL be internally or externally lit for so long as the street lighting system is illuminated (when it SHALL also be reflectorised if lit for only part of the night) or throughout ALL of the hours of darkness unless erected temporarily: i. for a temporary statutory provision; ii. by reason of some emergency; or iii. if there is a speed limit of 30 mph or under, by reason of the execution of works or of any obstruction on the road. When the sign is not internally or externally lit regularly throughout ALL of the hours or darkness (whether it is required to be or not) it SHALL be reflectorised.
B	The sign MAY be internally or externally lit, but if it is not so lit throughout ALL of the hours of darkness it SHALL be reflectorised.

*The three lamps need not be in the same street

Code	Method of Illumination
C	The sign SHALL be internally or externally lit throughout the hours of darkness.
D	When fixed to traffic light signals the sign SHALL be internally illuminated at all times except when the signals are being maintained or repaired.
E	When mounted in an internally illuminated bollard the sign SHALL be illuminated throughout the hours of darkness.
F	The supplementary plate SHALL be illuminated by the same means (internal or external lighting) as that used for the sign with which it is associated, unless the lighting provided for the sign adequately illuminates the plate. The plate SHALL be relectorised if the sign is reflectorised except Dia. 662.
G	The hazard marker shall accord with the requirements of Regulation 17 and Direction 23 of the Traffic Signs Regulations and General Directions 1981.
H	The school crossing patrol sign shall accord with the requirements of Regulation 18(3) (b) of the Traffic Signs Regulations and General Directions 1981.
I	The “ANOTHER TRAIN COMING” sign shall accord with the requirements of Regulation 15(6) of the Traffic Signs Regulations and General Directions 1981.
X	There is no specific requirement for the illumination of the sign, but see para A2.1 of this Annex.

Table 1

DIAGRAM	CODE	DIAGRAM	CODE	DIAGRAM	CODE
501	A	536	X	557	B
502	F	537	A	558	B
503	F	537.1	F	559	B
504.1	A	537.2	F	560	G
505.1	A	537.3	F	561	G
506.1	A	537.4	F	562	B
507.1	A	538	A	563	F
508	A	539	B	564	A
509	A	540	B	564.1	F
510	A	541	B	564.5	A
511	F	542	B	565.1	A
512	A	542.1	B	565.2	A
513	A	542.2	B	565.3	A
515	B	543	A	565.4	A
516	A	544	A	566	A
517	A	544.1	A	567	X
518	F	544.2	A	567.1	X
519	F	545	B	567.2	A
519.1	F	546	F	569	B
520	A	547.1	F	569.1	B
521	A	547.2	F	569.2	A
522	A	547.3	F	569.3	A
523.1	A	547.4	F	569.4	B
524.1	A	548	B	570	F
525	F	549	B	571	F
526	F	550	B	572	F
527	F	550.1	B	573	F
528	A	551	B	574	B
529	A	552	B	575	F
529.1	A	553	F	576	X
530	A	554	B	577	B
532.1	A	554.1	B	578	B
533	A	555	A	579	F
534.1	F	556	A	580	B
534.2	F	556.3	F		
535.1	F	556.4	F		

Table 2

DIAGRAM		CODE	DIAGRAM		CODE	DIAGRAM	CODE
601.1		A	619.4		F	642.1	F
602		A	620		F	643	F
602.1		F	620.1		F	644	F
603		C	621		A	645	F
604		C	622.1A		A	646	B
605.1		H	622.2		A	647	B
606	(not in a lit bollard or	A	622.3		F	649.1	A
606	(with light signals)	D	622.5		X	651	X
606	(in an internally lit	E	624		X	652	A
607		F	625.1		X	654	A
608		F	625.2		F	655	B
609	(not in a lit bollard)	A	626.1		A	656	F
609	(in an internally lit	E	627		F	656.1	F
610	(not in a lit bollard)	A	629		A	660.2	F
610	(in an internally lit	E	629.1		A	661	X
611	(not in a lit bollard)	A	632		A		
611	(in an internally lit	E	633		B		
611.1		A	635		B		
612	(not with signals)	A	636		X		
612	(with light signals)	D	636.1		X		
613	(not with signals)	A	637		X		
613	(with light signals)	D	638		X		
614	(not with signals)	A	639		X		
614	(with light signals)	D	639.2		X		
615		A	640		X		
616	(not in a lit bollard)	A	640.1		X		
616	(in an internally lit	E	640.2A		X		
617	(except with 618)	A	640.4		X		
617	(used with 618)	X	640.5		X		
618		F	641		X		
618.1		F	642	(450 mm or less dia)	B		
619		A					
619.1		A	642	(greater than 450 mm)	A		
619.3		F					

Table 3

DIAGRAM	CODE	DIAGRAM	CODE	DIAGRAM	CODE
701	A	722	B	736.1	B
702	A	723	B	737.1	B
702.1	A	724	B	739	X
703	A	724.1	B	739.1	X
703.1	A	724.2	B	739.2	X
703.2	A	725	B	739.3	X
703.3	A	726	B	741	X
704	A	727	B	741.1	X
705	A	727.2	B	742.1	X
706	A	728	A	742.2	X
707	A	728.1	B	742.3	X
708	A	728.2	B	742.4	X
709	A	728.3	B	743.1	X
710	A	729	B	744.1	X
710.1	A	729.1	B	746.2	B
711	A	729.2	B	747	X
712	A	730	B	748	X
712.1	A	732	B	749	X
713	B	732.1	B	750	X
714	A	732.2	B	751	X
715	B	732.4	B	752	X
716	B	733	B	752.1	X
717	B	733.1	B	753	X
718	B	734.1	B	753.1	X
718.1	B	734.2	B	754	B
718.2	A	734.3	B	755	B
718.3	A	734.4	B	755.1	B
719	B	734.5	B	756	B
719.1	B	734.6	B	756.1	B
719.2	B	734.7	B	757	B
719.3A	B	734.8	B	758	X
719.4	B	734.9	B	759	X
720	B	734.10	B	760	B
721.1	B	736	B	761	B

Table 4

DIAGRAM	CODE	DIAGRAM	CODE	DIAGRAM	CODE
801	B	824	B	856	B
801.3	X	825	B	857	X
801.4	X	826	X	858	A
801.5	X	827	B	858.1	A
802.1	F	828.1	I	858.2	A
803.1	F	828.2	B	861	B
804.1	F	830	B	862	B
804.2	F	830.1	B	863	B
804.3	F	830.2	B		
805	F	831	B		
806	B	832	B		
806.1	B	832.1	B		
806.3	B	832.2	B		
807	F	833	X		
808.1	B	834	X		
808.3	B	835	X	901.1	A
810	X	836	X	903.1	A
810.1	X	837.1	A	904.1	A
811	B	838.1	A	905	A
812	B	838.2	A	906	A
812.1	B	838.3	B	906.1	A
812.2	B	838.4	B	906.2	A
812.3	F	841	X	907	A
812.4	F	841.1	X	908.1	A
814	C	842.1	X	908.2	A
815	X	842.2	X	909.1	A
816	X	842.3	X	910	A
816.1	X	842.4	X	910.1	A
817	X	843	X	911	A
817.1	F	844	X	912	B
818	A	845	X	913.2	X
818.1	A	846	X	913.3	X
818.2	A	847	X	915	A
819.1	A	848	X	916	A
819.2	A	849	X	916.1	A
819.3	B	850	X	917	B
820	B	851	X	918.1	A
821	B	852	X	919.1	A
822	B	854	B	920	B
823	B	855	B	925	B

GENERAL GUIDANCE ON THE STATUTORY REQUIREMENTS FOR THE ILLUMINATION OF SPEED LIMIT SIGNS

B1. The purpose of this Annex is to enable the illumination requirements for any speed limit sign to be readily ascertained.

B2. The definition of 'terminal sign' and the sizes and diagrams of signs are given in the Traffic Signs (Speed Limits) Regulations and General Direction 1969, SI 1969 No 1487.

B3. ILLUMINATION REQUIREMENTS

B3.1 Any terminal sign of size 1 or 2 to diagrams 1 to 4, when erected on a trunk or principal road within 50 m of an electric street lamp SHALL either be:

(a) continuously illuminated by internal or external lighting throughout ALL of the hours of darkness, and MAY also be reflectorised, or

(b) externally lit while the street lamp is lit and SHALL also be reflectorised.

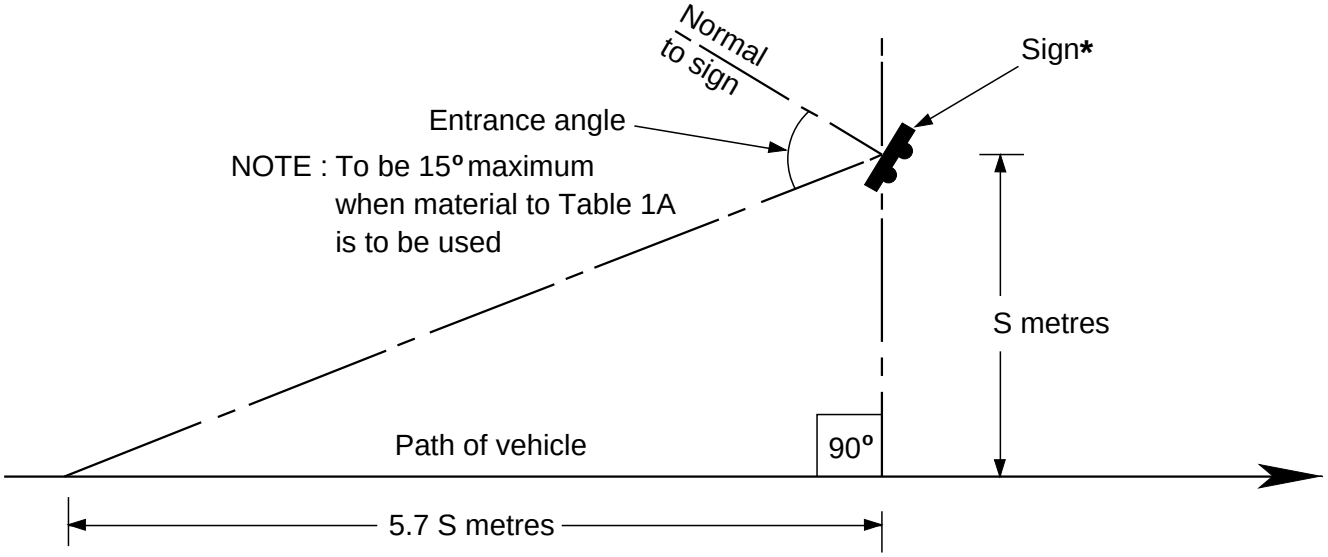
B3.2 Any sign not directly lit throughout ALL of the hours of darkness SHALL be reflectorised.

B3.4 If any sign is directly lit (whether it is required to be or not) then every other sign of the same diagram number erected nearby on the road or at the same junction and which serves the same purpose as the lit sign SHALL be lit throughout the same period and by the same means of internal lighting; and, if any one of the signs is reflectorised, then they SHALL all be reflectorised.

PHOTOMETRIC PROPERTIES OF REFLECTIVE MATERIALS

C1. The full angular performance of reflective material conforming in all respects with Table 1 in this Annex makes it suitable for the applications mentioned in paragraphs 4.2, 4.3 and 4.4.

C2. However, a material with lower coefficients of retro-reflection at wide angles is acceptable in situations where the entrance angle could not exceed 15 degrees from any view point from a vehicle being driven on the carriageway, at a distance 5.7S metres from the sign (S is the sideways displacement of the sign) - See Fig below. The photometric performance of this narrow entrance angle material should comply with the requirements set out in Table 1A of this Annex.



PLAN VIEW OF SIGN AND VEHICLE PATH FIG.1

***** Orientated where necessary in order to avoid specular reflection, see TSM Chapter 1 (1977), Section 6.

Table 1 - Reflective Material

Minimum coefficient of retro-reflection (cd/lux/m²) when new.

Entrance Angle	Observation Angle	Minimum Coefficient of Retro-Reflection				
		Red	Yellow	Green (1)	Blue	White
		minimum candelas/lux/m²				
-5°	12'	35	170	20	20	250
	20	25	120	14	14	180
	1.0°	2	12	0.3	1	20
15°	12'	30	120	15	15	200
	20'	20	80	10	10	150
	1.0°	1.5	8	0.2	0.7	15
40°	12'	16	80	6	9	120
	20'	13	65	5	7	95
	1.0°	1	3	0.1	0.5	5

Notes: 1. In no circumstances shall the coefficient of retro-reflection of any material exceed 1000 cd/lux/m².

2. Green (1) is the background colour used for primary route signs.

Table 1A - Reflective Material

Minimum coefficient of retro-reflection (cd/lux/m²) when new.

Entrance Angle	Observation Angle	Minimum Coefficient of Retro-Reflection				
		Red	Yellow	Green (1)	Blue	White
		minimum candelas/lux/m²				
-5°	12'	35	170	20	20	250
	20	25	120	14	14	180
	1.0°	2	12	0.3	1	20
15°	12'	30	120	15	15	200
	20'	20	80	10	10	150
	1.0°	1.5	8	0.2	0.7	15
30°	12'	12	50	5	4	70
	20	10	35	5	3	50
	1.0°	1.5	3	1	0.6	5
40°	12'	3	8	1	1	15
	20'	2.5	5	1	0.8	10
	1.0°	0.3	0.5	0.2	0.1	1.5

Notes: 1. In no circumstances shall the coefficient of retro-reflection of any material exceed 1000 cd/lux/m².

2. Green (1) is the background colour used for primary route signs.

Table 2 - Reflective Material

Minimum coefficient of retro-reflection (cd/lux/m²) when new.

Entrance Angle	Observation Angle	Minimum Coefficient of Retro-Reflection				
		Red	Yellow	Green (2)	Blue	White
		minimum candelas/lux/m²				
-5°	12'	12	50	5	4	70
	20	10	35	5	3	50
	1.0°	1.5	3	3	0.6	5
15°	12'	10	35	3	3	55
	20'	8	20	3	2	45
	1.0°	1	2	1	0.3	3
40°	12'	3	8	1	1	15
	20'	2.5	5	1	0.8	10
	1.0°	0.3	0.5	0.2	0.1	1.5

NOTES: Green (2) is used for the green parts of signs other than primary route signs.

Table 3 - Reflective Material

Minimum coefficient of retro-reflection (cd/lux/m^2) when new.

Entrance Angle	Observation Angle	Minimum Coefficient of Retro-Reflection				
		Red	Yellow	Green (2)	Blue	White
		minimum candelas/lux/m^2				
-5^0	20'	5.0	15.0	3.0	3.0	30.0
	1.0'	0.8	2.0	0.4	0.4	4.0
	2.0^0	0.3	0.8	0.2	0.1	1.5
15^0	20'	4.2	11.0	2.0	2.0	21.0
	1.0'	0.5	1.3	0.3	0.2	2.5
	2.0^0	0.3	0.8	0.2	0.1	1.5
40^0	20'	0.8	2.1	0.4	0.4	4.2
	1.0'	0.3	0.6	0.1	*	1.2
	2.0^0	0.1	0.4	*	*	0.8

* Indicates less than 0.1.

Notes: Green (2) is used for the green parts of signs other than primary route signs.