

CSS Street Lighting Project SL5/2007
Published Project Report PPR383

Guidance on the lighting requirement for traffic signs and bollards

J Cooper and J Mitchell



Foreword

In pursuing its goals of providing advice and guidance to lighting practitioners, the CSS Lighting Group, in partnership with SCOTS, Transport Scotland, ILE, and TfL has commissioned five research projects to advance some major lighting issues.

One of these involved investigation of the cost / benefit of the illumination of traffic signs across the UK. The work was undertaken by TRL Ltd and the full report is available as a download.

This guidance document was developed to accompany the research with the intent of clarifying which specific traffic signs need to be illuminated in different circumstances and provide practical advice on an evolving range of low energy and solar powered lighting solutions.

Modern retroreflective and other materials may provide a possible channel for future relaxation in regulations governing illumination, but there are actions that local authorities can take now that will assist in minimising energy consumption, carbon footprint and the hazards created for operatives when working on lighting installations in close proximity to live traffic. These are included as recommendations in the document.

Since completion of the research, DfT have announced a traffic signs policy review and one aspect of this is the illumination requirements for traffic signs. I hope that the report and this guidance document is able to inform that review and proves to be valuable in assisting lighting and traffic engineers in their work.

The project was managed on behalf of CSS-LG by Lindsay McGregor, Dundee City and Perth and Kinross Councils and Dave Johnson, TfL. The efforts of the many individuals at local authorities throughout the UK who supported the project by providing invaluable background information must also be acknowledged.

This guidance document was endorsed by the CSS Lighting Group on 18th June 2008.

When purchased in hard copy, this publication is printed on paper that is FSC (Forest Stewardship Council) registered and TCF (Totally Chlorine Free) registered.

GUIDANCE ON THE LIGHTING REQUIREMENT FOR TRAFFIC SIGNS & BOLLARDS

by J.Cooper and J.Mitchell

TRL
Crowthorne House
Nine Mile Ride
Wokingham
Berkshire
RG40 3GA

Prepared for: Project Record: Brief SL5/07

Client: CSSLG, UKLB, SCOTS, ILE and TfL

Copyright Transport Research Laboratory June 2008

This Published Report has been prepared for CSSLG, UKLB, SCOTS, ILE and TfL. Published Project Reports are written primarily for the Client rather than for a general audience and are published with the Client's approval.

Copyright TRL June 2008

Commissioned by Transport for London (TfL)

CSS Project led by

Dave Johnson (TfL) and

Lindsay McGregor (Dundee City and Perth & Kinross Council)

Endorsed by the County Surveyors Society Lighting Group, 18 June 2008.

CONTENTS

Executive Summary	iii
Recommendations	iii
1 Introduction	1
2 Statutory lighting requirements	2
2.1 Traffic Signs	2
2.1.1 Regulatory Signs	2
2.1.2 Warning signs	2
2.1.3 Directional signs	3
2.1.4 Informatory signs	3
2.1.5 Bus, tram and pedal cycle signs	3
2.2 Traffic Bollards	4
3 Process of obtaining special signs authorisation on an 'area wide' basis	5
3.1 Procedures for applying for 'authority wide' use of unlit traffic signs	5
3.2 Procedures for applying for 'authority wide' use of unlit or solar powered retroreflective traffic bollards	5
4 Traffic sign retroreflective materials and lighting: official guidance	7
4.1 Introduction	7
4.2 Traffic Signs Manual Chapters 3 and 4	7
5 Factors adversely affecting the retroreflective performance of signs	8
5.1 Dew formation	8
5.2 Dirt	8
5.3 Graffiti	9
6 Practical advice on the use of various traffic signs & bollards	10
6.1 Introduction	10
6.2 Internally and externally illuminated traffic signs	10
6.2.1 Using LEDs as the light source instead of standard luminaries	11
6.2.2 Low voltage lighting systems	11
6.2.3 Solar powered signs	11
6.3 Electroluminescent signs	12
6.4 Traffic bollards	13
6.4.1 Introduction	13
6.4.2 Retroreflective self-righting bollard (RSRB)	14
6.4.3 Solar powered retroreflective self-righting Bollards (RSRBs)	15
Acknowledgements	16
References	16
Appendix A. - Illustration of traffic Signs with illumination requirements	17
Appendix B. - Application for special signs approval	19

Executive Summary

This guidance provides highway / road authorities with advice on the current requirements for the illumination of traffic signs and bollards, outlines the prerequisite process of obtaining authority to use non-illuminated traffic bollards on the highway and provides information on current retroreflective, solar powered and low energy sign lighting materials. The following recommendations have been derived from the work undertaken by TRL in order to reduce carbon footprint, energy consumption, and sign clutter.

Recommendations

Highway / Road authorities should:-

1. Audit their traffic signs and consider removing any unnecessary sign lighting.
2. Consider the removal of unnecessary traffic signs. DfT have stated that it is essential that all unnecessary warning signs be removed.
3. Consider the use of LED or other low voltage / energy sign lighting, solar powered sign lighting or using electroluminescent signs.
4. Make application for the use of retroreflective self righting traffic bollards and consider using them in situations where safety is not likely to be compromised. It is also strongly recommended, for safety reasons, that non-illuminated traffic bollard should be properly maintained, i.e. the retroreflective faces are regularly cleaned and replaced immediately following damage.
5. Consider the use of solar powered traffic bollards.
6. Where practicable 'switch' bollards and signs so they are only illuminated during the hours of darkness.
7. Remind designers of traffic schemes of their responsibilities under the CDM regulations (TSO, 2007b) to ensure that a safe working environment can be provided for electrical maintenance operatives when working in close proximity to live traffic.
8. Before installing new traffic signs and bollards:
 - Undertake a risk assessment, to include assurance of appropriate arrangements for maintenance
 - Weigh up the benefits against the whole life cost to ensure best value
9. Note that further work is due to investigate what methods can be used to improve the conspicuity of traffic signs in areas with street lighting, so as to overcome the current requirement to provide direct illumination to many traffic signs.

1 Introduction

A review has been conducted by TRL into the costs and benefits which accrue from the current statutory regulations, i.e. the Traffic Signs Regulations and General Directions, 2002 for the illumination of traffic signs and traffic bollards. This review was initiated as a result of escalating energy costs, the need to minimise carbon footprints and the development of high performance retroreflective signing materials, which may in some circumstances, provide acceptable levels of conspicuity without the need for direct lighting.

This document provides guidance and practical advice on:

- The current legal requirements for the illumination of traffic signs, i.e. which signs must be lit and, those signs which have exemptions to the statutory requirements regulations under specified conditions.
- The luminance levels required for both internally and externally lit signs, as specified in BS EN 12899-1:2007.
- The illumination requirements for transilluminated traffic bollards.
- Department for Transport's (DfT's) current position regarding any possible relaxations to the requirement to light traffic signs and bollards in areas with street lighting.
- Procedures for applying for 'authority wide' basis for the use of unlit retroreflective traffic bollards in areas with street lighting.
- Official guidance given in the appropriate Traffic Signs Manual on the use of high performance retroreflective signing materials for different types of traffic sign.
- Factors affecting the optical performance of retroreflective traffic signs, plus preventative and maintenance measures.
- Practical advice on the use of various types of illuminated traffic signs & traffic bollards (both lit and unlit).

More detailed information related to this review of the lighting requirements for traffic signs and traffic bollards can be found in the project report (Cooper, et al, 2008).

2 Statutory lighting requirements

2.1 Traffic Signs

Section 64 of the Road Traffic Regulation Act 1984 enables the making of traffic sign regulations. Current “Traffic Signs Regulations and General Directions” were issued in 2002 (TSRGD, 2002) and illumination requirements are laid out in Schedule 17. Within Schedule 17, a ‘system of street lighting’ is defined as “at least three lamps not more than 183 metres apart, [185 metres in Scotland]”. Neither RTRA 84 nor TSRGD 2002 extend to Northern Ireland.

The relevant regulations listed in Schedule 17, as they apply to five main types of permanent traffic sign: regulatory signs, warning signs, directional signs, informatory signs and signs for bus, tram and cycles, are summarised below:

2.1.1 Regulatory Signs

- Regulatory signs, other than those relating to stopping or parking and speed limits, are covered by Schedule 17 Item 1 and need to be directly lit if located in a system of street lighting and within 50 metres of a street lamp, otherwise they must be reflectorised.
- Terminal speed limit signs¹ need to be directly lit if on a principal road (i.e. a classified ‘A’ road), located in a system of street lighting and within 50 metres of a street lamp; other maximum speed limit signs do not, but must be reflectorised.
- Terminal minimum speed limit signs and national speed limits apply signs need to be directly lit if erected on a trunk or principal road and located in a system of street lighting, otherwise they must be reflectorised.

2.1.2 Warning signs²

- These signs fall within the scope of Item 1 or Item 4 of Schedule 17.
- Following the revision of TSRGD in 2002, some warning signs still require lighting in all circumstances and these are listed in Schedule 17 Item 1. i.e. signs to diagram numbers 501, 520, 530, 531.1, 532.2 (in respect of the triangle symbols), 532.3 (in respect of the triangle symbols), 543, 544, 544.1, and 544.2
- Some warning signs need to be lit unless they are located on a single carriageway, non-principal or non-trunk road with a speed limit of 30mph or less, in which case they must be reflectorised. These are signs to diagram 504.1, 505.1, 506.1, 507.1, 508.1, 509.1, 510, 512, 512.1, 512.2, 513, 516, 517, 521, 522, 523.1,



Sign 530



Sign 516

¹ A terminal speed limit sign is that which marks the change of a speed limit, e.g. from the national speed limit to 40mph.

² Diagrams of warning signs for each of the three categories described are shown in Appendix A.

524.1, 528, 529, 529.1, 545, 557.1 & 950

- Warning signs which indicate potential dangers are shown in schedule 17 Item 4, and are required to be either reflectorised or directly lit. These are signs to diagrams 515, 515.1, 515.1A, 528.1, 548, 549, 550, 550.1, 550.2, 551, 551.1, 551.2, 552, 553.1, 554, 554.1, 554.2, 555.1, 556, 556.1, 557, 558, 558.1, 559, 562, 574, 581, 582, 583, 584



Sign 557

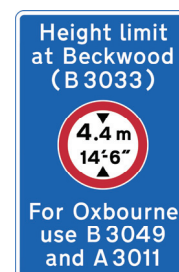
2.1.3 Directional signs

- All directional signs, except tourist destination signs, fall under Schedule 17 Item 4, and so must be either reflectorised or directly lit. Tourist destination signs are covered by Item 9 and do not require lighting or reflectorising.



2.1.4 Informatory signs

- Most informatory signs fall under Schedule 17 Item 4 and are required either to be reflectorised or directly lit, exceptions to this being informatory signs aimed at pedestrians or informatory signs related to car park accesses or similar scenarios, which fall under Item 9 and do not require either.



2.1.5 Bus, tram and pedal cycle signs

- Most bus, tram and pedal cycle signs aimed at motorists fall under Schedule 17 Item 4 and are required either to be reflectorised or directly lit. Exceptions to this include the regulatory sign 952 (buses prohibited), signs showing the route for buses and pedal cycles only (953) and the route for use by tramcars only (953.1). All of these signs are listed in Schedule 17 Item 1 and still require lighting in all circumstances.
- Most signs aimed at cyclists do not have any specific lighting requirements apart from signs 955, 956 and 957 which are covered by Schedule 17 Items 3 and 7 and must be directly lit if they are a terminal sign erected on a road that is within 50 metres of a street lamp which forms a system of street lighting.



Sign 953



Sign 955

2.2 Traffic Bollards

The luminance requirements for transilluminated traffic bollards are set out in BS EN 12899-2:2007. This British Standard has recently replaced BS 873 Part 3:1980.

Two lamps operated on independent, separately fused circuits must be used so that in the event of failure of one lamp, illumination of the bollard still occurs.

Regulatory signs, where mounted in a traffic bollard, fall under TSRGD, 2002 Schedule 17 Item 7. Where mounted in a bollard fitted with a means of lighting it internally, the sign must also be internally illuminated throughout the hours of darkness. The signs in question are those to diagram: 606, 610, 611, 616, 951, 955, 956 and 957.



Sign 606



Sign 611



Sign 616

The last few years have seen the introduction of the retroreflective self-righting traffic bollard (RSRB). In certain circumstances, which are specified in Section 3 of this Guidance document, these non-illuminated traffic bollards can be authorised for use by the Department for Transport (DfT), or the Scottish or Welsh Government as appropriate in place of traditional internally lit bollards.³

³ See appendix B

3 Process of obtaining ‘area wide’ special signs authorisation

Section 64 (2) of the Road Traffic Regulation Act 1984 enables authorisation of signs of a character not stipulated within TSRGD 2002. In England this authorisation is obtained via the Department for Transport, in Scotland via The Scottish Government, and in Wales via the Welsh Government. Separate procedures apply in Northern Ireland where neither the Road Traffic Act 1984 nor TSRGD 2002 applies. Detail of application requirements and addresses are given at appendix B.

3.1 Procedures for applying for ‘authority wide’ use of unlit traffic signs

DfT have said that they are unable to issue special authorisations on a national basis or to multiple local highway authorities because of legal restrictions placed upon them. On the basis that this also applies in Scotland and Wales each authority must apply individually.

In terms of authorising the removal of lighting from traffic signs, each sign is individually assessed and the lighting requirements for that sign are set out on a national basis, with no scope for local variations. If any signs that normally required lighting were to be exempted, then this would be done on a sign by sign basis. In practice, approval is unlikely.

3.2 Procedures for applying for ‘authority wide’ use of unlit or solar powered retroreflective traffic bollards

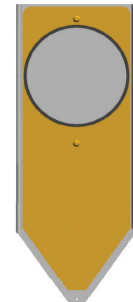
In order to use unlit retroreflective bollards, it is first necessary to receive specific authorisation.⁴ Approvals will normally authorise use in the following situations:

- In any location which falls outside a System of Street Lighting, i.e. over 50 metres from a street lamp
- Centre Islands/Refuges when used in conjunction with a Centre Island Column with an independently lit D610 (keep left) or D611 (pass either side) sign
- Centre Islands/Refuges at zebra crossings when used in conjunction with a Centre Island Column carrying two belisha beacons
- Side Road Junctions when used in conjunction with a Centre Island Column with an independently lit D610 (keep left) or D611 (pass either side) sign
- In front of Traffic Signals without any supplementary signage or lighting.

⁴ See appendix B for details

Solar powered bollards also require specific authorisation from the DfT or the Scottish or Welsh Government as appropriate⁵. This can be obtained on an authority wide basis and they can then be used in any suitable location in place of a standard lit bollard.

It should be noted that the single sided Opal/Plain Face type of traffic bollard is exempt from the above criteria and requires no authorisation for its use in any location regardless of street lighting provision, because it carries no traffic sign.



Opal Plain Face bollard
(Picture courtesy of TMP Limited)

⁵ See Appendix B for details

4 Traffic sign retroreflective materials and lighting: official guidance

4.1 Introduction

The statutory requirements laid out in Section 2 of this document give the scenarios where lighting *must* be used, and in that sense, following them exactly is carrying out the minimum requirements.

4.2 Traffic Signs Manual Chapters 3 and 4

Chapters 3 and 4 of the Traffic Signs Manual provide practical advice and guidance on the use of retroreflective signing materials for Regulatory and Warning signs respectively. Both Chapters point out that although modern microprismatic retroreflective materials achieve high levels of luminance for many drivers in defined situations, they do not do so for all drivers in all circumstances. Thus, they recommend that beyond the requirements of TSRGD, 2002 Schedule 17, there are other situations where direct lighting of signs may be considered desirable, and detail some of these situations. The revised version of Chapter 3, currently in draft form⁶, states:

“...some signs may be sited where they will not receive adequate illumination from headlamps, and it might be prudent to provide direct lighting regardless of the regulatory requirements. Examples include signs mounted unusually high above the level of the carriageway, on the off side of the road or at the entrance to a side road.”

Chapter 3 of the Traffic Signs Manual also recommends the lighting of **all** terminal speed limit signs, to minimise the risk of them not being seen, even though this is above and beyond the regulations set out in Schedule 17 of the TSRGD, 2002.

The use of warning signs should be considered carefully. Chapter 4 states:

“Appropriate warning signs can greatly assist road safety. To be most effective, however, they should be used sparingly. Their frequent use to warn of warn of conditions which are readily apparent tends to bring them into disrepute and detracts from their effectiveness”

DfT have stated that it is essential that any unnecessary signs should be removed, for the above reasons. Many unnecessary warning signs are currently installed in areas of street lighting. Those that require lighting are needlessly adding to both costs and the carbon footprint of local authorities.

⁶ This document is due for publication in August 2008

5 Factors adversely affecting the retroreflective performance of signs

5.1 Dew formation

The formation of dew on traffic signs can cause a marked deterioration in their performance. The water on the surface of the sign distorts the path that light takes as it reaches the sign, and again as it is reflected back so that it does not reach the driver. As less of the incident light is returned to the driver, the sign appears to be dimmer and gives the appearance of being dirty. Consequently the luminance is significantly reduced. The figure below shows this effect on a directional sign.

Dew is most predominant on rural signs, although urban signs are by no means immune to this problem. In locations that require a high level of luminance, consideration should be given to applying dew resistant film to any signs which are intended to be unlit.



The same sign viewed at night, in the presence (left) and absence (right) of dew formation

5.2 Dirt

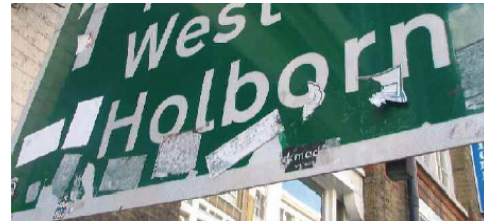
Dirt and grime are not reflective and so a dirty sign will perform less well than a clean one. How quickly a sign gets dirty varies from site to site and depends on the exact location of the sign. Generally signs in rural areas are more likely to become dirty, and signs located near trees are more inclined to suffer from algae growing on them. The figure below shows algae on a warning sign in daytime conditions.



Algae on a warning sign, reducing conspicuity by both day and night

5.3 Graffiti

In certain urban areas graffiti can be a large problem. This can be both in the form of spray graffiti and stickers being attached to a sign face. The figure below shows both types of graffiti. Graffiti can render signs completely useless and needs to be removed from sign faces in order for them to be effective in both daytime and night-time conditions.



Spray and sticker graffiti can both detract from a sign's message

However, care needs to be taken when removing graffiti, as the retroreflective material on the sign face can easily become damaged, as shown below. It may be considered prudent to invest in graffiti protective overlay film for signs in especially vulnerable locations, especially if they are to be unlit.



Removal of graffiti can damage the retroreflective surface of signs

6 Practical advice on the use of various traffic signs & bollards

6.1 Introduction

Retroreflective signing material provides a comparable level of illumination to direct lighting in many circumstances, but does not in itself provide sufficient illumination to justify the removal of all lighting of bollards and signs. Consideration therefore needs to be given to appropriate methods of lighting for these situations where it still is required.

6.2 Internally and externally illuminated traffic signs

The levels of illumination required for both internally and externally lit traffic signs are specified in BS EN 12899 – 1: 2007. The required sign luminance levels for different levels of background illumination are shown in the table below:

	Level of background luminance	
	Other	High (e.g. major retail areas)
Mean luminance level required by external sign lighting ⁷	25 – 150 cd/m ²	⁸ 100 – 350 cd/m ²
Mean luminance level required by internally illuminated signs	40 – 150 cd/m ²	150 – 300 cd/m ²

- Standard fluorescent tube luminaires can be replaced with LED lighting, reducing energy consumption and number of maintenance visits to change lamps. Manufacturers of LED sign lighting should take into consideration LED manufacturers' predicted lumen depreciation figures and factor in an allowance for this depreciation when engineering LED light output units. In order to allow for light level fall - off (i.e. lumen depreciation) on LED devices in the order of 30%, good practice would be to light the sign as near to 150 cd/m² as possible when new, so as to provide long term satisfactory performing, clear conspicuous sign installation over the projected 50,000 hours of LED lamp life.
- Low voltage (24 volt) lighting systems are now available, reducing installation time, installation costs, energy usage and increasing personal safety.
- Solar powered sign lighting may be considered as a practical alternative to using mains power, especially in situations where electrical connections and associated cabling are not yet installed.
- Electroluminescent signs can offer both improved performance and reduced power consumption over traditional sign lighting.

⁷ For external sign lighting, the luminance levels shown in this table are for an externally illuminated white reference panel with a luminance factor of a least 0.85

⁸ In practice it will be difficult to achieve the upper levels of mean luminance specified for externally lit signs

6.2.1 Using LEDs as the light source instead of standard luminaries

LEDs offer energy savings and a vastly improved lifespan compared with conventional luminaries, thus reducing maintenance requirements (and giving cost savings). Unlike standard luminaries, which stop working suddenly and entirely, LEDs fail over time by gradually getting dimmer. The lamp life quoted is usually when the LED is performing at 60 – 70% of its initial light output, so another potential advantage is that even after ‘failure’ LEDs still provide some light on the sign face.

6.2.2 Low voltage lighting systems

Low voltage lighting systems (24V) are now available on the market which are able to power both internally and externally illuminated traffic signs. The use of a low voltage power supply should reduce installation costs and installation time, thus causing less disruption to passing traffic. Safety will also be enhanced for both the lighting engineers and for the general public.

6.2.3 Solar powered signs

The installation of electrical connections and cabling to traffic signs can be a significant upfront cost. This makes solar powered signs a very attractive proposition. A solar panel and control equipment can quickly be installed on an existing sign post.

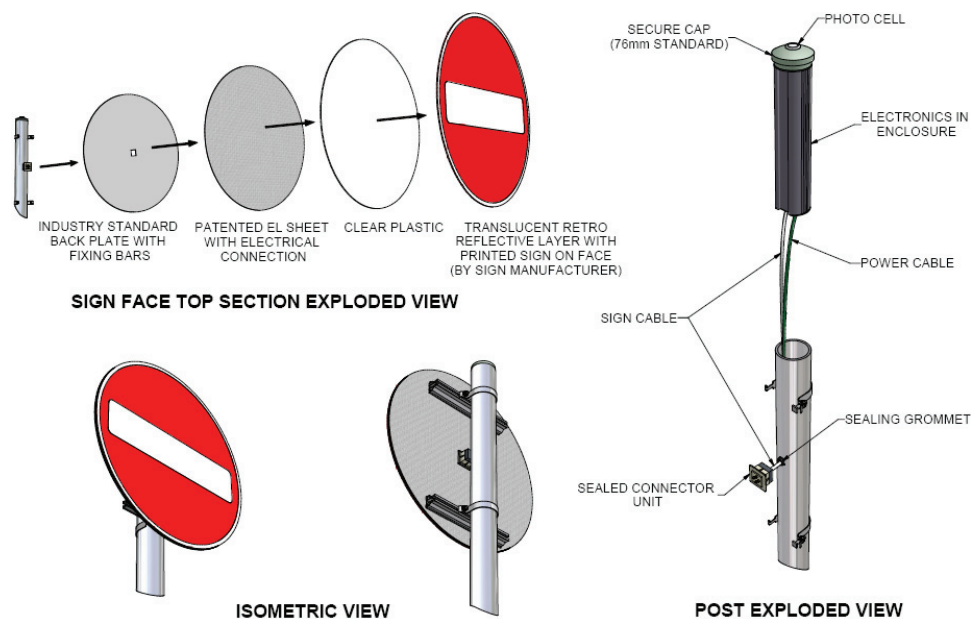
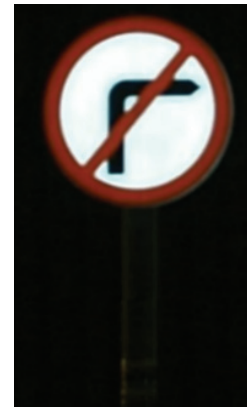


A traffic sign with solar powered lighting (photo courtesy of Solagen Ltd)

Some UK companies supply solar powered lighting units which can be installed onto existing signposts. These units are currently suitable for small circular (up to 750mm diameter), or similar sized triangular signs, but these units could be used for larger signs. Installation times should take less than an hour. Once installed, the maintenance of these signs should be minimal. Batteries should require changing between seven and eight year frequencies, while the LEDs should last over 20 years and the solar panel at least 40 years.

6.3 Electroluminescent signs

Electroluminescent signs are a specific type of internally illuminated sign, lit from within by a thin electroluminescent sheet. This is built into the sign face and fits between the metal sign backing and the retroreflective sheeting on the front. The retroreflective sheeting is translucent to allow the light to pass through it. The photocell and electronics are all contained in a sealed unit which can be mounted inside the sign pole. Should the electroluminescent material fail, or there is a loss of power, the sign will continue to be as effective as a normal unlit retroreflective sign.



Composition and appearance of an electroluminescent sign (courtesy of One2see signs Ltd)

As well as the above benefits in terms of safety, there are also potential energy and cost savings. One2see Ltd's electroluminescent signs currently operate at 15W, in comparison with standard lamps which operate at around 25W. Furthermore, the lifetime of the electroluminescent material is ten years and during that time no lamp changes or other maintenance should be required, other than possibly sign cleaning. As light comes from within the sign there is also no light pollution. One drawback of this sign is that once the electroluminescent sheet stops working, the whole sign has to be replaced. There is the future possibility of decreasing the operating power of this sign, and then to power this type of sign by solar energy, or even kinetic energy produced by vibrations from vehicles driving over the road. Another potential future benefit is the ability to vary the luminance output of the sign. In line with DfT recommendations, the signs currently output the minimum luminance required of 10 candelas per square metre, but there is the potential for this to be increased slightly depending on background luminance levels.

6.4 Traffic bollards

6.4.1 Introduction

One of the chief advantages of a standard type internally lit traffic bollard is the uniformity of light across the whole bollard, and the fact that it is cast equally in all directions. This means that the bollard can be seen from any angle, particularly useful in situations where this may vary significantly, such as at roundabouts.



Standard type internally lit bollards have developed over the years and if installed correctly will now often survive impacts from vehicles and remain functional. If the bollard sustains damage and becomes deformed in shape then it can still operate to some extent. In the event of a severe impact, which shears the bollard from the base completely, the base light will still be operational and perform a similar function to a cat's eye.

It is assumed that most bollards are group switched, so that they illuminate only after the hours of darkness. For any bollards that are not already switched, consideration should immediately be given to doing so. Low voltage lighting systems are now available, reducing installation time, installation cost, energy usage and increasing safety. Low voltage cables can be run to the bollard sites, involving slitting rather than excavation, and consequently saving on both installation time and on cost. Up to nine 11W lamps can be powered by one of these low voltage systems.

Due to rising electricity costs, unlit retroreflective bollards are now an attractive proposition. There are already some specific situations (listed in Section 3.2) where illumination is not required for traffic bollards and in these circumstances retroreflective bollards may be used instead. Where lighting is still required, solar powered bollards may be considered for use.

It is important to stress that traffic bollards provide a very valuable contribution to road safety, and where road hazards exist it is important that these are clearly visible by both day and night through the use of bollards. Nonetheless it is worth considering whether there are any circumstances in which traffic bollards can be removed altogether, through the removal of any unnecessary road islands (those not used by pedestrians or to deter overtaking) or other situations such as pinch points where they are used for traffic calming purposes.

6.4.2 Retroreflective self-righting bollard (RSRB)

Retroreflective self-righting traffic bollards are increasingly used as an alternative to lit bollards. These bollards do not require any power as well as offering potentially reduced maintenance costs. When installed at new sites they also negate the need for electrical cabling, offering a significant saving both in time and money. Mounted on a spring, they are self-righting and in many circumstances will return to their original position after impact with a vehicle. They are available in both single and double sided options.



Retroreflective self-righting bollard (photo courtesy of TMP Limited)

The circumstances in which they are permitted to be used are outlined in Section 3.2.

Installation of these bollards is simple. The expected lifetime of these bollards is dictated by that of the retroreflective material, and is approximately 10 – 12 years.

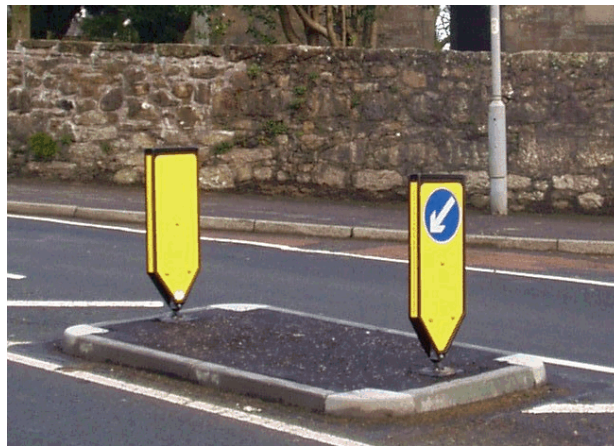
As these bollards rely on their retroreflective sign faces for illumination, these faces will need to be kept clean in order for the bollard to function correctly. For the same reason, to maintain usefulness, it is also imperative that the bollard does not become significantly twisted after impact, and that the retroreflective sheeting is not significantly damaged. If either of these occurs then the bollard will require maintenance or, more likely, replacement. In the event of a severe accident, which shears the bollard from the base, no illumination will be provided so urgent repair will be required.

Concern has been expressed about the widespread use of RSRBs. Bollards are, by nature, located in positions vulnerable to vehicular impact, and being mounted in a low position are also highly likely to accumulate pollutants, dirt, salt and grit on the face, as well as being vulnerable to vandal attack and graffiti. If damaged or it being covered with dirt or graffiti, the level of illumination of the bollard will be significantly reduced, and if completely removed from its foundations there will be no illumination at all.

At existing sites, where the required electrical infrastructure for lit bollards is already in place, cost savings from installation of RSRBs may be fairly small. This is due to the upfront costs of RSRBs being significantly higher than the standard lit bollard, but also the added cost of making safe the existing electrical connections.

6.4.3 Solar powered retroreflective self-righting Bollards (RSRBs)

Given the limited situations in areas with street lighting where unlit bollards are authorised for use, solar powered bollards have recently become available on the market. These bollards combine retroreflective sign face material with LED lighting for the regulatory sign symbol. The same benefits are realised as for the case of unlit bollards in terms of energy usage and cabling requirements, but with the additional benefit that DfT authorise their use in any location. The figure below illustrates a pair of solar powered bollards installed on a traffic island.



Solar powered retroreflective self-righting Bollards (photo courtesy of TMP Limited)

Except for the retroreflective material, most parts are replaceable in case of damage from a vehicle. The bollard is highly vandal proof and in testing one bollard was shown to still light after being driven over 12 times. The life of the battery is about 6 – 7 years and it is suggested that it be changed after 5 years. The LEDs have an expected lifetime of 15 years. The life expectancy of the whole product is again limited to 10 – 12 years by the lifetime of the retroreflective material. Installation is exactly the same as for the other types of unlit bollard.

These bollards are only available single sided at present and the same maintenance requirements apply as for other RSRBs in order for them to remain effective. The solar panel will need to be kept clean enough to function, and the retroreflective material needs to be kept clean. A bollard pointing in the wrong direction will be of little or no use as the retroreflective material and light are only on one side. Again, if sheared completely from the base, there will be no source of illumination warning drivers of the hazard.

Similar concerns exist for solar powered bollards as for unlit RSRBs. Only a relatively small part of the bollard is illuminated and the rest of the sign face relies again purely on retroreflectivity. The level of illumination is smaller than for standard lit bollards and it is assumed this may affect the viewing distance. In order to use solar powered bollards, special signs authorisation is required. The process is the same as for unlit RSRBs and outlined at S3.2 and appendix B.

Acknowledgements

The work described in this report was carried out in the TNP Group of TRL. The authors are grateful to Ewan Hardman who carried out the quality review and auditing of this report.

The authors would like to thank the following for their assistance:

- Liz Newell-Hart (3M UK PLC)
- Trevor Wren (Rennicks UK)
- Scott Horne (Avery Dennison GRPD Europe)
- Paul Grice and Eric Woodhouse (Simmons signs Ltd)
- Gaetan Dalle (Solagen Ltd)
- Peter Morris (Traffic Management Products Ltd)
- Mark Walter (One2See Signs Ltd)
- Muriel Killin (Head of Traffic Signs Technical Branch, Department for Transport)

References

BSI (1980). BS 873 1980. Road traffic signs and internally illuminated bollards. Part 3: Specification for internally illuminated bollards.

BSI (2007). BS EN 12899-1:2007. Fixed, vertical road traffic signs – Part 1: Fixed signs.

BSI (2007). BS EN 12899-2:2007. Fixed, vertical road traffic signs – Part 2: Transilluminated traffic bollards.

Cooper J, Stafford K, Owlett P and Mitchell J (2008). Review of the lighting requirement for traffic signs and bollards. Report UPR/T/017/08 (Unpublished), TRL, Crowthorne.

TSO (2002). The Traffic Signs Regulations and General Directions 2002.

TSO (2004). Traffic Signs Manual Chapter 4 – Warning Signs.









TSO (2007a). Traffic Signs Manual Chapter 3 – Regulatory Signs: draft version (due for publication - September 2008).

TSO (2007b). The Construction (Design and Management) Regulations 2007.
























Statute law database (2008) Road Traffic Regulation Act 1984
<http://www.statutelaw.gov.uk/content.aspx?activeTextDocId=2223862>

Appendix A – illustrations of signs with lighting requirements



























Category 1: Warning signs that require lighting in all circumstances (Schedule 17 Item 1)

					
501	520	530	531.1	543	544
					
544.1	544.2				

Category 2: Warning signs that need to be lit unless located on a single carriageway, non-principal or non-trunk road with a speed limit of 30mph or less - in which case they must be reflectorised (Schedule 17 Item 1 with asterix (*))

					
504.1	505.1	506.1	507.1	508.1	509.1
					
510	512	512.1	512.2	513	516
					
517	521	522	523.1	524.1	528
					
529	529.1	545	557.1	950	

Category 3: Warning signs which need to be either reflectorised or directly lit

					
548	549	550	550.1	550.2	551
					
551.1	551.2	552	553.1	554	554.1
					
554.2	555.1	556	556.1	557	558
					
558.1	559	562	574	581	582
					
583	584				

Appendix B

Application for special signs approval

Section 64 (2) of the Road Traffic Regulation Act 1984 enables authorisation of signs of a character not stipulated within TSRGD 2002.

In England this authorisation is obtained via:-

Department for Transport,
Traffic Management Division, TM4,
76 Marsham Street,
London SW1P 4DR

In Wales authorisation is obtained via:-

Road Network Management Division
Transport Wales
Welsh Assembly Government
Cathays Park
Cardiff CF10 3NQ

For either of the above the Applications must include a detailed drawing of the sign / bollard and a plan or description of the region in which it is to be used.

In Scotland via The Scottish Government, Transport Directorate, Bus, Road Safety and Local Roads Policy, Area 2F(North) Victoria Quay, Edinburgh, EH6 6QQ and the application forms for this follow overleaf.

Separate procedures apply in Northern Ireland where neither the Road Traffic Act 1984 nor TSRGD 2002 applies.

Your ref:
Our ref:

**APPLICATION FOR AUTHORISATION OF NON-PRESCRIBED
TRAFFIC SIGNS AND SPECIAL DIRECTIONS (LOCAL ROADS)**

TO:-

The Scottish Government, Transport Directorate, Bus, Road Safety and Local Roads Policy, Area
2F(North) Victoria Quay, Edinburgh, EH6 6QQ

Please consider issuing an authorisation or special direction for the following:

TITLE/DESCRIPTION OF SIGN/SCHEME

NAME OF TRAFFIC AUTHORITY

ENCLOSURES	TICK to confirm inclusion
5 copies of each site plan, showing the locations proposed for each sign to be authorised. <i>(N.B. The Scottish Government can be asked to advise in particular cases whether a brief written description of the site or sites would be acceptable instead)</i>	
5 copies of each sign drawing, clearly marked with colours and sizes.	
For regulatory signs:- A statement of the restriction(s), requirement(s) or prohibition(s) to be indicated by each sign design (or a draft or made TRO).	
For other signs:- A statement of the purpose of/reasons for erecting a non-prescribed sign	

**THE SIGNING SCHEME DESIGNER SHOULD COMPLETE
THE CHECKLIST OVERLEAF AND SIGN THE APPLICATION
FORM BEFORE FORWARDING IT.**

Guidance on the lighting requirement for traffic signs and bollards



Improvements in the quality of street lighting and the development of high performance retro-reflective signing materials potentially make unlit traffic signs more visible at night. TRL conducted a technical review, commissioned by Transport for London, into the requirement for local highway authorities to comply with the current statutory requirements for lighting traffic signs and bollards in areas with street lighting.

This guidance document has been produced to inform local highway authority engineers when it is currently permitted to remove traffic sign and bollard lighting, and identifies future research opportunities that may lead to wider relaxation of lighting requirements. As well as reviewing the regulations and the appropriate British Standards, a whole life cost benefit exercise was conducted. This covered the costs of different types of traffic signing material, their luminaires, life expectancy and maintenance. In addition, the costs, life expectancy and maintenance of alternative types of illuminated traffic sign were established. Documentation was produced describing the process of obtaining official authorisation from the appropriate government department in order to relax the use of traffic signing without external illumination in areas with street lighting.

Other titles in this series

- SL1** Review of the class and quality of street lighting. G I Crabb, R Beaumont and D Webster. TRL Published Project Report PPR380. 2009
- SL2** Invest to save – sustainable street lighting. P Fox. Mouchel. 2009
- SL3** Review of luminaire maintenance factors. A Sanders and A Scott. Mott MacDonald. 2009
- SL4** The use of passively safe signposts and lighting columns. G L Williams, J V Kennedy, J A Carroll and R Beesley. TRL Published Project Report PPR342. 2009
- SL5a** Review of the lighting requirement for traffic signs and bollards. J Cooper, K Stafford, P Owlett and J Mitchell. TRL Published Project Report PPR382. 2009

TRL
Crowthorne House, Nine Mile Ride
Wokingham, Berkshire RG40 3GA
United Kingdom
T: +44 (0) 1344 773131
F: +44 (0) 1344 770356
E: enquiries@trl.co.uk
W: www.trl.co.uk

Published by



IHS
Willoughby Road, Bracknell
Berkshire RG12 8FB
United Kingdom
T: +44 (0) 1344 328038
F: +44 (0) 1344 328005
E: trl@ihs.com
W: <http://emeastore.ihs.com>

Price code: 2X

ISSN 0968-4093

ISBN 978-1-84608-774-5



9 781846 087745

SL5b/PPR383