INTERIM ADVICE NOTE 180/14

Guidance for the selection of remote controlled temporary traffic management signs for use on the Highways Agency trunk road and motorway network

Summary
This document gives guidance to purchasers and users on the selection of remote controlled temporary traffic management signs for use during road works.

Instructions for Use
This IAN is to be used in conjunction with the applicable legislation, specifications and guidance documents relating to temporary traffic management signs.

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1. Introduction

1.1 Background

The Highways Agency (HA) has set out its overarching Aiming for Zero (AfZ) Strategy in April 2010. The AfZ Road Worker Safety Strategy has an overall aim of significantly reducing health and safety risks to road workers, by eliminating road worker fatalities and serious injuries and significantly reducing personal injury accidents to road workers.

Traditional setting out of temporary traffic management (TTM) signs on A-frames at ground level at road works regularly exposes road workers to high speed traffic, which has potentially fatal consequences. Removing the requirement for road workers to cross a live carriageway significantly reduces this risk, however, there is still a requirement for temporary traffic management signs to be used. The use of remote controlled temporary traffic management signs provides an opportunity to address both issues.

Currently, remote controlled temporary traffic management signs are used in a few areas around the HA network, however, it is envisaged that their use will become more common place, particularly on managed motorways schemes and on all parts of the HA network to meet Aiming for Zero targets to significantly reduce risks to road workers by December 2016. As a number of remote controlled TTM sign products are already available, and more are expected, it is important that any TTM sign chosen for use is appropriate for its application not just at installation time but for the serviceable life of the sign.

1.2 Purpose

The aim of this Interim Advice Note (IAN 180/14) is to provide designers, maintainers and end users with guidance to allow the selection of the most appropriate remote controlled temporary traffic management signs to meet their scheme or network requirements. This guidance covers both fixed and portable remote controlled TTM sign applications.

1.3 Limitations of Use

This document does not provide guidance on maintenance strategies or the use of other alternatives for the implementation of temporary traffic management. This guidance does not cover the use of remote controlled signs in relation to operational network management by the Traffic Officer Service. The overall approach to maintenance for a scheme or location should be considered and all approaches evaluated to determine if remote controlled temporary traffic management signs are appropriate for the application.

1.4 Relationship

The advice and requirements contained within this document are given on the basis that the remote controlled temporary traffic management signs comply with the requirements of TR 2603, DfT Traffic Signs Manual (TSM) - Chapter 8 Parts 1 and 2 and GD 04/12.

1.5 Implementation

This IAN should be used with immediate effect.

2. Remote Controlled Temporary Traffic Management Sign Overview

This section presents the two main categories of remote controlled temporary traffic management signs currently available and in use in the UK, namely electromechanical and optoelectronic. The former of these can be subdivided into blind and rotating prism types.

2.1 Electromechanical Signs

Electromechanical signs are defined as having electrically driven moveable elements, which are used to reveal / hide the display or vary the message they are displaying. Their display surfaces make use of retro-reflective materials in a similar way to fixed signing.

2.11 Blind

Blind signs make use of a fabric roller blind which covers the display surface when the sign is not in use. When the sign needs to be used, a remote command causes the blind to lift and reveal the message. The display surface may have fixed or a mix of fixed and variable elements, such as configurable lane wickets. These variable elements will move into position to display the required message. An illustration of a blind type sign is shown in Figure 2-1.

Figure 2-1: Blind Sign

2.12 Rotating Prism

Rotating Prism signs make use of a number of tubes with a triangular cross section that are rotated to present the appropriate face to road users. The triangular shape allows the sign to have three faces, with one of the faces being plain grey or black. When the sign is required for use, the tubular sections rotate to the display the desired face. These can be grouped or form modules such that they can be controlled independently of each other, which is used for lane control. An example of a rotating prism sign can be seen in Figure 2-2.

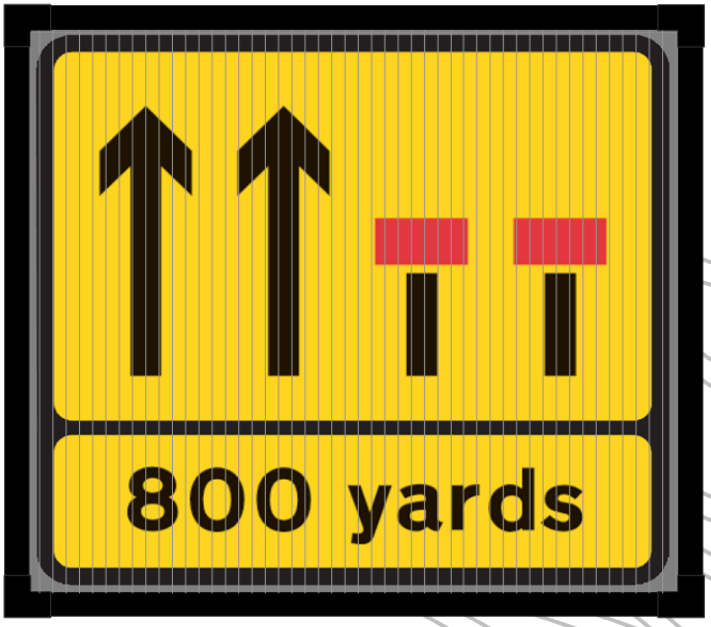

Figure 2-2: Rotating Prism Sign

2.2 Optoelectronic Signs

Optoelectronic signs make use of light emitting elements to form the message, thus require no illumination from external sources to be visible to road users. These panels may be fully populated with multi-coloured elements to allow a range of legends to be displayed or may only be populated to display a specific legend. An example of an optoelectronic sign can be seen in Figure 2-3.

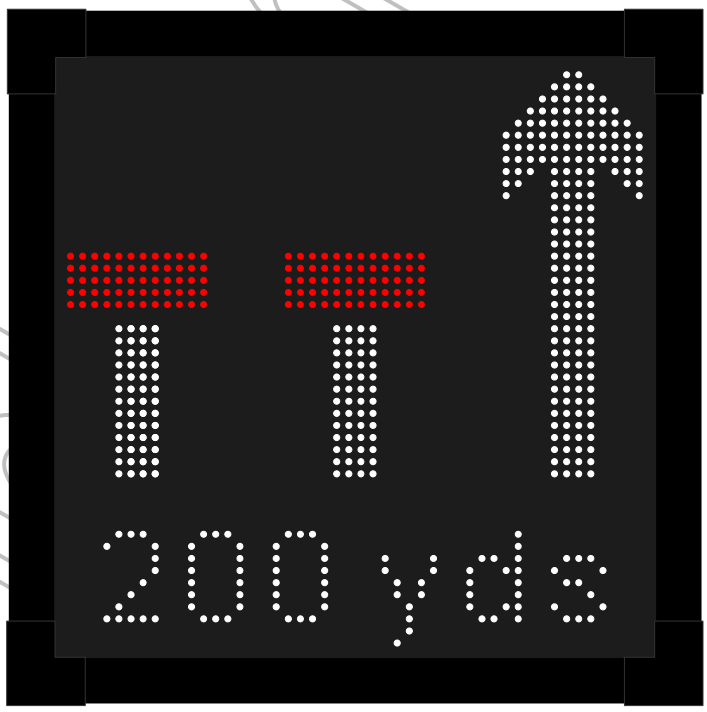

Figure 2-3: Optoelectronic Sign

2.3 Comparison of Sign Categories

Element	Electromechanical	Optoelectronic
Power	Overall power requirements are low, with high draw only being necessary during sign transitions / blind operation making them suitable for battery power. Batteries can be contained within the units with a relatively compact energy generation unit (solar, wind, etc.) being required. Can be mains powered.	Power requirements are relatively high, requiring either mains power with battery back-up or a large array of batteries combined with a suitable output energy generation unit.
Maintenance	Maintenance requirements will be relatively onerous. The mechanical components required regular lubrication and cleaning. Debris and dirt will need to be removed from the path of moving parts. Sign faces will need cleaning. Internal batteries will need to be replaced at manufacturer specified intervals. Regular use or exercising of the signs is likely to be beneficial.	Maintenance will generally be less than an electromechanical sign due to fewer moving parts. The sign and energy generation units requiring cleaning. Batteries will need to be replaced at manufacturer specified intervals.
Size	Sign sizes will be marginally larger than the fixed plate equivalent due to the sign frame. Relaxations in character sizes will be as per Chapter 8.	Sign size may be smaller than the fixed plate equivalent due to the optoelectronic elements, meaning that contrast ratios can be achieved without large backboards. Also, character sizes can be smaller as the active elements appear larger to road users.
Cost	Initial purchase prices are typically significantly cheaper than the optoelectronic equivalent. However, on-going costs may be higher, due to the more onerous maintenance requirements.	Higher initial purchase prices, but lower on-going costs in relation to maintenance. Replacement of the battery pack during the life of the sign may counter the maintenance savings.
Failsafe	Failure in operation of electromechanical signs will nominally occur prior to or after live works.	Failure in operation of an optoelectronic may occur at any time. This is likely to be more of an issue if mains power with battery back-up does not form part of the design.
Additional Considerations	High annual maintenance costs. Higher risk of the TTM sign not working when needed, due to mechanical breakdown.	Large battery packs may require local or remote storage, the latter may require ducted cabling. In addition, specialist lifting equipment may be needed to move the batteries when they are being replaced / maintained.

Table 2-1: Sign Category Comparison

3. Sign Choice Considerations

This section provides guidance on factors that designers, purchasers and users of remote controlled temporary traffic management signs should consider when determining which category and type of sign is most appropriate for their requirements.

In determining the most appropriate sign type an assessment will be required of three main factors, as illustrated in Figure 3-1.

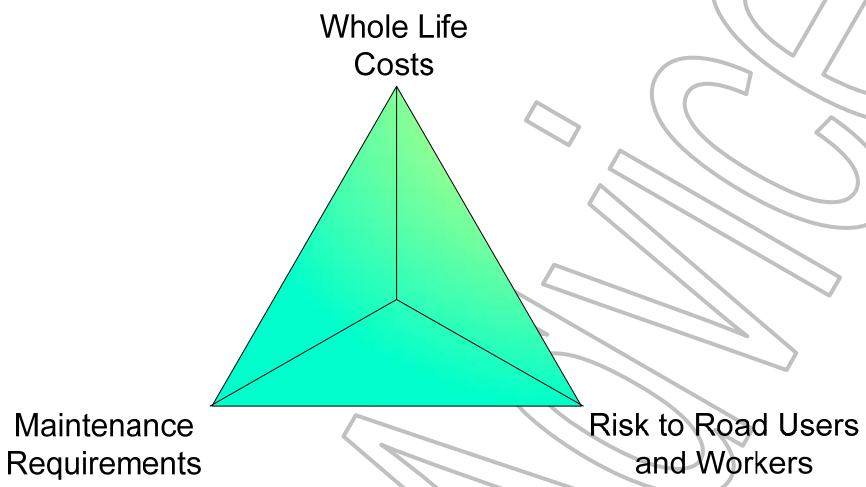

Figure 3-1: Balance of Factors

In order to expedite this assessment process, Sections 3.1 and 3.2 provide some initial considerations.

Any sign chosen for use on the road network should be conspicuous and legible to enable all road users to read the sign far enough upstream of the sign and adjust their driving behaviour in a safe and timely manner.

3.1 Fixed Sign Considerations

It has been determined that two considerations dominate the sign choice process, namely the provision of mains power or space for off-board battery packs, and ease of access to the signs.

The first consideration affects the ability to deploy optoelectronic signs, which have considerably higher power requirements than their electromechanical counterparts. If a mains power source is not available then space adjacent to the sign will be required to store an optoelectronic sign's off-board battery packs or mount any associated renewable energy generators. If mains power or space are not available, then there is typically a high cost associated with providing them due to the ducting and cabling requirements, as well as the potential connection point to the local electricity company supply. In this case it is likely that an electromechanical sign will be more suitable, due to its lower power requirements and self-contained power source.

The second consideration, the frequency of access, affects the ability to undertake regular maintenance of the signs. Electromechanical signs typically have higher maintenance requirements than optoelectronic signs, due to their moving parts, many of which are exposed to the harsh environment presented on the road network. Thus, if the frequency of

access is low (less than four times a year) then an optoelectronic sign may be more suitable than an electromechanical device. It is important for all signs that the frequency of access allows them to be maintained in line with manufacturers' recommendations. More detail regarding maintenance can be found in Annex A.

The fixed sign considerations are summarised in Table 3-1.

Mains power or space available for off-board battery packs	Ability to access the signs at least every three months	Most Appropriate Sign Type
Yes	Yes	Either
Yes	No	Optoelectronic
No	Yes	Electromechanical

Table 3-1: Primary Sign Choice Considerations

If neither of these can be met, then it is recommended that the location or approach to maintenance be reconsidered to satisfy at least one of the considerations.

3.2 Portable Sign Considerations

In choosing signs for portable applications it is assumed that they will typically be battery powered and that access to the signs for maintenance will occur when the signs are not deployed. The factors that are most likely to be prominent are:

- Whole life costs – see Section 3.3.
- Maintainability – Sign designed to allow maintenance to be performed, without specialist tools or training, may provide advantages over signs that require suppliers or extensive training to undertake these activities.
- Practicality and handling considerations:
    - Adaptability of the sign in relation to number of lanes.
    - Size of the sign in relation to the likely deployment locations.
    - Character size in relation to the permanent / temporary speed limit.
    - Expected battery duration and charging arrangements.
    - Manual handling of the sign, both from a size and weight perspective.
    - Ease of set up and take down.
    - Requirement for any specialist tools or vehicles.
- Robustness – Signs designed specifically for the harsh operating environment on the road network, the wear and tear experienced through frequent set up and take down, as well as the wear and tear caused by frequent transportation, may provide significant advantages when compared to other less well designed products.

3.3 Whole Life Costs

This section presents a number of elements that contribute towards the whole life cost of the signs, which need to be considered by designers as a minimum.

3.3.1 Initial purchase of signs

As well as the base cost of the sign, there may also be additional costs associated with extra features and functionality, such as special finishes or rotational actuators to allow the sign to be 'parked' when not in use. Also, power options may incur additional costs, such as battery packs, uninterruptible power supplies and off-board power generation.

3.3.2 Maintenance of signs and associated infrastructure

Maintenance of the signs may incur a wide range of costs, depending on the proposed maintenance strategy for the scheme or area. Consideration should be given to:

- The manufacturer and distributor's long term support of the product, i.e. manufacturing and keeping stocks of commonly used spares, and the lead times associated with obtaining them.

- Manufacturers recommended maintenance and service intervals, and the costs to the HA associated with implementing them.

- Any special arrangements that need to be made for maintaining the signs, such as elevated working platforms or lifting equipment.

- Training and requirements for suitably qualified staff to maintain the sign and associated equipment, along with the availability of manuals and parts lists from the manufacturer.

- Maintenance materials and consumables, such as lubricants, etc. (excluding spares).

3.3.3 Maintenance spares

It is likely that the majority of equipment will require parts to be replaced during its design life. Some parts may be provided upfront, such that they are in stock in case of an unexpected failure and other items may be best obtained at the time they are required, such as batteries. Maintenance spares may include, but are not limited to:

- Display panel parts.
- Drive chain elements.
- Batteries.
- Blinds.
- Bearings.
- Energy generation components.
- Actuators.
- Motors or servos.
- Posts and sign support systems.

Depending on the maintainability of the device, it may also be necessary to hold stocks of complete signs, such that installed signs can be swapped for spares and then maintained at the depot or by the manufacturer.

3.3.4 Communications requirements

The signs should normally have two way communications with the control system to allow commands to be sent to the sign and monitoring / confirmation information to be returned to the control system. A number of options exist for connectivity, including, short range radio frequency communication, use of mobile data communications (GSM) and connections to roadside communications infrastructure.

During design work for all fixed installations, the HA NDD NRTS team must be consulted in order to determine the most appropriate solution for the application.

The designer needs to consider the cost of any communications hardware and cabling as well as the on-going data connection costs.

Further details regarding communications can be found in Section 4.3.

3.3.5 Power costs

If mains power is provided for the signs then the costs of installing the power supply and on-going energy use will need to be factored into the whole life costs.

3.3.6 Infrastructure requirements

In mounting the sign and housing any associated equipment, consideration needs to be given to the cost of:

- Modifications to existing road restraint system or supporting structures, such as to accommodate the signs, battery packs and any energy generation system (e.g. solar panels, wind turbines).
- Design and installation of the foundation.
- Road restraint system.
- Provision of mains power (where used).
- Mounting Posts.
- Rotational systems, i.e. where the sign is rotated through 90^0 when not in use for TTM purposes.
- Brackets.
- Chambers.
- Cabling.
- Ducts.
- Cabinets.

3.3.7 Specialist vehicles, security devices and storage (portable signs)

Remote controlled TTM signs are typically larger, heavier and may present more of a theft target than their fixed plate equivalents. This has a number of potential impacts which may include:

- Modification of existing traffic management deployment vehicles, or the requirement for new vehicles, to accommodate the signs during transportation and to facilitate their safe deployment.

- Security devices and Global Positioning System tracking systems to be incorporated into the sign or to be installed externally, such as: chains, locks, shackles, etc.

- Storage space at depots for the signs when not in use.

3.4 Maintenance Requirements

During design work for all installations consideration must be given as to how the sign is going to be accessed to allow maintenance to be performed**, in a safe and cost effective manner**.

This may be achieved through dedicated visits to the signs or as part of general maintenance works being performed adjacent to the signs. Sufficient time will need to be allowed to perform the appropriate maintenance activities, including:

- Inspection, cleaning and basic upkeep of the signs.

- Service intervals (manufacturers' required maintenance regimes).

- Maintenance swap outs / technology refresh / software updates.

The signs are likely to be mounted above head height, therefore, access to the signs may require use of a mobile elevated working platform or for the signs to be lifted down to an appropriate working height.

Signs should ideally include sufficient remote diagnostics capability to minimise road worker maintenance visits and reduce exposure to risk.

Where fixed signs are located in the central reserve, they may only be accessible from one carriageway. Appropriate working practices need to be developed to minimise the risk of maintenance activities in relation to these signs affecting the opposite carriageway. This may include the use of traffic management on both carriageways to provide a safe working area.

In-situ maintenance may not be possible, due to the nature of the equipment, environmental conditions or the availability of suitably qualified staff, thus the maintenance swap outs may prove more efficient and effective. This should be evaluated when considering products.

The outputs of this exercise should be incorporated, as appropriate, into the overall maintenance strategy.

3.5 Risks to Road Workers and Road Users

GD 04/12 provides the standard for safety risk assessment on the strategic road network and should be used to identify, assess and mitigate any risks associated with the implementation and use of remote controlled temporary traffic management signs. Potential risks to road workers and to road users that have been identified in the preparation of this guidance are provided within this section, however, it should be noted that this list is neither complete nor exhaustive, and site specific factors as well as general factors must be included as part of the risk assessment.

3.5.1 Vehicle strikes

An assessment of the available space to achieve an acceptable sign face/frame set back from the carriageway will need to be carried out, as part of the design process. This will inform the maximum sign size and, thus, the maximum character x-height that can be achieved. Note that the minimum character x-height should normally be used in accordance with Section 3.5.2.

The horizontal setback distance from the edge of the sign or sign support system to the edge of carriageway marking (non-traffic side) should normally be 450 mm or more.

Where the sign size is such that clearance distances fall below acceptable values (DfT Traffic Signs Manual - Chapter 1, Section 6), consideration should be given to including a rotational feature, which will move the sign into a ‘parked position’ parallel with the flow of traffic when the sign is not in use. This reduces the exposure of the sign for the majority of the time to vehicles strikes. Note that when the sign is in its operational position clearances will still need to conform to DfT Traffic Signs Manual - Chapter 8.

An alternative mitigation may be to increase the sign mounting height, however, this may have an impact on the illumination and legibility of the sign depending on the category of sign chosen.

3.5.2 Legibility of the sign and driver compliance

The reduction of character height used to obtain a sign size that meets the clearance requirements may have a detrimental effect on the legibility of the sign and the compliance of the road user with the sign.

Any non-prescribed TTM sign designs or sign sizes must be authorised by HA Netserv prior to use.

3.5.3 Sign failures

The risks to road workers and road users, should a sign fail, must be robustly evaluated and the risk assessment documented appropriately.

Factors that influence any action taken when a failure occurs will be dependent upon the failure mode of the sign, its location in relation to the sign group, the message it is or is not displaying and the messages set on other signs within a group or on supporting infrastructure (AMIs and MS4s). The assessment should consider:

- The inability to set or unset individual or multiple signs.
- Potential conflict scenarios and their impacts.
- If a failure would prevent work from starting or continuing.
- Can the signs be safely accessed to correct the message should a failure occur.
- How soon can the message be corrected.
- Is there/what is the fall back position.

3.6 Conformance with Standards and Legislation

The advice and requirements in this document are given on the basis that the equipment deployed will comply with the governing legislation and standards, in relation to the legend displayed, the construction of the device and the technical and performance criteria.
This includes the requirements of Department for Transport's Traffic Signs Regulations and General Directions.
Sign designs and character heights should normally conform to guidance in the DfT Traffic Signs Manual - Chapter 8.

4. Practical Implementation Guidance

This section presents guidance to assist with the procurement and implementation of remote controlled temporary traffic management signs, typically once a sign type has been chosen.

4.1 Number of Signs Required

In complying with the guidance provided in the Traffic Signs Manual - Chapter 8 Parts 1 and 2, a number of signs will be required to form a group. The absolute number and types of signs required will be dependent upon:

- The use of gantry based signalling to support the implementation of temporary traffic management, which may allow the 1 mile road works sign (7001 and 572), speed limit (670), end of works (7001 and 645) and de-restriction (671) signs to be omitted.

- Alternative TTM techniques available, such as Offside Signs Removal in accordance with IAN 150.

4.2 Positioning and Orientation

Caution should be taken when installing optoelectronic signs adjacent to street lighting, as there is the potential for the street lighting to prevent the signs from correctly assessing the ambient light conditions and dimming their displays accordingly.

Solar panels should be positioned and orientated to maximise their exposure to the sun. Locations for these should be avoided where they may be subject to shadows cast by nearby infrastructure, i.e. the sign itself, over-bridges, etc. In a similar manner, where wind turbines are used, they should be positioned to allow an unhindered flow of air over their blades.

Where a solar panel is affixed to a sign that rotates to a parked position when not in use, the direction of rotation should ideally be configured such that the solar panel is orientated to face in a southerly direction.

4.3 Communications

The connection of remote controlled TTM signs to their associated control system will be determined by the sign implementation (fixed or portable) and the availability of NRTS services.

Fixed signs will typically make use of a standard service category connection from NRTS to provide the connectivity to one or more of the signs. A local communications system may be used to connect the signs to each other (such as MESH, Wi-Fi (802.11x), Zigbee (802.15), etc.) provided that it meets the requirements of the Code of Connection, provides the appropriate level of security and resilience, allows each sign to be individually addressable and is easily configurable. In some areas where a hardwired NRTS connection is not available, then a mobile data connection (GSM) should be used.

In the case of portable signs, the use of mobile data connections would be the preferred method of connectivity. However, the use of short range radio frequency communications with the signs may also be considered where there are suitable safe locations for an operative to control and observe the signs. The Agency recommends that any device purchased has security features, such as passwords and usernames, to prevent unauthorised access to the device

4.4 Continuity of Sign Appearance

All signs within a group should have the same appearance to road users, ideally being from the same supplier. Where the signs are installed in fixed locations as part of a scheme, then there should be consistency across the scheme.

4.5 Control System

A separate specification is being produced, which will define the function and performance requirements for the control system for remote controlled TTM signs.

5 Contacts

Further information may be obtained from:

Mark N. Pooley,
National Health and Safety,
Highways Agency,
GA Federated House,
London Road,
Dorking,
Surrey
RH4 1SZ

Tel: 01306 87 8282. GTN: 3904 8282.

Email: Standards_Feedback&Enquiries@highways.gsi.gov.uk

6. Normative References

- DfT Traffic Signs Manual (TSM) Chapter 8 (2009) Traffic Safety Measures and Signs for Road Works and Temporary Situations, Part 1 - Design & Part and 2 - Operations.
  http://www.dft.gov.uk/publications/traffic-signs-manual/

- Statutory Instrument 2002 No. 3113 Traffic Signs Regulations and General Directions 2002 (TSRGD).
  http://www.dft.gov.uk/topics/tpm/traffic-signs-signals/

7. Informative References

7.1 Highways Agency - Aiming for Zero and Road Worker Safety

The following documents can be downloaded from the HA web site using the links provided:

- Highways Agency Aiming for Zero introduction.
  http://www.highways.gov.uk/aboutus/27625.aspx

- Aiming for Zero overarching strategy.
  Road Worker Safety Strategy.
  http://www.highways.gov.uk/aboutus/27625.aspx

- Guidance for Safer Temporary Traffic Management.
  http://www.highways.gov.uk/aboutus/10848.htm

Annex A – Guide to Sign Features and Maintenance Implications

A1 General

A1.1 In evaluating signs there are generic and specific features to each of the sign types, which may have implications with regards to maintenance. The list below may be used as a guide when comparing products.

A1.2 Power supply units and invertors

These convert electrical power from the main power source and any power generation units into a voltage that is appropriate for the electronics and electrical elements within the sign. Failure of this unit will disable the sign. Ideally, this until should be modular with quick release connectors to allow easy replacement.

A1.3 Control circuitry

Each sign will have control circuitry which translates received commands into the display or removal of aspects. In addition, it will provide monitoring facilities of major components to check the device is working correctly. A failure of this until may result in a partial or complete loss of sign control or status reporting. Ideally, this until should be modular with quick release connectors to allow easy replacement.

A2 Electromechanical – Blind Type

A2.1 Blind

The blind is typically a plastic coated fabric, used to hide the display panel when the sign is not in use. Use and exposure to environmental conditions found adjacent to a heavily trafficked carriageway can result in deterioration of the blind. This element may need to be replaced during the lifetime of the product. Different materials used for the blind may extend its life.

A2.2 Blind rails and runners

Blind rails and runners are used to facilitate and guide the movement of the blind. The rails can collect dirt over time, which may increase the effort required to move the blind or could cause it to be displaced. Similarly the runners may also be affected by the ingress of water, salt and dirt, leading to greater effort being required to move them. The use of environmental protection and non-corroding materials may provide mitigation against these issues. Regular cleaning and lubrication are likely to be required.

A2.3 Flap actuators

Where lane use indicators are dynamic, an actuator is used to move the appropriate symbol into place, usually through a rotational motion. When the sign is in use, these actuators will be exposed to environmental conditions found adjacent to a heavily trafficked carriageway. This can lead to the flaps requiring more effort to move over time. The use of environmental protection and non-corroding materials may provide mitigation against this issue. Regular cleaning and lubrication are likely to be required.

A3 Electromechanical – Rotating Prism Type

A3.1Prism element deformation

The prism elements are triangular tubes that are used to make up the display surface. They can be produced from a number of materials, including plastic and aluminium. Handling and transportation of the sign, as well as extremely strong winds may cause the tubes to deform, ultimately leading to loss of clarity of the sign or jamming. Stronger materials may prevent deformation. Regular inspection and occasional replacement of prism elements are likely to be required.

A3.2 Jamming of elements

The display panel is exposed to the ingress of dirt and other airborne items. These can cause the elements to jam, especially if they get trapped in between them. Regular cleaning of the panels and the removal of objects that have entered the signs is likely to be required.

A4 Optoelectronic

A4.1 LED Failures

Multiple LEDs are used to form text and symbols on the display surface. The failure of one or more LEDs can lead to these not being displayed correctly. The display elements should ideally be modular to allow the replacement of the portion with the failed LEDs, rather than the complete display panel.