ASSOCIATION FOR ROAD TRAFFIC SAFETY AND MANAGEMENT

GUIDANCE DOCUMENT

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PROVIDING GUIDANCE TO MANUFACTURERS AND USER COMMUNITIES

GUIDANCE ON THE DESIGN, MANUFACTURE AND USE OF FLAP SIGNS

Introduction

This guidance is given to assist authorities, sign designers, contractors and managing agents, purchasers and sign manufacturers of flap signs. It highlights the factors to be considered at the outset when determining whether a flap sign should be used. In particular it highlights the following:

- UK design and manufacturing requirements
- Testing limitations
- Design considerations
- Operational requirements
- ARTSM recommendations

What is a flap sign

A fixed, permanent flap sign is a fixed plate sign with additional plate(s) attached, either vertically or horizontally, intended to provide temporary changes of message for the driver. They are generally used for the purposes of notifying of temporary but re-occurring hazards – eg flooding; road closed; and diversions.

Flap signs are intended to be manually operated and function in such a way that the whole or part of the message can be concealed when not required or an alternative message displayed.

UK requirements for fixed plate signs

Design

UK traffic sign faces are designed in accordance with the requirements of Traffic Signs Regulations & General Directions 2016 (TSRGD, 2016) together with the DfT Working Drawings and guidance contained within the Traffic Signs Manual (TSM) (specifically Chapter 7).

Any associated plate legend must be prescribed or authorised by DfT. If any sign does not comply with S2-p2-item 56 it may be deemed as an obstruction and unlawful.

Manufacture

Under TSRGD 2016, permanent fixed plate signs are required to be manufactured to meet the requirements of BS EN 12899 (an EU harmonised standard which falls under Construction Products Regulations (CPR));

Flap Signs are manufactured to BS 8442:2022 – Miscellaneous road traffic signs and devices – requirements and test methods, which then references BS EN 12899-1:2007: Fixed, vertical road traffic signs – Part 1: Fixed signs (and the UK National Annex thereof) for the testing of the Reflectivity, Chromaticity & Luminance of the Reflective material as well as the Impact resistance, and load bearing capabilities of the substrate used.

Section 11 of BS 8442 states:
(extract)
'A flap sign shall consist of a sign plate constructed in such a way that the whole or part of the message can be concealed when not required or an alternative message displayed.
The sign shall be so constructed that not more than 5% of its surface is obscured by fittings used to effect the changes. Any hinge plates or other fitting shall be fitted to the back of the sign.
To avoid staining of the sign face, the fittings shall conform to BS EN 12899-1:2007, 7,1,7 Table 15 for either SP1 or SP2.

NOTE: when the message is concealed, the Traffic Signs Regulations & General Directions 2016 require the parts of the sign visible to drivers to be grey or black

Means shall be provided for the assembly to be locked in both the displayed and concealed positions in such a manner that the sign face is not damaged

Visual performance of the sign face material of flap signs shall conform to A.3

The flap sign shall conform to BS EN 12899-1:2007'

Testing limitations - Windloading

The windloading requirements for traffic signs the UK are identified in the National Annex of BS EN 12899 or by calculation to BS EN 1991-1-4 and the contractor/designer should provide to the manufacturer details of the windloading specification for the location of the sign as specified in BS EN 12899.

These calculations are based on the testing regime identified in BS EN 12899 and manufacturers base their fixings on that basis (see our Guidance for Specifying Permanent Traffic Signs).

BS EN 12899 wind loading requirements do not factor in either the impact of wind between the main substrate of the sign and the flap element or the operating factors of the sign. Annex A of BS EN 12899 defines the test points for horizontal and vertical loads, which determine deflection of sign support and deflection of sign face.

At clause 5.3.1.1 BS EN 12899 states:
…wind pressure shall be applied as a uniformly distributed load over the area of the sign plate and act at the centre of pressure of the sign plate in order to calculate the bending moments in the supports and sign plates.

There are no specific testing requirements / regulations or specific guidelines providing for the testing and fixing of additional sign plates to be added to fixed vertical signs, generally identified as flap signs.

The calculations for windloading identified in BS EN 12899 do not account for the use of more than one sign face substrate, only for the load and size of the product. This means that the testing available to manufacturers is incomplete when determining the appropriateness of a flap sign for use.

In addition, designs submitted to manufacturers will vary both in size and in build requirements and it is therefore likely that one test will not meet the requirements of all designs.

It is important therefore that when designing in a flap sign that the contractor/designer under CDM fully understands the limitations of the testing criteria under BS EN 12899 and, that they have undertaken due diligence to ensure that the product will be sited in a suitable location which has been assessed for impact and have undertaken an appropriate risk assessment for the installation and operation of the sign.

For any product that is custom-made the manufacturer should obtain from the purchaser written confirmation of acceptance of the information provided by the manufacturer, which should include specifications, drawings, product schedules, performance statement and component parts listings, before manufacturing is undertaken.

Design considerations

Signs generally

The designer (under CDM) should determine aspects such as channel size, type and spacing which is generally done in discussion with the identified manufacturer.

Guidance is provided within the Design Manual for Roads & Bridges (DMRB) at CS 125 and ARTSM have produced Guidance on Specifying permanent traffic Signs and Guidance on Gantry Signs which may also be of assistance to the contractor/designer.

The Contractor/designer must provide the following information

(i) Geographic location of the traffic signs
(ii) All appropriately numbered scheme specific drawings
(iii) Drawings must include overall maximum dimensions of sign plates together with the mounting height to the underside of the sign plate from the carriageway
(iv) Details of any light spill screens and backing boards required
(v) Requirements for type of material, preparation, and finish, for sign plates, and uprights
(vi) Details of any requirements for anchorages and attachment systems, including loadings and torque settings, cable ducting and other equipment or features that may affect the design of the traffic sign (including any angle setting requirements)
(vii) The number, type, size, and positioning of all uprights. (Note. Where spacing is greater than 2500mm you must seek further recommendations from the sign manufacturer)
(viii) Details of overhang required (Note. Where this is greater than 750mm you must seek further recommendations from the sign manufacturer)
(ix) Details of any electrical equipment compartments
(x) The type of sign face material including the class of any retroreflective material
(xi) The type of direct illumination, whether internal or external, overhead mounted or upward pointing luminaires
(xii) The method of switching the illumination, [e.g., photo-electric control, time switch]
(xiii) Any requirement for the covering of traffic signs
(xiv) Details of location identifying marks
(xv) Site specific basic wind load
(xvi) All Sign face drawings with all dimensions in accordance with TSRGD 2016 and relevant DfT working drawing and published guidance; the TSM; Chapter 7: Design of traffic signs, or DfT Authorisation
(xvii) Any specific requirements not covered above

Additional requirements specific to flap signs:

When determining that a flap sign should be used, consideration needs to be made at design as to the integrity of the product for the intended operation. it is essential that a risk assessment has been undertaken to ensure that such a sign will be fit for purpose which must take account of the factors below.

As stated in the TSM, specifiers should be mindful that this type of sign is intended to be easily accessible, to be swiftly operated by one person from a position of safety (which includes being at ground level without the need for steps/ladders).

Key factors to consider in determining suitability of a flap sign include:

Size of overall sign and size of flaps used
Location – expected weather conditions
Accessibility for operator – ground surfaces/ mounting heights/
Materials – of base sign and flaps - weight / height / flexibility

Operational use

BS 8442 shall be applied to the design of permanent upright traffic signs which are to be manufactured as flap signs.

A permanent upright traffic sign, which is to be manufactured as a flap sign, **shall only be proposed where a safe system of work for accessing and operating the sign has been identified**.

It is recommended in TSM Chapter 8 that intended operators of a flap sign should be consulted about the location and design of the flap sign to provide assurance that the proposed solution is feasible.

Operational use of flap signs can be found in TSM Chapter 8
(Current Chapter 8 as at May 2025)

O10.7.9 Flap type variable message signs should be constructed to facilitate opening/closing by a person standing in a safe position. They should be fitted with a means of securing them in both the open and closed positions. The construction and colouring of these signs should be such that the appearance of the sign is not compromised regardless of whether the flaps are up or down. Particular attention should be given to the flap hinge detail in this respect.

The operation of the flap sign (including onsite maintenance) should be undertaken by a suitably competent operative who should record and evidence such operation, to ensure appropriate use. Such competency should be determined on the basis of the guidance for use provided by the manufacturer and the authority for whom the sign is provided. For example a local parish flood warden for a small flood sign may not be suitably trained for a larger fixed plate flap sign on a high speed road. Inappropriate misuse in operation should not be regarded as a failure of a sign.

Any issues identified by the operative in respect of fixings etc should be reported to the appropriate authority (road authority or maintenance contractor) to ensure that the product is maintained effectively and free from damage.

ARTSM Recommendations

Where possible, there should be a designing out of flap signs for alternative methods of signage. But where flap signs are designed in, structural engineering principles needed for flap signs should include consideration on the areas covered below.

Points of failure can include:

Integrity of infrastructure – are posts installed fit for increased weight
Poor quality fixings – are they of a quality suitable for the sign life
Location – ground condition – ground bearing pressure
Opening mechanism – can it be operated effectively and safely
Mounting height/width – is this operationally effective

Any solution must be fit for purpose and alternatives to flap signs should be considered.

Size:

The size of any sign is a factor when determining not only whether it will require additional supports, but also whether a flap sign is the most suitable product for the specific purpose or is there an alternative.

Factors to consider here would be whether the base sign size will require flaps which are too difficult to operate safely.

What are the possible dimensions of the flaps required?
Should the sign have one or more flaps for operational safety?
If using more than one flap how will safe operation be addressed?
Will a single flap be the most robust solution?

Any “flap” element should be manufactured using a single piece of substrate and should not be used with signs which are multi-panelled.

The maximum sizes to be used for flap signs should be no greater than can be operated at ease by a single operator at ground level. Where the base sign is of a significant size then the flaps are also likely to be large – either width or height or both. This will impact on the ability of a single operator to operate the flaps, particularly in poor weather conditions.

Flap sizes above 2500mm would be deemed to be borderline for safety in operation.
The use of flap signs for multiple sign faces is also likely to compromise performance.

Mounting Height

The Sign should be cable by nature and size and position of being able to be operated by a person using a safe system of work eg on a firm level surface, including when swinging a sign around. Mounting heights specified in the TSM must be maintained for the safety and visibility of traffic signs.
Where

- The size
- Exposure
- Mounting height
- Ground topography

make operation higher risk, by increased strain, working at height, significant handling etc designers must consider all alternatives before providing a flap type signs that will potentially need a specifically designed access/operational arrangement and inspection regime to meet the requirements of the Construction (Design & Management) Regulations 2015 (CDM) to design for operation and maintenance.

Consideration should also be given to passively safe support requirements. Generally, the minimum mounting height on a passively safe post is 1800mm.

Similarly, when more than one additional message is required, consideration should be given to a secondary flap sign to be erected as a separate sign to the main directional sign. If not possible due to location limitations, then the main directional sign could be mounted higher to allow for the flap sign to be mounted below.

Location

This is particularly relevant where access to the location to operate or maintain the sign is difficult or where there are known areas of high winds. Consideration should also be given to evidence from the Met Office for weather warnings identified.

Materials selected for manufacture

ARTSM would direct readers to its Guidance on procurement of fixed plate signs, 2022 and, in particular, the information required to be provided by the contractor/designer and assumptions made when information is not supplied.

Substrate

Consideration should be given to the substrate selected. It is important to recognise the differing responses of substrate to wind and weight. Different substrates will act differently. A composite is a softer material and has potential to tear at hinges and bolts and should not generally be used for larger flap signs.

Contractor/designers should be mindful of materials used for both the base sign and the flaps and their suitability for the intended purpose.

Flap signs should preferably be manufactured from solid aluminium alloy due to its added strength and durability over other substrate materials.

Channel & Fixings

- Consideration should be given to a requirement for wider channel and/or butting plates to be included, particularly on larger size signs to provide additional strength for rigidity and increased weight – which will be dependent on material used and size.
- Contractor/designers must always consider the most effective use of fixings for the flap hinge mechanism for the size and weight of the flap sign as designed.
- If fixings are not stated by the contractor/designer then the manufacturer may use the most appropriate method of fixing as below.

U-Bolts

Manufacturers currently have u-bolts and hinges available. The quality of the fittings should mirror the quality and longevity requirement of the sign and should be corrosion resistant. The selected fixings should be fit for purpose and dependent on the location of siting, size – width and height and weight of flaps.

The sign shall be so constructed that not more than 5% of its surface is obscured by fittings used to effect the changes.

- If u-bolts are used for flaps, they should be Stainless Steel U-Bolts with a minimum diameter of 8mm.
- Spacing of U bolts must be determined based on the size and weight to enable secure and stable fix and ease of turning the flaps

- Holes in backing board and flap for U-Bolt fixings may be strengthened with eyelets when composite is used.

Hinges

- If hinges are used for flaps, then they should be Stainless Steel
- Continuous hinges will spread load, but in all cases each single hinge should not be overloaded and placement should be fit for purpose dependent on size, location and weight of flap affixed.

Locking Mechanisms

Anti Luce Fasteners (Toggle Bolts)

- In all cases fasteners must be accessible for operational use and positioned to enable an operative to reach from ground level.
- Toggle Bolts to be minimum 100mm from bottom of sign plate and if mounting height allows to be as high as possible up to the centre of the sign or max 1900mm.
- Toggle Bolts to be 100mm in from the sides of sign.

Shepherds Crooks or equivalent

- Shepherds Crooks or equivalent locking systems allow for additional secure locking at height.
- Recommended for vertical flap signs where the full height of the sign makes lower level locking only insufficient

Manufacturing Drawings

Manufacturers should provide drawings with details of quantity and location of fixings based on the information received from the contractor/designer for approval as per normal contract terms.
The contracting contractor/designer is responsible for determining whether the installation of a flap sign at the location is sufficiently robust and that all calculations have been determined for that specific location and the sign will meet the requirements of the intended operation.

Additional Recommendations for larger flap signs

Because there is no standard requirements for flaps it is important that the specifier and the manufacturers communicate from the outset and specifiers should discuss with manufacturers the suitability of solutions proposed.

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