ASSOCIATION FOR ROAD TRAFFIC SAFETY AND MANAGEMENT

GUIDANCE DOCUMENT

WG1/02/24

PROVIDING GUIDANCE TO MANUFACTURERS AND USER COMMUNITIES

GUIDANCE ON PASSIVELY SAFE PRODUCT REQUIREMENTS IN THE UK

Introduction

This guidance is intended as an introduction to the characteristics of passively safe products.

Passively safe structures are designed to reduce the severity of injury to road users in the event of an impact on collision. With a safe systems approach being adopted across the UK it is key for highways engineers and designers to be aware of and understand the performance criteria of crash friendly products, designed to deform or break on impact, and tested against recognised performance criteria which minimise damage to vehicles and their occupants.

This guidance aims to provide basic information about the different ways products react on impact, which is relevant not only to those in road design and road safety teams, but also to those who install products on the highway that use or require passively safe structures.

It also provides an update on the UK position for CE/CA marking and the use of TOPAS Registration.

ARTSM will be issuing further guidance notes on specific product types.

BS EN 12767 and the UK

Below we set out the requirements under the UK National Annex to BS EN 12767 providing a brief explanation on the different levels of passive safety permitted and terminology used in testing.

BS EN 12767 was revised in 2019 and further proxies were added to provide enhanced information on areas of impact. The proxies are now:

- Speed class
- Energy absorbing categories
- Occupant safety class
- Backfill Type (foundations)
- Collapse mode
- Direction class
- Risk of roof indentation

The current recommendations in the UK have been determined through the BSI B509/10 shadow committee and are stated in the UK National Annex.

Currently the UK does not call up a value requirement for the proxies of :

- Occupant Safey class
- Backfill Type (foundations)
- Collapse mode

Where NR (No Requirement) is specified, any class listed in the standard for that proxy is acceptable.

These proxies are however important, and a brief note is presented below on the rationale behind the UK position. They are however factors that designers may wish to take into account in determining which passively safe product is used for the specific location(s) intended.

Performance requirements in the UK – what do they mean?

Speed class:

All certified products are tested with the mandatory low speed test of 35 km/h. In addition, a higher speed test is also performed. This can be 50, 70 and/or 100 km/h which is the speed class determined by the manufacturer for the product to be tested.

At the mandatory low speed the total energy of the collision and resulting outcome is below the permitted threshold, although products may act in a rigid manner at low speed.

At high speed the test evidences how the product deforms or breaks to absorb some of the collision energy and limits the impact on the vehicle and its occupants.

The kinetic energy observed from an impact at 100 km/h is four times greater than the kinetic energy observed from an impact of 50 km/h. Designers should consider this when specifying the product for the specific roadside scenario. So where speed limits are >40 mph class 100 is applicable. For lower speed limits also 70 can be used.

Products must be identified with the speed tests that have been conducted.

Energy Absorption – HE, LE, NE:

The energy absorption of the product indicates how much the car with occupant(s) is reduced in speed on impact. Any residual speed may still be significant for any secondary impact of the car with occupants, and other road users, and should be a factor considered when specifying the type of product required at the specific site.

High Energy (HE) products severely retard the exit speed of the errant vehicle, in some cases bringing the vehicle to a complete stop. Category HE supports (which in practice are normally limited to longer supports) are generally designed to yield in front of and under the impacting vehicle and might sometimes wrap around the errant vehicle.

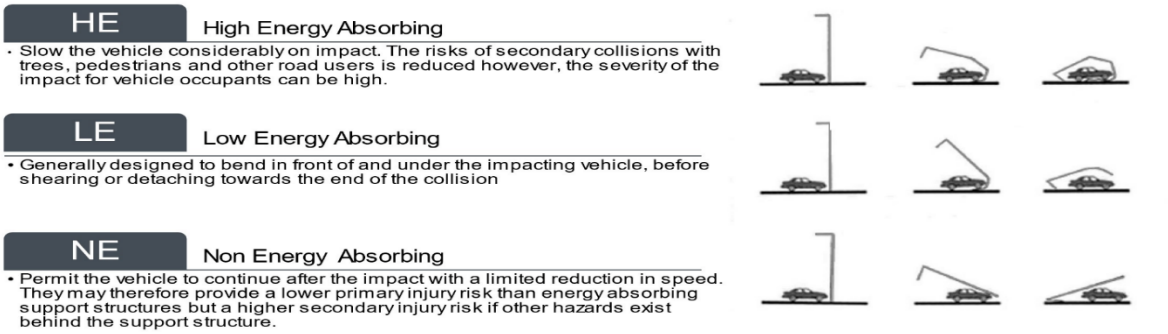
Low Energy (LE) products retard the exit speed of the errant vehicle by a little bit. Category LE supports are generally designed to yield in front of and under the impacting vehicle before shearing or detaching towards the end of the impact event.

Non Energy (NE) products do not have any significant retardation in speed of the errant vehicle. Category NE supports are generally designed to fail and detach at the base.

Normally these are smaller sized products or products with a break-away mechanism at ground level. When no other road users are in risk this is the best choice for the occupants of the car as the impact normally is very short. NE results in significant residual speed after the impact. Examples such as self righting bollards and delineator posts and other items normally not attached to a foundation.

There is a simplified manner to test these kind of products.

This diagram shows the expected response of products of different energy absorption.



Designers should consider these categories when determining which product to supply, particularly where there is a perceived risk to other road users, for example in urban or built up areas. Generally a Non Energy (NE) absorption product would be used where environment permits higher road speeds, whilst High Energy (HE) or Low Energy (LE) absorption products should be considered where there may be a secondary risk for pedestrians or other road-users.

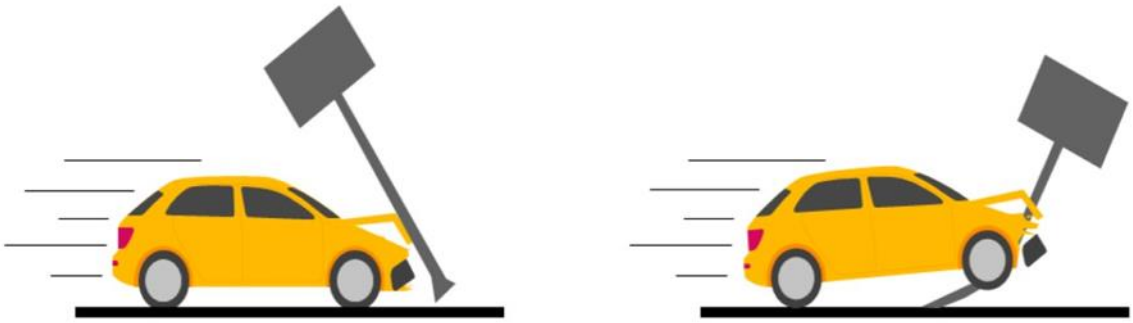
Lighting columns and tall signs and signals will normally fall back over the impacting vehicle, falling approximately in the original position. Smaller traffic signs may fall a short distance from the foundation, usually in the direction of travel, and may be passed over by the impacting vehicle.

If that risk is too high designers should consider the use of additional vehicle restraint systems, to create further protection against impact with the local HE product.

Collapse Mode

Non energy products tend to break away following impact (SE – separation upon impact) and High Energy products tend not separate from their foundation (NS non separation) and collapse in a more controlled manner.

The image below shows the difference between SE (separation upon impact) and NS (non separation)



When determining which type of passively safe product to use designers should consider collapse mode the risks associated with impact for vehicle and occupants and also perceived risk for other road users. However, in the UK we do not specify this as a specific class requirement and therefore NR is given in the National Annex.

Designers should also be aware that there can be significant difference between 2 HE products. For an impact speed of 100 km/h the HE level is reached when the residual speed is below 50 km/h.

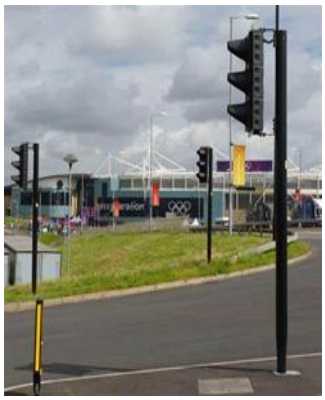
Similarly, when other hazards are present behind the product it may be better to use HE to protect the occupants against impact with this secondary hazard.

Direction class – SD, BD, MD

The EN 12767 impact angle is set at 20 degrees from the direction of travel, which is the assumed average angle of an errant vehicle. This is the same angle that safety barriers & bridge parapets are tested to, so gives commonality amongst other types of roadside infrastructure.

Standard signposts or lighting columns are manufactured from circular, hexagonal or octagonal sections and tend to behave in the same irrespective of impact direction.

Some products may have an additional mechanism or exist as multiple supports so it is not always possible to get this most preferred non-direction-sensitive performance.



Single Directional impact (SD) – this is only valid for impacts under 20 degrees from the direction of travel. Some of the first break-away systems were designed in this way (asymmetric) and only perform at impact angles up to 20 degrees. Any significant change to the angle of impact (ie 20 degrees or above), may not activate the break-away mechanism and may result in the product not performing either at all, or as originally tested.

Bi Directional impact (BD) - valid for products which perform to the tested 20 degrees impact angle in two directions of travel. Bi Directional products are normally symmetrical in one axis.

Multi Directional impact (MD) – this is the classification for products that can be impacted from any direction and still perform as originally tested. Multi Directional products are normally symmetrical in two or more axes.

The preferred direction class for products used in the UK is Multi Directional. BD & SD can be used if MD is not available and where a full risk analysis has been undertaken. It should also be borne in mind that a product that acts as MD when used singularly, may become restricted when used in a multi leg attachment.

Risk of roof indentation

This classification was added to the 2007 revision of the standard after experiences of accidents in the real world showed that some passively safe tested products could cause severe injury to occupants of an errant vehicle; this is especially problematic for HE products that can fold around a vehicle.

Two classifications are identified in the standard:

- 0: roof deformation less than 102 mm; and
- 1: roof deformation equal to or greater than 102 mm

Only class 0 products are recommended for use on roads in the UK

Annex K products - deemed to comply

The BS EN Standard also identifies Deemed to Comply products. In general steel tubes with diameter of 89mm x3.2mm or smaller are deemed to be passively safe and no testing is needed. The requirements are **maximum figures**. Over-prescribing will render the passive safety element as 0 – non compliant.

Be aware when putting these in multiples behind an attachment, especially with smaller inter-distance than 1.5m, because then a non-passive multileg may be created.

Rules for 'deemed to comply' signposts are given in Annex K of EN 12767 and are summarised as follows:

a) For two or more supports, the clear opening between the supports must be equal to or bigger than 1500 mm measured at an impact angle of 20°.

b) Where post centres are less than 1500 mm, post dimensions shall not exceed 76 mm diameter and 3.2 mm wall thickness.

c) In such a case with only two posts, the post centres should not be less than 750 mm.

d) No bracing should be used between the posts, which should only be connected by the sign.

Further information relating to bending moments will follow in other ARTSM guidance. However, sections of posts with a bending capacity of less than 88.9x 3.2 S355J2H are deemed to comply under Annex K of the BS EN 12767.

Non Harmful support structures

The BS EN 12767 standard allows for the use of non harmful support structures. These are normally lightweight plastic devices such as traffic bollards, flexible chevrons, traffic wand and delineators.

To certify a non harmful support structure as passive, the testing is very much simplified with the following exemptions to the main testing standard

- A driver can be used during the test and no vehicle instrumentation is required.
- Only the high speed test shall be carried out.
- The impact speed can be measured immediately before the impact.
- The exit speeds can be measured immediately after the impact.
- Measurements of pitch and roll angle are not required.
- The high speed film cameras and /or high speed video cameras can be replaced by normal film camera and/or video camera.
- A simplified test report is acceptable, with just the relevant parts included

As such, a manufacturer can test and certify these types of products without the need for external third party testing, but in order to do so, must maintain a full technical file with full evidence of compliance to the testing requirements of EN 12767 as evidence of compliance.

Occupant Safety Class

Whilst it is mandatory for this test requirement to be carried out. The UK consider that all classes listed are appropriate for all scenarios on roads in the UK. Therefore we state NR as a class determined.

Backfill Types (foundations)

In the UK the general requirement for installation is to use concrete backfill. Therefore the UK requirement is NR as a class determined. However the importance of the foundations should always be considered. The foundation is part of the passive safe solution and you should always ask for the installation instructions from manufacturers so that the product is installed in the right way to achieve the right outcome in a collision.

Some passively safe signposts, lighting columns and signal poles are designed to be readily replaced after an impact by employing socketed foundations, anchored cradles, buried precast foundation units and driven or screwed steel foundations. It is important that any foundation does not signficantly protrude above the ground to avoid catching a vehicle in an impact.

TOPAS Registration

Industry has determined that a more robust process should exist for evidence of testing and technical requirements to be verified. This will also assist procurers in determining correct testing has been undertaken and that evidence provided for passively safe testing has been scrutinised by an independent third party.

TOPAS™
Traffic Open Products and Specifications

Registration to TOPAS means that the technical files and the certifications have been checked for completeness in full, removing the need for procurers to undertake this. This is particularly important for products covered under BS EN 12767 since there are different testing regimes (eg non harmful structures) and because there is no CE/CA mark requirement. The TOPAS process undertakes independent assessment and provides a public register of those products for use by procurers and other manufacturers. It is a robust process which is well recognised in other areas of the UK road traffic management, safety and control.

TOPAS has created a specification which encompasses BS EN 12767; TOPAS 2546.

The register will identify the classes which have been tested for the products submitted. Manufacturers may register their products through independent technical assessors identified as approved by TOPAS, and procurers can then satisfy themselves that products registered with TOPAS have been externally verified. Manufacturers will receive a TOPAS Certificate of registration and be permitted to use the TOPAS logo for the products registered.

CE/CA Marking

EN 12767 itself does not fall under the Construction Products Regulations and so does not require CE/CA marking, although it does require external testing. However, when products are used in the UK for the purposes of sign support (including supports for signals and variable message signs) and/or lighting columns then certification is required according to the annex ZA of the applicable product standards in which is referred to EN12767. Specifically products used for sign supports and lighting columns must be marked to EN 12899 or EN 40 and apply the classes identified in the respective UK National Annexes of those standards, including the passive safety performance class met.

The position on CE/CA marking in the UK for products under the CPR. The UK continues to accept CE marking of these products, currently until June 2025. Whilst CE marking has been extended for other EU directives, this has yet to be confirmed by the Department for Levelling Up.

Summary of guidance currently available

Information has been drawn from several sources, in an effort to produce a succinct guidance. Reference sources are listed and should be referred to for more detailed information.

- Institute of Lighting Professionals TR30 – Guidance on the implementation of Passively Safe Lighting Columns and signposts (2011)
- Institute of Highways Engineers Structures Guide (2019)
- Passive Safety UK Guidelines (2022)
- BS EN 12767, 2019 and the UK National Annex

If you have any questions regarding passive safety please get in touch with ARTSM www.artsm.org.uk . We will providing further guidance in this passively safe series. Specifically in relation to prioritisation under Vision zero, consideration of TR30, signs size and software, electrical requirements and product specific guidance.

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