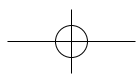
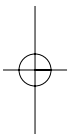
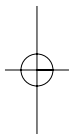
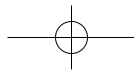


Passive Safety UK Guidelines
for
Specification and Use of
Passively Safe Street Furniture
on the UK Road Network

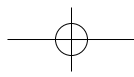
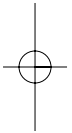
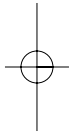




PASSIVE SAFETY UK GUIDELINES

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Passive Safety UK Guidelines for Specification and Use of Passively Safe Street Furniture on the UK Road Network

Passive Safety UK's central objective is to promote safer roadsides. Passive safety can greatly reduce the road toll on non-trunk roads where most of our road casualties now occur. We understand no-one in the UK has been killed or seriously injured hitting an item of passively safe street furniture or in a related secondary accident where a passively safe item of street furniture breaks away.

These guidelines are to assist Highway Authorities in employing passive safety to help make their roads safer. They make the case for passive safety, advise on how to employ passively safe street furniture and discuss targeting scarce resources to most benefit in safety and economic terms. They also explore measures to reduce casualties from hitting trees. Advice has been provided in the past for Trunk roads in TA89/04 and TA89/05 but these new guidelines target local authority roads where most 'Killed and Serious Injured' accidents occur.

With any new development there will be concerns about risk. With passive safety this has centered on the possibility of frangible posts hitting pedestrians or causing other secondary accidents. Whilst this aspect is explored in these guidelines, the real risk is from impacts with conventional street furniture and above all trees, as is so clearly demonstrated in the relevant road casualty statistics.

I would like to thank David Milne for his significant contribution to this document.

Andrew Pledge
Passive Safety UK

Endorsements

It should be a cause for concern that in 2007 nearly 600 people were killed or seriously injured in single vehicle collisions with 'street furniture' Add in those from multiple vehicle collisions (where such 'street furniture' is not counted in the statistics) and the scale of the problem we should be addressing becomes clear.

These guidelines now set out how ALL of us involved in the design, construction and operation of ALL roads in the UK should be actively considering the use of passively safe street furniture.

Previous advice on the use of passively safe street furniture contained in the Design Manual for Roads and Bridges may, unfortunately, have led many to have seen passive safety as a trunk road network issue only. Yet, the majority of the single vehicle fatal accidents in the UK occur on local authority A and B class roads.

The Highways Agency and a number of innovative local highway authorities have now established the worth of passively safe street furniture and their efforts should be applauded.

The current road safety targets set by Government require a reduction of 40% in Killed and Seriously Injured casualties by 2010 (set against an average for 1994-98) and in most Highway Authorities this is likely to be achieved.

Future targets beyond 2010 are, quite rightly, to be as 'challenging' to Highway Authority's and passive safety will be an essential element in any 'toolbox'.

The IHE firmly supports the work done by Andrew Pledge and David Milne who are to be congratulated on their continuing efforts to establish a 'forgiving' infrastructure

IHE fully support and commend this new guidance to its members and all local highway authorities. Its adoption will play a significant part in establishing safer roadsides and in doing contribute to the reduction in the unacceptable cost, both emotionally and monetary, to our communities and economy.



Anthony Sharp
President, Institute of Highway Engineers

The UK continues to be a world leader in road safety. Our casualty rates are among the lowest in Europe, and we have a long history of developing and applying the latest techniques to improve the safety of our roads. Local authorities and their partners play a vital part in making our roads as safe as they are. Around 90% of all accidents occur on local roads and the most successful authorities have reduced killed and seriously injured casualties by embracing new ideas and implementing them on their roads.

But the more we achieve the harder it will become to achieve more. It has been demonstrated that whilst the concepts of 'forgiving roads' and 'proactive safety' are forward thinking approaches they are successful approaches that contribute to minimising the severity of injuries. These new guidelines on passive safety are a welcome addition to a designer's documentation and one that contributes to the concepts previously mentioned.

The Chartered Institution of Highways and Transportation, has for many years been seen by the profession as a leading advocate of the importance of the delivery of effective safety management on our public highways for all users. Through its Road Safety Panel, the CIHT is committed to delivering and disseminating 'Good Practice' in the field of road safety to the profession and it is pleased to commend these guidelines to practitioners.



John Smart BSc C. Eng FIHT MICE
Director of Professional and Business Development,
Chartered Institution of Highways and Transportation

These Guidelines will be invaluable to the Road Safety Practitioner, particularly when designing schemes within rural areas. The casualty statistics outlined in the Guidelines indicate that the majority of sites for locating passively safe street furniture will be in the countryside. There will, however, be the occasional need in built up areas, where speeds (lawful or otherwise) are likely to be high. The philosophy of minimizing clutter and creating a forgiving environment should apply everywhere.

Safer roadsides are key to the whole concept of rural safety management. Fundamentally, Engineers should firstly pose the question, "is this sign really needed?" If it is, then "is it impossible for the feature to be located outside the so-called '4.5m clear zone'?" If the answer to both these questions is yes and speeds are likely to be in excess of 25mph, then passive posts should be used. (The Guidelines recommend that an 'Exception Report' be produced to justify non-use, with reasoning.)

The Guidelines will encourage the long-overdue debate, concerning ways of reducing the high involvement of roadside trees in the fatality figures. There is a fine line between wholesale destruction of our countryside with removal of trees and the alternative - a continuing loss of human life. Approximately one death in every thirteen is as a result of hitting a tree, in a single vehicle loss of control accident (250 deaths and 1031 serious injuries in 2007 alone). Road Safety Education will play a key role in making drivers aware of the scale of the problem and hence addressing the concerns of the environmental lobby. Alternatively, publicising the problem may have the benefit of reducing the need for the cull. In any event, these Guidelines offer a structured way of evaluating and treating the problem.

AIRSO is delighted to support the work and ethos of Passive Safety UK. The new comprehensive advice given in Passive Safety UK Guidelines will make a valuable contribution to casualty reduction now and beyond 2010.



Working for Safety on the Road

Nick J Stilwell

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Road Safety Engineering and Sustainability – Portfolio Holder for AIRSO

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References and Sources of Further Information

CHAPTER 1: INTRODUCTION

1.1 The guidelines provide advice for the adoption and selection of the appropriate type of passively safe signposts, lighting columns, traffic signal poles, bollards and other passively safe street furniture for all rural and urban roads. The guidelines are advisory and we advise highway authorities to take a conscience decision on whether to adopt them in full or in part. Passive Safety UK believes there are no safety risks but only safety benefits if they are adopted. Advice is given on prioritising passive safety to those roads where it is likely to offer the greatest benefit.

1.2 Passively safe signposts and lighting columns are now widely used on trunk roads where the speed limit is 50 mph or over. The DMRB Advice Note TA89 legitimised passively safe sign posts in 2004 and its update in 2005 extended coverage to passively safe lighting columns on trunk roads. As a result passively safe lighting columns and signposts are the preferred alternative to conventional larger signposts and lighting columns safeguarded by safety fences on the trunk road network. No deaths or serious injuries having been reported with impacts with this passively safe street furniture. Traditional signposts, lighting columns and utility poles were together responsible for 103 deaths and 233 serious injuries in single vehicle accidents in 2008 alone. There will have been further deaths and serious injuries from hitting these items in multiple vehicle accidents which are not included in the single vehicle accident statistics. It is becoming increasingly clear that using passively safe signposts and lighting columns saves lives on trunk roads and this benefit is transferable to their broader use outside the trunk road network. Passively safe street furniture can significantly reduce deaths and serious injuries on these roads. It should be noted while speed affects the severity of accidents the statistics demonstrate serious injury casualties and deaths with street furniture frequently occur in both urban areas and on rural roads.

1.3 The term ‘accident’ is used in these guidelines to accord with ‘Road Casualties Great Britain’ statistics but driver error or behaviour is often a prime cause in street furniture impacts. Use of passively safe street furniture almost eliminates the chance of serious injury or death in these impacts regardless of ‘blame’.

1.4 Although passively safe street furniture is usually more expensive than its traditional counterpart, measures like striving for clear zones next to the carriageway and reducing unnecessary signs and roadside clutter can cost little or even save money. A widening range of passively safe lighting columns and signposts is coming to the market typically using aluminium or composites which offer a long and maintenance free life. Competition is reducing initial costs and several electrical suppliers have developed electrical isolation systems for the passively safe lighting column and traffic signal market. Roadside passive safety is becoming increasingly affordable.

1.5 Chapter 9 discusses electrical safety for passively safe items with a power supply. This is relevant to illuminated signs, lighting columns and traffic lights. Currently a more rapid electrical isolation time of 0.4 seconds is required for passively safe street furniture in an impact because the items breakaway in an impact. This imposes a significant extra cost. Many items of non-passively safe

street furniture also break away (but the impact is far more dangerous). We believe there is a need to harmonise electrical isolation requirements to a common standard to avoid unfairly mitigating against passive safety. In particular we believe the use of the low voltages increasingly used for traffic signals presents little or no risk of electrocution.

1.6 The difficult area of trees and roadside safety is explored. Balancing environmental interests, people’s love of trees and roadside safety is emotive and difficult to reconcile. Deaths and serious injuries from impacts with trees are frequent but the toll can be reduced if suitable measures are taken.

1.7 Using passively safe signposts and lighting columns saves lives and the main barriers to their broader use are initial cost, inertial resistance to change and a lack of appreciation by highway authorities of the safety benefits they can certainly deliver.

CHAPTER 2: PRIORITISING ROADS FOR PASSIVE SAFETY

2.1 Passive Safety UK advises that A and B roads should be prioritised for the use of passively safe street furniture as follows in Table 1:

Roads with traffic volumes and speeds commensurate with A or B roads should use the appropriate classification from Table 1.

Priority	Rural A-Roads
Priority 2	Urban A-Roads with a speed limit of 40 mph
Priority 3	Rural B-Roads
Priority 4	Urban B-Roads with a speed limit of 40 mph
Priority 5	Urban A-Roads with a speed limit of 30 mph
Priority 6	Urban B-Roads with a speed limit of 30 mph

Table 1: Prioritising Roads for the Specification of Passively Safe Street Furniture

Note: Rural roads are defined as having a speed limit of 50 mph or more for the purposes of this document

Trunk roads are not included in the above prioritisation because roadside hazards are typically protected by barrier or passively safe street furniture used to accord with DMRB document TD19.

2.2 The following roads are lower risk and are unlikely to need passively safe street furniture (unless accident history or other risk factors indicate otherwise):

- a) Roads with 20 mph speed limits
- b) Roads usually lined with parked cars
- c) Residential and factory estate roads and roads where traffic speeds are unlikely to exceed 25 mph
- d) Country lanes and roads with low traffic volumes (unless there is a pertinent accident history or an obvi-

ous high risk feature such as a heavy concrete lighting column on the outside of a sharp bend).

REASONS FOR THE PRIORITISATION INCLUDE:

- a) A-roads comprise only 12% of the road network but have 57% of fatal single vehicle accident casualties (excluding pedestrians).
- b) B-roads comprise 8% of the road network and these roads have 20% of fatal single vehicle accidents (excluding pedestrians).

MAPPING OF ACCIDENTS

2.3 All roadside furniture and trees exceeding 250 mm girth should be recorded on a mapping system for A and B roads (identifying where it is passively safe or not). Injury accidents and accidents involving roadside infrastructure should be plotted to help identify roads and locations where passive safety and other safety initiatives are likely to be advantageous.

ROAD SCHEMES AND ROADSIDE INFRASTRUCTURE RENEWAL

2.4 Where road schemes are undertaken or roadside furniture is to be installed or renewed on any A or B road we recommend both creating clear zones within 4.5 metres of the carriageway or as much of this width as is possible within boundaries and constraints and the use of passively safe street furniture in the clear zone. Renewals and road schemes offer the most cost effective windows for deploying passively safe street furniture.

CHAPTER 3: GENERAL GUIDANCE ON PASSIVE SAFETY CLEAR ZONES

PROVISION OF CLEAR ZONES

3.1 A clear zone next to the highway will make a large contribution to roadside safety. Historically the DMRB advised a clear zone of 4.5 metres for trunk roads where speed limits were 50 mph and over. The advice for trunk roads is given in the Design Manual for Roads and Bridges document TD19 where barrier provision/clear zone width is subject to a risk analysis approach.

For non trunk A roads and B roads a 4.5 metre clear zone is recommended free of hazardous obstructions where verge space is available but all efforts to provide as much of a 4.5 m clear zone width as is reasonably possible are likely to improve safety. Signposts and lighting columns within 4.5 metres of the edge of the carriageway should be passively safe unless behind a barrier (and safely outside the working width of the barrier).

There are locations where a 4.5 metre clear zone may be judged insufficient. Examples are:

- a) where vehicles have in the past left the road at speed at bends ending up a long way from the carriageway
- b) where the ground falls away from the road

In these cases a wider clear zone or barrier may be needed.

In built-up areas it may often be impossible to provide these clear zones as the footpath is often next to the road

and there are often buildings or boundary walls at the back of the footpath but the use of passively safe street signs and lighting columns next to the road will still be advantageous in these situations.

3.2 Utilities such as electricity and telephone cables are preferably located below ground. Where utility poles are necessary, they should be sited where possible 4.5 metres or more from the carriageway on A and B roads. The casualty statistics in Road Casualties Great Britain Table 20 and a crash demonstration conducted at MIRA demonstrate utility poles are a real risk.

3.3 Keeping non-passively safe street furniture and all heavy roadside obstructions and potential hazards outside the clear zone for A and B roads may often involve only careful planning and should be considered as a goal for all road schemes.

DESIREABILITY OF ENERGY ABSORPTION IN PASSIVELY SAFE PRODUCTS

3.4 Many but not all passively safe lighting columns and signposts yield and crush at point of impact and absorb energy in the process. If an energy absorbing post or column is of a breakaway type (LE or Low Energy and NE or No Energy types) it will not gain significant kinetic energy in an impact and will fall to the ground fairly close to the foundation. The test in EN 12767 has no limits on spread of debris but it is advisable to view the high speed EN 12767 test video for any product to check the post or column behaves safely and does not bounce at speed off the vehicle. Also energy absorbing posts will safely yield if one should hit another vehicle in a secondary accident. Chapter 4 discusses EN 12767 classifications in more detail.

SLIP BASED POSTS

3.5 Slip based signposts and lighting columns have been rarely used in the UK. They traditionally have a slotted base plate which allows the post to slip and break away on impact. They are certainly much safer than traditional non-passively safe lighting columns and signposts but suffer from the following problems:

- a) Corrosion can cause lock-up in the slip release mechanism
- b) Bolt torques need to be checked at regular intervals
- c) They are directional in that the impact has to come from the right direction for slip and breakaway
- d) The steel posts used with slip bases are not yielding, can be relatively heavy and may bounce elastically away from the car in the impact raising fears of a secondary accident.
- e) If used on embankments the vehicle may be airborne and hit the post at height. Slip bases may lock up when impact occurs at height

Traditional slip based posts have been associated with serious and fatal accidents in Scandinavia and Iceland and are not recommended by Passive Safety UK.

'DEEMED TO COMPLY' STEEL TUBULAR SIGNPOSTS

3.6 Rules for deemed to comply steel tubular posts are given in Annex F of EN 12767 and are summarised as follows:

- a) Steel tubular posts up to 89 mm diameter and 3.2 mm wall thickness have been crash tested by TRL and classified as 100 NE2.
- b) Post centres for multiple post signs should not be less than 1500 mm (so a car is unlikely to hit more than

a single post in an impact).

- c) Steel posts of 76 mm dia and 3.2 mm wall thickness may be used with post centres as close as 750 mm
- d) No bracing should be used between the posts.

In crash tests these small tubular steel posts flatten under the vehicle and are very unlikely to break away. For smaller signs these posts provide an economical and passively safe solution for all locations.

Larger steel thin walled posts tested to EN 12767 in aluminium and steel can provide economical solutions to passive safety for medium sized signs and traffic lights.

TREES

3.7 Trees on British roads are statistically equally, if not more of a danger, than man-made roadside infrastructure. The challenge for designers is to reconcile these road safety issues, with landscape/streetscape considerations, within the current environmental legislation. In 2008, 180 people were killed and 796 people were seriously injured in single vehicle accidents with trees.

About 1 in 13 of deaths on the roads in Great Britain was due to hitting a tree in a single vehicle accident in 2008. Further tree impact deaths will occur in multiple vehicle accidents. Trees are exceptionally dangerous to strike as a result of their weight, strength and rigidity. A motorway accident is four times more likely to result in a fatal injury if it involves a vehicle that strikes a tree, than if it hit a road sign.

3.8 The DMRB document TD 19 advises a tree or trees having, or expected to have a trunk girths of 250 mm or more (measured at a height of 0.3m above ground level) at maturity are a risk. Many non-trunk rural roads will have numerous trees exceeding this limit close to the carriageway.

3.9 Passive Safety UK proposes that:

- a) All trees exceeding the 250 mm girth limit should be mapped and identified as potential risks on A and B roads as part of the mapping exercise proposed in Chapter 1.
- b) Accident records with trees and street furniture should be recorded on the same system
- c) A programme of preventative culling should be established to maintain clear zones within 4.5 metres of the carriageway where possible
- d) Boundary hedges should be cut and maintained to prevent them becoming rows of trees

3.10 Factors affecting whether trees are a severe risk will include:

- a) Whether trees are on bends
- b) The speed limit
- c) History of accidents on the length of road

3.11 What can be done

- a) At risk trees can be protected by continuous barriers
- b) Individual trees can be protected with individual barriers
- c) Lower speed limits
- d) Preventative coppicing (where trees are suitable)
- e) Tree removal (possibly with compensatory planting away from the carriageway) legal restrictions permitting

- f) A landscaping policy that encourages only shrubs to be planted near the road and for larger trees to be sited at a safe distance from the carriageway especially on A and B roads will pay dividends.

MOTORCYCLE SAFETY AND PASSIVELY SAFE STREET FURNITURE

3.12 Passively safe street furniture while relatively safe for car occupants is likely to cause severe injury or death if hit by a motorcyclist at even modest speeds. However conventional sign posts or lighting columns guarded by crash barriers are a bigger risk to motorcyclists as the barrier posts are a very dangerous continuous obstacle for a dismounted and sliding motorcyclist. Signs and lighting columns present only an isolated obstruction and are more likely to be missed. There are barriers and barrier products which provide continuous lower level sheeting screening the sharp posts and allowing motorcyclists to slide along the barrier without hitting the potentially lethal posts. This type of product should be used where motorcyclists are judged likely to leave the road.

3.13 It is now possible to protect posts with padded crash cushions. There is a crash cushion type product available to surround or shield signposts, lighting columns and utility poles from a motorcyclist impact. The product consists of an egg box type matrix cushion within a relatively flexible shell with carefully engineered crush characteristics. The product has demonstrated its safety performance in a testing regime used for motorcycle helmets. It is early days but this development has the potential to protect motorcyclists in low to moderate speed impacts with street furniture which would otherwise often be serious or fatal.

3.14 While this document does not address barriers it is worth noting steel barriers with exposed posts present a severe risk to motorcyclists. EN 1317 'Road Restraint Systems' is being updated to include a section on tests for motorcycle friendly barriers. This type of barrier is available and the use of such barriers is recommended at all sites where there is a history of motorcycle accidents.

RE-USE OF FOUNDATIONS

3.15 Some passively safe signposts, lighting columns and traffic signal poles are designed to be readily replaced after an impact re-using the undamaged foundations. On a busy road network being able to quickly replace lighting columns traffic signal poles or signposts with no foundation works and little, or no, traffic management gives safety and cost advantages and reduces the potential for traffic disruption.

These solutions include:

- a) anchor cradles in a cast concrete foundation
- b) driven or screwed steel foundations which can be rapidly installed
- c) buried precast concrete foundation units

These foundations are usually product specific but are especially suitable where traffic management and traffic delays are a potential problem either in installation or after an impact.

It is important that any foundation does not protrude above the ground to avoid catching the vehicle in an impact.

CHAPTER 4: BS EN 12767:2007 'PASSIVE SAFETY OF SUPPORT STRUCTURES FOR ROAD EQUIPMENT. REQUIREMENTS, CLASSIFICATION AND TEST METHODS'

4.1 Passively safe street furniture is evaluated and classified by crash testing to BS EN 12767. BS EN 12767 is used to evaluate whether items of street furniture (and in particular their supports) are unlikely to cause injury to vehicle occupants in a crash when hit at speed. Signposts, traffic light poles, lighting columns and traffic bollards have been crash tested and classified to this pan-European standard. Products tested to the standard have also been used for masts to mount roadside cameras. Any roadside equipment item can be crash tested in its field configuration to the standard to see if it is passively safe.

4.2 There have been no reported deaths or serious injuries in accidents with passively safe street furniture meeting any of the classes to BS EN 12767:2007 in the UK to date. In Europe passively safe street furniture generally has an excellent safety record. However slip based posts have not always broken away as intended and HE lighting columns when hit at very high speed on motorways can cause dangerous roof deformations.

4.3 BS EN 12767:2007 contains:

- a) A detailed protocol for the crash tests including the vehicles to be used, the instrumentation and measurement requirements (brief details are given below).
- b) A classification system which uses the results to classify the item tested into one of a number of classes for speed, energy absorption and safety level
- c) The UK National Annex to BS EN12767 contains detailed advice on how to use passively safe street furniture in the UK. In particular the National Annex (NA) gives rules for what classification of passively safe street furniture is suitable for which location.

BS EN 12767:2007 TEST DETAILS

4.4 It is advisable to read BS EN 12767 for a full account of the test and the test classifications

4.5 To achieve an EN 12767 classification a product has to successfully undergo two crash tests, a low speed test at 35 kph and a high speed test (50 kph, 70 kph or 100 kph dependant on the classification sought). The tests use a light 900 kg car (with specified crush characteristics). Typical calibrated test cars are Ford Fiestas, Suzuki Swifts and Peugeot 205's. Accelerations are carefully measured throughout the crash in 3 dimensions and high speed films of the impact made.

Important properties for passive safety are:

- a) Light weight which reduces dynamic impact forces (a heavy VMS sign or a heavy battery for a Vehicle Actuated Sign may not be passively safe even when mounted on passively safe posts)
- b) Ability to absorb energy. Even where the prime mode of failure is by shear or breakaway it is important the actual structure absorbs energy by yield for a metal or by progressive material degradation for a composite so the column or signpost does not bounce away from the vehicle in an impact creating a possibility for a sec-

ondary accident. Energy absorbing products are inherently more failsafe than more rigid products with a single failure point.

Passively safe street lighting columns, signposts and traffic signal poles can be of aluminium, steel, or composite glass or carbon fibre construction.

CLASSIFICATION OF PASSIVELY SAFE STREET FURNITURE TO EN 12767

4.8 A typical classification to BS EN 12767 could be 100 NE 2 where

- 100 means the item has been crash tested at 100kph (and at the 35 kph mandatory test speed)
- NE means the item has lost minimal speed in the impact (see Table 1, page 7)
- 2 means the item has an occupant safety level of 2 based on ASI and THIV values.

Products can be rated for 3 speeds – 50 kph, 70 kph and 100 kph. In practice products are only rated at 100 kph (100 kph high speed crash test and a mandatory 35 kph crash test) and at 70 kph (70 kph high speed crash test and a mandatory 35 kph crash test)

The products are divided into three classes dependant on the speed loss of the car in the impact in the high speed test NE or No Energy, LE or Low Energy or HE or High Energy. The requirements are given in Table 2 (page 11).

In practice all passively safe products (even NE products) are safer if they yield (or for composites degrade) at point of impact as this prevents the passively safe furniture item 'bouncing' off the impacting car. A criticism made of steel slip based posts is they can bounce elastically off the impacting vehicle on impact at speed and then carry some distance because they do not absorb energy.

4.9 For full details of the test it is recommended BS EN 12767 is consulted.

CHAPTER 5; PERFORMANCE CLASS RECOMMENDATIONS FOR PASSIVELY SAFE PRODUCTS

5.1 Advice is given in the revised National Annex to BS EN 12767:2007 published in October 2009 on the appropriate class of passively safe products for lighting columns, signposts and non harmful support structures. A table giving the recommendations is included in Table 3 (page12).

When selecting products from the table the following points are relevant:

- a) Not all product classifications are available. A continually updated list of available passively safe products and their classifications is available at: <http://www.passivesafetyuk.com>
- b) All passively safe products tested to EN 12767 will be much safer in any impact at any speed than traditional steel or concrete posts. The decision to use an EN 12767 tested product is far more important than the class selected to EN 12767.

c) HE products are preferred in urban situations because they offer a measure of increased safety for pedestrians. Typically lighting columns can be HE but HE signposts and signal posts are now available. Because HE products significantly retard or stop a light vehicle in an impact and the posts do not break away they marginally increase safety for pedestrians and other NMU's (non-motorised users) in any secondary accident after the initial collision. Vehicle occupants are also safeguarded from the vehicle carrying on at speed into such a secondary impact. HE lighting columns however will make a very uncertain safety fence for increasing pedestrian safety and they will not significantly slow a large commercial vehicle. In practice there are few if any reported secondary accidents after a primary collision with a passively safe item of street furniture and NE signposts have been widely used across Norway in urban situations for more than ten years without any reported injuries in primary or secondary accidents.

d) Passive Safety UK does not recommend HE products for motorways and dual carriageways with speed limits > 40 mph because Scandinavian experience has shown car roof deformation can be a problem in very high speed impacts.

e) Traditional slip based products are not recommended as they have some history of the breakaway connection locking up and failing to release in use

f) NE4 'non harmful support structures' are exceptionally safe in any impact.

g) The National Annex prefers products tested at 70 kph (and the compulsory 35 kph test) for use where speed limits are 40 mph speed limits or less. In practice many of the products on the market have been only been tested at the highest speed 100 kph (and the compulsory 35 kph test) and there is no evidence that these products perform unsatisfactorily in intermediate speed impacts.

h) The National Annex does not recommend use of products tested at 50 kph (and 35 kph).

i) All occupant safety levels (levels 1 to 4) in BS EN 12767 are acceptable.

j) Roof deformation is measured in BS EN 12767 testing. Products with a test roof deformation in testing exceeding 150 mm are not recommended.

CHAPTER 6: SPECIFYING PASSIVELY SAFE SIGNPOSTS TO BS EN 12899

6.1 Highway signposts need to meet the requirements of: *BS EN 12899-1:2007 Fixed, vertical road traffic signs. Fixed signs*

This document also introduces CE marking for signposts to demonstrate compliance with EN12899 and where passive safety is required with EN 12767. CE marking of highway signposts will become a UK requirement.

A list of available passively safe signposts and their classifications can be found at:

<http://www.passivesafetyuk.com>

The National Annex to EN 12899 advises on designing for UK wind loads. More comprehensive advice on designing signs and foundations for wind loading is given in the Sign Structures Guide published on the web by the Institute of Highway Engineers at:

<http://www.homezones.org.uk/documents/Structures-Guide.pdf>

A copy of this document is also available at:

<http://www.passivesafetyuk.com>

Advice on foundation design for signposts can also be found in the Design Manual for Roads and Bridges Document BD94/07 Design of Minor Structures. This document is currently being revised.

Passively safe signposts tested to EN 12767 are available in steel, fibre glass composite, carbon fibre composite, and

NE or No Energy	The car loses minimal speed in the impact. 70 kph rating - exit speed is between 30 kph and 70 kph in the 70 kph test 100 kph rating – exit speed is between 70kph and 100 kph in a 100kph test
LE or Low Energy	The car loses some considerable speed in an impact. 70 kph rating - exit speed is between 5 kph and 30 kph in the 70 kph test 100 kph rating – exit speed 50kph and 70 kph in a 100kph impact
HE or High Energy	The car is significantly arrested or slowed in an impact 70 kph rating - exit speed is less than 4 kph (and may well be totally halted) 100 kph rating – exit speed is 50 kph or less Most HE items use their length to achieve the necessary retardation by bending round and flattening under the vehicle bringing it to a relatively gradual halt. The items remain embedded in the ground and do not shear or break free. The ability to halt or almost halt a vehicle at medium speeds make them very suitable for town use to safeguard pedestrians.

Table 2: Exit Speed Requirements for NE, LE and HE ratings

PASSIVE SAFETY UK GUIDELINES

aluminium. Passively safe signposts can have moments of resistance of up to 150 KN m and can carry all but the very largest motorway signs.

SITING PASSIVELY SAFE SIGNPOSTS

6.2 Passively NE safe signposts will be considerably safer than non-passively safe signposts for all locations but because most types of passively safe signposts break away on impact care should be taken at locations where such posts could be displaced into a different or oncoming carriageway. These sensitive locations include:

- central reserves,
- nosings
- central islands on the main carriageway.

For smaller signs steel posts of less than 89 mm diameter

and 3.2 mm wall thickness are passively safe and do not break away but flatten under the vehicle and are recommended for these locations. Again some composite signposts do not breakaway because the longitudinal fibre reinforcement remains intact and these posts are again suitable for these locations. Where breakaway signposts are needed they should be carefully sited to reduce the chance of carrying into an oncoming carriageway in an impact. Where breakaway passively safe signposts are used they should deform or degrade at point of impact and not bounce off the vehicle as demonstrated by very limited carry in the high speed EN12767 crash test.

6.3 Signposts sited in the working width behind any restraint system/crash barrier must be passively safe so they

Table 3: Summary of the Recommendations in National Annex to BSEN 12767: 2007 for the use of Performance Classes to EN 12767

Situation	Location	Type of support structure		
		Lighting column Classifications listed (a), (b), (c) etc are in order of preference ⁽²⁾	Sign or signal support ⁽¹⁾ Classifications listed (a), (b), (c) etc are in order of preference ⁽²⁾	Non-harmful support structures
Non-built up all-purpose roads and motorways with speed limits > 40mph	Generally in verges of motorways, dual carriageways and single carriageway roads	100:NE:1-3	100:NE:1-3	100:NE:4
	With significant volume of NMUs ⁽³⁾ at the times when impact events occur	100:HE:1-3	(a) 100:HE:1-3 ⁽⁴⁾ (b) 100:LE:1-3 ⁽⁴⁾ (c) 100:NE:1-3 ⁽⁴⁾	100:NE:4
	Where major risk of items falling on other carriageways. Below (e.g. at grade separated interchanges)	100:HE:1-3	(a) 100:HE:1-3 ⁽⁴⁾ (b) 100:LE:1-3 ⁽⁴⁾ (c) 100:NE:1-3 ⁽⁴⁾	100:NE:4 or 70:NE:4
Built up roads and other roads with speed limits 40mph or less	All locations	(a) 70:HE:1-3 (b) 100:HE:1-3 (c) 70:LE:1-3 (d) 100:LE:1-3	(a) 70:HE:1-3 ⁽⁴⁾ (b) 100:HE:1-3 ⁽⁴⁾ (c) 70:LE:1-3 ⁽⁴⁾ (d) 100:LE:1-3 ⁽⁴⁾ (e) 70:NE:1-3 ⁽⁴⁾ (f) 100:NE:1-3 ⁽⁴⁾	100:NE:4 or 70:NE:4

(1) Can include other supports for items of similar weight to that of the item supported in the test, such as variable message signs and speed cameras

(2) Subject to the availability of compliant products which meet the specific needs of the particular situation

(3) Non-motorised user

(4) Category NE can be accepted in any situation where the standard steel posts defined as 'deemed to comply' in Annex F are used

will break away or bend as the restraint system deflects in the impact.

6.4 Where possible signs should preferably have a minimum clearance to the edge of the hard carriageway of 1.2 metres to reduce the chance of a sign impact and subsequent replacement costs. Signs should never be closer to the carriageway than the limits given in the Traffic Signs Manual Chapter 1, Part 6.

6.5 See para 3.6 for rules on steel posts deemed to comply with EN 12767

CHAPTER 7: SPECIFYING PASSIVELY SAFE LIGHTING COLUMNS TO BS EN 40

7.1 All lighting columns need to meet the requirements of BS EN 40. BS EN 40 has 7 parts and covers the requirements for lighting columns in steel, aluminium, polymer composites and concrete and also covers load testing and strength from calculation, dimensions and most importantly the requirements for CE marking.

7.2 Lighting columns must now be CE marked to EN 40 and the CE marking or documentation should identify the passive safety class to EN 12767 where passive safety is required.

7.3 Passively safe lighting columns are now all CE approved to EN40. A list of current passively safe lighting columns is given at:

<http://www.passivesafetyuk.com>

7.4 There are passively safe lighting columns available in steel, aluminium and fibre reinforced composite construction.

7.5 Any lighting column located in the working width of a restraint system must be passively safe. These lighting columns can be of NE, LE and HE types and have typically been tested at 100 kph (and the mandatory 35 kph) but one manufacturer's range has been tested at both 100 kph and 70 kph with a NE rating at 100 kph and an LE rating at 70 kph. One HE column has been tested at 70 kph but not at 100 kph. A column tested at 70 kph and not at 100 kph should be restricted to speed limits of 40 mph or lower.

7.6 To aid specification of lighting columns to EN 40 and avoid the need to carry out the wind loading and design strength calculations for every specific location BSI committee have published *PD 6547:2004 'Guidance on the use of BS EN 40-3-1 and BS EN 40-3-3'*. This document defines four classes of lighting column in terms of the wind pressures that they can withstand as Light, Medium, Heavy and Extra Heavy. Manufacturers can declare the class of each product, for a given maximum bracket length and luminaire size. Annex A gives the appropriate wind loading class for each administrative area of the UK, up to a

maximum altitude. Above this altitude a full calculation to EN 40 must be carried out using the appropriate wind speed data for the location and altitude. PD 6547 also gives guidance on foundation design

CHAPTER 8: SPECIFYING PASSIVELY SAFE SIGNAL POLES

8.1 Most traffic signals are mounted on mild steel poles of 114 mm diameter and up to 4.0 mm wall thickness. These posts are frequently hit by vehicles and anecdotal evidence suggests few if any people are seriously injured or killed in these collisions. However it is unlikely that these poles would achieve an EN 12767 crash testing classification if tested.

8.2 It is very advantageous for traffic light poles to be easily replaced as they are regularly hit by vehicles. Specialist foundation socket arrangements are advantageous in this respect and provide for the necessary power supplies.

8.3 Suitable passively safe traffic light poles meeting EN 12767 requirements are listed at:

<http://www.passivesafetyuk.com>

CHAPTER 9: SPECIFYING POWER SUPPLIES AND ELECTRICAL SAFETY FOR PASSIVELY SAFE STREET FURNITURE

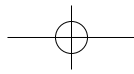
9.1 Electrical safety requirements are a specialist area and only general advice on electrical isolation and the systems available is included here.

9.2 Lighting columns, traffic lights, illuminated signs and VMS signs all need power supplies. These power supplies are usually the mains voltage of 240 volts. Because passively safe products typically yield or shear in an impact there will always be concern that apparatus, posts or cables become live after an impact and put the public or emergency services at risk following an impact. Electrical safety requirements are addressed in NA 8 of the National Annex to BS EN 12767.

9.3 Cabling systems must not interfere with the passive safety failure mode in an impact. Heavy armoured cables must not tether or interfere with the clean break away of a signpost or lighting column. Pullout plugs are often provided to prevent tethering and to provide electrical isolation in an impact where posts shear in an impact.

9.4 Some manufacturers provide isolation plug/socket connections for posts which electrically isolate when a post shears relative to its base plate on impact.

9.5 To provide electrical isolation within the 0.4 second of an impact as required in the National Annex to EN 12767 special electrical solutions have evolved. These include electrical tilt switches, impact sensors and residual



PASSIVE REVOLUTION GUIDELINES APPENDIX

current devices. They typically isolate the supply away from the post or lighting column. Suppliers can be found on the current list of available passive safety products at: <http://www.passivesafetyuk.com>

9.6 Where LED traffic lights and LED illuminated signs operate at ELV (extra low voltage) of 50 volts or below it is questionable whether electrical isolation devices are required although such devices can be used to isolate individual signals for maintenance. There still may be a small residual risk of a spark setting fire to an impacted vehicle with a damaged tank or fuel line. Cables may still need to pull away in any impact to prevent tethering.

REFERENCES AND SOURCES OF FURTHER INFORMATION

Designing Safer Roadsides – A Handbook for Highway Engineers.

For sale from d.milne@homecall.co.uk. at a price of £10.00. This book offers broad and relevant advice on all aspects of passive safety, barriers, crash cushions and Zero Vision

British Standards

BS EN 12767:2007 (as modified in October 2009) Passive safety of support structures for road equipment.

Requirements, classification and test methods

BSEN 12767 refers to EN 1317 for some of the test and classification procedures and requirements:

BS EN 1317-1: 1998: Road restraint systems. Terminology and general criteria for test methods.

BS EN 1317-2: 1998 Road restraint systems. Performance classes, impact test acceptance criteria and test methods for safety barriers

BS EN 12899-1:2007 Fixed, vertical road traffic signs. Fixed signs

TRL Reports (available from TRL)

Implications of using energy absorbing masts to support signs, without protective safety fencing. TRL Project Report PR/SE/VE/637/02 1st August 03;

Passive Safety Tests on Steel Circular Hollow Section

Signposts Tests 09NB, 10 NB & 12 NB. 1st July 03

DMRB (Design Manual for Roads and Bridges) Documents

BD 94/07 DESIGN OF MINOR STRUCTURES) available from <http://www.standardsforhighways.co.uk/dmr/vol2/section2/bd9407.pdf>

This document covers the design of minor highway structures, including lighting columns cantilever masts for traffic signals and/or speed cameras, CCTV masts, fixed vertical road traffic signs.

IHIE document

SIGN STRUCTURES GUIDE SUPPORT DESIGN FOR UK TRAFFIC SIGNS TO BS EN 12899-1 is available from.

<http://www.homezones.org.uk/documents/StructuresGuide.pdf> and covers design of signs for wind loads.

Road Casualties Great Britain: 2008 are available at:

<http://www.dft.gov.uk/pgr/statistics/datatablespublications/accidents/casualtiesgbar/rrcgb2008>

TRAFFIC SIGNS	ROAD SAFETY & CONSULTING	TRAFFIC SIGNALS	STREET LIGHTING	RESTRAINT SYSTEMS
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CKG Consultancy	Eclipse Partnership	FLL Structures	Exterior Lighting Solutions (UK)	Hill & Smith
Exterior Lighting Solutions (UK)	Mott MacDonald	Mott MacDonald	Fabrikat (Nottingham)	Systema
Fabrikat (Nottingham)	TMS Consultancy	NAL	FLL Structures	UK Roads
FLL Structures	UK Roads	Poletech Systems	Glasdon UK	Varley & Gulliver
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JPCS Signs		The Post & Column Co	NAL	
Linpac Environmental		Traffic Management Products	Nuite Lighting	
Mott MacDonald		TOFCO	Poletech Systems	
NAL		UK Roads	Sapa Pole Products	
One2SeeSigns			Sign Post Solutions	
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COMPANY DIRECTORY

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UK Roads Ltd



We don't make or sell anything! But we organise events across the UK including UK Roads 'Road Shows' and Passive Safety Workshops in conjunction with TMS Consultancy. We also operate a series of websites (including www.passivesafetyuk.com) which provide information and best practice advice.

Why not visit www.ukroadsltd.com for more information.

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Varley & Gulliver Ltd



Varley and Gulliver has been the UK's premier manufacturer of both steel and aluminium bridge parapets for over 40 years. To satisfy the demands in road safety Varley and Gulliver has developed an extensive range of systems with approvals to the European standard EN 1317. To compliment their vehicle restraint systems, in 2009 the company launched two new products; a light weight steel gantry to meet the demands of the UK's Highways Agency requirement for managed motorways and a passive sign support 'HiMAST'.

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Westcotec Ltd



Westcotec manufacture, supply and maintain a wide range of innovative lightweight vehicle activated signs. Various power options available including wind, solar, battery or mains.

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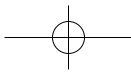
COMPANY DIRECTORY

WIMED



WIMED supply the Support structures PROLIFE to create the latest, highly advanced, universal installation system for vertical traffic signs. The system is based on the European rules for passive safety of road signs' structures and it is a great tool in shaping the road surroundings as 'forgiving a driver's mistakes'. The system is based on specially profiled steel poles and has undergone a comprehensive examination including crash tests according to the norm PN-EN12767.

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