How passively safe street future is creating safer roads

INTRODUCTION
Passively safe street furniture (primarily signposts, lighting columns and traffic lights poles) deform, yield or shear when hit by a car which greatly reduces the accelerations and damage to the car and consequently the forces and risk of physical injury to the vehicle’s occupants.

EN 12767 describes the crash test methodology. Cars weighing 950 kg are crashed into the test item at high speed (100 kph or 70 kph) and low speed (35 kph). The measured accelerations and vehicle behaviour determine the EN12767 classification.

EN12767 products have excellent safety records in the UK, Finland, Norway and Denmark.

The demand for passively safe street furniture products has attracted many suppliers from across Europe to the UK and competition is certainly driving down the cost of all passively safe products.

EN 12767 TEST REQUIREMENTS
A brief outline of the EN 12767 test procedures and classifications is given below.

EN 12767 testing must be carried by an accredited testing organisation and the results assessed by a notified body.

Products will also need to conform to the relevant product standards e.g. EN 40 Lighting Columns [4] for lighting columns and EN 12899-1; 2001 Fixed, vertical road traffic signs [5] for road signs.

In an EN12767 test evaluation:
1) 950 kg cars are crashed into the test item in two separate tests, the high speed test (usually 100 kph) and the low speed test (always 35kph). Vehicle speed, direction and impact position are carefully controlled. The chosen vehicle’s crash characteristics must lie within specified limits. Crash test procedures, methodology and safety evaluation closely follow the EN 1317 Road Restraint Systems protocols for crash
barrier tests. Test cars are instrumented with accelerometers in 3 dimensions to log accelerations during the impact.

b) The vehicle must behave safely in the crash with no dangerous intrusion into the vehicle.

c) Measured vehicle accelerations in three orthogonal directions are used to calculate values of ASI (Accident Severity Index with limits reflecting maximum safe accelerations for the human body) and THIV (Theoretical Head Impact Velocity with velocity limits reflecting the safe velocity for an “unrestrained human head” to hit the inside of the vehicle). These ASI and THIV values determine the safety level. There are 4 safety levels in EN 12767 but the UK has considered all of these levels to be acceptable in the National Annex to BS EN 12767.

d) Speed loss in the high speed impact is used to classify the item either as NE (no energy), LE (low energy), or HE (High Energy) where:

- NE products only marginally slow the vehicle over the course of the impact.
- LE products significantly slow the vehicles.
- HE products greatly slow or totally stop a vehicle relatively gently over several metres as the metal deforms to absorb the energy of the vehicle.

e) The classification NE, LE or HE reflects how much of the vehicle’s kinetic energy is absorbed by the product in the high speed test. Signposts are typically NE products which usually break away barely slowing the vehicle. Lighting columns may accord to NE LE or HE classifications. HE lighting columns may be favoured for town use because they greatly slow or stop the vehicle thus reducing the chance of a vehicle careering on and hitting a pedestrian or another vehicle or obstacle in a secondary impact.

f) Products if they pass the two tests are classified to EN12767. The label shown in Figure 4 for a Varley and Gulliver Hi-Mast signpost gives a classification 100:NE:2 which means:

- The product was successfully crash tested at 100 kph (and at the mandatory 35kph test).
- Minimal velocity was lost in the 100kph impact resulting in NE classification.
- Safety level was 2 (but any of the 4 safety levels are acceptable in the UK).

**HISTORY OF PASSIVE SAFETY IN THE UK**

In 2002 the main contractor, Costain Skanska and their designer, Mott Macdonald for A43 Silverstone bypass trunk road scheme asked the Highways Agency for permission to use the Norwegian Lattix passively safe signposts (supplied in the UK by Signpost Solutions) for the 30 large signs on the scheme so he could omit the usual lengths of safety barrier in front of the signs. This was the first major use of a passively safe product in the UK and set a precedent for the UK road construction industry which was actively adopted by contractors on other schemes.

Prior to 2002 small numbers of Lattix signposts had been installed notably by Neil Theobald of Cheshire CC.

In 2004 the UK published TA89/04 Use of Passively Safe Signposts to give guidance on the use of passively safe signposts for use on the trunk road network. The document was published to avoid the need for approvals on a scheme by scheme basis and also to encourage the use of passively safe street furniture. The document legitimised the use of passively safe street furniture but steel posts protected by barrier remained a permitted alternative.

UK employs crash barriers on the national trunk road network to prevent direct impacts with roadside hazards including large signposts, bridge piers and tall embankments. Large signs would typically be protected by 37.5m lengths of crash barrier. Since TA89/04 Use of Passively Safe Signposts was published most large new signs on the UK trunk road network employ passively safe signposts installed with no barrier provision.

The advantages are:

- Passively safe signposts are usually cheaper than structural steel signposts safeguarded by barrier.
- Contract period is reduced as barriers are the last item to be installed on a new road scheme.
- Less visual clutter.
- Damaged passively safe signposts can often be easily replaced on an undamaged foundation with minimal traffic disruption.
Lack of barrier speeds erection of new signs on existing trunk roads and reduces traffic disruption on the busy network.

The Highways Agency before publishing TA89/04:
- Discussed the Lattix safety record with the Norwegian government and were suitably reassured.
- Carried out EN 12767 tests to determine the maximum size for a circular hollow section steel post. The answer was the surprisingly small size of 89 mm diameter and 3.2 mm wall thickness.

In 2005 TA89/05 Use of Passively Safe Signposts, Lighting Columns and Traffic Light Posts to EN 12767 was published. This extended the rules for passive safety to cover lighting columns and traffic signal posts for trunk road use.

EN 12767 was updated in 2007. The British version of EN 12767 now contained a National Annex giving national recommendations for the use of passively safe street furniture in particular where to use what class of EN 12767 product. TA89/05 was then withdrawn.

In 2010 a new free document available on the internet was published by UK Roads Passive Safety: UK Guidelines for Specification and Use of Passively Safe Street Furniture on the UK Road Network. This document provides comprehensive advice on the use of passively safe street furniture for all highways.

**USE OF PASSIVELY SAFE PRODUCTS IN THE UK**

On trunk roads, passively safe signposts and lighting columns are almost universally used for new large signs and new lighting columns where the speed limit is over 50 mph or over (unless barriers are needed for other reasons).

For non-trunk roads and in cities progress has been slower. Barrier is rarely specified on these roads to safeguard signs from impact so the immediate cost saving of omitting barrier when installing a large sign is unavailable.

The more progressive highway authorities are however now starting to use passively safe signposts and lighting columns on their faster and busier roads but it is harder to make the case for passively safe street furniture when roadside hazards such as trees, stone walls and ditches are so ubiquitous.

A priority should be larger signs and lighting columns on 50 and 60 mph non-trunk rural A Roads where so many of our accidents happen.

Initially passively safe products were Scandinavian. Passively safe products have now been developed in the UK and are now sold and exported outside the UK.

**EN 12767 products available in the UK include:**
- 5 suppliers of passively safe signposts (materials include glass fibre/resin composites, carbon fibre/resin composites, and aluminium)
- 5 suppliers for passively safe lighting columns (materials include steel folded plate construction, glass fibre resin composites and extruded aluminium)
- Several bollard suppliers (typically plastic)
- Several suppliers for traffic light poles (materials are aluminium and glass fibre composites)
- Aluminium signposts have also been used to mount roadside cameras
- Passively safe EN 12767 emergency roadside phones

An up to date list of passively safe products (with links to the suppliers) is maintained by Passive Safety UK on their website [10].

**SAFETY RECORD**

In 2002 the only passively safe product being actively marketed was the Lattix aluminium mast promoted by Signpost Solutions in the UK. Lattix today is still the only signpost strong enough for very large signs. Signpost Solutions have sold about 12000 Lattix posts. About 180 of these posts have been hit by vehicles (and replaced free of charge by Signpost Solutions in exchange for an account of the accident). Nobody has been seriously injured in any of these accidents. Most of these signposts will have been specified because they were significantly cheaper than structural steel signposts when guarded by barrier.

There has been only been one single severe injury accident with an EN 12767 product since their introduction which was a car hitting two resin/glass fibre composite signposts supporting a large sign in a side impact.

In comparison in 2009 alone 46 people were killed and 269 were seriously injured in single vehicle accidents with safety barrier alone on UK roads in 2009. Deaths and serious injuries from hitting roadside furniture in Britain in 2009 in single vehicle accidents are listed in Table 1.

Passively safe signposts have proved safer than conventional structural steel signposts guarded by crash barrier. There are more than 40 deaths a year from impact with barriers. It is also usually a much cheaper alternative to

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**PASSIVELY SAFE STREET FURNITURE**

Figure 4: Varley and Gulliver Signpost Label on a passively safe signpost showing the EN12767 classification.

Figure 5: Hi-Mast passively safe signposts by Varley and Gulliver (the steel post supporting the smaller sign is small enough to be passively safe)
protection by barriers which explains why passively safe signposts and lighting columns have made such inroads on the trunk road network.

The Table 1 casualty figures could be greatly reduced if passively safe street furniture was universal and trees close to the carriageway were felled. Many of these accidents occur on rural non-trunk A roads.

**RECOMMENDATIONS FOR THE USE OF PASSIVELY SAFE STREET FURNITURE**

Highway authorities should consider creating forgiving roadshides that are safer for vehicles leaving the road at speed. Suitable actions are:

- Non-trunk rural A roads have many of the worst accidents and new schemes should target passively safe street furniture.
- Creating a clear zone on these roads next to the carriageway free of trees, larger road signs, lighting columns and utility poles. A width of 4.5m if at all possible should be provided.
- Limiting the size of steel signposts in the clear zone. Circular hollow section posts for signs in the clear zone should not exceed the EN 12767 limits of 102 mm in diameter and 3.2 mm wall thickness.
- Using passively safe signposts and lighting columns to EN 12767 within the clear zone.
- To visit countries who use passively safe products to see how they are used and to discuss policies and experiences with the highway authorities.
- Visit the Passive Safety UK website for lists of products and much valuable background information [10]
- Consult the Institution of Lighting Professionals document TR30 Passive Safety which gives much advice especially for lighting columns.

**THE FUTURE FOR PASSIVE SAFETY**

Passively safe street furniture is demonstrably much safer than traditional large signposts and lighting columns (and safety barriers) and this is being increasingly recognised by the public.

Scandinavia countries are aiming for “zero vision” with zero vehicle deaths and in the UK targets for reducing road deaths will similarly pressure highway authorities to improve safety.

Highway authorities should be on every highway authority’s agenda because:

- some responsibility for injuries and deaths where cars leave the road may in time fall on the highway authority
- there will be is an ongoing need to reduce traffic accident casualties
- passive safety is becoming more affordable
- passive safe street furniture demonstrably works

**REFERENCES**

[1] EN12767 Passively safe support structures for roadside equipment
This document gives Finland’s national policy for use of passively safe lighting columns in Finland and can be read on: http://alk.tiehallinto.fi/thohje/fen9e.pdf
[3] TA89/05 Use of Passively Safe Signposts Lighting Columns and Traffic signal Posts To BSEN 12767
This document was withdrawn in 2008 but can be read on: http://www.signfix.co.uk/pdfdata/advicenote-ta8905.pdf
[4] EN 40 Lighting Columns Parts 1 to 7
Describes the requirements for lighting columns in all materials.
This document gives the requirements for road signs and their design including the loading and structural strength requirements for sign supports
[6] BS EN 1317 Road restraint systems Parts 1 to 8
Describes requirements for different barriers, crash cushions, terminals and transitions
[7] Passive Safety UK Guidelines for Specification and Use of Passively Safe Street Furniture on the UK Road Network. This document can be viewed at:
[8] Road Casualties Great Britain 2009. A comprehensive breakdown of all the road casualties in Britain can be viewed at:
The casualties for single vehicle accidents with roadside objects are given in Table 20
This book is the best source of advice on all issues relating to passive safety. It can be purchased from
d.milne@homecall.co.uk for £10.00 plus p&p
[10] Passive Safety UK
This organisation provides information on passively safe products. The website can be viewed at:
http://www.ukroads.org/passivesafety/
Information includes:
a) A list of passively safe products available in the UK
b) Videos of crash demonstrations of vehicles being crashed into EN 12767 products (and steel circular hollow section posts demonstrating how much better passively safe products perform)

Figure 8: The HE Kapu lighting column hit by the car, left, progressively deformed during the impact

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