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Passive Safety of Support Structures for Road Equipment

DN-REQ-03040
October 2023

DN Design

Standards

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TII Publications

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1. Introduction

1.1 General

This Standard details the design requirements for the Passive Safety of Support Structures for Road Equipment, including traffic sign and lighting column installations and their associated fixtures.

The Standard adopts the performance requirements of I.S. EN 12767:2019 Passive safety of support structures for road equipment – Requirements and test methods, which has superseded I.S. EN 12767:2007 Passive safety of support structures for road equipment – Requirements, classification and test methods.

1.2 Scope

The principles of Forgiving Roadsides (as provided in DN-GEO-03036) are intended to minimise the risk and severity of incidents involving collisions between errant vehicles and roadside hazards. It seeks to reduce the number of fatalities and serious injuries associated with run-off road incidents through the design of safer roadsides that:

1. Minimise the risk of vehicles leaving the carriageway without resorting to VRS installation in the first instance.
2. Provide adequate recovery space (clear zone) when errant vehicles do run off the road.
3. Ensure that any collision that does occur in the roadside will be with objects that limit the impact forces on vehicle occupants to minor levels (no serious injury outcomes).

Passively safe support structures are designed to provide less resistance during impact, thereby reducing the severity of an impact for the occupants of errant vehicles. They provide a viable alternative to providing a Vehicle Restraint System (VRS) to protect street furniture or where the inclusion of a VRS may not be possible due to a physical constraint. Passively safe support structures are typically constructed from steel, aluminium plastic or fibreglass and do not look dissimilar to more traditional support structures.

The requirements contained within this Standard apply to passively safe support structures for road equipment in common situations in the clear zone of verges and central reserves of roads. The requirements for positioning and detailing of these supports, as well as their limitations, are also included within this Standard.

In addition to the information contained in I.S. EN 12767:2019, further information is required to inform specifiers of these products in an Irish context, as outlined in this Standard.

1.3 Implementation

This Standard shall be used forthwith on all schemes for the construction and/or improvement of National Roads.

Prior to designing or specifying a passively safe support structure, it is expected that the principles of forgiving roadsides provided within DN-GEO-03036 Cross Sections and Headroom have been adopted and that suitable mitigation and/or removal of support structures from the Clear Zone have been attempted. It is intended that this Standard be used when the mitigation and/or removal of a support structure from the Clear Zone of a National Road scheme has not been possible.

The main reasons for specifying/installing a passively safe support structure instead of a traditional support structure are:

i. To allow for the exclusion of a VRS in situations where the VRS itself could pose a hazard or where sufficient space to install a VRS may be unavailable.

ii. To minimise injuries to the occupants of errant vehicles that collide with support structures.

iii. To minimise associated risks resulting from collisions with support structures such as electrical shocks.

iv. To facilitate the installation of support structures without the need to also install protection in the form of a VRS.

v. To improve upon the ease and speed of replacing damaged support structures through the use of socket type fittings.

vi. To provide a more cost effective and suitable alternative to traditional support structures which may on their own be cheaper but will also require the installation of a VRS.

If this Standard is to be used for the design of Regional and Local Roads (non-National Roads), the Designer shall agree with the relevant Road Authority the extent to which the document is appropriate in any particular situation.

There may be situations where it may be necessary to apply for a Departure from Standards in respect of the provisions of this Standard. Proposals to adopt Departures from Standards must be submitted to Transport Infrastructure Ireland (TII) for acceptance before incorporation into a design layout to ensure that safety is not unduly compromised, refer to GE-GEN-01005 – Departure from Standards and Specification. For new road schemes or improvement schemes, the Designer shall apply for a Departure in the normal manner.

1.4 Definitions

1.4.1 General

For the purposes of this Standard, the following terms defined in I.S. EN 12767:2019 apply:

- Impact test
- Impact angle
- Vehicle impact point
- Test item impact point
- Impact speed
- Exit speed
- Test vehicle
- Test item
- Support structure
- Sign support
- Signal support
- Lighting column
- Utility pole

- Cantilever support
- Gantry support
- Multi-legged support
- Non-harmful support structure
- Acceleration Severity Index (ASI)
- Theoretical Head Impact Velocity (THIV)
- Ballast
- Total mass
- Collapse mode
- Anthropomorphic test device (ATD)
- Performance class
- Product family
- Object length
- Object mass

1.4.2 Additional Definitions

- **Forgiving Roadsides**: The principles of Forgiving Roadsides (as provided in DN-GEO-03036) are to minimise the risk and severity of loss of control incidents. It seeks to reduce the number of fatalities and serious injuries associated with run-off road incidents through the design of safer roadsides.
- **Hazard**: A hazard is any physical obstruction which may, in the event of an errant vehicle leaving the carriageway, result in significant injury or death to the occupants of the vehicle, refer to DN-REQ-03034.
- **Clear Zone**: The Clear Zone is the total width of traversable land on the nearside or offside of a road which is to be kept clear of unprotected hazards. This width is available for use by errant vehicles. The zone is measured from the nearest edge of the trafficked lane: i.e. the hard shoulder or hard strip forms part of the Clear Zone, refer to DN-GEO-03036.
- **Designer**: The organisation responsible for undertaking and/or certifying the design.
- **Central reserve**: The area which separates the carriageways of a dual carriageway or Motorway. Note that this includes any offside hard strips.
- **Verge**: The part of a road cross-section alongside a carriageway but not including embankment or cutting slopes. Note that this includes hard strips but not hard shoulders.
- **Active Travel:** Walking. wheeling, and cycling for all users for all trip purposes where walking, wheeling, and cycling mean:
    i. **Walking and wheeling:** Engaging in the typical act of walking plus jogging, using mobility aids (i.e. manual and electric wheelchairs as well as motorised mobility scooters), and using non-motorised mobility scooters and
    ii. **Cycling:** Cycling using any type of cycle, such as bicycles, electric cycles, adapted cycles and cargo cycles. Cycles must, except for specific situations, be treated as ‘vehicles’, not as ‘pedestrians'.

- **Hardened Verge**: An area of the verge set aside for emergency or maintenance situations for vehicles to stand or park. The surface should be sufficiently strengthened to support vehicles.

2. Changes from I.S. EN 12767:2007

The main technical changes incorporated in I.S. EN 12767:2019 that differentiate it from the previously published I.S. EN 12767 are as follows:

- The incorporation of the Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonized conditions for the marketing of construction products and repealing Council Directive 89/106/EEC terminology.
- The introduction of a push-pull test to enable a comparison to be made between the backfills used in the test and those on-site.
- The harmonisation of the boundary values for occupant safety (Acceleration Severity Index (ASI) and Theoretical Head Impact Value (THIV)) is independent of the energy absorption class.
- The replacement of the occupant safety class by an alphanumeric character instead of a number to make a clear distinction with the old (EN 12767:2007 occupant safety level 1 – 4) approach. Now, NE-C, LE-C and HE-C have the same occupant safety class (C). The best occupant safety is achieved for A.
- The introduction of collapse modes to classify if test items become detached or do not become detached.
- The introduction of direction classes to take into account any sensitiveness to impact angle.
- The improved test description, include installation manual and translation of roof deformation into a measurable value, to reduce the influence of the vehicle structure on the test results.
- Better rules for the determination of families (product families) based on the tested limit(s).
- The introduction of a risk assessment approach, in line with the EN 1317-1:2010 Road restraint systems - Part 1: Terminology and general criteria for test methods, for assessing modifications, and the use of (for example) virtual testing in this; and
- The possibility to declare, under certain conditions, intermediate speed classes.

3. Road Safety

3.1 General

This chapter provides details on the principles which may have a significant impact on decisions to use passively safe support structures over a non-passively safe product that may in turn require additional protective measures by way of a VRS.

3.2 Passive Safety

Passive Safety is a concept that has been in general use for many years. The concept of Passive Safety in relation to roadside furniture and support structures seeks to reduce the number of fatalities and serious injuries resulting from impacts with hazards such as traffic sign posts and lighting columns located in road verges and central reserves.

The first European Standard focusing on passive safety in relation to support structures was published in 2000, EN 12767:2000 Passive safety of support structures for road equipment and provided a methodology for crash testing a 'support structure'.

The Passively Safe industry has historically been manufacturer led, however, EN 12767 and Standards such as this, now provide a means by which Designers can more uniformly specify products that will be acceptable for use on National Roads.

3.3 Roadside Hazards

A roadside hazard is any physical obstruction which may, in the event of an errant vehicle leaving the carriageway, cause harm to the occupants of the vehicle in the event of a collision. Traffic sign and lighting column installations present hazards which can be reduced in severity, or removed entirely, through the use of an appropriate passively safe support structure.

Traffic signs and lighting columns are considered single fixed objects / point hazards. Other roadside furniture installations, when located within the Clear Zone, can also present potential hazards to errant vehicles.

Lighting columns that are not passively safe and tubular steel posts > 89mm diameter and 3.2mm wall thickness or equivalent strength are considered as High-Risk Hazards in Appendix D of DN-REQ-03034.

Hazards in locations with high collision histories and/or locations with regular pedestrian and/or bicycle usage may require additional consideration by a Designer.

3.4 VRS vs Passively Safe Support Structures

On National Roads schemes, traditionally, VRS have been installed to minimise the risk of injury to the occupants of errant vehicles. However, VRS themselves are considered a hazard which can, in the event of a collision, have a physical impact on an errant vehicle and its occupants. Therefore, they are a special case as they can be considered both a hazard and a roadside treatment for safety. For cases where a VRS is being proposed solely to shield a hazardous street furniture installation, a passively safe street furniture product shall be Installed where possible removing the requirement for a VRS. Where passively safe street furniture or support structure cannot be provided a departure from standard may be sought.

Passively safe support structures can provide an alternative to the installation of VRS and offer some advantages over the traditional non-passive products as follows:

- They are much less likely to lead to serious injury for the occupants of an impacting vehicle.
- They can be easier to replace if impacted by an errant vehicle.
- They do not require VRS protection and in many cases may be significantly cheaper than the supply and installation of a traditional non-passive product and associated VRS.

4. Performance Class Designations

I.S. EN 12767 defines seven individual performance class designations for passively safe support structures. These class designations enable Designers and/or specifiers of such equipment to select an appropriate performance class for use across the National Road network.

The seven performance class designations are described in more detail in the following sections of this chapter and include a class designation for each of the following:

- Impact Speed
- Energy Absorption Category
- Occupant Safety Class
- Backfill Type
- Collapse Mode
- Direction Class
- Risk of Roof Indentation

The recommended performance class designations considered most suitable for use on National Road Schemes in Ireland are provided in this Standard. It is the responsibility of the Designer to specify the required performance classes required for use on National Roads.

It should be noted that products which comply with a particular performance class when tested at an impact speed of 100 km/h cannot be assumed to comply with the same or any other class when impacted at 70 km/h or 50 km/h.

4.1 Speed Class

The Speed Class identifies the impact speed in the high-speed test. I.S. EN 12767 defines Impact Speed as “measured impact speed of the impacting vehicle, measured along the test vehicle approach path at a distance no further than 6m before the impact point” (see Figure 4.1).

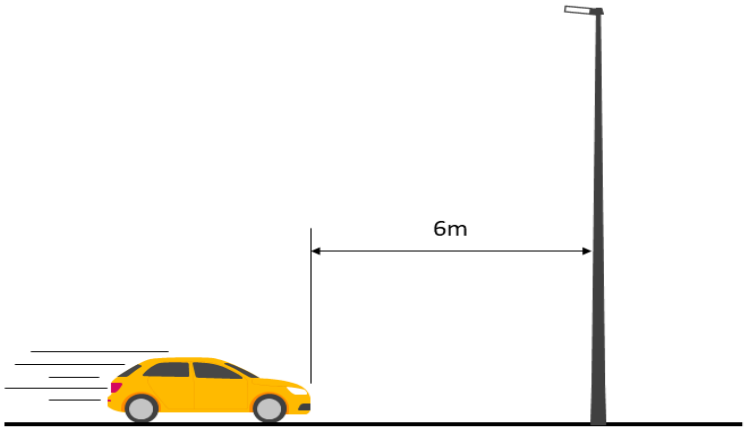

Figure 4.1 Measured impact speed of the impacting vehicle

Each model of support structure is tested, and can be classified, under three Impact Speed Classes which define the appropriate design speed within which the passively safe support structure can be installed. These speed classes are presented in Table 4.1.

Table 4.1 Support Structure Speed Class

Operational / Design speed	Speed Class	Impact Speed km/h	Impact Speed Tolerance km/h
50, 60	50	50	±3
70, 80	70	70	±5
90, 100, 120	100	100	±5

Where the design speed cannot be determined the design / operational speed shall be determined based upon the following:

For all new road schemes (new builds, road realignments and minor improvements) where a new of revised road cross section is being provided, the Designers shall use the design speed as calculated using DN-GEO-03031 (Rural Road Link Design).

For retrofitting works where the existing cross section is not being changed i.e. road signage works only, the Designer may use the operational speed for the section of road under consideration. Indicative operational speed for use when assessing / designing road signage on legacy National Roads **only** are available for download from the downloads section of the TII publications website. The operational speed shall be rounded up to the next closest design speed band as set out in Chapters 1 to 10 of DN-GEO-03031 (Rural Road Link Design).

Passive safe products shall only be installed in scenarios which are similar to those for which the product has been successfully tested. However, on motorways and high-quality dual carriageways with a speed limit of 120 km/h, passively safe supports may be installed with prior acceptance from TII. Such acceptance shall be in the form of a Departure from Standard.

4.2 Energy Absorption Category

The Energy Absorption Category refers to the way in which a support structure responds to an impact from an errant vehicle and reflects a loss of velocity of the vehicle during impacts.

There are three categories of energy absorption for passively safe support structures based on impact and exit speed class. As follows:

A support structure classed as **High Energy Absorbing (HE)** slows the vehicle considerably on impact. 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 vehicle. They might straighten out again as the impact event proceeds. The risk of secondary collisions with trees, pedestrians and other road users is reduced, however the severity of the impact for vehicle occupants can be high (see Figure 4.2).

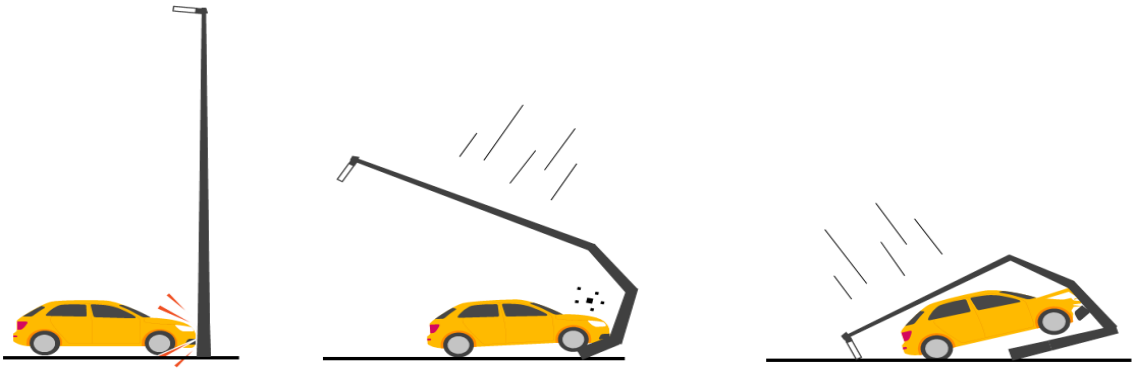

Figure 4.2 Behaviour of a high energy absorbing (HE) column

A support structure classed as **Low Energy Absorbing (LE)** is generally designed to bend in front of and under the impacting vehicle, before shearing or detaching towards the end of the impact thus reducing the severity of the impact for vehicle occupants (see Figure 4.3).

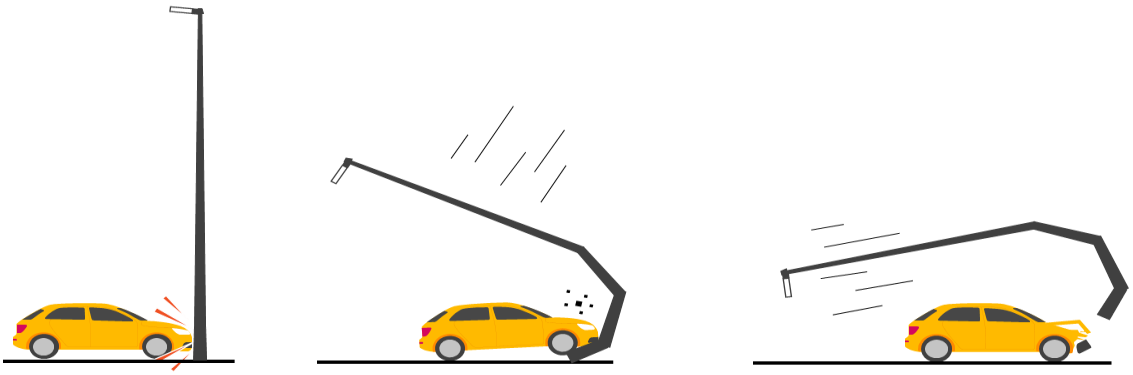

Figure 4.3 Behaviour of a low energy absorbing (LE) column

A support structure classed as **Non-Energy Absorbing (NE)** permits the vehicle to continue after the impact with a limited reduction in speed. They may therefore provide a lower primary injury risk than energy absorbing support structures, but a higher secondary injury risk if other hazards exist behind the support structure (see Figure 4.4).

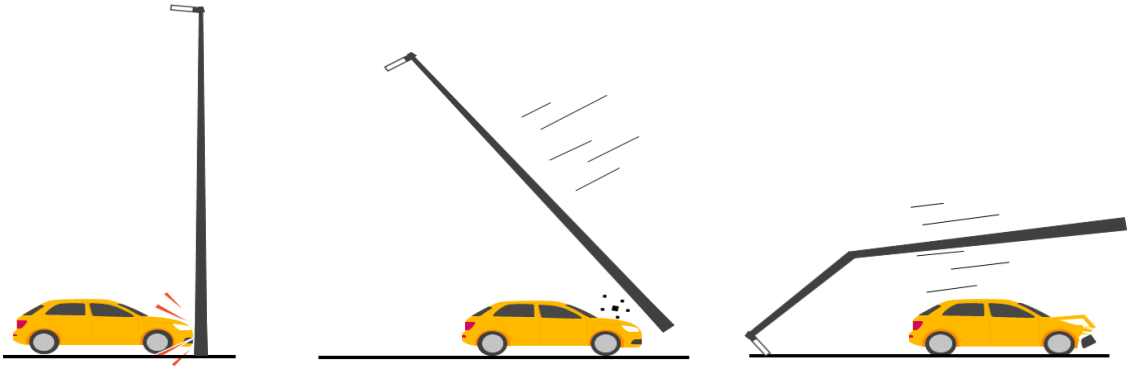

Figure 4.4 Behaviour of a non-energy absorbing (NE) column

Category NE supports are generally designed to fail and detach at the base. 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.

It should be noted that some category NE supports are of the slip base type, where the column/post base is designed to slip relative to its foundation and release the column/post when the bolts holding the base plate to the foundation fail in shear. Such designs should be used with caution, as they may not operate satisfactorily where there is a difference in level between carriageway and support position, and operation can be dependent on angle of impact if different from the 20º test impact angle.

The requirements for vehicle exit speed during testing relating to the energy absorption category are presented in Table 4.2.

Table 4.2 Energy Absorption Categories

Speed Class	50	70	100
Energy Absorption Category	Vehicle Exit Speed, v_e km/h		
HE	$v_e = 0$	$0 < v_e < 5$	$0 < v_e < 50$
LE	$0 < v_e < 5$	$5 < v_e < 30$	$50 < v_e < 70$
NE	$5 < v_e < 50$	$30 < v_e < 70$	$70 < v_e < 100$

4.3 Occupant Safety Class

The Occupant Safety Class is informed predominantly by the Acceleration Severity Index (ASI) and Theoretical Head Impact Velocity (THIV) values exerted on vehicle occupants during an impact. There are five Occupant Safety Classes included in I.S. EN 12767 – A, B, C, D and E with Occupant Safety Class A being the highest level of occupant safety and Occupant Safety Class E being the lowest level of occupant safety.

The requirements of I.S. EN 12767 require the following in terms of Occupant Safety Class:

- The test item shall perform in a manner predicted by the manufacturer.
- The test item or detached elements, fragments or other major debris from the test item shall not penetrate the occupant compartment or present an un-necessary hazard to other traffic, pedestrians or personnel in a work zone.
- The vehicle shall remain upright for not less than 12m beyond the impact point with a roll angle less than 45° and a pitch angle less than 45°.

Occupant Safety Classes for each energy absorption category can be determined from Table 4.3.

Table 4.3 Impact Severity Indexes

Energy absorption categories	Occupant safety class	Speeds			
		Low speed test 35 km/h		High speed test 50 km/h, 70 km/h, 100 km/h	
		Maximum values		Maximum values	
		ASI	THIV km/h	ASI	THIV km/h
HE / LE / NE	E	1	27	1.4	44
HE / LE / NE	D	1	27	1.2	33
HE / LE / NE	C	1	27	1	27

Energy absorption categories	Occupant safety class	Speeds			
		Low speed test 35 km/h		High speed test 50 km/h, 70 km/h, 100 km/h	
		Maximum values		Maximum values	
		ASI	THIV km/h	ASI	THIV km/h
HE / LE / NE	B	0.6	11	0.6	11
NE	A	No Test Required	No Test Required	No ASI and THIV measurements	

4.4 Backfill Type

The following three Backfill Types are available for specification:

- Type S: standard aggregates.
- Type X: special foundation; and
- Type R: rigid foundation.

Type X is an allowance for any installation which does not meet the requirements of Type S or Type R (i.e., a soil type that contains a considerable amount of sand/ peat). A passive product tested in standard aggregates may be installed in a rigid foundation but the inverse of this is not permitted.

4.5 Collapse Mode

The collapse mode can be considered to describe how a support structure behaves in the event of a collision. For some support structures breakage or detachment of the pole allows the product to achieve its passive safety class and in other cases it is necessary for the pole to remain attached to its foundation following an impact. The choice of product type will be dependent on each particular scenario.

Two collapse modes are available for specification (see Figure 4.5):

- SE: separation; and
- NS: no separation.

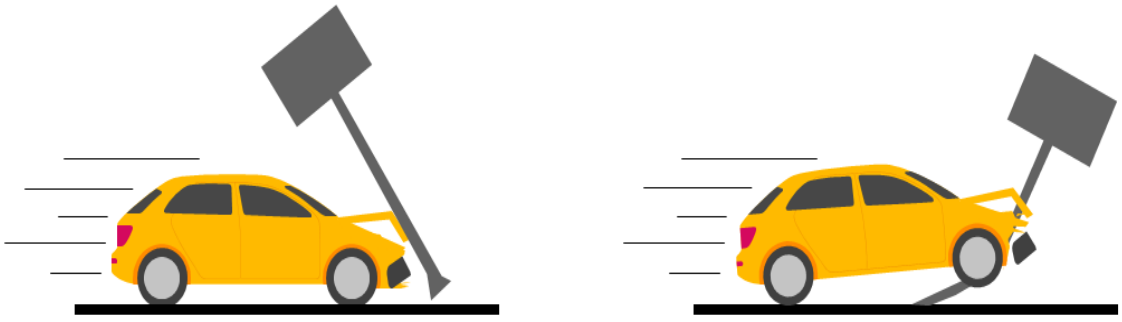

Figure 4.5 Separation mode (SE) and Non-separation mode (NS)

Both types of collapse mode may be specified on higher-speed roads, but where there is a potential risk of a secondary collision involving Non-Motorised Users (NMUs) or other road users, NS shall be installed.

4.6 Direction Class

The Direction Class of a support structure allows for the product to be considered passively safe under impact conditions from specified directions.

Three direction classes are available for specification (as indicated in Figures 4.6, 4.7 and 4.8):

- SD: single-directional (mandatory 20° impact angle);

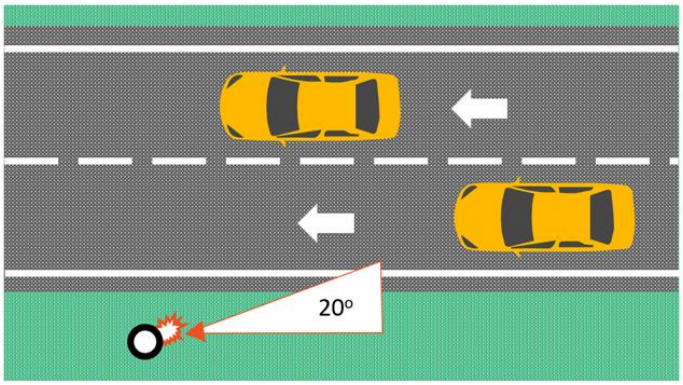

Figure 4.6 Single Directional (SD) Direction of Impact

Structures with a direction class of SD are suitable for use when the risk of impact comes from one direction only such as on motorways or dual carriageways where it is not possible to cross the central reserve. These structures are designed to be impacted at an angle of up to 20° from the direction of travel.

- BD: bi-directional (mandatory 20° impact angle + additional 160° impact angle);

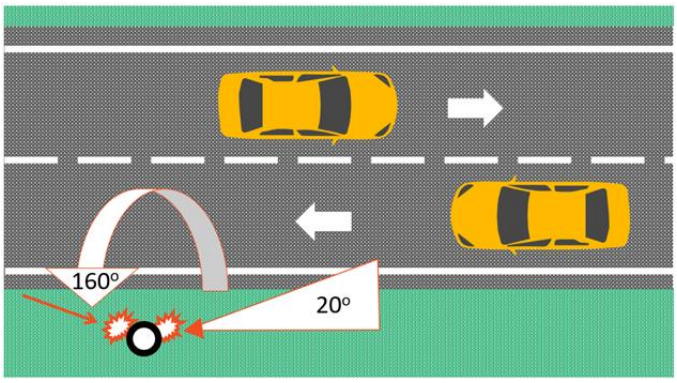

Figure 4.7 Bi-Directional (BD) Direction of Impact

Structures with a direction class of BD are suitable for use when the risk of impact comes from two directions such as on single carriageway roads where it is possible for errant vehicles to impact the structure from both sides. These structures are designed to be impacted at an angle of up to 20° from the direction of travel in either direction. Structures with a direction class of BD are also suitable for use in scenarios where the risk of impact comes from one direction only.

- MD: multi-directional (mandatory 20° impact angle + if more than two symmetries are identified)

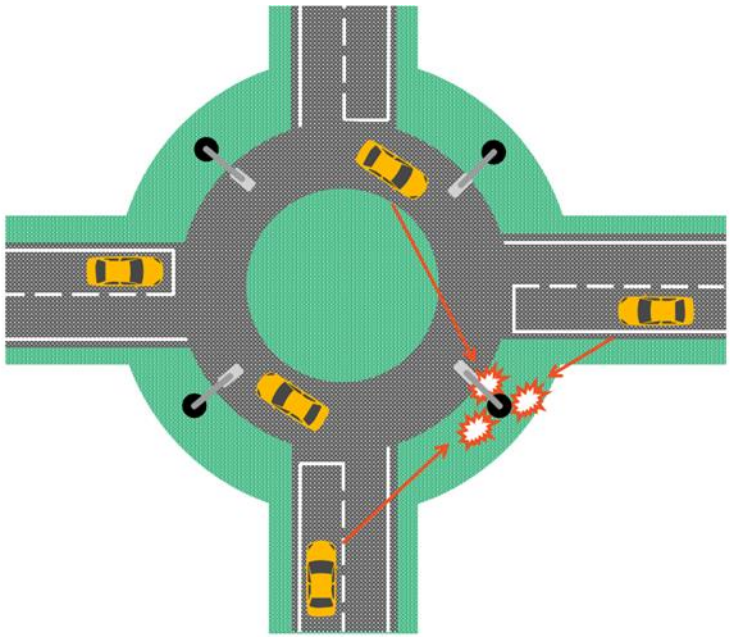

Figure 4.8 Multi-Directional (MD) Direction of Impact

Structures with a direction class of MD are suitable for use when the risk of impact comes from a variety of directions such as at roundabouts or other junction types. These structures are designed to be impacted at an angle of up to 20 degrees from the direction of travel and an additional two other impact angles. Products that perform irrespective of direction of impact (MD) are generally preferred, given the unexpected and unforeseeable nature of collisions, though this direction class is not a general requirement for all situations.

The recommended order of preference, in terms of direction class, is MD, BD and SD for all situations.

4.7 Risk of Roof Indentation

The Risk of Roof Indentation class allows for the consideration of deformation to the impacting vehicle roof structure following impact by a collapsing support structure.

Support structures shall be classified for the risk of roof indentation in the event of a collision. Two classes are available for specification:

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

Deformation shall be measured at three positions, as indicated in Figure 4.9.

- behind the windscreen (B1).
- in line with the rear edge of the front doors (B2).
- in front of the rear window (B3).

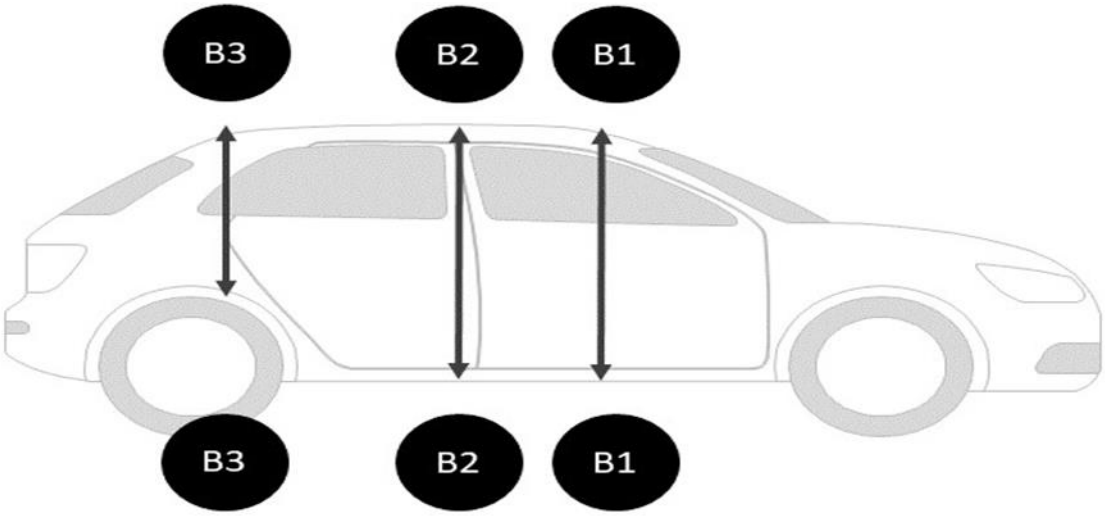

Figure 4.9 Roof deformation measurement positions

The class of roof deformation shall be determined by taking the highest value measured across all three positions.

5. Specifying Passively Safe Products

The performance class of passively safe products shall be specified in the following format; speed class - energy absorption category - occupant safety class - backfill type - collapse mode - direction class - risk of roof indentation i.e. 70-HE-A-S-SE-SD-0, as shown in Table 5.1.

Table 5.1 Passive Safety Performance Types

	Alternatives	Reference (I.S. EN 12767)
Speed class	50 / 70 / 100	A.2
Energy absorption category	HE / LE / NE	A.3
Occupant safety class	A / B / C / D / E	A.4
Backfill type	S / X / R	5.2.1, Table 1
Collapse mode	SE / NS	A.5
Direction class	SD / BD / MD	A.6
Risk of roof indentation	0 / 1	A.7

5.1 NR – No Requirement.

It may not always be considered necessary to specify a particular performance class for a given scenario. I.S. EN 12767 states that *"If not all properties are of interest for the specifier, they can put NR (no requirement) for that property*".

5.2 Speed Class

The performance class parameter selected for Speed Class shall be one of 50, 70 or 100 and shall be dependent on the design speed for the section of road along which the passively safe support structure is to be installed.

Design Speed: The parameter that is used to determine geometric design of a road or cycle facility.

Although multiple speed classes for different situations are included in I.S. EN 12767:2019, only the 70km/h and 100km/h are recommended for use on National Roads. Signs located at proposed Traffic Calming Gateways and in close proximity within the Transition Zones shall be passively safe.

5.3 Energy Absorption Category

The performance class parameter selected for Energy Absorption Category shall be one of HE, LE or NE.

Category NE supports provide a lower risk of injury to vehicle occupants than HE and LE supports and can be the most appropriate choice on non-built-up roads with insignificant volumes of NMUs.

Category LE and HE supports reduce the risk of secondary incidents and collisions with NMUs, as the vehicle exit speed is lower, and thus LE and HE supports shall be provided where active travel (AT) facilities in accordance with DN-GEO-03036 (*Cross Sections and Headroom, date May 2023*) are provided on urban roads and where there is a significant volume of NMUs.

Recommended energy absorption categories for traffic sign supports, traffic signal poles and lighting columns in different situations are incorporated in the performance class recommendations given in Table 5.2. Where multiple options are given, these are listed in order of preference. When selecting a performance class from the list, it might be necessary to check that suitable products that meet the specific requirements of the particular application are available and compliant with that class.

Energy absorption category NE is appropriate in all situations for small non-harmful support structures, whether or not they have been tested to the Standard. These can include delineators conforming to IS EN 12899-3:2007, for example:

- small sign support structures where the sign is integral with the support and the total height does not exceed 1200 mm; and
- flexible chevron signs.

The environment surrounding the support structure will have a large effect on the type of Energy Absorption Category specified by a Designer. In scenarios where there is a significant amount of open space available beyond the support structure a NE support structure may be appropriate as it may be acceptable for the impacting vehicle to impact with the structure and continue unimpeded until coming to a stop. In other scenarios such as built-up urban areas or areas where there may be pedestrians or cyclists present, it may not be desirable for the support structure to allow an impacting vehicle to continue through the structure after impact and a HE Energy Absorption Category may be required. Engineering judgement will be required in selecting the appropriate performance class for Energy Absorption Category.

5.4 Occupant Safety Class

For vertical traffic sign supports, traffic signal poles and lighting columns, any of the occupant safety classes B–E as specified in this Standard are acceptable. For this reason, NR can be specified for this class for use on National Roads.

Occupant safety class A is appropriate for small non-harmful support structures.

5.5 Backfill Type

Three backfill types are identified and described in section 4:

- Type S (Standard aggregates);
- Type X (Special aggregates); and
- Type R (Rigid).

There is no evidence of any obvious safety issue with the use of passive products tested with a standard aggregate with a special or rigid foundation or socket. NR is therefore recommended for this class for use on National Roads. However, consideration should be given to the as tested installation method being used to ensure compliance with IS EN 12767.

5.6 Collapse Mode

Two collapse modes are identified and are described in section 4:

- SE: separation; and
- NS: no separation.

Both types of collapse mode can be specified on higher-speed roads. Where there is a specific risk of a secondary collision involving NMUs, NS shall be specified. However, where there is no specific risk NR may be specified for use on National Roads.

5.7 Direction Class

Three direction classes are identified and described in section 4:

- MD: multi-directional.
- BD: bi-directional; and
- SD: single-directional.

Products that perform irrespective of direction of impact are to be preferred, given the unexpected and unforeseeable nature of collisions. The recommended performance classes are therefore (in order of preference) MD, BD and SD for all situations on National Roads.

5.8 Risk of Roof Indentation

Two classes are identified and are described in section 4:

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

Products that meet the criteria for Class 0 or Class 1 may be specified for use on National Roads.

Table 5.2 includes performance class recommendations:

Table 5.2 Performance Class Requirements.

Situation	Location	Type of support structure		
		Lighting column **Classifications listed (A, B, C, etc.) are in order of preference (1)**	**Sign or signal support (2)** **Classifications listed (A, B, C, etc.) are in order of preference (1)**	**Non-harmful support structure**
Rural Motorways and all-purpose national roads with speed limits >60 km/h	Generally located in verges of motorways, dual carriageways and single carriageway roads	100 : NE : NR : NR : NR : MD : NR(3)	100 : NE : NR : NR : NR : MD : NR(3)	100 : NE : A
	With significant volume of non-motorized users at the times when impact events occur	100 : HE : NR : NR : NR : MD : NR(3)	(A) 100 : HE : NR : NR : NR : MD : NR(3,4,5) (B) 100 : LE : NR : NR : NR : MD : NR(3,4,5) I 100 : NE : NR : NR : NR : MD : NR(3,4,5)	100 : NE : A
	Where major risk of items falling on other carriageways below (e.g., at grade separated interchanges)	100 : HE : NR : NR : NR : MD : NR	(A) 100 : HE : NR : NR : NR : MD : NR(3,4,5) (B) 100 : LE : NR : NR : NR : MD : NR(3,4,5) (C) 100 : NE : NR : NR : NR : MD : NR(3,4,5)	100 : NE : A or 70 : NE : A
Urban all-purpose national roads with speed limits ≤60 km/h	All locations	(A) 70 : HE : NR : NR : NR : MD : NR (B) 100 : HE : NR : NR : NR : MD : NR (C) 70 : LE : NR : NR : NR : MD : NR (D) 100 : LE : NR : NR : NR : MD : NR (E) 70 : NE : NR : NR : NR : MD : NR(3,4) (F) 100 : NE : NR : NR : NR : MD : NR(3,4)	(A) 70 : HE : NR : NR : NR : MD : NR(3,4,5) (B) 100 : HE : NR : NR : NR : MD : NR(3,4,5) (C) 70 : LE : NR : NR : NR : MD : NR(3,4,5) (D) 100 : LE : NR : NR : NR : MD : NR(3,4,5)	100 : NE : A or 70 : NE : A

(1) Subject to the availability of compliant products that meet the specific needs of the particular situation
(2) Includes supports for items of similar weight to that of the item supported in the test, such as variable message signs and speed cameras
(3) Category MD is the most preferable in all situations, followed by category BD or category SD
(4) Category NE can be accepted in any situation where standard posts defined as 'deemed to comply" in Annex K are used
(5) Foundations shall comply with the requirements of Section 7.
(6) Selection of type of support structure shall consider the potential for climbing or interference in areas of significant NMU's

5.9 Passive Safety Performance Type Format

Figure 5.1 shows an example of how this information is to be presented:

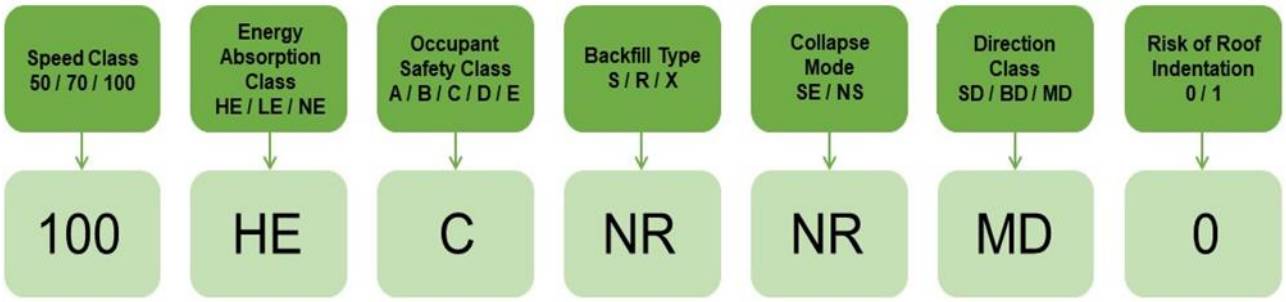

Figure 5.1 Passive Safety Performance Type Format

5.10 Additional Considerations

Passively safe installations must not present any additional dangers that could be considered to be greater than the threat posed by either an errant vehicle or a VRS installation – an example of this would be the choice to use a passively safe lighting column which could theoretically collapse into a lane of oncoming traffic or into a pedestrian area if impacted by an errant vehicle.

Sign supports, and lighting columns shall be located beyond the working width of all VRS installations even if they are passively safe so as not to interfere with the performance of the VRS.

6. Traffic Sign Post Spacing and Sign Plate Recommendations

6.1 Sign Post Spacing

Section 2.1.1.1 of DN-REQ-03034 states that steel tubular posts up to 76mm diameter and 3.2mm wall thickness may be used as passively safe posts where post centres are ≥ 750mm spacing. Steel tubular posts up to 89mm diameter and 3.2mm wall thickness may be used as passively safe posts where post centres ≥ 1500mm spacing. All other scenarios shall be considered a hazard. Where passively safe supports are used, they shall comply with I.S. EN 12767.

Multi-leg sign supports are normally impact crash tested against one leg with a clear opening between the legs of not less than 1.5 m at the impact angle of 20°. Supports tested in this way should not be used at closer centres, as the performance is likely to be significantly different if both supports are impacted in the same impact event.

If one member of a family of sign supports has been satisfactorily tested in multi-leg format, other members of the same family that have been accepted as single supports under the product family requirements of Annex G in IS EN 12767 can be regarded as suitable for use in multi-leg format, subject to the requirements for sign plates and fixings.

7. Foundations

Foundations protruding above ground level can be struck by errant vehicles and can be a trip hazard to pedestrians on footways and generally in urban areas. Foundations shall be flush with the surrounding footways and ground levels, reprofiling of footways and ground levels may be required.

If foundations different from those used in the certified impact crash test are to be used in practice, the ground resistance to shear forces of the foundation to be used should not be less than that of the foundations used in the test. This does not apply to class NE supports, for which the action on the foundation caused by an impact with the support is minimal.

Guidance on the design and verification of foundations for lighting columns is given in CC-SPW-01300 - Specification for Road Lighting Columns and CCTV Masts.

8. Underground Cabling

Underground cables are installed for the impact crash tests and are fixed in the ground. The purpose of this requirement is to ensure that the support is not tethered by the cable during the impact, preventing proper operation of the support. The requirement thus assumes that the cable is a solid connection.

The electrical supply to passively safe installations shall automatically electrically disconnect within 0.4 seconds to ensure that any vehicles that strike the columns do not become live upon impact. Additional guidance on the implementation of passively safe columns can be found in ILP TR 30.

Cable installations to passively safe supports must therefore still comply with all appropriate electrical regulations, standards and guidance without tethering those structures that are intended to shear or slip.

9. Certification Requirements

All components of passively safe support structures that fall within the scope of the Construction Products Regulation (EU No. 305/2011) (CPR) shall be CE marked in accordance with the requirements of the CPR and the relevant harmonised standard.

10. Limitations of Use

Designers shall consider the following when specifying passively safe products:

- Passively safe products are considered inappropriate for use at locations where there is a risk of the impacted product collapsing into areas containing oncoming traffic or Vulnerable Road Users (VRUs).
- Passively safe products are only suitable for use in scenarios where no other hazards exist that would otherwise require a VRS – i.e., no benefits exist where a passively safe product is installed directly in front of or in close proximity to a hazard.
- The installation of passively safe products in close proximity to each other shall be minimised as doing so can potentially compromise the performance of each individual product. This does not apply in the case of multiple musoir poles installed as a set at a single location.
- Passively safe products, except those with an energy absorption category of NE, are not suitable for use at locations where the foundation requirements specific to the product cannot be achieved due to restricted space / poor ground conditions.
- At locations with a posted speed limit of 40 km/h or less, there are limited benefits to be gained by installing passively safe products as the collision risk associated with traditional support products is considered minimal.

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