

PROVIDING GUIDANCE TO MANUFACTURERS AND USER COMMUNITIES

GUIDANCE ON FOUNDATIONS FOR PASSIVELY SAFE PRODUCTS IN THE UK



Introduction

The purpose of this guidance is to provide information on the suitability of different types of foundations for different types of passively safe products that are used to support traffic signs and traffic control devices and lighting columns. Whilst current guidance and software provides detailed calculations for design, it does not assess any of these calculations against the types of products intended to be installed. Designers must determine which foundation is most appropriate for the location and need intended before applying any software design.

Primarily, the first question will always be “Is this particular type of product and this foundation appropriate in these circumstances?” It is imperative that design teams do not rely only on calculation methods alone to determine the suitability of the complete installation.

Passive safety devices are typically proprietary components engineered to ensure safe and predictable performance within a complete installation system (comprising foundation, post, and the device itself, such as a luminaire or signage board). These products often have highly specific characteristics, and when their safety classification specifies a designated backfill type 'X', the foundation design must strictly follow the manufacturer's installation and design guidelines.

This guidance is therefore intended as additional information supplementing guidance applicable to all roads: BSI PD 6547 for lighting columns; Guidance on the use of BS EN 40-3-1; and BS EN 40-3-3; BS EN 12899 Fixed Signs; and BS EN 12767 Passive Safety of Support Structures for Road Equipment and for motorways and trunk roads additional guidance found within National Highways Design Manual for Roads and Bridges (DMRB) CD 354 Design of Minor Structures (currently version 2.0)

All locations where passively safe equipment is considered for use should be determined by risk assessment as detailed in DMRB CD377 Requirements for Road Restraint or the Department for Transport (DfT) Provision of Road Restraint on Local Authority Roads. Further guidance can also be found in the Institute of Lighting Professionals (ILP) Technical Report TR30 Passive Safety: Guidance on the implementation of passively safe lighting columns and signposts.

When there is a requirement for multileg supports, It is also important to check the permitted spacing between multileg supports against how the product was originally tested. You should ensure that a product you intend to use meets these requirements and adjust the software design accordingly. **Where software design calculations include a smaller width to that tested, then the product may be deemed to be no longer passively safe** and you should therefore contact the manufacturer for further guidance.

Guidance on post sizes, post spacing and foundation height above the ground can be found in BS EN 12767 National Annex NA1 and NA5.

For electrical safety of lighting columns and illuminated signs disconnection times should comply with BS7671 Requirements for Electrical Installations. IET Wiring Regulations and the Electricity at Work Regulations.

This is the second in a series of guidance documents on passively safe products used in the UK.

BS EN 12767 Backfill requirements for testing

In the UK the backfill type most commonly used backfill is concrete - Type R – of an appropriate size and volume to provide anchoring of the product without being displaced. If in any doubt, it is advisable or normal to use rigid foundations.

BS EN 12767 describes foundations as backfill types of which there are three types that can be used when products are tested. It is a key requirement to state which backfill was used in the testing, as this is an extremely important part of the complete installation that determines the performance of the product under vehicular impact.

The different backfill types listed in the Standard are:

Types S – standard aggregate

Type X – special

Type R – Rigid

The test procedure expressly states that the backfill type used in testing is the same for all products within a product family. It must always be borne in mind that products are tested in a particular stated foundation – this is intended to be the worst case scenario for that particular product.

The UK National Annex to BS EN 12767 provides a requirement of NR (No UK specific class requirement). That is to say, any type of backfill used in the test is acceptable for use in the UK. It is also permissible to use a more rigid foundation that is used when the product was originally tested.

Whilst current DMRB guidance provides calculations for various types of foundations, it does not fully provide information relating to the different types of passively safe supports that are available and how these products are dependent upon differing types of installation and foundation in order to perform as designed.

It is advisable to check that the foundations intended to be used for an individual installation enable the product to perform correctly and are passively safe under vehicular impact conditions.

The consideration of foundations for the type of product used is therefore an integral part of the design of an individual installation. You should always ask for the installation instructions from manufacturers so that the product is installed in the correct way to achieve the right outcome in a collision. This information is identified in all TOPAS registrations.

It is essential in all cases to check the performance upon impact of the product deployed, to ensure that the correct foundation is used

Where there is an engineered solution within the product that makes the product passively safe, the product must be installed in the same way that it was designed. For example, a baseplated design should not be changed to a planted design without further testing, or vice versa since the product may not perform in the same manner as that when tested. BS EN 12767 states that the tested product must have the same design of fixing or anchoring to ground (Annex G).

Types of foundation

One of the most important features in design for the use and installation of any passively safe post products, whether it be traffic signs, lighting columns, traffic signals or non-harmful support structures, is how the passively safe product is affixed to ground. When the passively safe product is fixed to ground correctly, the product will perform as designed and tested under BS EN 12767.

Some passively safe signposts, lighting columns and signal poles are designed to be readily replaced after an impact by employing maintenance friendly foundations.

There are a number of different ways in which a passively safe structure can be installed: -

- Spread foundations
- Planted foundations

- Sockets (with a rigid foundation)
- Screw piles

Spread Foundations

Spread foundations are essentially big excavations to install products such as larger traffic signs. These spread foundations can be either a single spread foundation - where each foundation is for a single support on a multi legged sign assembly; or a mass spread foundation that houses all the supports for that particular sign assembly

Single spread foundations often use less concrete than the mass spread foundations. Care should be taken to ensure there is sufficient soil between individual single spread foundations. Otherwise, for a width of soil of say 300mm or less there is significant risk that this wall may collapse into the excavation during construction.

For local roads, reinforcement may not be required as per the Institute of Highways (IHE Signs Structures Guide 2021; although the DMRB CD354 notes that spread foundations should have reinforcement incorporated into the design. This could be as simple as mesh being used at the top and bottom of the foundation, though more detailed designs are likely for more challenging locations, such as embankments and slopes. The individual design should determine the most appropriate reinforcement requirement for a specific location.

The IHE Signs Structures Guidance provides example calculations for spread foundations.



Some passively safe products require an anchor cradle to be embedded into the foundation to support the finished structure. Anchor cradles are suspended into the excavation often by means of wooden batons prior to concrete pour.

Any anchor cradle deployed within a spread foundation must be adequately secured so that during pouring of concrete the anchor cradle remains in the correct position both horizontally and vertically and is not rotated by the weight or movement of the concrete. Care should be taken to follow manufacturer's instructions to remove any temporary spacing template (e.g.

plywood sheet shown in photo).

Removal of air pockets and voids within the foundation

The single most important element of any spread foundation installation is that the concrete must be fully compacted (vibrated) during pour to eliminate any air pockets and voids in the finished foundation; failure to fully compact the concrete will lead to a severe reduction in strength within the foundation, potentially leading to complete failure of the whole passive system; full compaction is particularly important in the area where anchor cradles are

deployed as the closely spaced bars can reduce access, making it difficult to fully remove trapped air pockets.

Spread foundations may require multiple visits to site to complete the installation of a passive assembly. Whilst hardeners can be deployed into the concrete mix to speed up the curing process, the size of the foundation will determine application. Some of the larger excavations are not suitable for using hardeners since the bottom of the foundation will be almost fully cured before the whole base has been poured.

Typically spread foundations can be used for all types of passively safe products.

Planted Foundations

Planted foundations are narrow bores into the ground where the passive support is inserted into the bore and backfilled.

There is a significant cost saving when deploying planted foundations over spread foundations, because there is less spoil to remove and much less concrete used in a planted foundation. However, care should be observed if the installation is to be deployed on a cutting or embankment as a greater planting depth may be required. The IHE Sign Structures Guide 2021 provides guidance on design and calculation for planted foundations and PD6547 provides similar for lighting columns.

It is important that during the design process it is established whether the foundations are required to meet either DMRB CD354 (and any update) or to use the method described in the IHE Sign Structures Guide for signs and posts and the *PD 6547 method for columns*. This will affect the root length/depth of foundation required and whether a concrete surround is acceptable or not.

It is always advisable that any software design calculation is checked and reviewed manually and a risk assessment includes why the selected design is used and/or any changes to the design implemented.

Sockets and sleeves

There are two types of socketed foundation

- Oversized twin walled sleeve;
- Retention sockets

Oversized twin walled sleeves can be deployed in both spread and planted foundations and are placed where the supports will eventually be installed. The concrete is poured around the outside of the twin walled sleeve and allowed to set, the supports are then inserted inside the sleeve and backfilled. For planted foundations, concrete is poured to a depth of approximately 20cm, the support installed in the twin walled sleeve and made plumb using sharp sand, and then topped by a concrete cap of 20cm thick. This allows the supported product to be removed and replaced in future if necessary.

Retention sockets may be deployed to future proof foundation designs because the foundation remains completely intact if the passive support is damaged during a collision and the use of retention sockets assists in removal and replacement.

Both types of foundations are used in the UK. It is recommended that you seek clarification from the manufacturer of any socket and/or the product selected for use case.

Screw Piles

It is recommended that any designer wishing to deploy screw piles as a planted foundation should seek the advice and guidance of specialist geotechnical engineers during the design and build, especially as they are more likely to be deployed in areas of made ground where the soil support may not be as sound as other locations.

Maintenance and repair

Maintenance and repair must also be consideration in the design process when deploying a passive support into a foundation. Accessibility for removal of below ground elements following any incident needs to be considered at the design stage.

When deploying installations such as

- Electrically lit signs
- Vehicle activated signs
- Signs at sites which may require removal (for example signs mounted on bends where a wide load may come into contact)
- Sites with regular product strikes (urban and rural)

Retention sockets or any system which allows the supported post to be quickly changed may be considered at design stage as part of cost effective and sustainable requirements

TOPAS

Following calls from industry, TOPAS now provides a means of registering a product under BS EN 12767 on an open register accessible to manufacturers and procurers. The process provides an independent assessment of the technical files for products tested to BS EN 12767 and the UK National Annex, and is recognised as a means of confirming those test results independently. Calling up TOPAS registered products in tenders provides assurance that the claims made by manufacturers have been verified by an independent body.

The TOPAS register can be found using this link [Product Register | Topas Group](#)

Summary of guidance currently available

ARTSM recommends that this guidance be read in conjunction with the guidance referenced below.

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

- BS EN 12767: Passive Safety of Support Structures for Road Equipment 2019 and the UK National Annex
- BS EN 40 Lighting Columns (all parts)
- BSI PD 6547: 2023 – Guidance on the use of BS EN 40-3-1 and BS EN 40-3-3
- BS EN 12899: Fixed vertical road traffic signs and the UK National Annex
- Department for Transport Provision of Road Restraint on Local Authority Roads
- National Highways Design Manual for Roads & Bridges – trunk roads
 - CD354 Design of Minor Structures (latest revisions)
 - CD377 Requirements Road Restraint Systems (latest revisions)
- Institute of Highways Engineers Sign Structures Guide (2021)
- Institute of Lighting Professionals TR30 – Guidance on the implementation of passively safe lighting columns and sign posts
- TRL CSS SL4/2007 PPR342 - The use of passively safe signposts and lighting columns

If you have any questions regarding passive safety please get in touch with ARTSM www.artsm.org.uk . We will providing further guidance in this passively safe series.

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