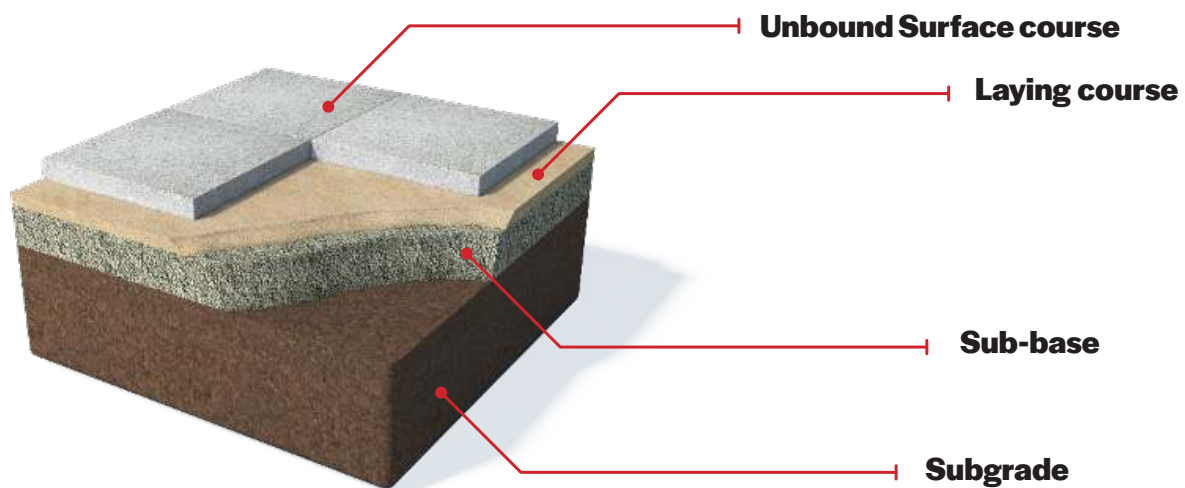


GUIDANCE FOR THE INSTALLATION OF "UNBOUND" CONCRETE FLAGS.

The following information is an overview of the comprehensive detail contained in BS 7533 and therefore should be considered guidance for the installation of unbound concrete flag pavements. We strongly advise that this overview is read in conjunction with the relevant parts of the BS 7533 series of standards and a full in-depth detailed design is carried out by a qualified professional.

Figure 1. Typical cross section of pavement



Product Inspection

Upon delivery, all flags should be inspected and any issues identified must be reported prior to installation.

Prior to commencing installation

It is good practice to sort the flags to ensure consistency of colour, texture and dimensional tolerance.

Health & Safety

It is the installer's responsibility to ensure that all safe working practices are being adhered to and full PPE must be worn.

Flags with plan dimensions greater than 450 x 450mm are normally laid using the bound method on a mortar bed.

Please see Guidance for the Design and Installation of "Bound" Concrete Flag Paving.

Installation

Preparation of the subgrade.

The sub-grade should be fully compacted. Any soft or unsuitable material must be removed and a suitable material should be used to replace it.

Edge restraints

All paved areas must have solid edge restraints around their perimeter. Edge restraints can be raised kerbs, flush kerbs and edge courses which will be installed using concrete. A building or wall also acts as an edge restraint. Edge restraints prevent the surface course moving and also prevent loss of laying course material.

Preparation of sub-base

The sub-base material should be installed in layers to the specified depth and fully compacted to provide a close textured surface.

The sub-base material is Type 1 aggregate in accordance with clause 803 of the Department for Transport Specification for Highway Works or clause 804 in accordance with the National Roads Authority Specification for Road Works (Ireland)

To ensure surface water runs off the flag surface a minimum longitudinal fall of 1.25% (1:80) and cross-fall of 2.5% (1:40) should be incorporated into the sub-base.

Unbound Installation**Laying course**

The laying course material should be naturally occurring unbound sand. It should not contain any material such as cement or lime which would detract from its unbound nature. See *table 1*.

Table 1.

Sieve Size (mm)	Percentage by mass passing %
8	100
6.3	95-100
4	85-99
0.5	30-70
0.063	0-3

Recycled material can be used provided it meets the same performance of naturally occurring sand.

The laying course sand should be screeded to a thickness of 25mm after final compaction. It must not be used for achieving falls.

Lay screeding rails on top of the sub-base and spread the laying course sand. Using a screeding bar, screed the sand to the correct depth. Compact the sand using a vibrating plate compactor to achieve a smooth textured surface. Remove the screeding rails and fill the void. Screed over the void.

Installation of flags

Flags should be laid onto the screeded laying course sand in the nominated pattern. Example laying patterns can be found in **Annex 1**. Use string lines to ensure proper alignment and make adjustments where necessary.

Flags must have a joint width of 2-5mm. (to allow for the products dimensional tolerances and to create a gap to allow brushing in of kiln dried jointing sand)

Important: Straightness of lines is dependent on workmanship and any differences in sizes of the flags that result from the manufacturers permitted tolerances. Installing the flags using a 2-5mm joint can help achieve straight lines.

Butt jointing (flags installed tight together) will make achieving straight lines more difficult.

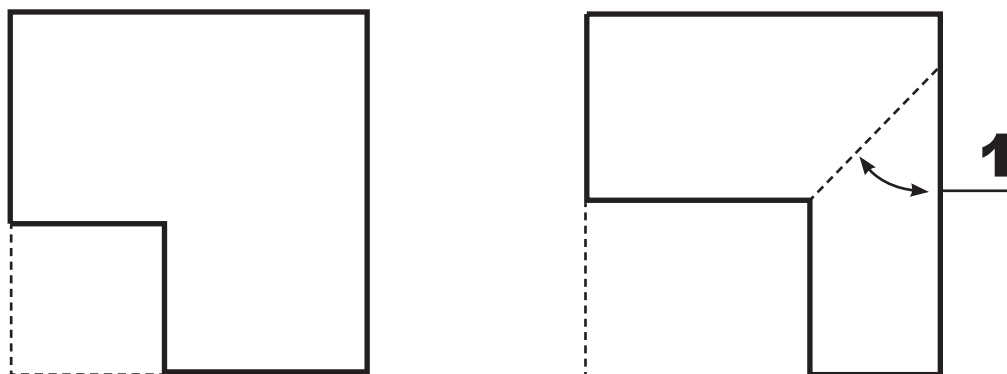
Tobermore do not recommend butt jointing flags.

Cutting

Once all full size flags have been laid use cut flags to complete the area. Where cut flags are required avoid cuts which are less than a quarter of the original plan size. The use of in-board cuts can help to achieve this. Flags should be cut using a masonry saw with water suppressant. Full PPE must be worn.

When 25% of a flag needs to be cut the remaining piece should be cut from the internal corner of the cut to the external corner of the flag at an angle of 45 degrees. See Figure 2.

Figure 2.



Key: 1) 45° desirable

Prior to final compaction - Jointing using kiln dried sand

Fill the joints with kiln dried sand by brushing it over the surface ensuring all joints are filled. Joint filling should commence as soon as possible to prevent ingress of water into the laying course.

Final Compaction

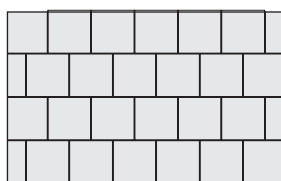
Final compaction should be carried out as soon as possible after the flags have been laid and jointed. Use a vibrating plate compactor to fully bed the flags into the laying course. This may require two or more passes. We recommend a vibrating plate compactor with a protective rubber mat to avoid scuffs and scratches occurring. Top up joints with jointing sand if necessary.

Important: The paved area should not be cleaned by vacuum road sweepers for a minimum of 3 months. This prevents loss of jointing sand and allows sufficient time for the sand to self stabilise.

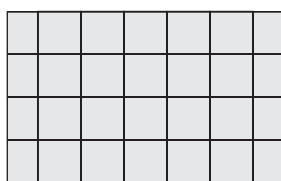
If necessary, the jointing sand can be stabilised immediately by using a sand joint sealant.

Annex 1 - Laying Patterns

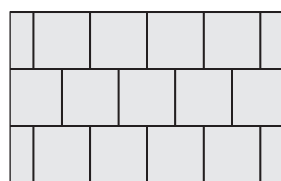
PAVING FLAGS



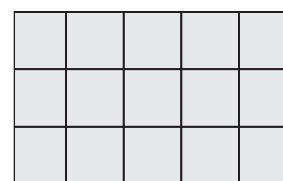
Stretcher bond
400 x 400mm



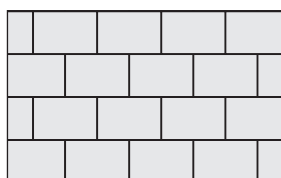
Stack bond
400 x 400mm



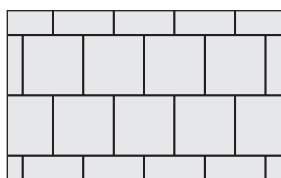
Stretcher bond
450 x 450mm



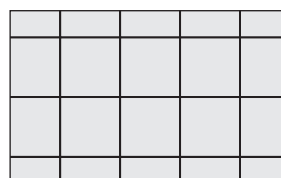
Stack bond
450 x 450mm



Stretcher bond
600 x 400mm



Stretcher bond
600 x 600mm



Stack bond
600 x 600mm

Disclaimer

This guidance has been produced in good faith, however no warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by Tobermore Concrete Products Ltd in relation to the adequacy, accuracy, completeness or reasonableness of this guidance.

All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This guidance is provided as is, and is to be used at the recipient's own risk. The recipient is advised to consider seeking professional guidance with respect to its use.

Instructions & Warnings

As referred to in Tobermore's Conditions of Sale

CORE TERMS (PAVING & WALLING)

Product

All products should be carefully inspected for defects or damage upon delivery and prior to being laid or fitted.

Product Information

Within Tobermore, design and development of products is a continuing process, and product information is subject to change without notice. Accordingly, please check with Tobermore to ensure that the product information you have represents the most up-to-date product information.

Prior to Installation

It is good practice to sort products to ensure consistency of colour, texture and dimensional tolerance. Any defects must be reported without delay. If products are installed with any form of defect which was clearly apparent prior to installation the installer will be responsible for all costs incurred to rectify the issue.

Installation

All products should be installed in accordance with the latest British Standard.

Colour/Shade & Texture

Tobermore produces paving and walling products with excellent density and durability. All products are manufactured in batches using naturally extracted raw materials including aggregates, pigments and cement etc. Products such as Braemar, Sienna, Fusion, Mayfair Flags, Manhattan, City Pave and Fusion Kerbs are manufactured using premium naturally occurring granite aggregates. To achieve their final appearance some products undergo secondary processes, this involves shot blasting or grinding the surface of the product.

Whilst we have several factory procedures in place to help control shade, colour and texture within and between batches we cannot guarantee consistency. This is due to the natural materials and secondary processes. Therefore, slight variations in the finished products is normal between and within batches. These variations actually enhance the character and natural beauty of the products.

To achieve the best possible finish we recommend the following advice is followed to evenly distribute any slight variations in shade, colour and texture over a large area.

When the circumstances allow complete one area of paving, one retaining wall or one house / building by using products taken from the same batch. This is achieved by checking the batch code label displayed on the packs.

Always, thoroughly mix products from a minimum of three packs.

Where products are supplied in packs with vertical slices always take them "vertically slice by slice" this ensures that colours are distributed evenly.

When the circumstances do not allow the use of products from the same batch then it is extremely important to minimise possible colour banding / shading by always, thoroughly mixing products from a minimum of three packs concurrently with some overlap between deliveries / batches.

Mixing thoroughly from a minimum of three packs is of particular importance when installing single colours such as Golden, Buff, Natural, Charcoal, Graphite, Silver, Mid-Grey, Sandstone, Alto Silver, Aaron Stone, Jura Grey and Innis Black.

We would always recommend that when purchasing products, especially in larger quantities, that they are all ordered at the same time.

Please note that the colour of new products will inevitably vary compared to those that have been installed for a period of time as weathering does take place.

All colour illustrations are as accurate as the printing process will allow. For a more accurate colour match please refer to actual product samples, which can be provided.

Colours and textures illustrated are representations and therefore should not be expected to be an exact match.

Note: Whilst we strive to ensure consistency, complimentary products such as Kerb Specials, Step Flags, Facing Brick Specials, Historic Circles etc. may not be an exact colour / texture or shade match to the standard version of the product as they will have been manufactured at varying times using different processes.

Tegula

Tegula is manufactured using a secondary process that distresses the edges and corners of the blocks to give the desired aged antique appearance. The process randomly distresses the blocks, therefore some blocks will be more distressed than others will, this is completely normal and does not affect the product performance.

Staining

Some chemicals that are commonly used in gardens such as lawn feed containing Ferrous Sulphate can stain concrete products. Any chemicals that are spilt must be removed immediately by rinsing away with clean water. Please check the information on the instruction label of the container holding the chemical.

Moisture

Occasionally, after installation, some units may show variations in shade and have a patchy appearance. This is due to the varying amounts of moisture within the concrete and the ground. The drying out process of concrete continues in-situ after installation. Some units may also retain more moisture than neighbouring

units and take longer to dry out. This is caused by the variations in density of the naturally extracted aggregates used in the manufacturing process. Given time and natural weathering, the capillaries within the surface of the concrete will gradually close and any patches or moisture retention will dissipate as the product matures. This does not affect long-term performance.

Efflorescence

Efflorescence is a crystalline deposit that occurs naturally on the surface of concrete materials. It usually appears as white deposit but can also be brown or yellow in appearance. Tobermore use market-leading technology to significantly suppress the occurrence of efflorescence, however, if it occurs, it may mask the colour of the product for a period of time, but tends to be washed away gradually by rain. Tobermore do not replace products with efflorescence. Packs of products which have had packaging removed should always be re-covered with appropriate packaging to prevent the occurrence of secondary efflorescence.

Surface Scratches

Minor scuffs or bruises may occur during delivery, movement onsite, and installation (for example, during any plate vibrating process). In Tobermore's experience, these marks usually weather off through time.

To reduce the risk of surface scratches we strongly recommend the use of a vibrating plate with a rubber protective mat.

Ordering

To avoid waste, please ensure that your contractor accurately measures the area on site before ordering products. In Tobermore's experience, dimensions taken from a project plan can vary significantly from the final layout.

Depending on the layout of the project, we recommend ordering an additional 2-5% of material to allow for cutting, detailing and wastage.

Manufacturing & Quality Systems

Tobermore is a BS EN ISO 9001, BS EN ISO 14001 and BES 6001 registered company. Tobermore uses an integrated management system to manage all health & safety and environmental issues.

Product Maintenance

Routine cleaning and maintenance is required to keep the overall appearance of products in pristine condition.

All concrete products can develop algae, lichen, and moss growths due to environmental conditions and may require cleaning. Areas adjacent to plant borders and trees may discolour from transfer of plant-life. Tobermore cannot accept responsibility for any of these conditions.

Queries & Complaints

Please contact one of Tobermore's Paving & Walling Centres or offices (contact details at www.tobermore.co.uk) with any queries or complaints. Any complaints must be notified to Tobermore without delay.

CORE TERMS (PAVING ONLY)

Paving installed unbound should have a close joint width of 2-5mm to allow for the dimensional tolerances of products and to create a gap to allow the brushing in of kiln dried jointing sand. The straightness of lines will be dependent on workmanship and product tolerances. String lines must be used to help achieve straight lines.

Tobermore do not recommend Butt jointing as this will make achieving straight lines more difficult.

Product Maintenance

Light coloured paving blocks and flags emphasise tyre marks and oil spills on the driveway. Please note that these products will need more maintenance if overall appearance is to be maintained.

Initial Cleaning

When an area has just been paved, allow it to settle for a few days. After this, you may wish to lightly hose down the paving to remove any excess sand or dirt. The area should then be treated with a weed killer suppressant 2-3 times per year as required.

General Cleaning

Paving requires regular maintenance, including regular sweeping to prevent the build up of detritus. Tobermore recommends that paving is cleaned 2-3 times per year.

For general cleaning of dirt and algae, vigorous brushing with a stiff yard brush with plenty of hot detergent solution (washing up liquid or non-bio washing powder), thoroughly rinsed with clean water, should suffice. Repeated treatment may be required for paved areas sited beneath trees or in permanent/near permanent shade.

A light power hose at medium pressure is generally all that is required to clean general dirt and grime. Any jointing material which is removed must be replaced. Do not use high pressure powerwashers as aggressive power-washing can damage the product surface. A trial area should be tested before large scale

powerwashing takes place.

Moss, Lichen and Algae

Thick growths of moss or lichen must be removed first by scraping out the joints and then treating the area with a moss killer such as anti-moss paving cleaner. Anti-moss is designed to remove moss, lichens and algae. It is best applied in dry weather. After being applied it will take a few days to be fully effective. Once the moss and lichens have been killed, they can easily be brushed off. Anti-moss also leaves a residue in the sand joint which will help reduce the likelihood of re-growth. The manufacturer's instructions should always be followed when using any cleaning agent.

Weeds

Large weeds should be removed by hand and then the area treated with a weed killer (available from any good garden centre). Smaller weeds can then be treated directly with weed killer and these weeds should start to die within days. The manufacturer's instructions should always be followed when using any weed killing agent.

Block Paving Sealer

It is possible to seal block paving with a resin material which combats staining and weed growth and which also enhances colour and appearance. The acrylic sealer is sprayed onto the block paving and forms a 'skin' on top of the paving and the jointing material giving an easily maintained finish. The manufacturer's instructions should always be followed when using any sealing agent.

FOR HYDROPAVE PRODUCTS

Installation - Hydropave

Tobermore recommends that its Hydropave products be installed in conjunction with a BS EN 7533-13:2009 designed permeable paving system.

Note: A permeable paving design relies heavily on using the correct aggregates. Prior to installation, we would ask you to test both the 4/20mm coarse graded aggregate and also the 6.3-2mm bedding and jointing grit as per the relevant British Standard specification (BS EN 13242:2002). In particular, the material should be categorised as LA20 according to Table 9, SZ18 according to Table 10 and MDE15 according to Table 11 within this standard. The grit should be insoluble in dilute hydrochloric acid and should be naturally occurring material. In our experience, incorrect use of aggregates is one of the most common reasons for failure of a permeable paving system.

Joint Filling

All joints must be filled to the top with 6.3 – 2mm grit to prevent movement and spalling of the blocks. We recommend that after a few weeks use, any joints which have settled and are not full, are topped up with grit. Joints should be kept filled at all times. You will need approximately one tonne of grit for every 100m² of 80mm paving.

Note: Care should be taken that the permeable joints do not become contaminated as work on the scheme is completed. Special care needs to be taken when soft landscaping is carried out so that soil does not enter the joints. When this type of work is being carried out, the surface of the permeable paving should be protected by an appropriate cover to protect the joints from being contaminated.

Hydropave Maintenance

Please refer to Tobermore's detailed 'Permeable Paving Maintenance Guidelines' available on our website: www.tobermore.co.uk

FOR EASYCLEAN PRODUCTS

Handling & Installation

During installation, the surface should be protected at all times from scratching and abrasion.

Once the protective glue dot has been removed do not stack flags directly on top of each other.

Use a plate vibrator with a rubber mat.

Do not scratch the surface with tools. (Spade, trowel etc.)

User advice

Do not drag garden furniture across the surface of the flags.

Do not pressure wash.

Do not use chemical cleaning products (e.g. solvents/acids).

FOR FACING BRICK & COUNTRY STONE PRODUCTS

Important Note:

Where the circumstances allow, it is beneficial to complete one building / structure using bricks taken from one batch and mixed on site from a minimum of 3 packs to avoid colour banding / shading. If the circumstances do not allow for this then it is important to minimise the possibility of banding / shading by always mixing bricks from 3 packs concurrently with some overlap between deliveries.

Where the site conditions allow, it will also be beneficial to take receipt of as many bricks as possible at an early stage to maximise colour consistency throughout the site.

Installation – Facing Bricks

Please refer to Tobermore's detailed 'Guide to the use of Tobermore Concrete Bricks' available on our website: www.tobermore.co.uk

Installation – Country Stone

Tobermore's Country Stone products are designed to recreate traditional stone sizes and to co-ordinate with standard cavity wall construction. When used in housing projects, a clear cavity must be retained.

All work must be protected during construction and must be designed and built in accordance with accepted industry standards and practice. Builders familiar with conventional brickwork will find that similar installation principles apply.

Joints can be finished flush or tooled depending on the overall effect required. Raked joints are not recommended. It is vital that all horizontal and vertical joints between Country Stone blocks must be compacted and free from voids. Shell bedding should not be used.

Good Practice during Construction - Facing Bricks & Country Stone

- If mortar dry's on the surface of the bricks it will stain the product and may not be removed.
- Mortar extruding from joints should be removed when the mortar is wet and during the process of laying.
- Any mortar smears on the brick surface should be removed by dry or wet brushing.
- Scaffolding should be installed as per regulatory instructions. Please note that mortar can drop and hit the scaffolding and then also go onto the wall. You should inspect the work area at all times to ensure the brick surface remains mortar free.
- When it rains be careful that any wet mortar on the scaffolding does not get 'splashed' onto the wall.
- When work stops or is interrupted by inclement weather conditions, brickwork should be protected immediately with polythene sheeting that is held in place with a suitable fixing. If new brickwork is not protected efflorescence, patchy mortar colour, patchy brickwork and staining can occur.
- Bricks should always be covered with polythene sheets to avoid getting damp or dirty when not being used.

General Cleaning Advice - Facing Bricks & Country Stone

- It is always important to keep bricks as clean as possible while laying and tooling. See Good Practice above.
- If mortar has been allowed to dry on the surface of the bricks the options you have to clean it off are as follows; Each process should be tested first and should ensure the facing bricks are not damaged - Dry brushing b. Wet brushing c. Using a 'like coloured' brick to rub the stained brick d. Pressure washing - should only be used as a last resort as it will damage the surface and the mortar joint if not completed correctly (this method cannot be attempted until the area has been allowed to set for a minimum of 7 days).
- Acid cleaning should be avoided.

Movement Joints and Mortar Guidance - Facing Bricks & Country Stone

1. NHBC recommends that walls constructed of concrete facing bricks should have vertical movement joints included every 6m to allow for drying/shrinkage, see PD6697:2010 section 6.2.6.3.4, maximum ratio for brickwork panels is to be 3:1 length : height. PD6697:2010 section 6.2.6.4 gives advice on joint positions, the benefit of brickwork reinforcement at window openings is covered in section 6.2.6.7 of the same document. Movement joints should be planned prior to commencing any construction to enable them to be concealed behind down pipes etc. and ensure the aesthetic of the building is maintained.
2. It is important to ensure that the mortar specified for the construction is suitable for the contract, see table 15 of PD6697:2010 - class M4 is the maximum recommended for normal external facing brick walls. This should not be exceeded when using Tobermore Concrete facing bricks.
3. We would recommend that you discuss this guidance with all parties involved in the design, construction and installation of this scheme. We also recommend that you refer to BS EN 1996-1-1 and PD6697:2010.
4. Specific professional advice should be obtained at all times before commencing building work.

Important Guidance Information: Tobermore Concrete Facing

1. Professional advice, specific to the project, should be sought before commencement of the building work.
2. Tobermore Facing Bricks have different properties to clay bricks especially in relation to moisture movement. Please refer to 'Guide to the Use of Tobermore Concrete Facing Bricks', which is available on request or at www.tobermore.co.uk
3. Tobermore recommends that vertical movement joints be spaced at no more than 6m apart. Panels of brickwork where the length: height ratio exceeds 3 are particularly vulnerable to cracking; if they cannot be avoided they should include movement joints at closer centres.
4. Movement joints should be planned prior to any construction so that they can be concealed behind drainpipes etc. Further guidance on moisture movement is available in the 'Guide to the Use of Tobermore Concrete Facing Bricks' and BSI documents BS EN 1996 (Eurocode 6) and PD 6697 (Recommendations for Design).
5. It is important to ensure that the mortar specified is suitable for the construction, see Table 15 of PD 6697. Mortar of strength class M4 will generally be suitable. Please refer to 'Guide to the use of Tobermore concrete facing bricks', which is available on request.
6. When building with dissimilar materials allowances should be made for differential movement. Design guidance from a structural engineer should be sought when combining dissimilar materials such as clay and concrete facing bricks. Examples of using dissimilar materials would be where a clay brick is used to build up to the dpc level and then Tobermore concrete facing bricks are used above the dpc. In some circumstances the dpc acts as a slip plane to separate the two materials which helps to dissipate tensile stress. However expert guidance should always be sought as to ensure structural stability as further slip planes or bed reinforcement may need to be incorporated into the design.
7. It is recommended that this guidance is discussed with all persons involved in the design and construction of the building work.

FOR SECURA PRODUCTS

Installation - Secura

All Secura products should be installed in accordance with British Standard BS8002. When constructing a retaining wall, ensure that you follow the design provided by the scheme engineer.