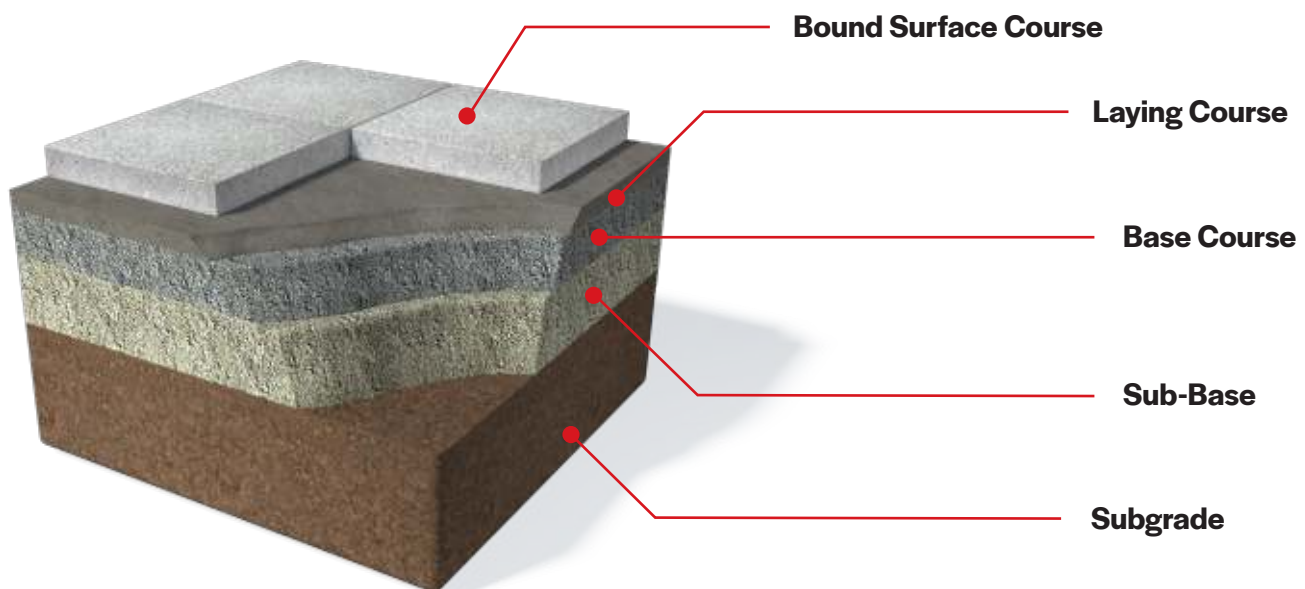


## GUIDANCE FOR THE DESIGN AND INSTALLATION OF “BOUND” CONCRETE FLAG PAVING

The following information is an overview of the comprehensive detail contained in BS 7533:101:2021 and therefore should be considered guidance for the design and installation of 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.

The longevity, durability and performance of a paved surface is not only about the quality and characteristics of the chosen surfacing material it also relies on the bedding, jointing and sub-base materials being specified and installed correctly.

Bound installation which was previously known as rigid installation refers to concrete flag pavements where the paving units are laid on and jointed with cementitious mortar irrespective of the base material, which may be bound or unbound



IMPORTANT NOTE: BS 7533 Part 101:2021 refers to two methods of bound installation for concrete flag paving.

### Bound system A

Refers to a bound surface course installed over a conventional hydraulically bound material (HBM), a bituminous bound asphalt concrete base (AC) or an unbound base layer, to which the bedding mortar is not adhered.

This system should be used for suitable depths of flags in traffic category 4 and below.

### Bound system B

Refers to a bound surface course bonded to a concrete base whereby a tensile adhesion bond of not less than 2 MPa exists between all layers connecting the surface unit with the base. To enable the best possible adhesion bond between paving units and mortar, paving units should be thoroughly cleaned prior to installation.

### Bound installation

Flags should **not** be laid when the ambient temperature is 2 °C and falling.

## Design Guidance

### Base design thickness for concrete flags

The base course design thickness should be selected from Table 1 based on the traffic category selected from Table 2.

The base design thickness and recommended traffic category for Bound System B on an unbound or bituminous base should be the same as for Bound system A.

**Table 1**

Traffic Category	Bound system A Select either Unbound base, AC base or Concrete base (mm)			Bound system B
	Unbound Base <sup>(A)</sup>	AC Base	Concrete Base	Concrete Base
1	75	50	100	100 <sup>(B)</sup>
2	100	70	100	100 <sup>(B)</sup>
3	NA	NA	100	100 <sup>(B)</sup>
4	NA	NA	NA	125
5	NA	NA	NA	125
6	NA	NA	NA	150
7	NA	NA	NA	150

(B) For concrete base, 100mm is considered the minimum practical construction thickness

**Table 2**

Traffic category	Standard axles per day	Typical applications
1	0	Pedestrian only areas
2	0	Pedestrian paths and cycle paths
3	0	Small car parks ( cars and light vans only ) Domestic driveways
4	1	Footways with no planned vehicular traffic. (1) Areas used by pedestrians and light commercial vehicles, emergency vehicles and maintenance vehicles
5	≤7	Pedestrian areas and car parks with occasional commercial vehicles
6	≤70	Adopted highways / Commercial and Industrial developments with a moderate number of commercial vehicles
7	≤350	Adopted highways / Commercial and Industrial developments with a high number of commercial vehicles

(1) If the area is being used for events or HGV loading the pavement should be designed for that loading.

## Important Information

### Maximum traffic categories for concrete flags

System	Maximum Traffic Category
Bound System A	4
Bound System B	7

### Minimum flag thickness in mm for Bound B installation only

Traffic Category	Flag strength class 3 (A)
1 <sup>(A)</sup>	30
2 <sup>(A)</sup>	50
3 <sup>(A)</sup>	50
4 <sup>(A)</sup>	50
5 <sup>(A)</sup>	50
6 <sup>(A)</sup>	50
7 <sup>(B)</sup>	60

(A) Characteristic bending strength Class in accordance with BS EN 1339

(B) For Traffic Category 7 a length to width ratio of 1:1 should be used

(C) Flags should have a maximum length/width ratio of 2:1

## Maximum traffic categories for concrete flag dimensions

Flag ref	Flag Dimensions in mm			Bound System A	Bound System B
	Length	Width	Depth		
G60	300	300	60	4	7
F50	400	400	50	3	6
E50	450	450	50	3	6
B50	600	600	50	3	6
A50	600	400	50	2	6
N/A	600	300	60	2	6
N/A	600	300	80	2	6
N/A	600	150	80	2	3

## Laying Pattern

Where an area is to receive vehicular traffic, a broken bond pattern should be used, such as stretcher bond. See Annex 1. The pattern should be orientated to avoid trafficking along continuous joints.

### Abrasion resistance

In areas subject to normal pedestrian and vehicle use (e.g. public footpaths and roads) the minimum abrasion resistance should be Class 3 in accordance with BS EN 1339:2003, Table 6.

### Movement joints

Movement joints should be incorporated into bound pavements to dissipate stresses from changes in temperature and moisture content.

Movement joints within the base course should be aligned with movement joints in the bound surface course. This ensures that each layer of the pavement can move together and be unconstrained by adjacent areas.

NOTE: *Movement joints are not required within bituminous base layers.*

The designer should position movement joints avoiding acute angles. The dimensions of individual bays should be limited to a 2:1 aspect ratio.

Coordination between the designers of the pavements structural element and designers of the laying pattern is crucial to ensure joints within the base and surface course layers can be aligned to achieve the desired aesthetics.

### Expansion joints

Consideration should also be given to the inclusion of expansion joints. Refer to BS 7533:101:2003 for detailed guidance.

## Material Specifications

### Sub-Base Materials

Type 1 unbound granular material in accordance with clause 803 of the Specification for Highway Works.

NOTE: Alternatively, any of the sub-base materials permitted in the SHW 800 series may be used, except 804 and 805, which may only be used up to and including traffic category 4.

### Base Course

One of the following base materials should be used.

1. AC 20 dense bin 40/60 des conforming to BS EN 13108-1
2. AC 32 HDM base 40/60 des conforming to BS EN 13108-1
3. AC 20 dense bin 100/150 rec conforming to BS EN 13108-1 traffic category 5 and below
4. AC 20 open bin 100/150 rec conforming to BS EN 13108-1 traffic category 5 and below
5. AC 32 dense base 100/150 rec conforming to BS EN 13108-1 traffic category 5 and below  
*NOTE: Proprietary asphalt materials might also be suitable for use as base materials. Porous asphalts might be particularly useful where improved base permeability is sought whilst maintaining structural integrity.*
6. Cement bound granular material (CBGM) base should be CBGM conforming to BS EN 14227-1:2013, strength class 8/10
7. Concrete base should be pavement quality concrete conforming to BS EN 13877-1:2013 with a minimum compressive strength class C32/40 for traffic categories 5 and above, and a minimum compressive strength class of C20/25 for traffic categories 4 and below

### Bedding course material for bound surface construction

The bedding course design thickness should be 40mm.

The bedding course should not be used as a regulating layer to correct the base level.

Type 25 bedding mortar may be used for Bound system A.

Type 35 bedding mortar together with a bonding mortar should be used for Bound system B.

A site batched bedding mortar may be substituted for Bound system A for traffic categories 4 and below.

### Proprietary bedding mortar

Proprietary bedding mortar should be in accordance with the characteristics in Table 3.

Bedding mortar complying with Table 3 may be assumed to be non-frost susceptible.

**Table 3**
*Bedding Mortar Characteristics*

Characteristic	Performance	
	Type 25 bedding mortar	Type 35 bedding mortar
Compressive Strength <sup>A)</sup>	≥25 MPa	≥35 MPa
Flexural Strength <sup>A)</sup>	≥3.5 MPa	≥4.5 MPa
Modulus of Elasticity <sup>B)</sup>	(15 000 ± 3 500) MPa	(18 000 ± 3 500) MPa
Shrinkage <sup>C)</sup>	≤0.09%	≤0.09%
Permeability <sup>D)</sup>	≥5 x 10 <sup>-5</sup> m/s	≥5 x 10 <sup>-5</sup> m/s

A) Measured in accordance with BS EN 13892-2 after 28 days.

B) Measured in accordance with BS EN 13412 after 28 days.

C) Measured in accordance with BS EN 12617-4:2002, Clause 6 after 56 days with curing in accordance with BS EN 12617-4:2002, A.1.2.

D) Measured in accordance with BS EN 12697-19.

NOTE: In all situations, Type 25 mortar may be replaced with Type 35 mortar.

NOTE: Tests in BS EN 13892-2 for compressive and flexural strength and BS EN 13412 for modulus of elasticity need to be made concurrently in the same testing facility, which has UKAS accreditation or equivalent for one or more of the tests.

NOTE : Factory production control testing may be carried out in the producer's own laboratory.

**Site-batched non-proprietary bedding mortar for bound surface construction**

For traffic categories 1 to 4, site-batched non-proprietary mortars may be used.

NOTE: Typically a mortar comprising 1:4 Portland cement-aggregate (proportions by volume) is suitable.

**Site-batched non-proprietary jointing mortar for bound surface construction**

For traffic categories 4 and below, site-batched non-proprietary jointing mortar may be used.

NOTE: Typically, a mortar comprising 1:3 Portland cement-aggregate mortar (proportions by volume), using fine aggregate conforming to BS EN 12620, GF85 0/1 (MP) is used.

**Slurry grout jointing mortar**

The maximum aggregate particle size should be not greater than 40% of the joint width.

The material used for jointing should be a cementitious slurry grout conforming to Table 4.

**Table 4**
*Jointing mortar characteristics*

Characteristic	Performance	
	Type 25 jointing mortar	Type 40 jointing mortar
Compressive Strength <sup>A)</sup>	≥25 MPa	≥40 MPa
Flexural Strength <sup>A)</sup>	≥3.5 MPa	≥6 MPa
Modulus of Elasticity <sup>B)</sup>	(18 000 ± 4 500) MPa	(20 000 ± 4 000) MPa
Shrinkage <sup>C)</sup>	≤0.15%	≤0.15%
Adhesive Strength <sup>D)</sup>	≥1.0 MPa	≥1.5 MPa
Frost/Salt Resistance Class <sup>E)</sup>	≤1 500g/m <sup>2</sup>	≤1 500g/m <sup>2</sup>

A) Measured in accordance with BS EN 13892-2 after 28 days.

B) Measured in accordance with BS EN 13412 after 28 days

C) Measured in accordance with BS EN 12617-4:2002, Clause 6 after 56 days with curing in accordance with BS EN 12617-4:2002, A.1.2.

D) Measured in accordance with BS EN 13892-8 after 28 days.

E) Measured in accordance with CEN/TS 12390-9 after 28 cycles (CDF Test)

NOTE: All tests, apart from the frost salt resistance class test, needs to be made concurrently in the same testing facility, which has UKAS accreditation or equivalent for one or more of the tests.

NOTE: Factory production control testing may be carried out in the producer's own laboratory.

Type 25 jointing mortar may be used for traffic category 3 and below.

Type 40 jointing mortar should be used in traffic categories 4 to 7 and may also be used in traffic categories 1 to 3.

## Installation Guidance

### Laying

The surface of the base layer should be cleaned of loose debris and water should be used to remove any dust. Immediately prior to the placement of the bedding mortar, the top surface of this base layer should be primed using a fine mortar slurry or proprietary bonding coat material to a thickness of 1 mm to 2 mm. The priming slurry should be fresh and wet when the bedding mortar is spread onto it.

Flags should be cleaned to remove any dust or loose material. The backs of the flags should be primed using a suitable fine mortar slurry to a thickness of 1mm to 2 mm immediately prior to placement upon the bedding mortar.(Image 1) The priming slurry should be fresh and wet when the units are placed onto the bedding mortar. The flags should be laid directly onto the bedding mortar (Image 2 & 3)

### Joint widths for bound concrete flags

Joints should be set appropriately to achieve the correct alignment.

For bound surface construction, joint widths should be between 6 mm and 10 mm. Joints should be filled with jointing material in accordance with Table 2.

Any minor adjustments necessary to maintain the laying pattern should then be made.

String lines should be used regularly to check the alignment of the flags and any adjustments should be made.

Note: Flags must be laid onto a full bed of mortar to provide full support.

Note: It may be difficult to achieve perfectly straight lines when laying flags because the straightness is dependent on the workmanship and the permitted manufacturing tolerances of the dimensions.



Image 1



Image 2



Image 3



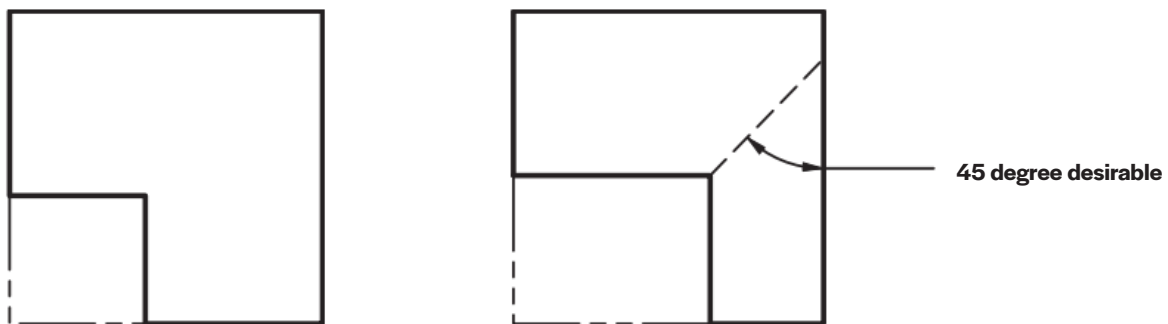
### Compaction

Compact the flags using a rubber mallet to line and level onto the full layer of bedding mortar. After bedding and compacting the flags should not rock. If any flags are rocking they should be lifted off the bedding mortar and re-laid correctly.

### Cutting in

Where flags need to be cut sizes smaller than a quarter of the original plan size of the flag should be avoided. To avoid cutting flags to smaller than a quarter of their original size, inboard cutting should be used to complete the area. Flags can be cut using either a disc cutter or a bench mounted masonry power saw with water suppressant. Full PPE must be worn. If more than a quarter of the flag needs to be cut, the remaining shape (from the internal corner of the cut-out to the external corner of the flag) should be cut as shown in Figure 1.

Figure 1.



### Joint filling

Jointing can commence after the bedding mortar has set, typically 12 hours.

### Trowel jointing

Prior to applying any jointing material, clean the surface of the flags of any debris.

Prior to joint filling the paving surface should be checked so that:

- the surface level tolerance conforms to Annex 2, Table A
- the flatness of the pavement conforms to Annex 2, Table A
- the difference in level at the joint of adjacent paving units conform to Annex 2, Table B
- joint width is consistent
- joints are correctly aligned
- any damaged or broken flags are replaced
- Any necessary corrective action should be taken to ensure that the pavement conforms.

Flags should have their joints filled to the full depth of the unit and to within 2 mm to 3 mm of their top surface. Mortar conforming to Table 3 is used. The mortar should be firmly pressed into the joints using a pointing trowel.

Any mortar remaining on the surface should be cleaned off immediately to avoid staining.

### Slurry jointing

**Note:** to avoid staining the surface of the flags, extreme care should be taken when slurry jointing.

Thoroughly soak the entire surface of the laid flags with clean water.

Spread the slurry mortar over the entire surface using a squeegee moving it towards the open joints.

Leave a quantity of the mortar slurry on the surface and move it across the surface to fill the joints. Repeat this process a minimum of two times in order to fully top up joints. The mortar should be kept in a wet condition by spraying water onto the surface.

Wet the surface with more water and use the squeegee to remove any excess mortar from the surface. Continue moving any excess material towards open joints.

As much of the excess slurry should be removed from the surface of the flags and the joints should be allowed to firm up.

Once the joints have begun to firm up any jointing slurry remaining on the surface of the flags must be washed off carefully taking care not to wash material from the joints. For best results use a sponge grout roller machine. Alternatively a pressure washer can be used with care.

**Important:** Slurry jointing mortars begin to set quite quickly allowing the paving to be cleaned shortly after jointing is complete. Determining the optimum time to allow the joints to start setting whilst still being able to remove the excess material is crucial. If left too long it will become much more difficult to clean any excess off and there is a risk of staining the flags permanently. Temperature and humidity will also affect the setting time. On very hot days, it may be best to leave jointing until late afternoon.

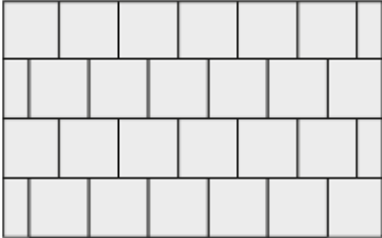
**We would strongly advise constructing a trial panel to determine the optimum time to ensure removing the excess can be completed.**

### Proprietary bedding, priming and jointing mortars.

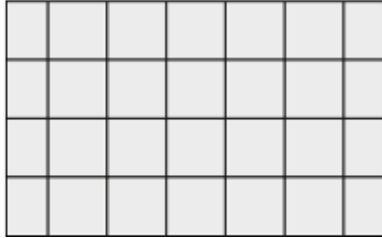
Proprietary bedding and jointing mortars are now used frequently. There are several manufacturers of these products which meet and exceed the requirements of BS 7533. When using these materials please follow the guidance provided by the manufacturer.



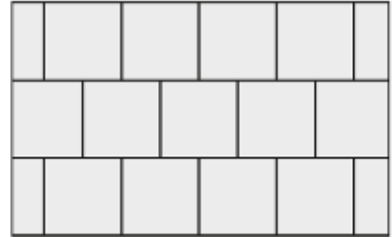
## Laying Patterns



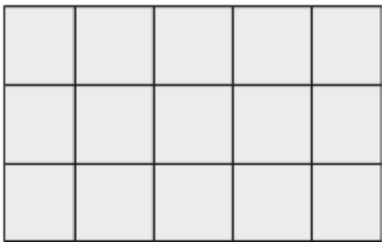
**Stretcher Bond**  
400 x 400mm



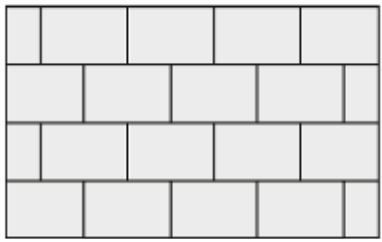
**Stack Bond**  
400 x 400mm



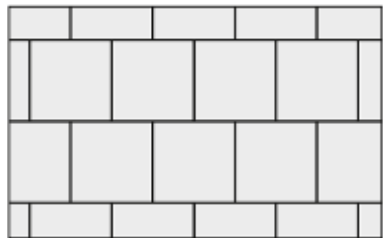
**Stretcher Bond**  
450 x 450mm



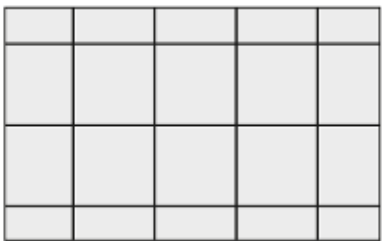
**Stack Bond**  
450 x 450mm



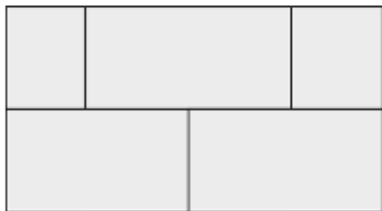
**Stretcher Bond**  
600 x 400mm



**Stretcher Bond**  
600 x 600mm



**Stack Bond**  
600 x 600mm



**Stretcher Bond**  
600 x 300mm

## Tolerances

**Table A**

*Maximum deviations on the surface levels*

Surface layer of paving	Maximum deviations from design level mm
Sub-base	+5 / -10
Base	+5 / -10
Bedding course	+5 / -10
Surface course	+6 / -6

**Table B**

*Regularity of surface course*

Measurement of surface regularity	Permitted tolerance
Flatness of paving when laid	3mm under a 3m straight edge
Difference between the levels at joints of adjacent flags	2mm

### 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](http://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 100m<sup>2</sup> 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](http://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](http://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](http://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.