

PROPERTIES OF CONCRETE PAVING FLAGS

(downloaded from <http://www.paving.org.uk>)



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Introduction

Concrete flag paving offers a clean, hardwearing and aesthetically pleasing surface. Flags are produced in a wide range of square or rectangular sizes of different thicknesses, offering a wide choice of patterns. Concrete flag paving is available in a wide variety of colours and textures, enabling it to be used to delineate different functions. Sizes range from 300 x 300 to 900 x 600 mm, offering designers the potential to use elements of a larger scale than block paving.

Applications

Used either on its own or in conjunction with block paving, concrete flag paving provides an attractive surface suitable for:

- pedestrian footways and precincts
- forecourts and entrances to public buildings
- approaches and surrounds to residential and industrial buildings
- areas surrounding shops and offices
- school playgrounds
- public and private gardens
- swimming pool surrounds
- footways where vehicular overrun is unavoidable
- home zones and urban regeneration
- and other areas where a durable external surface is required.

Colours and Finishes

Flags can be finished to produce a variety of surfaces including textured and profiled ground, with or without chamfers. Stable pigments are used to provide a range of permanent colours further increasing designer choice. Flags are also manufactured to reproduce the colour and texture of natural stone paving in various finishes including split, sawn and tooled. They are particularly useful for pedestrian surfaces in historic towns and conservation areas, matching the appearance of stone but with greatly improved stability and slip resistance, providing a cost-effective alternative. Full details of special products and finishes can be obtained from individual Interpave manufacturer Members.

Concrete flag paving is also manufactured with specific textures designed to assist the accessibility of blind and partially sighted people. These units, known as 'tactile' paving, have surfaces incorporating raised blisters or bars and specific colours which warn partially sighted or blind people of approaching hazards or other situations such as at pedestrian crossings, steps, cycle paths and rail platforms. Full details are available in the Interpave brochure *Accessible Paving* which can be downloaded from www.paving.org.uk.

Sizes

Flags can be divided into three main categories: standard, small element and decorative. All but decorative are manufactured to BS 7263 part 1/ BSEN 1339 in standard sizes in controlled factory conditions.

The level and type of pedestrian and vehicular use on a pavement determine the size and thickness of the flag, the selection of laying courses, the jointing materials and the depth of pavement construction below the flag. Guidance on the structural design of Small Element concrete flag pavements for occasional trafficking is available on the website. Reinforced flags are also now available which offer superior performance: please seek advice from Interpave Member manufacturers for specific information and recommendations.

The following table gives a guide to the type and thickness of flag which should be used for various applications.

Suitability of flags for various applications

Designation	Nominal Size	Thickness	Pedestrian Only	Vehicular 1	Vehicular 2	Vehicular 3
A	600 x 450	50 or 63	✓	✓	✓ 63 mm	✗
B	600 x 600	50 or 63	✓	✓	✓ 63 mm	✗
C	600 x 750	50 or 63	✓	✓ 63 mm	✗	✗
D	600 x 900	50 or 63	✓	✓	✗	✗
E (small element)	450 x 450	50 or 70	✓	✓	✓ 70 mm	✓ 70 mm
F (small element)	400 x 400	50 or 65	✓	✓	✓ 65 mm	✓ 65 mm
G (small element)	300 x 300	50 or 60	✓	✓	✓ 60 mm	✓ 60 mm

Key:

Vehicular 1 - very occasional use by cars and light mechanical sweepers, e.g. unprotected footways in no parking areas or where overrun is not a problem. These flags can be laid on either a sand or mortar laying course.

Vehicular 2 - footway where vehicles cross to access house driveways. The preferred laying course is sand.

Vehicular 3 - footways where cars and occasional commercial vehicles run over; unprotected pedestrian precincts with about 25 commercial vehicles each day; fire tender access ways. These flags to only be laid on a sand laying course.

Performance

The new European Standard BS EN 1339: 2003, *Concrete Paving Flags - Requirements and Test Methods* has introduced a different approach to the old British Standard that will give specifiers and suppliers more confidence in the use of concrete paving flags. Whereas the BS EN stipulates that the manufactured concrete must conform to a wider range of performance characteristics, determined on actual manufactured concrete paving flags. Additionally, instead of having "one size fits all", all the performance characteristics are classified into classes, which the manufacturer must declare, so that the specifier and supplier has the relevant information needed to make informed selections.

Before any product is launched it is subjected to the rigours of 'Initial Type Testing' which demonstrates conformity to the BS EN for a product family. A family of product types is best described as paving flags manufactured to give a similar surface using the same equipment, process and raw materials, e.g. a paving flag manufactured with a natural river gravel will belong to the same surface family (same performance characteristics) as a paving flag manufactured with crushed granite/limestone. Each manufacturer will declare their definitions of product families when asked.

The continuing conformance of the concrete paving flag to the BS EN is supported by 'Routine Type Testing' and additional measures established under 'Factory Production Control'. The BS EN describes how the performance characteristics are to be assessed with detailed test methods and procedures, as described below. These methods are to be used in all cases of dispute resolution. Other methods can be used routinely to check compliance with the BS EN provided correlation is established with the standard method.

Strength - is a measure of the ability of the concrete paving flag's ability to withstand load. It is determined under laboratory conditions applying bending strength. The paving flag is supported by two parallel and rigid bearers rounded to a radius of 20 ± 1 mm and a load uniformly applied to its length until failure is reached within 45 ± 15 sec. For each flag, the individual strength in MPa is determined by calculation. Both the final breaking load in kN and bending tensile strength in MPa are recorded to check compliance with the BS EN. The number of flags per sample will vary depending on previous production performance assessed statistically by attributes or variables.

Weathering Resistance - is a measure of the ability of the concrete paving flag to withstand weathering where specific conditions exist such as frequent contact of the surfaces with de-icing salt under frost conditions. It can be assessed under laboratory conditions by measuring the amount of spalled material from a surface under the cycle of freezing/thawing action using a de-icing salt solution. Or, if no de-icing salt is used, then the measurement of the porosity by measuring the water absorption of the flag should be used.

Abrasion Resistance - is a measure of the ability of the concrete paving flag to withstand erosion caused by trafficking in service. It is assessed under laboratory conditions by abrading the surface of the flag with a flow of a hard abrasive material while applying a known force. The resulting loss of material from the flag surface is measured by determining the abraded width.

Slip/Skid Resistance - is a measure of the ability of the concrete flag paving laid in service to withstand slipping for pedestrians and skidding for vehicles. The unpolished slip resistance value is determined using a "standard rubber" material attached to a Pendulum Friction Tester and tested under wet conditions. To determine the polished paver value (PPV) for all paving units, BS 7932: 1998 should be used. This standard has formed the basis for the European Test Method DD ENV 12633:2003. The test method measures the slip resistance of the flag paving after it has been synthetically trafficked (or polished) under laboratory conditions to replicate the performance of flag paving during its life under traffic conditions. For more details please contact Interpave.

Domestic paving

Flags currently manufactured for use in domestic situations are not included in the scope of British and European standards. However, many are manufactured to the requirements of current standards but are outside the dimensions required.