

BS EN 1342:2012



BSI Standards Publication

# Setts of natural stone for external paving — Requirements and test methods

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**National foreword**

This British Standard is the UK implementation of EN 1342:2012. It supersedes BS EN 1342:2001 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/507, Paving units and kerbs.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English Version

**Setts of natural stone for external paving - Requirements and test methods**Pavés de pierre naturelle pour le pavage extérieur -  
Exigences et méthodes d'essaiPflastersteine aus Naturstein für Außenbereiche -  
Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 6 October 2012.

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## Foreword

This document (EN 1342:2012) has been prepared by Technical Committee CEN/TC 178 "Paving units and kerbs", the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2013, and conflicting national standards shall be withdrawn at the latest by August 2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1342:2001.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

The following changes have been made in this new edition:

- a) Where possible the requirements refer to separate test methods prepared by CEN/TC 246, "Natural stones". The change was made to allow those placing the products on the market to use the same test results for a number of products.
- b) The values to be declared have been clarified and where applicable the declared values are now 'lower expected values'.

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## 1 Scope

This European Standard specifies the performance requirements and the corresponding test methods for all natural stone setts used for external paving and road finishes.

External paving use includes all pavements typical of road works, such as pedestrian and trafficked areas, outdoor squares and similar to be used in an outdoor condition that are subject to the weathering agents, such as temperature changes, rain, ice, wind, etc.

This European Standard provides also for the evaluation of conformity and for marking of the natural stone setts.

This European Standard also covers characteristics that are of importance to the trade.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1926, *Natural stone test methods — Determination of uniaxial compressive strength*

EN 1936, *Natural stone test methods — Determination of real density and apparent density, and of total and open porosity*

EN 12371, *Natural stone test methods — Determination of frost resistance*

EN 12407, *Natural stone test methods — Petrographic examination*

EN 12440, *Natural stone — Denomination criteria*

EN 13373:2003, *Natural stone test methods — Determination of geometric characteristics on units*

EN 13755, *Natural stone test methods — Determination of water absorption at atmospheric pressure*

EN 14157, *Natural stone test methods — Determination of the abrasion resistance*

EN 14231, *Natural stone test methods — Determination of the slip resistance by means of the pendulum tester*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

### 3.1

#### **sett**

unit of natural stone obtained by cutting or splitting used as a paving material, in which the working width does not exceed two times the thickness, and the length does not exceed two times the width

Note 1 to entry: The minimum working thickness is 40 mm.

**3.2**

**work dimension**

dimension of a sett specified for its manufacture to which the actual dimension should conform within specified permissible tolerances

**3.3**

**actual dimension**

dimension of a sett as measured

**3.4**

**overall length**

L

longer side of the rectangle with the smallest length able to enclose the sett

**3.5**

**overall width**

W

shorter side of the rectangle with the smallest area able to enclose the sett

**3.6**

**thickness**

T

distance between the upper face and the bedface of the sett

**3.7**

**upper face**

surface of a sett intended to be seen when in use

**3.8**

**bed face**

surface of a sett intended to be in contact with the bedding material when in use

**3.9**

**side face**

surface of a sett intended to be vertical when in use

**3.10**

**textured**

sett with a surface finish produced by secondary processing, from a saw or hewn surface

**3.11**

**fine textured**

surface finish with a maximum difference of 1,0 mm between peaks and depressions (for example polished, honed or sawn with a diamond disc or blade)

**3.12**

**coarse textured**

surface finish with more than 1,0 mm difference between peaks and depressions (for example dolly pointed, shot blasted or flame textured)

**3.13**

**hewn**

sett with a rough surface finish, for example a riven or split face

**3.14**

**lower expected value**

$E_L$

value which corresponds to the 5 %-quantile of a logarithmic normal distribution for a confidence level of 75 %



### 3.15

#### higher expected value

$E_H$

value which corresponds to the 95 %-quantile of a logarithmic normal distribution for a confidence level of 75 %

## 4 Requirements

### 4.1 General

#### 4.1.1 Denomination

The denomination shall always be declared in accordance with EN 12440 (meaning traditional name, petrological family, typical colour and place of origin as precisely as possible for example geo coordinates).

#### 4.1.2 Alteration of physical properties of the natural stone

If during production the natural stone setts have been subjected to a treatment process that physically alters the properties of the stone (for example chemical treatment, patching, or filling or other similar products for natural holes, faults or cracks) then the use of such a treatment shall be stated.

In addition, specimens for testing shall be representative of the product and any processes that the stone is subjected to.

### 4.2 Dimensions

#### 4.2.1 General

The work dimensions of the setts shall be declared.

Dimensions between faces shall be stated as a unitary nominal dimension or as a range of nominal minimum-maximum dimensions, e.g. (100 - 200) mm.

Dimensions of each shall be measured in accordance with EN 13373.

#### 4.2.2 Tolerances

##### 4.2.2.1 Plan dimensions and thickness

Plan dimensions and thickness of a sett shall be measured in accordance with EN 13373:2003, 5.2 and 5.3 and the deviations from the declared plan dimensions and thickness shall conform to tolerances given in Table 1.

Different deviations may be declared for plan dimensions and thickness.

Unless stated otherwise, a consignment of setts shall be intended to be laid in rectilinear patterns and all setts within a consignment, when measured in accordance with EN 13373:2003, 5.4, shall conform with the tolerances from the plan and thickness dimensions described in Table 1.

Table 1 — Tolerances on nominal plan dimensions and thickness

Nominal dimension		Class 0	Class 1	Class 2
≤ 60 mm	Textured	No requirements	± 7 mm	± 5 mm
	Hewn		± 10 mm	± 7 mm
> 60 mm ≤ 120 mm	Textured		± 10 mm	± 5 mm
	Hewn		± 15 mm	± 10 mm
> 120 mm	Textured		± 10 mm	± 7 mm
	Hewn		± 15 mm	± 12 mm

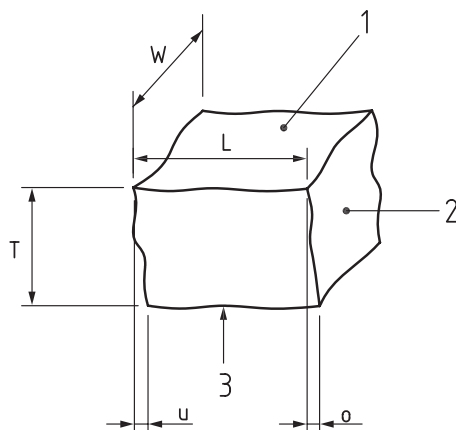
Where a consignment of setts is specifically designated for being laid in radial or arch patterns then it may include a proportion of the total agreed by the specifier, that are bigger, smaller and trapezoidal setts not varying from the dimensions allowed by the stated tolerance by more than 10 %.

When dimensions between faces are declared as a range of nominal minimum – maximum thickness, the deviation shall be declared on the limits of the range. This is particularly applicable to hewn setts.

In all cases the thickness of the setts shall be observed.

#### 4.2.2.2 Undercut of sides

When measured in accordance with EN 13373:2003, 5.5, deviations of the undercut of a side shall not exceed the tolerances given in Table 2 with respect to the perpendicularity of the upper face (see Figure 1).



#### Key

- 1 = upper face
- 2 = side face
- 3 = bed face
- u = undercut of side face
- o = overcut of side face
- T = thickness
- W = overall width

Figure 1 — Tolerances on under and overcut faces

Table 2 — Tolerances on the undercut of sides

Nominal Dimension	Class 0	Class 1		Class 2	
		Maximum one side	Maximum sum	Maximum one side	Maximum sum
≤60 mm	No requirement	10 mm	20 mm	5 mm	10 mm
>60 mm ≤ 120 mm		15 mm	25 mm	10 mm	15 mm
>120 mm		25 mm	30 mm	15 mm	20 mm

#### 4.2.2.3 Hewn and coarse textured face irregularities

When measured in accordance with EN 13373:2003, 5.3, deviations of upper and side face cavity and protrusions shall not exceed the tolerances given in Table 3.

Table 3 — Tolerances on hewn and coarse textured face irregularities

	Class 0	Class 1	Class 2
Hewn	No Requirements	± 10 mm	± 5 mm
Coarse Textured		± 5 mm	± 3 mm

### 4.3 Freeze/thaw resistance

#### 4.3.1 Freeze- thaw under normal conditions

When the setts are intended to be used in areas subjected to freeze and thaw freeze-thaw requirements, the freeze/thaw resistance shall be determined using the test method in EN 12371. The results shall be expressed and declared as the mean compressive strength before and after 56 cycles of freeze/thaw (technological test).

The frost damage, which a natural stone may suffer when installed, depends on the climatic conditions of the place of use, the relative position in the works (which determines the degree of saturation) and the predicted service life of the works. This number of cycles is appropriate to a specific project and may help to provide guidance for the interpretation of the test results. The selection of the stones is subjected to climatic zones and/or to codes of practice.

For some specific uses, for example in locations that are subject to temperatures below - 12 °C, it may be appropriate to use different test cycles, e.g. freezing in water, freezing to a lower temperature, or testing specimens embedded in non-porous siliceous granules or a different number of cycles, e.g. the identification test as defined in EN 12371.

#### 4.3.2 Freeze-thaw in the presence of de-icing salts

Where required, freeze-thaw resistance with the effect of de-icing salts shall be determined and declared. In the absence of a European test method, freeze-thaw resistance with the effect of de-icing salts shall be determined and declared according to national provisions valid in the place of use of the product.

### 4.4 Breaking strength — Compressive strength

The compressive strength shall be determined using the test method in EN 1926 and the lower expected value ( $E_L$ ) shall be declared.

### 4.5 Abrasion resistance

The abrasion resistance shall be determined using the test method in EN 14157 and the higher expected value ( $E_H$ ) shall be declared.

## 4.6 Slip and skid resistance

### 4.6.1 Slip resistance

The slip resistance shall be declared when the intended use of the setts is subject to regulatory requirements, or upon request, and, in any case, when the roughness of the surface, measured following EN 13373:2003, 5.3, is less than 1,0 mm.

The slip resistance shall be determined and the results expressed in accordance with the test procedure for both wet conditions in EN 14231.

Coarse textured and hewn setts are assumed to give satisfactory slip resistance. They cannot be reliably tested.

It should also be noted that the performance of setts when laid may have a different slip resistance value to that determined on individual setts or test specimens.

NOTE 1 The unpolished slip resistance value relates to setts as manufactured and helps to ensure adequate slip/skid resistance on installation.

NOTE 2 Experience has indicated that a USRV measurement made using a wide slider / full swing on a pendulum in wet conditions that is greater than 35 can usually be considered acceptable for surfaces that are horizontal or sloping at less than 6 %.

### 4.6.2 Skid resistance

Where required, skid resistance shall be declared.

In the absence of a European test method, skid resistance may be determined and declared according to national provisions valid in the place of use of the product.

### 4.6.3 Durability of slip or skid resistance

When required, durability of slip and skid resistance shall be declared.

In the absence of European test methods, durability of slip and skid resistance shall be determined and declared according to national provisions valid in the place of use of the product.

## 4.7 Appearance

### 4.7.1 General

The colour, veining, texture, etc. of the stone shall be identified visually, typically by a reference sample of the same stone suitable for providing a general description of visual appearance.

A reference sample shall be provided by the supplier in accordance with 4.7.2.

### 4.7.2 Reference sample, visual inspection and acceptance criteria

A reference sample shall be an adequate number of setts of natural stone of sufficient size to indicate the general appearance of the finished work. They shall indicate the range of appearance regarding the colouring, the vein pattern, the physical structure and the surface finish. In particular the reference sample shall show specific characteristics of the stone, such as specific holes, glass seams, spots, crystalline veins and rusty spots.

The reference samples does not imply strict uniformity between the sample itself and the actual supply; natural variations may always occur.

If the processing of the stone involves the use of patching, fillers or other similar products for natural holes, faults or cracks, then the reference sample shall similarly display the impact of the same on the finished surface.

All the characteristics as shown by the reference sample shall be considered typical of the stone and not as flaws, therefore they shall not become a reason for rejection, unless their concentration becomes excessive and the typical character of the stone is lost.

The name and address of the manufacturer or the supplier of the stone, as well as the denomination of the stone in accordance with 4.1 and/or information on the treatment in accordance with 4.1.2, above, shall be indicated on the reference sample.

Any comparison between production sample and reference sample shall be carried out by placing the reference sample against the production samples and viewing them at a distance of about 2 m under normal daylight conditions and recording any visible differences in the characteristics of the stones.

#### **4.8 Water absorption**

Where required the water absorption shall be determined using the test method in EN 13755 and the higher expected value ( $E_H$ ) shall be declared.

#### **4.9 Apparent density and open porosity**

The apparent density and open porosity shall be determined using the test method in EN 1936 and the mean values declared.

#### **4.10 Petrographic description**

A petrographic description shall be provided, including a petrographic name, of the stone type, in accordance with EN 12407.

#### **4.11 Dangerous substances**

National regulations on dangerous substances may require verification and declaration on release, and sometimes content, when construction products covered by this standard are placed on those markets.

In the absence of European harmonised test methods, verification and declaration on release/content should be done taking into account national provisions in the place of use.

NOTE An informative database covering European and national provisions on dangerous substances is available at the Construction web site on EUROPA accessed through: <http://ec.europa.eu/enterprise/construction/cpd-ds/>.

### **5 Evaluation of conformity**

#### **5.1 General**

The conformity of the product (i.e. natural stone setts) to the requirements of this standard and with the declared performances (e.g. values, classes) for the characteristics relevant for the intended use of the product, shall be demonstrated by:

- a) initial type testing,
- b) factory production control by the manufacturer, including product assessment.

For the purposes of testing, the products may be grouped into product families, where it is considered that the results for one or more characteristics from any product within the family are representative for the same characteristics for all products within that family.

A product may be in more than one family for different characteristics.

## 5.2 Initial type testing (ITT) and Type testing (TT)

Initial type testing and type tests, if any, shall be performed for all characteristics included in this standard for which the performances are to be declared:

- when a new product type is developed (and before it is placed on the market) or
- at the beginning of a new or modified method of production where this may affect the declared performances.

The declared performances should be representative of the current production, e.g. the lower expected value in normal production.

Whenever a significant change occurs in the raw material or the production process, which could change any of the declared performance of the product, this shall be considered as a new product and any of such characteristic shall be re-assessed for a new declared performance.

Reference to the test method standards should be made to allow the selection of a suitable representative sample.

All essential characteristics, given in bold in Table 4, for which the manufacturer declares performances, are subject to Initial Type Testing.

In addition, the need to perform Type Tests applies to all other characteristics included in Table 4, when the manufacturer claims compliance, unless the standard gives provisions (e.g. use of previously existing data, CWFT and conventionally accepted performance) for declaring performances without performing tests.

Initial type testing of the product, as given in Table 4, shall be carried out on:

- first application of this document or at the beginning of the production with a new type of stone;
- when significant variations occur in the material, determined visually or by significant changes in FPC results.

Tests previously performed in accordance with the provisions of this document (i.e. same type of stone, same characteristic measured with the same test method, same sampling procedure and system of attestation of conformity) may be taken into account for the purpose of ITT.

**Table 4 — Characteristics of natural stone setts for paving for initial type testing and type tests**

Requirements Subclause	Characteristics (properties)	Test method in accordance with:	Expression of results
4.4	Breaking strength - Compressive strength	EN 1926	Declared value
4.3.1	Durability of compressive strength against freeze/thaw resistance – normal conditions	EN 12371	2 declared values
4.3.2	Durability of compressive strength against freeze-thaw resistance– de-icing salts	See 4.3.2	Declared value(s)
4.6.1	Slipperiness - Slip resistance	EN 14231	Declared value
4.6.2	Skid resistance	See 4.6.2	Declared value
4.6.3	Durability of slip resistance	See 4.6.3	Declared value
4.6.3	Durability of skid resistance		Declared value
4.2.2.1	Tolerances – Plan dimensions	EN 13373:2003, 5.2	Tables 1 and 2
4.2.2.1	Tolerances – Thickness	EN 13373:2003, 5.2	Table 3
4.2.2.2	Tolerances – Face irregularities	EN 13373:2003, 5.3	4.2.2.3
4.2.2.2	Tolerances - Undercuts	EN 13373:2003, 5.5	Table 4
4.5	Abrasion resistance		Declared value
4.8	Water absorption	EN 13755	Declared value
4.9	Apparent density and open porosity	EN 1936	Declared values
4.10	Petrographic description	EN 12407	Declared description
4.11	Dangerous substances	See 4.11	Declared value or class, as relevant

Assessment of compliance should be undertaken using the same method (identification or technological).

The declared performances may be supported by a test report supplied with the block or raw slabs provided that test have been performed according to the requirements and test methods of this European Standard.

The results of the selected tests shall be expressed as referred to in Clause 4.

### 5.3 Factory Production Control

**5.3.1** A factory production control system (FPC) shall be established and documented. The factory production control system shall consist of procedures for the internal control of production. The results of the tests carried out during FPC shall demonstrate that products placed on the market conform to this document and with the declared performances of the product's characteristics, established under ITT in accordance with Clause 4.

In cases when the processing of the natural stone is likely to change any of these declared performances, relative to the initial stone (e.g. as a consequence of the type of processing or because the physical properties

have been modified by impregnation, use of patching, fillers or other similar products for natural holes, faults, cracks and similar), then this shall be considered within FPC as requested by this document.

**5.3.2** The factory production control shall consist of regular inspection checks and tests and the utilisation of the results to control incoming materials (i.e. stone), equipment, the production process and the product.

When alternative tests to the reference tests are used for the test procedure, their correlation to the reference test shall be determined and available for inspection.

All test equipment shall be calibrated and the procedure, frequency and acceptance criteria stated.

**5.3.3** A sampling plan for the testing of products shall be defined and the results shall be recorded and available for inspection.

NOTE Guidance on sampling is given in Annex B.

**5.3.4** The stock control of the products, together with procedures for dealing with non-conforming products, shall be detailed.

**5.3.5** Manufacturers' records shall include at least the following:

- a) identification of the product tested;
- b) information on sampling:
  - 1) place and date of sampling;
  - 2) identification of the production lot sampled;
  - 3) frequencies of sampling;
  - 4) size and number of samples;
- c) test methods applied;
- d) test and inspection results;
- e) calibration records of apparatus.

**5.3.6** Any testing procedure (reference or alternative tests) adopted for the FPC shall include the relevant acceptance criteria. In case of non compliance, a specific action plan shall be defined as part of the FPC. As a rule this plan shall include the repetition of the FPC procedure on an extended quantity of specimens or of products. In cases when the results of these tests do not conform with the declared performances, final assessment of compliance shall be provided adopting the same test method (identification or technological) as used in determination of declared performances and making reference to Table 5.



Table 5 — Characteristics of natural stone setts for paving for factory production control

Requirements Subclause	Characteristics (properties)	Verification during production	Test method in accordance with:	Minimum testing frequency (see 1) and 3) below)	Acceptance criteria
4.2.1	Dimensions	Continuous verification in accordance with manufacturer's factory production control (see 2) below)	EN 13373	Each lot	Within the tolerance range <sup>a</sup>
4.2.2.1	Tolerances – Plan dimensions		EN 13373:2003, 5.2		
4.2.2.2	Tolerances – Thickness		EN 13373:2003, 5.2		
4.2.2.3	Tolerances – Face irregularities		EN 13373:2003, 5.3		
	Tolerances – Undercuts		EN 13373:2003, 5.5		
4.4	Compressive strength		EN 1926	Every 2 years <sup>b</sup>	> 80 % of the individual results >declared value
4.8	Water absorption		EN 13755		> 80 % of the individual results >declared value
4.9	Apparent density and open porosity		EN 1936		No requirement
4.3.1	Freeze/thaw resistance – normal conditions		EN 12371	Every 10 years <sup>b</sup>	Within the tolerance range <sup>a</sup> for 2 declared values
4.3.2	Freeze/thaw resistance – de-icing salts		See 4.3.2		Within the tolerance range <sup>a</sup> for declared value(s)
4.5	Abrasion resistance	EN 14157	> 80 % of the individual results <declared value		
4.6.1	Slip resistance	EN 14231		≥ declared value	
4.6.2	Skid resistance	See 4.6.2		≥ declared value	
4.6.3	Durability of slip resistance	See 4.6.3		≥ declared value	
	Durability of skid resistance			≥ declared value	
4.10	Petrographic description	EN 12407	Complies with declared description		
4.11	Dangerous substances	See 4.11	Individual results complying with		

					declared value or class
1)	The testing frequency should be established so that it represents a means to guarantee constancy of product's performance and a reliable declaration for both the users and the manufacturer.				
2)	The control testing of each of these characteristics is to be carried out using the most appropriate indirect test/check method(s), which is to be detailed in the manufacturer's quality control plan for the parameter(s), set up under ITT, if any, and related to the performance of such characteristic (e.g. incoming materials, composition).				
3)	In cases when the processing of the stone is likely to change the characteristics of the finished product relative to the initial material (e.g. as a consequence of the type of processing or because the use of patching, fillers or other similar products for natural holes, faults, cracks and similar), then this has to be considered in determining the frequency of testing.				
<sup>a</sup>	Usually referred to in the requirements subclause.				
<sup>b</sup>	These represent the upper limits of the testing frequency (see 1)).				

## 6 Marking, labelling and packaging

As a minimum of identification, each consignment of natural stone setts shall carry the following indications:

- a) the denomination of the natural stone in accordance with EN 12440 (see 4.1.1);
- b) quantities and dimensions of the setts.

Additional information is advisable:

- c) the mass of the setts;
- d) dimensions and mass of packaging.

These indications shall be given on labels, packaging or on accompanying documents.

An identification system may be used in order to identify individual setts; in such a case individual stones shall be clearly marked accordingly. Marking will usually consist of alphanumeric codes and symbols (e.g. to define proper orientation at installation).

The setts shall be clean before packaging.

Packaging shall allow adequate, solid and durable protection for packed stones, both during transport and during handling and storage. Movement of setts inside the packaging shall be prevented by securing individual pieces.

Packaging shall be of appropriate mass and size in consideration of transportation and lifting facilities; the top and bottom of the packaging as well as stacking possibility shall be indicated.

Safety against contamination, caused by packaging materials, in wet or dry conditions, shall be ensured. Packaging and tapes which are likely to stain shall not be used. Sensitive polished surfaces of the setts shall be protected by appropriate means (e.g. plastic foil). Products with caustic properties shall not be used.

## **Annex A** (informative)

### **Guidance on sampling**

#### **A.1 General**

The annex specifies guidelines for methods for obtaining samples of natural stone from quarries, plants and construction works. Sampling from buildings may be necessary if the delivered natural stone slab is already applied in construction works.

The aim of sampling is to obtain a bulk sample that is representative of the average properties of the batch and of its variability.

The methods described are based on manual procedures. The methods described are limited to building and civil engineering purposes.

It is important that samplers are accordingly trained in the application of the methods set out in this European Standard.

In case of dispute or if tests are to be done by more than one organisation, all interested parties should have the opportunity to observe the sampling and should agree upon the number of sampling increments to be taken.

#### **A.2 Principles of sampling**

Proper and careful sampling and sample transport is a prerequisite for an analysis to expect reliable results. An adequate number of samples have to be taken to obtain a good estimation of the natural heterogeneity of the batch.

The sampler shall be informed of the aim of the sampling.

#### **A.3 Taking bulk samples**

The number and sizes of samples shall depend on the test methods for which they are taken. The number and shapes of specimens required are given in the relevant test methods.

#### **A.4 Preparing a sampling plan**

A sampling plan shall be prepared, prior to sampling, taking into account the following:

- type of natural stone (following EN 12440 and EN 12670);
- aim of the sampling, including a list of the properties to be tested;
- identification of sampling points;
- orientation of samples relative to resource or bed, etc;

- approximate size of samples;
- number of samples;
- sampling apparatus to be used;
- methods of sampling;
- marking, packaging and dispatch of the samples.

## **A.5 Sampling apparatus**

Any suitable cutting equipment for natural stone may be used for sampling. In addition, drills, which are suitable for taking drill cores, may be used.

## **A.6 Sampling methods**

### **A.6.1 General**

The sampling methods will inevitably involve the samplers working at a quarry, plant or building. Regulations for safety and ergonomics shall be followed.

### **A.6.2 Sampling from quarries**

#### **A.6.2.1 General**

The main objective of sampling from such deposits is to establish, where possible, the average, the range of variations and the differences in the structure and properties of the rock, taking account of the fabric and geological structure and the anticipated mining conditions.

#### **A.6.2.2 Sampling of solid rock**

##### **a) Identification of anisotropy and orientation of samples**

If the exploratory work reveals a pronounced fabric or geological structure which is not necessarily visible at the sample scale (e.g. stratification, massive bedding, lamination, cleavage or rift), the sample shall be marked accordingly.

##### **b) Sampling for petrographic analysis**

For petrographic analysis, hand specimens shall be taken from all distinct types and varieties which characterise the rock in terms of mineral composition, fabric and geological structure.

Samples from drilling (cores and pieces) may also be used.

In addition to samples of fresh material, samples shall also be taken to illustrate the effects of weathering.

##### **c) Sampling for physical testing**

For physical testing, sample blocks and hand specimens shall be used as samples, their number and location depending on the results of the petrographic analysis and the test methods required.

The sample blocks shall measure approximately 0,40 m x 0,25 m x 0,25 m, or more where a coarse-grained and/or a large-pored rock is to be sampled.

The sample blocks shall be broken as carefully as possible. It is recommended that they are taken from larger natural stones which have been least affected by blasting. Care shall be taken to ensure that neither the sample blocks nor the hand specimens show any hairline cracks resulting from the removal process.

Samples may also be cut from rough blocks, slabs or dimension stones, the number and size of samples depending on the particular test method.

### **A.6.3 Sampling from production units and consignments**

A representative sample of adequate size and characteristic of the rock in terms of mineral composition, fabric and geological structure, shall be taken from the material to be tested (e.g. setts, dimension stones), taking into account the intended use of the material.

### **A.6.4 Sampling from construction works**

Sampling points should be selected according to the rules for obtaining a representative sample taking into consideration any differences in properties visible to the naked eye. Where necessary, taking a single slab to assess the mechanical properties of slabs, should be sufficient.

The location of the sample in the construction works shall be reported.

## **A.7 Marking, packaging and dispatch of the samples**

The samples or containers shall be clearly and durably marked. Marking shall include:

- a) unique code; or
- b) identification of the laboratory samples, place of sampling, date of sampling and denomination of the material.

The laboratory samples shall be packed and transported in such a way that they are protected from damage.

## **A.8 Sampling report**

**A.8.1** The sampler shall prepare a sampling report for each laboratory sample or for each group of laboratory samples from a single source. The sampling report shall refer to this document and state:

- a) sampling report identification (serial number);
- b) laboratory sample identification mark(s);
- c) date and place of sampling;
- d) sampling point or identification of the batch sampled;
- e) reference to the sampling plan prepared according to A.4;
- f) name of the sampler(s).

**A.8.2** Depending on the circumstances, other information might be relevant. Table A.1 shows an example of a comprehensive sampling report.

**Table A.1 — Example of a sampling report**

Sampling report identification (serial n°):	
Laboratory sample identification mark:	no. of package

Description of the natural stone and sampling places

Name of the quarry or production plant or building:
Name of producer:
Origin of batch:
Purpose for which the natural stone is to be used:
Location of sampling point(s):
Identification of the batch:
Size of the batch:
Other comments (e. g. warnings, if appropriate):

Description of the sampling method

Date and time of sampling:
Reference to sampling plan used:
Sampling procedure (drilling, cutting, etc.):
Purpose of the sampling:

Samples

No. and dimensions of samples:
Other comments:
Dispatch of the samples:
Sampler(s) (print name):

Contract details

Contract identification:
Name and address of party requesting the sampling:..... .....
Name of person(s) present at sampling:..... .....
Signatures:..... ..... .....

## Annex B (informative)

### Example of calculation of Lower Expected Value

#### B.1 Scope

This annex establishes a method for the lower expected value ( $E_L$ ).

#### B.2 Symbols and definitions

Measured values  $x_1, x_2, \dots, x_i \dots, x_n$

Number of measured values  $n$

Mean value  $\bar{x} = \frac{1}{n} \sum_i x_i$

Standard deviation  $s = \pm \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$

Coefficient of variation  $v = \frac{s}{\bar{x}}$  (for individual values)

Logarithmic mean  $\bar{x}_{\ln} = \frac{1}{n} \sum_i \ln x_i$

Logarithmic standard deviation  $s_{\ln} = \pm \sqrt{\frac{\sum (\ln x_i - \bar{x}_{\ln})^2}{n-1}}$

Maximum value Max

Minimum value Min

Lower expected value  $E = e^{(\bar{x}_{\ln} - (k_S \cdot s_{\ln}))}$  where  $k_S$  (quantile factor) is given in Table B.1

Quantile factor  $k_S$ ; see Table B.1

#### B.3 Calculation of Lower Expected Value

For the calculation of the lower expected value ( $E_L$ ) a logarithmic normal distribution is assumed. The lower expected value ( $E_L$ ) corresponds to the 5 % quantile of a logarithmic normal distribution for a confidence level of 75 %.

**Table B.1— Quantile factor ( $k_s$ ) in dependence on the number of measured values ( $n$ ) in correspondence to the 5 % quantile for a confidence level of 75 %**

$n$	$k_s$
3	3,15
4	2,68
5	2,46
6	2,34
7	2,25
8	2,19
9	2,14
10	2,10
15	1,99
20	1,93
30	1,87
40	1,83
50	1,81
$\infty$	1,64
Quantile factor ( $k_s$ ) dependent on the number of measured values ( $n$ ) in correspondence to the 5 % quantile for a confidence level of 75 %.	

The following examples should help to clarify the method:

EXAMPLE 1

Calculation of mean value, standard deviation, maximum value and minimum value of six measured values



**Table B.2 — Calculation of mean and standard deviation**

Measurement no	Measured value $x$
1	2 000
2	2 150
3	2 200
4	2 300
5	2 350
6	2 400
	-----
Mean value	2 333
Standard deviation	147
Maximum value	2 400
Minimum value	2 000

EXAMPLE 2

*Calculation of mean value, standard deviation, coefficient of variation and lower expected value of 10 measured values*

**Table B.3 — Calculation of lower expected value**

Measurement no	Measured value $x$	( $\ln x$ )
1	2 000	(7,60)
2	2 150	(7,67)
3	2 200	(7,70)
4	2 300	(7,74)
5	2 350	(7,76)
6	2 400	(7,78)
7	2 600	(7,86)
8	2 750	(7,92)
9	2 900	(7,97)
10	3 150	(8,06)
	-----	-----
Mean value	2 480	(7,807)
Standard deviation	363	(0,143)
Variation coefficient	0,15	

From Table B.1 for:  $n = 10$   $ks = 2,1$  and the Lower expected value 1 819

## **Annex ZA** (informative)

### **Clauses of this European Standard addressing the provisions of the EU Construction Products Directive**

#### **ZA.1 Scope and relevant characteristics**

This European Standard has been prepared under a Mandate M/119, as amended, given to CEN by the European Commission and the European Trade Association.

The clauses of this European Standard shown in this annex meet the requirements of the Mandate M/119, as amended, given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the natural stone setts covered by this annex for their intended uses indicated therein; reference shall be made to the information accompanying the CE marking.

This annex establishes the conditions for the CE marking of the construction products intended for the uses indicated in Table ZA.1 and shows the relevant clauses applicable.

This annex has the same scope as Clause 1 of this standard.

**Table ZA.1 — Scopes and relevant clauses**

<b>Construction products:</b> Setts of natural stone			
<b>Intended uses:</b> Paving units for external uses and road finishes			
<b>Essential characteristics</b>	<b>Requirement clauses in this standard</b>	<b>Levels and/or classes</b>	<b>Notes</b>
<b>RELEASE OF DANGEROUS SUBSTANCES</b>	4.11	-	as relevant
<b>BREAKING STRENGTH</b> , dealt with by:			
- <b>compressive strength</b>	4.4	-	tested for acc. to EN 1926 and declared as the lower expected value ( $E_L$ )(in MPa)
<b>SLIPPERINESS</b> <sup>a</sup> , dealt with by:			
- <b>slip resistance</b>	4.6.1	-	tested for acc. to EN 14231 and expressed/declared as the wet and dry USRV result
<b>SKID RESISTANCE</b> <sup>b</sup> , dealt with by:			
- <b>skid resistance</b>	4.6.2	-	declared according to national provisions valid in the place of use of the product
<b>DURABILITY OF BREAKING STRENGTH, OF SLIPPERINESS AND OF SKID RESISTANCE</b> , dealt with by:			
- <b>freeze/thaw resistance - general</b>	4.3.1	-	mean values of compressive strength before & after 56 freeze/ thaw cycles (technological test acc. to EN 12371) (in MPa)
- <b>freeze/thaw resistance – de-icing salts</b>	4.3.2		declared according to national provisions valid in the place of use of the product
- <b>polishing in use</b>	4.6.3		declared according to national provisions valid in the place of use of the product
<sup>a</sup> For the pedestrian circulation areas only.			
<sup>b</sup> For the vehicular circulation areas only.			

The requirement on a certain characteristic is not applicable in those Members States (MSs) where there are no regulatory requirements on that characteristic for the intended use of the product. In this case, manufacturers placing their products on the market of these MSs are not obliged to determine nor declare the performance of their products with regard to this characteristic and the option “No performance determined” (NPD) in the information accompanying the CE marking (see ZA.3) may be used.

## **ZA.2 Procedure for the attestation of conformity of setts of natural stone**

### **ZA.2.1 System of attestation of conformity**

The system of attestation of conformity of natural stone setts indicated in Table ZA.1, in accordance with the Decision of the Commission 97/808/EC of 1997-11-20 (see OJEC L331 of 1997-12-03), as amended firstly by 1999/453/EC of 1999-06-18 (see OJEC L178 of 1997- 07-14), secondly by 2001/596/EC of 2001-01-08 (see OJEC L209 of 2001-08-02) and thirdly by 2006/190/EC of 2006-03-01 (see OJEC L66 of 2006-03-08), as

given in Annex III of the Mandate M/119 for "Floorings", as amended, is shown in Table ZA.2 for the indicated intended uses and relevant level(s) or classes.

**Table ZA.2 — System of attestation of conformity**

Product(s)	Intended use(s)	Level(s) or classes(s)	Attestation of conformity system(s)
Rigid flooring products Paving units (with flat or tactile surface) including pavers; flags; kerbs; blocks; pavement lights; self finished decking of metal sheet; rigid floor tiles; slate; tiles; mosaics; quarry tiles; terrazzo tiles; expanded metal or grid floor decking; floor gratings.	For external uses and road finishes to cover external pedestrian and vehicular circulation areas	-	4 <sup>a</sup>
<sup>a</sup> System 4: See Directive 89/106/EEC (CPD) Annex III.2(ii), third possibility.			

The attestation of conformity of the setts of natural stone in Table ZA.1 shall be according to the evaluation of conformity procedures indicated in Table ZA.3 resulting from application of the clauses of this European Standard indicated therein.

**Table ZA.3 — Assignment of evaluation of conformity tasks for setts of natural stone under AoC system 4**

Tasks		Content of the task	Evaluation of conformity subclauses to apply
Tasks under the responsibility of the manufacturer	Factory production control (FPC)	Parameters related to characteristics of Table ZA.1, the performance of which are to be declared for the intended used	5.3
	Initial type testing by the manufacturer	Characteristics of Table ZA.1, the performance of which are to be declared for the intended used	5.2

### ZA.2.2 EC Declaration of conformity

When compliance with this annex is achieved, the manufacturer or his agent established in the EEA shall prepare and retain a declaration of conformity (i.e. EC Declaration of conformity), which authorises the affixing of the CE marking. This declaration shall include:

- name and address of the manufacturer or their authorised representative established in the EEA, and place of production;

NOTE 1 The manufacturer may also be the person responsible for placing the product onto the EEA market, if he takes responsibility for CE marking.

- description of the product (type, identification, use...), and a copy of the information accompanying in the CE marking;

NOTE 2 Where some of the information required for the Declaration is already given in the CE marking information, it does not need to be repeated.

- provisions to which the product conforms (e.g. Annex ZA of this EN);
- particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions, etc.);
- name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or of his authorised representative.

The above mentioned declaration shall be presented in the official language or languages of the Member State in which the product is intended to be used.

### ZA.3 CE marking and labelling

The manufacturer or his authorised representative established within the EEA is responsible for the affixing of the CE marking. The CE marking symbol shall be in accordance with Directive 93/68/EEC and shall be shown on the label attached to each sett of natural stone or, when this is not possible, on the packaging of these setts or in the commercial documents, accompanying the such packaging (e.g. a delivery note). The information could additionally be communicated by the mean of all other modern communication tools (such as e-mail and website).

The following information shall accompany the CE marking symbol:

- a) name or identifying mark of the manufacturer (see NOTE 1 in ZA.2.2);

NOTE 1 Registered address of the manufacturer may also be added.

- b) last two digits of the year in which the marking was affixed;
- c) reference to this European Standard and the year of its publication (i.e. EN 1342:2012);
- d) description of the product and its intended use:
  - 1) generic name: "natural stone setts",
  - 2) traditional name, petrological family, typical colour and place of origin,
  - 3) intended use: "for external pedestrian and/or vehicular circulation areas",
  - 4) surface treatment of the stone (if any);
- e) performance on the essential characteristics listed in Table ZA.1, which are to be declared for the relevant intended use, as classes or values, including "Pass" for pass/fail requirements (where necessary), or as "No performance determined" (i.e. NPD) for characteristic(s), where this is relevant, namely:
  - 1) release of dangerous substances: where relevant (see 4.11),
  - 2) breaking strength, dealt with by: compressive strength;
  - 3) slipperiness, dealt with by: slip resistance;

NOTE 2 For the pedestrian circulation areas only.

- 4) skid resistance, where required,

NOTE 3 For the vehicular circulation areas only.

- 5) durability of breaking strength, of slipperiness and of skid resistance, dealt with by:
- i) freeze/thaw resistance, measured as the mean compressive strength (in MPa) after 56 freeze/thaw cycles;
  - ii) freeze/thaw resistance with de-icing salts;
  - iii) polished slip or skid resistance declared in accordance with national provision.

The “No performance determined” (NPD) option may be used when and where the characteristic, for a given intended use, is not subject to regulatory requirements in the Member State of destination.

Figure ZA.1 contains an example of CE marking to be given on the packaging of setts of natural stone.

<b>CE</b>	
AnyCo Ltd. <b>12</b>	
<b>EN 1342:2012</b> Natural stone setts Gunnersbury Buff, Sandstone, Brown Chiswick, England  for external pedestrian and/or vehicular circulation areas	
<b>RELEASE OF DANGEROUS SUBSTANCES</b>	NPD
<b>BREAKING STRENGTH, as:</b>	
- <b>compressive strength</b> (EN 1926), as: (lower expected value)	97,2 MPa
<b>SLIPPERINESS, as:</b>	
- <b>slip resistance wet</b> (EN 14231):	45
<b>SKID RESISTANCE, as:</b>	
- <b>skid resistance according to MS method xx</b>	35
Skid resistance	NPD
<b>DURABILITY, as:</b>	
- <b>compressive strength against: freeze/thaw</b>	(97,2/90,0) MPa
<b>Freeze-thaw with de-icing salts</b>	89.0 MPa
- of slip resistance	NPD
- of skid resistance	NPD

CE-marking symbol given in Directive 93/68/EEC

Name or identifying mark of the manufacturer

NOTE Registered address of the manufacturer may also be added.

Last two digits of the year in which the marking was affixed

Number of European Standard and the year of its publication

Description of product and its intended use

Performances of the regulated essential characteristics, which are to be declared for the relevant intended use

Figure ZA.1 — Example of CE marking on a packaging of setts of natural stone

## Bibliography

- [1] EN 12670, *Natural stone — Terminology*





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