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Wall and floor tiling

Part 5. Code of practice for the design and installation of terrazzo tile and slab, natural stone and composition block floorings

(Formerly part of CP 202)

Carrelages et dallages
Partie 5. Code de bonne pratique pour la
conception et l'installation des carreaux et
dalles granito, et des dallages en pierre
naturelle et en ciment

Wand- und Bodenfliesen
Teil 5. Leitfaden für das Verlegen von
Terrazzofliesen und-platten, sowie von
Bodenbelägen aus Natursteinplatten und
Zusammensetzungen

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 Department of the Environment (Building Research Establishment)
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 Health and Safety Executive
 Institute of Clerks of Works of Great Britain Inc.
 Mortar Producers' Association Limited
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 National Federation of Terrazzo - Mosaic Specialists
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Foreword

This Part of BS 5385 has been prepared under the direction of the Elements and Components (of Diverse Materials) for Buildings Standards Policy Committee. It is the fifth in a series of Parts of BS 5385 dealing with the installation of wall and floor tiling, the others being:

- Part 1. Code of practice for the design and installation of internal ceramic wall tiling and mosaics in normal conditions
- Part 2. Code of practice for external ceramic wall tiling and mosaics
- Part 3. Code of practice for the design and installation of ceramic floor tiles and mosaics
- Part 4. Code of practice for ceramic tiling and mosaics in specific conditions

This Part of BS 5385 is a revision of those sections of CP 202 not superseded by Part 3, but asphalt tiles, concrete tiles and cast stone tiles have been omitted since they are no longer generally available. CP 202 : 1972 is now withdrawn.

The section on design has been enlarged and now includes recommendations for laying flooring units on timber and asphalt bases, and the bedding techniques for laying the flooring units have been revised. The section on composition block flooring is a new addition to the code.

Assessed capability. Users of this British Standard are advised to consider the desirability of assessment and registration of a supplier's quality systems against the appropriate Part of BS 5750 by a third party certification body.

Enquiries as to availability of third party certification schemes may be forwarded by BSI to the Association of Certification Bodies. If a third party certification scheme does not already exist, users should consider approaching an appropriate body from the list of Association members.

Compliance with a British Standard does not itself confer immunity from legal obligations

Section 1. General

1 Scope

This Part of BS 5385 gives recommendations for the design and installation of terrazzo tile and slab and natural stone internal and external floorings and for composition blocks as internal flooring. The recommendations for natural stone flooring are for units no greater than 40 mm in thickness and 0.3 m² in area.

The types of bedding methods that may be used and their suitability are given; also recommendations for the protection, cleaning and maintenance of the finished floor surface.

Reference is made to floorings bedded directly to a screed. For the design and construction of screeds reference should be made to BS 5385 : Part 3.

NOTE. The titles of the publications referred to in this code are listed on the inside back cover.

2 Definitions

For the purposes of this Part of BS 5385 the definitions given in BS 6100 apply. An illustration of some definitions is shown in figure 1.

3 Exchange of information and time schedules

NOTE. This clause deals with the exchange of information for the whole floor, including the flooring, bed, base and screed (if any).

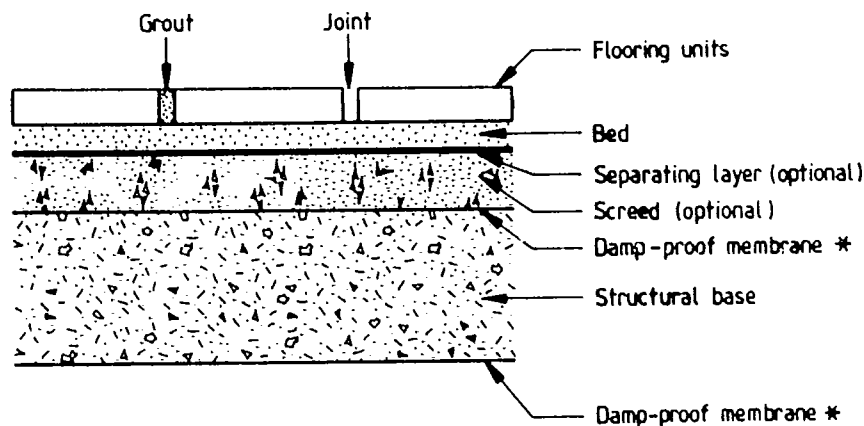
3.1 Exchange of information

The working drawings and specifications should be prepared in sufficient detail to afford proper

guidance in the preparation of estimates and the execution of the work.

At the tendering stage the following information should be provided.

- (a) *Site*. Location and means of access.
- (b) *Building*. Nature of building, assessment of type and density of traffic, particulars of corrosive or other potentially damaging conditions to which the installation may be subjected in service.
- (c) *Floor*. Structural floor, type of damp-proof membrane and its location within the floor construction, details of screed (including its surface regularity and the category of soundness required), curing and drying times, particulars of any floor warming installation, separating layer, movement joints, finished floor levels and falls with permissible deviations.
- (d) *Associated work*. Services embedded in or passing through the floor, skirtings and abutments, junctions with other adjacent flooring.
- (e) *Finishes*. Type of finishing product, bedding and jointing requirements and required surface plane.
- (f) *Contract*. Details, if the work is to be completed in any specific order or in sections.
- (g) *Health and safety*. Information on articles and substances for use during the work that are liable to be a health hazard.
- (h) *Time schedule*. A time schedule for the progress of the work.
- (i) *Testing*. Details of any compliance testing required.



* Alternative positions of damp-proof membrane.

Figure 1. Illustration of definitions

3.2 Provision of utilities, facilities and materials

3.2.1 General

To prevent misunderstanding, particularly at the tendering stage, it should be made clear whether or not the following will be provided and by whom:

- (a) adequate, clean, dry, storage (lock-up);
- (b) clean water supply adjacent to working areas;
- (c) adequate artificial lighting if required (see 3.2.2);
- (d) suitable scaffolding and staging, which should be in accordance with the requirements of the Building and Construction Regulations made under the Factories Act;
- (e) unloading and hoisting facilities;
- (f) electric power supply adjacent to working areas;
- (g) protection of work during and after fixing;
- (h) supplies of sand and cement in accordance with clauses 8 and 10.

3.2.2 Lighting on site

Lighting on site should be of the same type, direction and intensity as envisaged for the completed installation. If this condition is not met then the appearance of the finished floor might be different from that originally intended. This is a matter which should be appreciated by the specifier at the design stage.

3.3 Time schedules

The time schedule for the whole building work should be planned in the initial stages before operations are begun and, where possible, in consultation with those who will become responsible for carrying out the work of each of the trades concerned.

At least six weeks should be allowed for the structural floor to undergo initial drying shrinkage. If a screed is subsequently to be applied the screed should be left for at least a further three weeks. The only exception is where the flooring is to be fixed by the separating layer method. If the separating layer is directly over the structural floor the period of six weeks may be reduced.

The schedule should allow time for all cutting of holes and chases in the floor which is to receive the bedding.

Provision should be made for adjustment to the time schedule to allow for suspension of operations due to unfavourable weather or other conditions that jeopardize the success of the installation. Alternatively, consideration should be given to the possibility of providing a protective enclosure e.g. cocooning, to enable work to continue during unfavourable conditions.

Section 2. Materials

4 Transport and storage

The delivery of materials should be so arranged as to minimize handling. Adequate precautions should be taken to guard against the possibility of damage.

Products should be stored in a clean, dry area provided on the site and stacked in such a way that excessive handling, theft and damage is avoided.

5 Terrazzo tiles and slabs

Terrazzo tiles should comply with the requirements of BS 4131. These have a wear layer after grinding of at least 6 mm composed of graded marble chippings in Portland, white or tinted cement, on a base layer of fine concrete. They are machine ground after manufacture to expose the marble aggregate, and subsequently grouted.

Terrazzo precast slabs should comply with the requirements of BS 4357.

6 Natural stone

Natural stones suitable for flooring and their surface finishes are as follows:

- (a) granite: polished, eggshell, honed, fine rubbed, fine axed, dolly pointed, bush hammered, flame textured, air abrasive blasted or tooled.
- (b) marble, travertine and hard limestone: polished, eggshell, honed or gritted.
- (c) slate: fine rubbed, sawn, riven or flame textured.
- (d) quartzite: riven.
- (e) limestone: fine rubbed, sawn or tooled.
- (f) sandstone: fine rubbed, sawn, tooled or riven.

Natural stone flooring units are available in various sizes and thicknesses and those up to 0.3 m² in superficial areas and up to 40 mm thick may be fixed by the methods described in this code. Larger units may require different bedding procedures.

Slate should be either type A or B as described in clause 19 of BS 5642 : Part 2 : 1983 and should comply with the test requirements given in clause 23 of BS 5642 : Part 2 : 1983.

NOTE. Slate is classified as determined by the sulphuric acid immersion test; type A being suitable for areas of high air pollution whilst type B is suitable for areas of slight to moderate air pollution.

7 Composition block

Composition blocks are proprietary materials. A typical block is a mixture of cement, wood granules, mineral fillers, pigments and water, moulded under high pressure, cured and then saturated with linseed oil.

Composition blocks should be uniform throughout their thickness.

Most composition blocks are oblong, but square and other geometric shapes are available.

8 Cement

Unless otherwise stated the recommendations in this standard refer to cement complying with the requirements of BS 12 or BS 4027.

High alumina cement complying with the requirements of BS 915 may be used for particular purposes but it should not be mixed with other types of cement.

Cement should be stored under dry conditions and deliveries should be kept separate and used in order of delivery. Cement which contains air set lumps should not be used.

9 Lime

Lime should comply with the requirements of BS 890 and should be properly hydrated or slaked.

Lime may be measured either as putty prepared from quicklime, hydrated lime or by-product lime, or as dry hydrated lime; equal volumes of the lime putty and the dry hydrated lime are regarded for practical purposes as containing the same amount of lime.

10 Sands

Sands for cement : sand screeds and mortar beds should comply with grading C or M in table 5 of BS 882 : 1983.

NOTE. For sand for grouts see 17.2.

All stocks of sand should be protected from rain, frost and any form of contamination.

1

11 Water

Water should be fresh and clean. Sea water is not suitable. All containers used for storing or carrying water or for soaking flooring units should be clean.

12 Adhesives

The types used as beds for the flooring units in this code are:

- (a) *Cement-based adhesives* (hydraulically-hardening mortars);
- (b) *Organic-based adhesives* (dispersion, dispersion/cement, dissolved resin and reaction resin adhesives).

These are proprietary materials and those selected should comply with the requirements of BS 5980 and should be used in accordance with the manufacturer's instructions.

13 Admixtures

13.1 Admixtures for cement : sand mortar beds and screeds.

Admixtures for cement : sand mortar beds and screeds should comply with the appropriate Part of BS 5075.

13.2 Admixtures for adhesives

Admixtures for adhesives may be a polymer additive or some other liquid or powdered product incorporated to obtain greater adhesion, improved resilience or some degree of water repellence.

Admixtures should be used strictly in accordance with the manufacturers' instructions, and they should not be added to an adhesive unless approved by the manufacturer of the adhesive.

14 Reinforcement

Where light reinforcement is required in a screed or bed it should consist of steel fabric complying with the requirements of BS 4483 : 1985, reference D49 or D98.

Heavier reinforcement may be necessary in screeds constructed for structural purposes.

For reinforcement which does not have to provide a structural function, adequate tensile stresses can be absorbed by reinforcement of 2.5 mm or 5 mm diameter wire in mesh sizes of 50 mm × 50 mm, 100 mm × 100 mm, or 200 mm × 100 mm or 200 mm × 200 mm depending on screed or bed thickness.

15 Bonding agents

Bonding agents to improve the adhesion of screeds and/or beds to bases should be used in accordance with the manufacturer's instructions.

Manufacturers recommend particular grades and methods of application depending on the materials involved and service conditions, e.g. flooring in heavy duty areas, external applications.

16 Separating layers

16.1 Polyethylene film

A 500 gauge (0.125 mm) polyethylene film is recommended for most conditions.

16.2 Building paper

Building paper should be selected from those specified in BS 1521.

16.3 Bituminous felt

Bituminous felt should be selected from those specified in BS 747.

17 Grout materials

17.1 General

Grout materials should have good working characteristics, low shrinkage and good adhesion to the sides of the joints. Additional properties may assume special importance, for example, impermeability; resistance to water, heat, cleaning agents and chemical attack; resistance to mould growth and bacteria; resilience and compressibility. Flexibility of joint materials is given in table 2.

Proprietary grout materials should be stored and used in accordance with the particular manufacturer's instructions.

17.2 Sand for grout

For joints of nominal widths 6 mm and above, the sand for grout should comply with the grading limits of type B of table 1 of BS 1199 : 1976.

For joints of nominal widths 3 mm to 6 mm, sands should lie within the grading limits given in table 1. Sand complying with type G of table 1 of BS 1200 : 1976 may be suitable provided the fraction greater than 2.36 mm is screened off.

Table 1. Sands for grout for joints 3 mm to 6 mm wide	
BS 410 sieve	Percentage by mass passing BS sieves
mm	%
2.36	100
1.18	95 to 100
µm	
600	80 to 100
300	30 to 100
150	0 to 60
75	Not greater than 7

17.3 Pigments

Pigments should be inorganic and compatible with the grouting materials.

Pigments for cement : sand or cement-based grouts should comply with BS 1014.

NOTE. Coloured grouts cannot be expected to retain their pristine colour and appearance after wear.

18 Sealants and back-up materials for movement joints

Guidance on the selection and application of sealants is given in BS 6213. Suitable materials for movement joints in flooring are included in table 2. The selection of the most suitable materials will depend upon design considerations, (see section 3) and the manufacturer's advice should be taken into account.

Back-up materials should be compressible materials that will not force out the sealant when the joint closes. Suitable materials include cellular rubber and plastics such as cellular polyethylene, and cork boards. These materials are available in strip form.

Table 2. Flexibility of joint and sealant materials	
Materials	Flexibility
<i>Joint materials:</i>	
Portland cement mortar	Rigid
High-alumina cement mortar	Rigid
Rubber latex cement	Slightly resilient
Furane resin	Rigid and tough
Epoxide resin	Rigid and tough
<i>Sealant materials:</i>	
Bitumen compounds	Plastoelastic
Polysulphide	Very resilient
Silicone	Very resilient
Polyurethane	Very resilient
Epoxy/poly sulphide	Slightly resilient

19 Pre-formed strips

Pre-formed strips are suitable for use in stress-relieving or compression joints where a watertight seal is not critical. Materials such as cork, cork/rubber compounds, rubber/bitumen strips are suitable for use in light traffic areas. Materials such as PVC, or synthetic rubber strips are suitable for use in more heavily trafficked areas.

Section 3. Design

20 General

In solid and suspended floor constructions the stability and durability of the floor is dependent on the following:

- (a) the load it has to support;
- (b) the resistance it offers to the passage of liquid water or water vapour either from above or from below;
- (c) size changes produced by variations in moisture content and temperature within the floor and the attack of various corrosive agents, e.g. in chemical plants and industrial premises.

The floorings dealt with in this code could also be affected by the preceding factors, and the relative importance of these factors should therefore be assessed at the design stage so that due allowance may be made for their possible effect on the finished floor.

When possible, selection of the type of flooring including its bed should be made at the structural design stage so that the appropriate depth can be allowed between the base and the finished floor surface. The variety of thicknesses in and between flooring units and beds is considerable (see clause 29).

The designer should satisfy himself that the flooring proposed is suitable for the conditions contemplated. For example stones for flooring vary in their thickness according to the type of stone; the anticipated loading likely to occur and the size of the units used should also be considered.

21 Load considerations

When a floor is designed due allowance should be made for the ultimate weight it may have to support including the flooring installation, and reference should be made to BS 6399 : Part 1. Where an existing floor is to be covered by the materials given in this code of practice, a check should be made to ensure that the floor is sufficiently strong and rigid to accept the added load, particularly if the floor is of timber construction.

22 Bases

22.1 General

Concrete and cement : sand screeds are the most common bases over which the floorings dealt with in this code will be laid but other bases may be encountered, e.g. timber and asphalt. In

refurbishing work, it may sometimes be necessary to apply new finishes over old floors such as ceramic tiles, terrazzo, granolithic, stone etc.

Before the flooring is laid it is essential that:

- (a) the correct falls have been incorporated in the base, where required;
- (b) the base is free from contamination, loose areas and significant cracks;
- (c) the base is true to the specified plane (see also 33.4).

Bases suitable to receive flooring and the beds recommended in each case are summarized in table 3.

In new work it is necessary to specify the plane of the base in relation to that of the finished floor surface; usually this is possible only if the flooring units and the appropriate beds are selected at the design stage. The level of the base surface in relation to the finished floor surface should be such that the bed can be of the recommended thickness uniformly throughout the installation. An exception can be made when using a semi-dry mix bed as this can be applied in varying thicknesses, subject to the minimum of 40 mm, to overcome irregularities and to form falls. The recommended maximum and minimum final thicknesses of beds and their suitability under different floorings are given in table 4.

In refurbishing work the new floor surface may be higher than the original and the effect on existing features such as channels, outlets, skirtings, doorways etc. should be considered.

Where a separating layer is to be interposed between the base and the bed it is important that the base is accurately formed and has a true and smooth surface to enable the bed to slide freely over the base in the event of differential movement.

22.2 Concrete

22.2.1 Surface finish

When floor units are bedded directly to a concrete base without a screed, the concrete should be struck off level with a straightedge and the surface texture closed. When a bonded bed is required laitance should be removed by mechanical means. To receive a cement : sand bonded bed, the prepared concrete surface should be wetted down for several hours prior to the application of the bed. When a separating layer is to be interposed between the bed and a concrete base, the surface of the latter should be free of ridges or steps that would impair the sliding action between the two elements.



22.2.2 Tolerances on levels and surface regularity

Tolerances on levels and surface regularity are given in C.1.7 of Part 3 of BS 5385 : 1989

22.2.3 Elimination of construction moisture

Structural concrete should have been subjected to continuous air drying after the end of curing for at least 6 weeks before either a screed or bed is applied. The same allowance should be made for concrete with an integral screed surface. A longer period may be necessary in wet weather.

22.3 Screeds

A screed is often used as an intermediate layer between the structural base and bed to provide a true and even surface on which to apply a finish. Recommendations for the design, and laying of screeds is given in appendix C of Part 3 of BS 5385 : 1989.

22.4 Timber bases

NOTE. See clause 21 for load considerations.

New timber bases should be designed not merely to carry the additional dead load but also to provide a stiff floor. Noggings should be fixed between joists. The limit of deflection permitted in BS 5268 : Part 2 may be too great to avoid damage to a rigid finish and its bed.

Existing timber bases should be carefully examined to ensure that they can carry the additional dead load without excessive deflection. Consideration should be given to removing existing boards, stiffening the floor with noggings and proceeding as for new timber bases. Alternatively the required rigidity may be achieved by fixing exterior grade plywood over existing boards. It should also be established that ventilation is adequate and that effective damp-proof courses are correctly located. Timber floors of faulty construction have often

Table 3. Suitability of flooring beds for different bases

NOTE. S = Suitable, U = Unsuitable, C = Confirm suitability with manufacturer.

Base	Cement : sand, mortar and cement : lime : sand mortar		Cement : sand, semi-dry mix		Adhesives
	Bonded	Unbonded ¹⁾	Bonded	Unbonded ¹⁾	
New concrete (less than 6 weeks old)					
New screed (less than 3 weeks old)	U	S	U	S	U
Mature concrete					
Mature screed	S	S	S	S	S
Screed over suspended floor or underfloor heating	U	S	U	S	C
<i>Suspended in situ concrete</i>					
Rigid and new (less than 6 weeks old)	U	S	U	S	U
Rigid and mature	S	S	S	S	S
With significant deflection	U	S	U	S	C
Timber	U	U	U	U	C
Asphalt	U	S	U	S	C
<i>Existing hard floor finishes after preparation</i>					
Terrazzo	S	S	U	S	C
Unglazed ceramic tile	S	S	S	S	S
Glazed ceramic tile	S	S	U	S	C
Granolithic topping	S	S	S	S	S
Natural stone	S	S	S	S	S

¹⁾ Unbonded beds are unsuitable for heavy traffic conditions but see 23.2.