British Standard

BRITISH STANDARD

BS 4721:1981

Reprinted, incorporating Amendments Nos. 1 and 2

CONFIRMED
JUNE 1986

Specification for

Ready-mixed building mortars

UDC 691.53:666.971.052

Cooperating organizations

The Cement Gypsum Aggregates and Quarry Products Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following:

Association of Consulting Engineers
Association of County Councils
Association of District Councils
Association of Metropolitan Authorities
Autoclaved Aerated Concrete Products Association
British Precast Concrete Federation Ltd.*
British Quarrying and Slag Federation*
British Railways Board
British Ready Mixed Concrete Association
British Steel Industry
Cement Admixtures Association*
Cement and Concrete Association
Cement Makers' Federation*
Chemical Industries Association
Concrete Society Limited
County Surveyor's Society*
Department of the Environment (Building Research Establishment)
Department of the Environment (PSA)*
Department of the Environment (Transport and Road Research Laboratory)
Department of Transport
Federation of Civil Engineering Contractors
Gypsum Products Development Association
Institute of Quarrying
Institution of Civil Engineers
Institution of Highway Engineers
Institution of Municipal Engineers
Institution of Public Health Engineers
Institution of Structural Engineers*
Institution of Water Engineers and Scientists
National Federation of Building Trades Employers*
Natural Environment Research Council, Institute of Geological Science
Royal Institute of British Architects*
Royal Institution of Chartered Surveyors
Sand and Ballast Hauliers and Allied Trades Alliance
Sand and Gravel Association Limited*
Society of Chemical Industry*
Stone Federation*

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the Technical Committee entrusted with the preparation of this British Standard:

Aggregate Concrete Block Association
Brick Development Association
British Ceramic Research Association
British Civil Engineering Test Equipment Manufacturers' Association
Calcium Silicate Brick Association Limited
Mortar Producers Association Ltd.
National Federation of Plastering Contractors
Plasterers' Craft Guild

This British Standard, having been prepared under the direction of the Cement Gypsum Aggregates and Quarry Products Standards Committee, was published under the authority of the Executive Board and comes into effect on
31 July 1981

First published March 1971
First revision July 1981

The following BSI references relate to the work on this standard:
Committee reference CAB/6
Draft for comment 80/11148 DC

ISBN 0 580 12121 6

Amendments issued since publication

Amd. No.	Date of issue	Comments
4120	November 1982	
5041	March 1986	Indicated by a sideline in the margin

Contents

Foreword

Since 1971, when the first British Standard for factory made ready-mixed lime : sand for mortar was published as BS 4721, two additional types of ready-mixed building mortars have become generally available. The standard has been extended to cover these additional types and is now divided into four sections.

The second section of the standard is a revision of the 1971 edition which is therefore withdrawn. It now includes reference to gauging with gypsum for internal use and specifies the requirements for ready-mixed lime : sand for mortars and plasters to which specified amounts of Portland cement or gypsum are added on site. Water is also added on site to achieve the required consistence. The ready-mixed lime : sand for mortar may contain admixtures and/or pigments if required.

The third section of the standard specifies factory made ready-to-use retarded mortars for masonry, plastering and rendering. The mortars may be either of cement : lime : sand or cement : sand and are supplied in a ready-to-use condition, including requisite water. No further treatment on site is necessary. The presence of the cement-set retarder extends the useful working life of the mortar by a specified time. The mortar may contain admixtures and/or pigments if required.

Mortars produced in compliance with section 3 and those produced on site by the correct use of lime : sand complying with section 2 have nominal volume proportions in accordance with the mortar designations of CP 121.

The fourth section of the standard specifies factory made ready-to-use retarded mortars for screeds. These are mixtures of sand and cement and are supplied in a ready-to-use condition including requisite water. No further treatment on site is necessary. The presence of a cement-set retarder extends the useful working life of the mortar by a specified time.

A fifth section for screeds using lightweight aggregates.is under consideration.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

1 Scope

This British Standard specifies requirements for certain ready-mixed materials for mortars and ready-to-use mortars. It does not specify requirements for dry packaged mortar mixes, which are covered in BS 5838-2.

Section 2 of the standard specifies categories of factory-made mixtures composed essentially of lime, sand and water. These mixtures have the general description of ready-mixed lime : sand for mortar.

Section 3 of the standard specifies designations of factory made cement : lime : sand and cement : sand mortars, containing a cement-set retarding admixture for use in masonry work, external rendering and internal plastering.

Section 4 of the standard specifies designations of factory made cement : sand mortars containing a cement-set retarding admixture for use in screeds. This section of the standard does not cover screeds using special aggregates to provide thermal and lightweight properties.

An appendix to the standard gives guidance for the users of these materials and is intended to be read in conjunction with relevant British Standards publications.

NOTE For the sake of clarity, the aggregate used is referred to throughout as sand, but it should be noted that this covers both natural and synthetic materials.

2 References

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

3 Definitions

For the purposes of this British Standard, the definitions given in BS 4049 apply, with the addition of the following.

3.1
designation (of mix)

classification, using numerals, of mortars of different compositions by volume, but with nominally equivalent strengths

3.2
category (of mix)

classification of lime : sand for mortars by reference to their composition, in terms of the lime : sand ratio by volume

3.3
screed

a layer of mortar or other materials applied to a sub-floor or roof and brought to a defined level

4 Testing and sampling

If the purchaser requires tests, he shall state this to the supplier prior to taking a sample, in order that the manufacturer may be represented when the sample is taken and tested and that the testing laboratory may be mutually agreed.

Section 2. Ready-mixed lime : sand for mortars

5 General

5.1 Lime in the form of lime putty or dry hydrated lime is added to damp sand to produce ready-mixed lime : sand for mortar. This process is normally undertaken in a factory away from the building site. The mortar can also contain a pigment to change its colour.

5.2 After delivery to site it may be stored under suitable conditions until required for use: it is then mixed with either ordinary Portland cement, sulphate-resisting Portland cement or Portland-blastfurnace cement. For certain internal plasters, gypsum may be used. Under no circumstances shall both Portland cement and gypsum be added to the same batch of mortar.

5.3 The physical properties of a given category of lime : sand for mortar are assessed in the laboratory by adding to it specified amounts of ordinary Portland cement and water and testing the resulting mortar. This should not be confused with testing trial mixes of the actual mortars to be used on site.

NOTE Guidance on ordering and use of mixes to meet the requirements of a given building specification are given in the appendix to this standard.

6 Categorization

For the purpose of enquiries and order, ready-mixed lime : sand for mortar shall be categorized by referring to the ratio (by nominal volume proportions) of lime : sand present in the mix. The mix chosen shall be appropriate to the designation of mortar or plaster required.

NOTE Recommendations on the required cement or gypsum additions are given in Appendix A in Table 7 and Table 9 for volume proportioning or Table 8 and Table 10 for mass proportioning.

7 Materials

7.1 The ready-mixed lime : sand for mortar shall contain lime, sand and water as specified in **7.2** to **7.5**. Any pigments used shall be in accordance with **7.6** and air entraining agents or other admixtures in accordance with **7.7** and **7.8** respectively.

7.2 The lime shall be in the form of quicklime, dry hydrated lime or lime putty and shall comply with the requirements of BS 890. When quicklime is used it shall be slaked and the resulting lime putty made sound when tested in accordance with BS 890, before mixing with the sand.

7.3 When natural aggregate is used, the sand shall be natural sand, crushed rock sand or crushed gravel sand.

a) Where the mix is supplied for mortar for masonry, the sand shall comply with the appropriate requirements of BS 1200:1976 and its grading with Table 1 of that standard for unreinforced brickwork and blockwork and with Table 2 of that standard for reinforced brickwork and blockwork.

b) Where the mix is supplied for mortar for external rendering or internal plastering undercoats, the sand shall comply with the appropriate requirements of BS 1199:1976 and its grading with Table 1 of that standard.

Table 1 — Available lime content of lime: sand mixes

Category	Limits of available calcium hydroxide (percentage on dry mass)	
Nominal proportions of lime : sand by volume	Minimum	Maximum
	%	%
1 : 12	1.5	4.0
1 : 9	2.0	5.5
1 : 6	3.5	8.0
1 : 4½	4.5	9.5
1 : 4	6.5	10.5
1 : 3	9.0	14.0

7.4 Synthetic aggregate may be used alone or in combination with natural aggregates, subject to written evidence from the supplier that it will have no adverse effect on the durability or appearance of the mortar nor on any adjacent material or component, and that its grading is within the limits laid down for natural aggregate in **7.3**.

7.5 The water shall be of quality deemed suitable for concrete when tested by the methods in BS 3148.

7.6 Pigments used for colouring or modifying the colour of mortar shall comply with the requirements of BS 1014. The amount of pigment added shall not be such that it prevents the test mortar from complying with the requirements listed in Table 2.

7.7 Air entraining agents shall comply with the requirements of BS 4887 and the amount of agent added shall be limited such that the air content of the test mortar complies with the requirements of Table 2.

7.8 Admixtures containing calcium chloride shall not be used. Other admixtures may be incorporated for purposes of improving properties, subject to written evidence from the supplier that they will have no adverse effect on the durability or appearance of the mortar, nor on any adjacent material or component.

8 Sampling of the ready-mixed lime : sand for mortars

8.1 The ready-mixed lime : sand for mortar shall be sampled before delivery or within 72 h of delivery, either at the manufacturer's works or the user's site.

NOTE It is preferable to sample the material whilst it is in motion during the loading or unloading of the vehicle transporting the material to the site.

8.2 The sampling shall be carried out in accordance with clause **4** of BS 4551:1980. The reduced sample sent to the laboratory shall be not less than 15 kg and tests shall be made within 7 days from the time of taking the samples.

9 Available lime content of the ready-mixed lime : sand for mortars

The available lime content of the ready-mixed lime : sand for mortar, based on a sample prepared in accordance with **5.2** of BS 4551:1980 and chemically analysed by the method given in **6.3.1.3** of BS 4551:1980, shall be within the limits for the appropriate category shown in Table 1 of this standard.

10 Physical properties of the ready-mixed lime : sand for mortars

10.1 Physical properties shall be measured by carrying out the tests listed in **10.4** and shall be within the limits given in Table 2.

10.2 The sample shall be taken as described in clause **8** and shall, on receipt at the laboratory, be rendered homogeneous and sub-samples of masses required for the tests shall be prepared by coning and quartering or by means of a sample divider such as a riffle box. The quantity of material required for the various tests shall be assessed by reference to Table 4 of BS 4551:1980.

10.3 The tests shall be carried out on a mortar prepared with the lime : sand sub-sample taken as in **10.2**, using the method described in **9.4** of BS 4551:1980. The required quantity of ordinary Portland cement (which, at the time of use, shall comply with the requirements of BS 12) to be mixed with the sub-sample of the lime : sand mix shall be determined by reference to the appropriate category in Table 2 and to the mass of dry solids in the sub-sample, calculated as follows:

$$\text{Mass of dry solids} = \text{mass of sub-sample} \times \frac{100 - W}{100}$$

Table 2 — Specified properties of cement gauged mortars

Category Nominal proportions of lime to sand by volume	Percentage by mass of cement[a] to be added to the dry lime : sand mix	Water retentivity	Flow		Air content			Stiffening rate ratio		Compressive strength	
			For plastering or rendering	For jointing	Not air entrained	Air entrained				7 days	28 days
		Not less than	Not more than		Not more than	Not less than	Not more than	Not less than	Not more than	Not less than	
	%	%	%	%	%	%	%			N/mm^2	N/mm^2
1 : 12	30.0	88	—	135	7	7	12	0.6	1.5	10.7	16.0
1 : 9	20.0	89	125	135	7	7	12	0.8	1.7	4.3	6.5
1 : 6	15.0	90	125	135	7	7	15	1.0	2.2	2.4	3.6
1 : 4½	10.0	91	125	130	7	7	15	1.1	2.5	1.0	1.5
1 : 4	7.5	92	120	125	7	7	15	1.4	3.0	—	—
1 : 3	0	93	120	125	7	—	—	—	—	—	—

[a] The cement used shall be ordinary Portland cement complying with the requirements of BS 12 at the time of use.

where W = % of free water (wet mass basis), determined by the method given in **6.3.1.2** of BS 4551:1980 and using a sample prepared in accordance with **5.2** of that standard. This sample shall be prepared at the same time as the sub-samples described in **10.2**.

10.4 Sufficient water shall be added to bring the mortar sample to the consistence required, determined as described in clause **10** of BS 4551:1980. The following tests shall be carried out using the methods laid down in the respective clauses of BS 4551:1980.

Test	BS 4551:1980 Clause no.
Water retentivity	**11**
Flow	**12**
Air content	**13**
Stiffening rate	**14**, [determination b)]
Compressive strength	**15**

11 Manufacturer's certificate

The supplier shall ensure by adequate control and regular testing that the ready-mixed lime : sand for mortar complies, at the time of delivery, with the requirements of this standard. If requested, the supplier shall provide the purchaser with a dated certificate to this effect and, by arrangement, afford the purchaser the facility of inspecting the results of the tests and any control data.

12 Marking

The dated delivery note or supplier's certificate for the consignment of ready-mixed lime : sand for mortar manufactured in accordance with this standard shall be marked with the following particulars.

a) The name and address of the manufacturer.

b) The number and section of this British Standard, i.e. BS 4721/2[1)].

c) The category and purpose of the lime : sand mix, e.g. 1 : 6, rendering.

d) Type of aggregate, e.g. natural sand to BS 1199:1976, Table 1.

e) The type of any pigment in the mix, e.g. mineral oxide.

f) The type and purpose of any admixture in the mix, e.g. vinsol resin; air entraining.

g) Indication of health and safety requirements.

[1)] Marking BS 4721/2 on or in relation to a product is a claim by the manufacturer that the product has been manufactured in accordance with the requirements of the standard. The accuracy of such a claim is therefore solely the manufacturer's responsibility. Enquiries as to the availability of third party certification to support such claims should be addressed to the Director, British Standards Institution, Maylands Avenue, Hemel Hempstead, Herts HP2 4SQ in the case of certification marks administered by BSI or to the appropriate authority for other certification marks.

Section 3. Ready-to-use retarded mortar

13 General

13.1 Ready-to-use building mortars are factory made cement : lime : sand and cement : sand mortars which contain a cement-set retarding admixture and require no further treatment before use. The cement is normally ordinary Portland cement but may be sulphate-resisting Portland cement or Portland-blastfurnace cement, and in the case of non-lime mortars masonry cement.

13.2 The cement-set retarding admixture delays the initial set of the cement thus allowing the mortar to remain workable for a longer specified time before use, which is generally 24 h or 36 h, but may be as much as 72 h. After this time or when the mortar is used and suction has occurred, commencement of set takes place in a normal manner.

NOTE Guidance on ordering and use of mortars to meet the requirements of a given building specification are given in the appendix to this standard.

14 Designation

For the purpose of enquiries and orders, the ready-to-use mortar shall be referred to by the mortar designation (see Table 3), the type, the nominal proportions by volume and the length of working life required.

15 Materials

15.1 The ready-to-use mortar shall contain cement, sand, water and cement-set retarder, with or without lime, as specified in **15.2** to **15.7**. Any pigments used shall be in accordance with **15.8** and air entraining agents or other admixtures shall be in accordance with **15.9** and **15.10** respectively.

15.2 The cement shall be either ordinary Portland cement complying with the requirements of BS 12, Portland-blastfurnace cement complying with the requirements of BS 146 or sulphate-resisting Portland cement complying with the requirements of BS 4027. For cement : sand mortars only, masonry cement complying with the requirements of BS 5224 may be used.

15.3 The lime shall be incorporated in the form of quicklime, dry hydrated lime or lime putty and shall comply with the requirements of BS 890. When quicklime is used, it shall be slaked and the resulting lime putty made sound when tested in accordance with BS 890, before mixing with the sand and cement.

15.4 When natural aggregate is used, the sand shall be natural sand, crushed rock sand or crushed gravel sand.

a) Where the mortar is supplied as mortar for masonry, the sand shall comply with the appropriate requirements of BS 1200:1976 and its grading with Table 1 of that standard for unreinforced brickwork and blockwork and with Table 2 for reinforced brickwork and blockwork.

b) Where the mortar is supplied as mortar for external rendering or internal plastering undercoats, the sand shall comply with the appropriate requirements of BS 1199:1976 and its grading with Table 1 of that standard.

15.5 Synthetic aggregate may be used alone or in combination with natural aggregates subject to written evidence from the supplier that it will have no adverse effect on the durability or appearance of the mortar, nor on any adjacent material or component, and that its grading is within the limits laid down for natural aggregate in **15.4**.

15.6 The water shall be of quality deemed suitable for concrete when tested by the methods in BS 3148.

15.7 Cement-set retarding admixtures used shall be subject to written evidence from the supplier that they will have no adverse effect on the durability or appearance of the mortar nor on any adjacent material or component.

Such admixtures shall increase the working life of the mortar by a definite time and the time between the initial and final sets shall be as short as practicable.

15.8 Pigments used for colouring or modifying the colour of mortar shall comply with the requirements of BS 1014. The amount of pigment added shall not be such that it prevents the test mortar from complying with the requirements listed in Table 4.

15.9 Air entraining agents shall comply with the requirements of BS 4887 and the amount of agent added shall be limited such that the air content of the mortar complies with the requirements listed in Table 4.

15.10 Admixtures containing calcium chloride shall not be used. Other admixtures may be incorporated for purposes of improving properties subject to the written evidence from the manufacturer required in **15.7**.

16 Sampling of the ready-to-use mortar

The ready-to-use mortar shall be sampled before delivery or within the specified working life, either at the manufacturer's works or the user's site. If the load is delivered in containers, sub-samples should be taken from each container. The sampling shall be carried out in accordance with clause **4** of BS 4551:1980; the reduced sample sent to the laboratory shall be not less than 15 kg.

17 Composition of the ready-to-use mortar

The ready-to-use mortar sample shall be prepared as in **5.3** of BS 4551:1980 and chemically analysed by appropriate methods in **6.3** of BS 4551:1980. From the certificate of chemical tests as in **6.4.2** of BS 4551:1980, the mix proportions calculated on the dry mass basis by the methods in **7.3** of BS 4551:1980 shall lie within the limits shown in Table 3 of this standard.

18 Physical properties of the ready-to-use mortar

18.1 The sample shall be tested in accordance with clause **9** of BS 4551:1980 and its consistence determined by the method given in clause **10** of that standard and the dropping ball penetration recorded.

18.2 The following tests given in BS 4551 shall be applied to the sample without any further treatment.

Test	BS 4551: 1980 Clause no.
Water retentivity	**11**
Flow	**12**
Air content	**13**
Stiffening rate [determination a)]	**14**
Record the time taken to reach a resistance to penetration of 1 N/mm^2, which shall be taken as the end of the working life of the mortar.	
Add the time between manufacture and testing to obtain the total working life.	
Report as the stiffening rate ratio of the measured working life to that claimed by the manufacturer.	
Compressive strength (using moist air curing)	**15**

18.3 The results of the tests shall be within the limits of Table 4 of this standard.

19 Manufacturer's certificate

The manufacturer shall ensure by adequate control and regular testing that the ready-to-use mortar complies, at the time of delivery, with the requirements of this standard. If requested, the manufacturer shall provide the purchaser with a dated certificate to this effect and, by arrangement, afford the purchaser the facility of inspecting the results of the tests and any control data.

Table 3 — Composition of ready-to-use mortars

Required mortar (see note 1.)				Mass of original dry materials (see note 2.)	
Mortar designation	Nominal proportions by volume			Cement	Lime
	Cement : lime : sand	Cement : sand	Masonry cement : sand		
				%	%
i	1 : ¼ : 103			20.0 to 25.0	1.0 to 3.0
		1 : 3		20.5 to 25.0	0
ii	1 : ½ : 4 to 4½			14.0 to 19.0	1.5 to 4.5
		1 : 3 to 4		16.0 to 25.0	0
			1 : 2½ to 3½	17.0 to 27.5	0
iii	1 : 1 : 5 to 6			11.0 to 15.5	3.0 to 7.0
		1 : 5 to 6		11.5 to 16.5	0
			1 : 4 to 5	12.5 to 19.0	0
iv	1 : 2 : 8 to 9			7.5 to 10.0	4.0 to 8.5
		1 : 7 to 8		8.5 to 12.5	0
			1 : 5½ to 6½	10.0 to 15.5	0

NOTE 1 The proportions of the resultant mortar are those which have been specified traditionally.
NOTE 2 Calculated from chemical analysis in accordance with **7.3** of BS 4551:1980.

Table 4 — Specified properties of ready-to-use mortars

Mortar designation	Stiffening rate ratio (See clause 18)		Compressive strength at 28 days (see note)	Water retentivity	Flow		Air content		
					Not more than		Not air entrained	Air entrained	
	Not less than	Note more than	Not less than	Note less than	For plastering and rendering	For jointing	Note more than	Not less than	Note more than
			N/mm^2	%	%	%	%	%	%
i	0.9	1.1	11.0	88	—	135	7	7	18
ii	0.9	1.1	4.5	89	125	135	7	7	18
iii	0.9	1.1	2.5	90	125	135	7	7	18
iv	0.9	1.1	1.0	91	125	130	7	7	18

NOTE Extra curing time shall be allowed equal to the specified period of retardation.

20 Marking

The dated delivery note or manufacturer's certificate for the consignment of ready-to-use mortar manufactured in compliance with this standard shall be marked with the following particulars.

a) The name and address of the manufacturer

b) The number and section of this British Standard, i.e. BS 4721/3[2)].

c) The designation, type, traditional volume proportions and purpose of the mortar, e.g. iii, cement : lime : sand, 1 : 1 : 6, reinforced brickwork.

d) Type of aggregate, e.g. sand to BS 1200:1976, Table 2.

e) The date and time of final mixing and specified working life, e.g. 80–10–5 : 10.00 : 36 h.

f) The type and purpose of any admixtures in the mortar, e.g. hydroxycarboxylic acid; retarding.

h) Indication of health and safety requirements.

[2)] Marking BS 4721/3 on or in relation to a product is a claim by the manufacturer that the product has been manufactured in accordance with the requirements of the standard. The accuracy of such a claim is therefore solely the manufacturer's responsibility. Enquiries as to the availability of third party certification to support such claims should be addressed to the Director, British Standards Institution, Maylands Avenue, Hemel Hempstead, Herts HP2 4SQ in the case of certification marks administered by BSI or to the appropriate authority for other certification marks.

Section 4. Ready-to-use retarded mortar for screeds

21 General

Factory made screeding mortar is a mixture of ordinary Portland cement, sand, water and a cement-set retarding admixture produced in a forced-action mixer. This admixture delays the initial set of the cement thus allowing the mortar to remain workable for a longer specified time before use, which is generally 8 h. After this time, commencement of set takes place in a normal manner.

NOTE Guidance on ordering and use of mortars to meet the requirements of a given building specification is given in the appendix to this standard.

22 Designation

For the purpose of enquiries and orders, the ready-to-use screeding mortar shall be referred to by the mortar designation (see Table 5), the type, nominal proportions by volume and the length of working life required.

Table 5 — Ready-to-use screeding mortars

Designation	Traditional volume proportions cement : sand	Cement by mass of original dry material (see note)
		%
a	1 : 3	20.5 to 25.0
b	1 : 4	16.0 to 20.0
c	1 : 5	13.0 to 15.5

NOTE Calculated from chemical analysis in accordance with **7.3** of BS 4551:1980.

23 Materials

23.1 The ready-to-use screeding mortars shall contain cement, sand, water and a cement-set retarding admixture as specified below. Other admixtures may be incorporated in accordance with **23.6**.

23.2 The cement shall be ordinary Portland cement complying with the requirements of BS 12 or Portland-blastfurnace cement complying with the requirements of BS 146.

23.3 The sand shall be natural sand, crushed rock sand or crushed gravel sand. Synthetic aggregate may be used, subject to written evidence from the supplier that it will have no adverse effect on the durability or appearance of the mortar, nor on any adjacent material or component.

23.4 The water shall be of a quality deemed suitable for concrete when tested by the methods in BS 3148.

23.5 Cement-set retarding admixtures shall comply with the requirements of BS 5075-1.

23.6 Admixtures containing calcium chloride shall not be used. Other admixtures may be incorporated for purposes of improving properties, subject to written evidence from the manufacturer that they will have no adverse effect on the durability or appearance of the mortar, nor on any adjacent material or component.

24 Sampling of the ready-to-use screeding mortar

24.1 The ready-to-use screeding mortar shall be sampled before delivery or within the specified working life, either at the manufacturer's works or the user's site. If the load is delivered in containers, sub-samples shall be taken from each container. If the load is to be pumped, sub-samples shall be taken at the discharge nozzle at evenly spaced intervals throughout the pumping.

24.2 The sampling shall be carried out in accordance with clause **4** of BS 4551:1980. The reduced sample shall be used immediately to make strength test cubes (see clause **26**) and the remainder, which shall be not less than 15 kg, sent to the laboratory.

25 Composition of the ready-to-use screeding mortar

The ready-to-use mortar sample shall be prepared as in **5.3** of BS 4551:1980 and chemically analysed by appropriate methods in **6.3** of BS 4551:1980. From the certificate of chemical tests as in **6.4.2** of BS 4551:1980, the mix proportions calculated on the dry mass basis by the methods in **7.3** of BS 4551:1980 shall lie within the limits shown in Table 5 of this standard.

26 Physical properties of the ready-to-use screeding mortar

26.1 The sample shall be tested in accordance with clause **9** of BS 4551:1980. The tests given in the tabulated data in the adjacent column given in BS 4551:1980 shall be applied to the sample without any further treatment.

26.2 The ready-to-use screeding mortar shall comply with the requirements given in Table 6 of this standard.

Test	BS 4551:1980 Clause no.
Stiffening rate [determination a)]	**14**
Record the time taken to reach a resistance to penetration of 2 N/mm^2, which shall be taken as the end of the working life of the mortar.	
Add the time between manufacture and testing to obtain the total working life.	
Report as the stiffening rate ratio of the measured working life to that claimed by the manufacturer.	
Compressive strength (using hydraulic curing)	**15**

27 Manufacturer's certificate

The manufacturer shall ensure by adequate control and regular testing that the ready-to-use screeding mortar complies, at the time of delivery, with the requirements of this standard. If requested, the manufacturer shall provide the purchaser with a dated certificate to this effect and, by arrangement, afford the purchaser the facility of inspecting the results of the tests and any control data.

28 Marking

The dated delivery note or manufacturer's certificate for the consignment of ready-to-use mortar manufactured in compliance with this standard shall be marked with the following particulars.

a) The name and address of the manufacturer.

b) The number and section of this British Standard, i.e. BS 4721/4[3)].

c) The designation, and nominal volume proportions of the mortar, e.g. a, 1 : 3.

d) Type of aggregate, e.g. crushed rock sand.

e) The date and time of final mixing and specified working life, e.g. 80–10–5 : 10.00 : 8 h.

f) The type and purpose of any admixture in the mortar, e.g. hydroxycarboxylic acid, retarding.

g) Indication of health and safety requirements.

Table 6 — Specified properties of ready-to-use screeding mortars

Designation	Traditional volume proportions cement : sand	Stiffening rate ratio (see clause **26**)		Compressive strengths (see note)	
		Not less than	Not more than	7 days. Not less than	28 days. Not less than
				N/mm^2	N/mm^2
a	1 : 3	0.8	1.2	18.0	27.0
b	1 : 4	0.8	1.2	12.0	18.0
c	1 : 5	0.8	1.2	7.5	12.5
NOTE Extra curing time shall be allowed, equal to the specified period of retardation.					

[3)] Marking BS 4721/4 on or in relation to a product is a claim by the manufacturer that the product has been manufactured in accordance with the requirements of the standard. The accuracy of such a claim is therefore solely the manufacturer's responsibility. Enquiries as to the availability of third party certification to support such claims should be addressed to the Director, British Standards Institution, Maylands Avenue, Hemel Hempstead, Herts HP2 4SQ in the case of certification marks administered by BSI or to the appropriate authority for other certification marks.

Appendix A Notes on the selection and use of ready-mixed building mortars

A.1 General. By tradition, building mortars and plasters are specified in parts by volume of the constituents. Except for relatively minor variations the ratio of binder to aggregate is kept at 1 to 3. In the case of cement : lime : sand mortars, the volume of total binder (i.e. cement plus lime) is maintained at one-third of that of the sand but the relative proportion of cement to lime is varied according to the intended use and the requirements of working properties, strength, durability and risk of movement and cracking. In the case of air entrained cement : sand mortars, the entrained air should extend the volume of the cement paste fraction so that it is about one-third of that of the sand.

Mortars of high cement content have higher strength but tend to have poorer working properties and in some circumstances may be less suitable in respect of cracking caused by high rigidity.

The wide range of limits for the lime content of ready-mixed lime : sand for mortar arises because lime putty has a high plasticity and if dry hydrated lime is used, the volume may be increased by up to 50 % to produce similar workability. Similarly a well graded aggregate requires less lime than a poorly graded or single size aggregate.

A wide range of coloured mortars is produced by the addition of pigments which comply with the requirements of BS 1014. They can be added to the lime : sand for mortar in which case it is the responsibility of the user to control water and cement or gypsum additions on site to maintain uniformity of colour. They can also be added to ready-to-use retarded mortar by the manufacturer. It is essential that the amount and type of pigment added has no detrimental effect on the properties of the mortar.

The addition of air entraining agents to cement : lime : sand mortars can improve the frost resistance of the mortar and can also improve the working properties of mortars made with aggregates of poorer quality. With pigmented mortars control of air entrainment is necessary to ensure uniformity of colour in the finished product. The possible effects of prolonged mixing on the amount of air entrained should be checked.

A well graded aggregate generally produces mortar of high workability. Some angular aggregates, despite being well graded, produce mortar of poor workability and the addition of a non-air entraining mortar plasticizer may be beneficial.

Water retaining admixtures are used in some plastering or rendering mortars for application to high suction backgrounds. Frequently, small amounts of water repellents are added to rendering mortars to reduce the effect of the suction of backgrounds and to impart some water resistant properties to the hardened render.

It is essential that ready-to-use retarded mortars are not mechanically remixed on site and no additions should be made. It is the manufacturer's responsibility to ensure that the composition complies with the requirements of this standard.

Screeding mortars are used with an optimum amount of water such that after compaction there is none in excess of that required to fill the voids. There is a tendency for a more open texture with a decrease in the cement content.

The forced-action factory mixers used to prepare ready-to-use screeding mortars ensure that well graded sand is fully coated with cement during mixing, thus possibly producing screeding mortars with similar properties to site mixed material of higher cement contents.

Detailed recommendations for specific applications are given in BS 5262, BS 5492, BS 5628, CP 121, CP 203 and CP 204. Reference should be made to these publications and to the guidance given in PD 6472.

A.2 Specification for mortar. Reference has to be made to the relevant code of practice for the actual specification required. The ultimate strength of mortar for bedding and pointing, while adequate with respect to durability for the expected exposure conditions, should generally not exceed that of the units on which it is to be applied.

For plastering and rendering, the strength of the mortar, whilst adequate with respect to durability, should be less than the strength of the units on which it is to be applied.

The ultimate strength of screeds should be related to the expected service conditions. All screeds laid to a thickness of less than 50 mm should be fully bonded to the sub-base with a grout or bonding agent to reduce the incidence of any cracking or curling on drying out. To ensure complete bond the sub-base should be mechanically cleaned and roughened before the grout or bonding agent is applied.

A.3 Ordering mortars

A.3.1 *Ready-mixed lime : sand for mortar.* Table 7 to Table 10 give the quantities of cement or gypsum required for on-site gauging with various categories of lime : sand for mortar or plaster in order to produce mortars or plasters as specified traditionally. The user should order the required lime : sand mix only by the category given in Table 7 to Table 10 but is encouraged to give additional information. The manufacturer should then supply the lime : sand mix such that a properly taken sample will comply with the corresponding requirements of Table 1 and Table 2 in section 2; this can be expected to yield satisfactory mortars for the purpose intended when gauged with cement or gypsum in the proportions given in Table 7, Table 8, Table 9 and Table 10.

A.3.2 *Ready-to-use retarded mortar.* As the name implies, these mortars should be used without site mixing, although limited remixing using a trowel on a spot board is permitted. When the retardation time has been exceeded, no attempt to retemper the mortar using extra water is permitted.

Table 3 in section 3 gives the composition of various mixes and care should be taken to order the correct mix for the type of units and degree of weather exposure. The manufacturer should then supply the ready-to-use building mortar such that any properly taken sample will comply with the corresponding requirements of Table 4 in section 3.

When sulphate attack on the cement in the mortar is likely to occur, sulphate-resisting cement complying with the requirements of BS 4027 should be specified.

A.3.3 *Ready-to-use mortars for screeds.* These mortars should be laid without any further mixing or the addition of extra water. When the specified retardation time has been exceeded, no attempt to retemper the mortar using extra water is permitted.

Table 5 in section 4 gives the composition of various mixes and care should be taken to order the correct mix, noting that a higher cement content will increase the potential strength and load carrying capacity of the screed and produce a screed with better wearing properties but greater drying shrinkage.

It should be noted that although a reduced water content will potentially offer reduced drying shrinkage, excessively dry mixes can lead to under-compaction and consequent weakness.

The manufacturer should then supply the ready-to-use screeding mortar such that any properly taken sample will comply with the corresponding requirements of Table 6 in section 4.

A.4 Site storage

A.4.1 *Ready-mixed lime : sand for mortar.* These mixes are generally delivered in tipping vehicles and should be tipped on to a clean impervious surface and sheeted when not in use. Sheeting is particularly important in the case of pigmented lime : sand since rain and weathering will cause loss and segregation of fine material including pigments.

A.4.2 *Ready-to-use retarded mortar.* These mortars have a plastic condition and it is advisable to deliver them in containers such as skips. The container should be covered when not in use to protect against rain and weathering.

A.4.3 *Ready-to-use retarded mortars for screeds.* These mortars are generally delivered in tipping vehicles and should be tipped on to a clean impervious surface and sheeted when not in use.

A.5 Site batching

A.5.1 *Ready-mixed lime : sand for mortar.* Only the mortars in section 2 of this standard require site batching. In recent years most site mixed mortar has been produced in small concrete mixers. Mortar pan mills are still to be found on a few sites but details of their use are not included in this appendix.

The mechanical mixer has to be clean before starting mixing and always cleaned out when work ceases. All tools and containers should be cleaned and washed after use. Cleanliness is particularly important with pigmented mortar to prevent colour variations.

Water should be added to the mixer followed by the required quantity of cement. The cement should be added slowly to ensure a thin paste, free from lumps. The ready-mixed lime : sand for mortar should then be added.

Accurate proportioning is essential. This can be most readily achieved by weigh batching but where this is not possible gauge boxes should be used. A 10 litre steel bucket can be used as a gauge box. Separate containers should be used for the cement and for the lime : sand mix.

Time of mixing will depend on the efficiency of the mixer but is generally between 5 min and 10 min. With air entrained mortars attention to the possible effect of prolonged mixing on the amount of air entrained is necessary.

A.5.2 *Site control tests.* The details of the test mortars and the associated test limits given in section 2 for the purpose of ensuring that the lime : sand mix meets the requirements of this standard, are for laboratory testing. To meet a special performance requirement, modifications to the cement or gypsum additions recommended in Table 7, Table 8, Table 9 and Table 10 may be necessary and should be established by site testing of trial mixes. The properties of site-mixed mortars should be determined by testing samples withdrawn from the mixer. Regular testing of mortar for site control purposes should be in accordance with procedures laid down in BS 5628.

A.6 Site use

A.6.1 *Ready-mixed lime : sand for mortar.* One tonne of ready-mixed lime : sand, when gauged with the correct amount of Portland cement, is sufficient to lay approximately 1 000 standard format bricks as given in BS 3921. The number of blocks will be rather less and will depend on their sizes. Similarly one tonne will plaster or render an area of 55 m^2 to 65 m^2 when applied at a thickness of 10 mm.

Mortars and plasters have to be used before the initial set of the binder has taken place. On no account should the mortar be retempered after the commencement of initial set. Workability that has been lost by evaporation of water may be restored by the addition of small amounts of water. Thorough remixing is essential. Pigmented mortars should not be retempered.

It is essential that all tools and spot boards are cleaned and washed after the completion of work.

A.6.2 *Ready-to-use retarded mortar.* One cubic metre of mortar is sufficient to lay approximately 1 800 standard format bricks as given in BS 3921.

Mortars and plasters have to be used before the working life specified by the manufacturer expires. On no account should the mortar be remixed in a mechanical mixer.

All tools, spot boards and storage containers have to be cleaned and washed after the completion of work.

A.6.3 *Ready-to-use retarded mortar for screeds.* One tonne of screeding mortar will cover an area of approximately 9 m^2 when laid at a thickness of 50 mm.

It is essential that the mortar is used before the working life specified by the manufacturer expires. On no account should the mortar be remixed in a mechanical mixer.

Screeds have to be protected from traffic and damage after laying. Adequate curing and protection from the weather is essential and the surface should not be trafficked for at least 5 days after laying.

All tools have to be cleaned and washed after use.

Table 7 — Cement additions required before use; volume proportions

Required mortar (see note 1)		**Category of lime : sand to be used. Nominal proportions of lime to sand by volume**	**Amount of cement to be gauged with lime : sand mix** (see notes 2 and 3) **Proportions by volume of cement to lime : sand mix**	
Mortar designation	**Nominal proportions by volume cement : lime : sand**		**Normal use**	**Special use**
i	1 : ¼ : 3	1 : 12	1 : 3	—
ii	1 : ½ : 4 to 4½	1 : 9	1 : 4½	1 : 4
iii	1 : 1 : 5 to 6	1 : 6	1 : 6	1 : 5
iv	1 : 2 : 8 to 9	1 : 4½	1 : 9	1 : 8
v	1 : 3 : 10 to 12	1 : 4	1 : 12	1 : 10
—	0 : 1 : 2½ to 3	1 : 2½ to 3	(see note 4)	

NOTE 1 The proportions of the resultant mortar are those which have been specified traditionally.
NOTE 2 The sand volume does not increase when lime is added in the proportions shown in the third column. Thus in calculating the required cement additions, the volume of any lime present should be ignored.
NOTE 3 The proportions given for normal use result in mortars with the higher sand content given in the second column, If difficulty is experienced in attaining satisfactory strength of the cement : lime : sand mortars, the proportions of cement to lime : sand mix may be increased by adopting proportions as rich as those given for special use (last column) which result in mortars with lower sand contents given in the second column.
NOTE 4 A category 1 : 2½ to 3 mix is used without the addition of any cement in appropriate situations.

Table 8 — Cement additions required before use; mass proportions

Required mortar (see note 1)		Category of lime : sand to be used. Nominal proportions of lime to sand by volume	Mass of cement to be gauged with 1 tonne of lime : sand mix, kg (see notes 2 and 3)			
			Normal use		Special use	
Mortar designation	Nominal proportions by volume cement : lime : sand		Not air entrained	Air entrained	Not air entrained	Air entrained
i	1 : ¼ : 3	1 : 12	250	—	—	—
ii	1 : ½ : 4 to 4½	1 : 9	170	190	180	200
iii	1 : 1 : 5 to 6	1 : 6	125	150	135	160
iv	1 : 2 : 8 to 9	1 : 4½	90	100	95	105
v	1 : 3 : 10 to 12	1 : 4	65	75	70	80
—	0 : 1 : 2½ to 3	1 : 2½ to 3	(see note 4)			

NOTE 1 The proportions of the resultant mortar are those which have been specified traditionally.
NOTE 2 The proportions given for normal use results in mortars with higher sand content given in the second column. If difficulty is experienced in attaining satisfactory strength of the cement : lime : sand mortars, the proportion of cement to lime : sand mix may be increased by adopting proportions as rich as those given for special use (the last two columns) which result in mortars with lower sand contents given in the second column.
NOTE 3 The increased cement content required for air entrained mortars is needed to produce a final mortar with the same mass of cement in a given volume as with non-air entrained mortars.
NOTE 4 A category 1 : 2½ to 3 mix is used without the addition of any cement in appropriate situations.

Table 9 — Gypsum additions required before use; volume proportions

Required plaster (see note 1) Nominal proportions by volume of gypsum : lime : sand	Category of lime : sand to be used Nominal proportions of lime to sand by volume	Amount of gypsum to be gauged with lime : sand mix (see note 2) Proportions by volume of gypsum to lime : sand mix
3 : 2 : 6	1 : 3	1 : 2
1 : 1 : 3	1 : 3	1 : 3
1 : 3 : 9	1 : 3	1 : 9

NOTE 1 The proportions of the resultant plaster are those which have been specified traditionally.
NOTE 2 The sand volume does not increase when lime is added in the proportions shown in the second column. Thus in calculating the required gypsum additions, the volume of any lime present should be ignored.

Table 10 — Gypsum additions required before use; mass proportions

Required plaster (see note) Nominal proportions by volume of gypsum : lime : sand	Category of lime : sand to be used Nominal proportions of lime to sand by volume	Mass of gypsum to be gauged with 1 tonne of lime : sand mix, kg
3 : 2 : 6	1 : 3	230
1 : 1 : 3	1 : 3	150
1 : 3 : 9	1 : 3	50

NOTE The proportions of the resultant plaster are those which have been specified traditionally.

Publications referred to

BS 12, *Specification for ordinary and rapid-hardening Portland cement.*
BS 146, *Portland-blastfurnace cement.*
BS 890, *Building limes.*
BS 1014, *Pigments for Portland cement and Portland cement products.*
BS 1198, BS 1199 and BS 1200, *Building sands from natural sources.*
BS 3148, *Methods of tests for water for making concrete (including notes on the suitability of the water).*
BS 3921, *Clay bricks and blocks.*
BS 4027, *Specification for sulphate-resisting Portland cement.*
BS 4049, *Glossary of terms applicable to internal plastering, external rendering and floor screeding.*
BS 4551, *Methods of testing mortars, screeds and plasters.*
BS 4887, *Mortar plasticizers.*
BS 5075, *Concrete admixtures.*
BS 5075-1, *Accelerating admixtures, retarding admixtures and water-reducing admixtures. Metric units.*
BS 5224, *Specification for masonry cement.*
BS 5262, *Code of practice for external rendered finishes.*
BS 5492, *Code of practice for internal plastering.*
BS 5628, *Code of practice for the structural use of masonry.*
BS 5628-1, *Unreinforced masonry.*
BS 5838, *Specification for dry packaged cementitious mixes.*
BS 5838-2, *Prepacked mortar mixes.*
CP 121, *Walling.*
CP 203, *Sheet and tile flooring (cork, linoleum, plastics and rubber).*
CP 204, *In-situ floor finishes.*
PD 6472, *Guide to specifying the quality of building mortars.*

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL