British Standard

BRITISH STANDARD

BS 5328: Part 2:1997

Incorporating Amendments Nos. 1, 2 and 3 and Corrigendum No. 1 not issued separately

Concrete —

Part 2: Methods for specifying concrete mixes

ICS 91.100.30

BSI British Standards

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee B/517, Concrete, upon which the following bodies were represented:

British Aggregate Construction Materials Industries
British Cement Association
British Precast Concrete Federation Ltd.
British Ready Mixed Concrete Association
Building Employers Confederation
Cement Admixtures Association
Department of Transport (Highways Agency)
Federation of Civil Engineering Contractors
Federation of Resin Formulators and Applicators (Ferfa)
Institute of Concrete Technology
National House-Building Council
Sand and Gravel Association Limited
Society of Chemical Industry

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

Association of Lightweight Aggregate Manufacturers
British Civil Engineering Test Equipment Manufacturers' Association
Cementitious Slag Makers Association
Chartered Institution of Water and Environmental Management
Concrete Society
County Surveyors' Society
Department of the Environment (Building Research Establishment)
Electricity Association
Federation of Piling Specialists
Institution of Structural Engineers
Quality Ash Association

This British Standard, having been prepared under the direction of the Sector Board for Building and Civil Engineering, was published under the authority of the Standards Board and comes into effect on
15 March 1997

Amendments issued since publication

Amd. No.	Date	Text affected
9691	October 1997	
10365	May 1999	
10612	July 1999	
13877	10 September 2002	Indicated by a sideline

The following BSI references relate to the work on this standard:
Committee reference B/517
Draft for comment 95/107687 DC

ISBN 0 580 26723 7

Contents

Foreword

This Part of BS 5328 has been prepared by Technical Committee B/517. This Part, which includes designated mixes, is a new edition of BS 5328-2:1991, which is withdrawn, and, together with BS 5328-1, BS 5328-3 and BS 5328-4, forms a comprehensive standard for the specification of concrete to which codes of practice and contractual documents can refer. It includes recommendations originating from BS 8110-1.

This edition introduces technical changes but does not reflect a full review or revision of the standard. This edition makes provision for Portland limestone cement conforming to BS 7583.

Amendment number 2 takes account of the recent consensus reached by experts on provisions to resist damaging ASR in the UK. These recommendations are published in BRE Digest 330:1999. The technical content of this amendment has been derived from these recommendations.

Amendment number 3 takes account of the guidance in BRE Special Digest 1:Part 2 [4].

BS 5328 is due to be withdrawn in December 2003 and consequently BSI have decided not to revise this standard to reflect the new cement descriptions given in BS EN 197-1. Where traditional cements are specified the producer may use the equivalent BS EN 197-1, *Cements — Composition, specifications and conformity criteria for common cements*, see national annex NA to BS EN 197-1:2000 for guidance on equivalents.

As this standard involves selection by the specifier from a number of options and, in certain instances, agreement on requirements between the purchaser and producer, any requirement for conformity to BS 5328 or any claim of compliance with it has to be qualified by reference to the selection and to any such agreements.

This standard covers the methods for specifying and producing concrete as a construction material up to the point of delivery into the construction. The standard is in four Parts:

Part 1	*Guide to specifying concrete*;
Part 2	*Methods for specifying concrete mixes*;
Part 3	*Specification for the procedures to be used in producing and transporting concrete*;
Part 4	*Specification for the procedures to be used in sampling, testing and assessing compliance of concrete*.

Part 1 provides guidance, to the specifier and purchaser of concrete, on the selection of requirements for materials and concrete mixes. Part 2 provides a choice of methods by which the purchaser can convey the selected requirements to the producer. Part 3 specifies for the producer the procedures to be used in producing and transporting the concrete. Part 4 specifies the procedures to be used in sampling, testing and assessing concrete for conformity.

This standard provides methods for specifying concrete mixed on site or in a precast concrete factory and for the purchase and supply of ready-mixed concrete. It takes account of the distinct and different responsibilities of the purchaser and the producer. There are a number of instances in which the purchaser has to select from the various options given in this standard in order to specify the concrete required. The purchaser is responsible for passing on to the producer the requirements of the specifying body, e.g. the engineer's or architect's specification, together with any additional requirements. Throughout this standard the terms 'specify' and 'specification' are used in relation to both sets of requirements. There may be occasions where it is advantageous for economic or technical reasons to propose changes to the specification. In such cases the producer and purchaser should agree the proposed amendments for approval and sanction by the specifying body.

Precautions need to be taken when working with cement and fresh concrete and attention is drawn to these in BS 5328-3 and BS 5328-4.

This standard covers concrete produced by normal methods, but it does not apply to precast concrete products where the concrete is specified in other British Standards. Many of the requirements of this standard, e.g. the use of materials and the control of production, apply equally to precast concrete and to in situ concrete. However, some of the requirements concerning the responsibilities of the purchaser and the producer may not apply in the case of precast concrete. The specification of designated mixes is unlikely to be appropriate for factory produced precast concrete products.

It is necessary for the purchaser to take into account the requirements of specialized codes of practice and any influences of the construction process. Provisions are made in this standard for the inclusion of any special requirements.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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

This Corrigendum is issued to correct the error on page 14 in AMD 10365, issued in May 1999, where "Minimum" in Item 8 of Form A should have been "Maximum".

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 25 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

Sidelining in this document indicates the most recent changes by amendment.

blank

Section 1. General

Introduction

This Part of BS 5328 gives the methods to be used by the purchaser for specifying concrete. The standard is in five sections:

Section **1**	General;
Section **2**	Designed mixes;
Section **3**	Prescribed mixes;
Section **4**	Standard mixes;
Section **5**	Designated mixes.

Section **5** gives a new method of specifying concrete, the designated mix. This method of specification is primarily aimed at in situ concrete applications and it is unlikely to be applicable to factory produced precast concrete products. The purchaser specifies a mix designation appropriate to the end use and this is an instruction to the producer to comply with the specification given in section **5**. There is also a requirement that the producer holds current conformity certification based on product testing and surveillance coupled with approval of the producer's quality system to BS EN ISO 9001 by a certification body accredited by the Secretary of State (or equivalent) for the relevant areas of product and systems conformity certification, as this is the prime means of controlling conformity.

The methods, involving use of relevant information from BS 5328:Part 1:1997, enable the purchaser to specify clearly to the producer the requisite properties of the concrete. Ordinary prescribed mixes are now described as standard mixes using the prefix ST to avoid confusion with the grade designation of designed mixes. Standard mixes of 14 mm maximum size aggregate have been omitted as they are rarely used.

Annex A contains forms which may be used to specify either designed, prescribed, standard or designated mixes. The use of these forms should ensure that the purchaser specifies all necessary requirements and that the producer is in possession of all the relevant technical data.

Methods of assessing conformity to specifications for concrete mixes drawn up in accordance with this Part of BS 5328 are given in BS 5328:Part 4:1990.

Purchasers ordering in accordance with this standard are advised to specify quality assurance requirements for materials or for concrete in their purchasing contracts to assure themselves that products specified in accordance with BS 5328 consistently achieve the required level of quality. Purchasers of ready-mixed concrete are advised to specify certification meeting the requirements of the United Kingdom Accreditation Service, National Accreditation of Certification Bodies, for product conformity. They are similarly advised to specify that, where they are available, constituent materials should be obtained from suppliers operating quality systems in accordance with BS EN ISO 9000.

1.1 Scope

This Part of BS 5328 gives methods for specifying concrete. It does not apply when the concrete is specified as being in accordance with another British Standard.

1.2 References

1.2.1 Normative references

This Part of BS 5328 incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed on page 23. For dated references, only the edition cited applies; any subsequent amendments to or revisions of the cited publication apply to this Part of BS 5328 only when incorporated in the reference by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

1.2.2 Informative references

This Part of BS 5328 refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

1.3 Definitions

For the purposes of this Part of BS 5328 the definitions given in BS 5328:Part 1 and BS 6100 apply.

1.4 Minimizing the risk of damaging alkali-silica reaction

1.4.1 General

Unless otherwise agreed with the purchaser, the producer shall minimize the risk of damaging alkali-silica reaction in accordance with one of the sets of requirements given in **1.4.2**, **1.4.3**, **1.4.4**, **1.4.5**, **1.4.6** and **1.4.7**.

1.4.2 Low reactivity aggregate, option 1

No action is required if the following six conditions are satisfied:

a) the aggregate type or aggregate combination is classed as low reactivity by BRE Digest 330[1];

b) the cement or combination content is ≤ 550 kg/m^3 of concrete;

c) the declared mean alkali content of the Portland cement or the Portland cement type component of other cements and combinations is ≤ 0.75 % Na_2O eq;

d) the alkali from constituents other than the cement or combination ≤ 0.60 kg Na_2O eq/m^3 of concrete;

e) the guaranteed alkali limit of any ggbs is ≤ 1.0 % Na_2O eq and the guaranteed alkali limit of any pfa is ≤ 5.0 % Na_2O eq;

f) the concrete does not contain pfa other than that conforming to BS 3892-1.

NOTE See **3.8.1** of BS 5328-4:1990 for the calculation of equivalent alkali content.

1.4.3 Low reactivity aggregate, option 2

No action is required if the following six conditions are satisfied:

a) the aggregate type or aggregate combination is classed as low reactivity by BRE Digest 330;

b) the cement or combination content is ≤ 500 kg/m^3 of concrete;

c) the declared mean alkali content of the Portland cement or the Portland cement type component of other cements and combinations that contain ≥ 40 % ggbs or ≥ 25 % pfa by mass of cement, is >0.75 % $\leq$ 1.00 % Na_2O eq;

d) the alkali from constituents other than the cement or combination is ≤ 0.20 kg Na_2O eq/m^3 of concrete;

e) the guaranteed alkali limit of any ggbs is ≤ 1.0 % Na_2O eq and the guaranteed alkali limit of any pfa is ≤ 5.0 % Na_2O eq;

f) the concrete does not contain pfa other than that conforming to BS 3892-1.

1.4.4 Normal reactivity aggregate

No action is required provided the following four conditions are satisfied:

a) the aggregate type is not classed as:

i) highly reactive, e.g. does not contain:

— more than 10 % of crushed material as greywacke, greywacke-type sandstones, greywacke-type siltstones/mudstones or combinations of these materials;

— recycled demolition waste;

ii) or extremely reactive, e.g. does not contain:

— calcined flint;

— aggregates containing opal;

— glass (artificial of volcanic).

b) the cement or combination of the concrete is not more than the value given in table 0A or 0B depending on the alkali contribution to the fresh concrete from constituents other than the cement or combination (linear interpolation between the tables is permitted for intermediate alkali contributions from other constituents);

c) the guaranteed alkali limit of any ggbs is ≤ 1.0 % Na_2O eq and the guaranteed alkali limit of any pfa is ≤ 5.0 % Na_2O eq;

d) the concrete does not contain pfa other than pfa conforming to BS 3892-1.

1.4.5 Service record option

No action is required if it is agreed between the producer and the purchaser or a third party certification body, that the service record of the particular cement/aggregate combinations is well established and does not include any instances of cracking due to alkali-silica reaction. For such cases, the combination of coarse and fine aggregate used shall have had a satisfactory performance record for at least the past 10 years when used in a wet environment and with the selected or a higher cement content with cements of similar or higher alkali levels than the chosen cement.

1.4.6 Testing the source of crushed greywacke or crushed greywacke type aggregate

No action is required if the following six conditions apply:

a) the aggregate type is a crushed greywacke, crushed greywacke-type sandstone/siltstone/mudstone or a combination containing more than 10 % as crushed particles of these aggregates;

b) the aggregate comes from a source that has been tested and assessed in accordance with *Testing protocol for greywacke aggregates* [2];

c) where the test data obtained in accordance with the testing protocol in **1.4.6**b) give ≤ 0.08 % expansion at 2 years at 3.5, 4.0, 4.5 or 5.0 kg/m^3 Na_2O eq, the alkali content of the concrete is ≤ 2.0, ≤ 2.5, ≤ 3.0 or ≤ 3.5 kg/m^3 Na^2O eq respectively based on a calculation using the declared mean alkali content of either the Portland cement or the Portland cement type component of other cements and combinations that contain ≥ 50 % ggbs or ≥ 35 % by mass of cement;

d) the alkali from constituents other than the cement or combination is ≤ 0.20 kg Na_2O eq/m^3 of concrete;

e) the guaranteed alkali limit of any ggbs is ≤ 1.0 % Na_2O eq and the guaranteed alkali limit of any pfa is ≤ 5.0 % Na_2O eq;

f) the concrete does not contain pfa other than that conforming to BS 3892-1.

1.4.7 Other conditions

Where none of the sets of conditions given in **1.4.2**, **1.4.3**, **1.4.4**, **1.4.5**, and **1.4.6** are satisfied, the producer shall ensure that the concrete conforms to the guidance given in BRE Digest 330 or Concrete Society Report 30 [3]. Where constituent materials not covered by these documents e.g. silica fume, metakaolin or lithium compounds, are to be used, suitable provisions shall be agreed between the purchaser and producer.

Table 0A — Limiting values of cement or combination contents (kg/m^3) for not more than 0.20 kg Na_2O eq/m^3 of concrete from other constituents

Cement or combination	Guaranteed ≤0.60 % Na_2O eq	Declared mean alkali content of a cement[1] or the PC component of a combination, %[5]										
		0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00
PC, SRPC or LASRPC	550	550	550	550	540	500	465	375	355	335	315	300
PC plus ≥ 40 % ggbs[2)3)4)]	—	550	550	550	550	550	550	550	550	550	525	500
PC plus ≥ 25 % pfa[2)3)4)]	—	550	550	550	550	550	550	500	470	445	420	400

NOTE In the case of designated mixes, see **5.5.4** for maximum limiting values for cement or combination content.

1) Where a cement contains ggbs or pfa, classification is on the basis of the declared mean alkali content of its PC type component.
2) Proportions by mass of cement or combination as appropriate.
3) Where the proportion of ggbs is less than 40 % or the proportion of pfa is less than 25 %, the alkali contributions from these materials shall be calculated in accordance with BRE Digest 330.
4) For quantities of ggbs greater than 40 % and pfa greater than 25 %, calculations based on BRE Digest 330 may give higher values.
5) Linear interpolation is permitted for declared mean alkali contents in the range 0.50 to 0.75 and 0.76 to 1.00.

Table 0B — Limiting values of cement or combination contents (kg/m^3) for 0.60 kg Na_2O eq/m^3 of concrete from other constituents

Cement or combination	Guaranteed ≤ 0.60 % Na_2O eq	Declared mean alkali content of a cement[1] or the PC component of a combination, %[5]										
		0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00
PC, SRPC or LASRPC	550	550	525	485	445	415	385	300	280	265	255	240
PC plus ≥ 40 % ggbs[2)3)4)]	—	550	550	550	550	550	550	500	470	445	420	400
PC plus ≥ 25 % pfa[2)3)4)]	—	550	550	550	550	505	470	400	375	355	335	320

NOTE In the case of designated mixes, see **5.5.4** for maximum limiting values for cement or combination content.

1) Where a cement contains ggbs or pfa, classification is on the basis of the declared mean alkali content of its PC type component.
2) Proportions by mass of cement or combination as appropriate.
3) Where the proportion of ggbs is less than 40 % or the proportion of pfa is less than 25 %, the alkali contributions from these materials shall be calculated in accordance with BRE Digest 330.
4) For quantities of ggbs greater than 40 % and pfa greater than 25 %, calculations based on BRE Digest 330 may give higher values.
5) Linear interpolation is permitted for declared mean alkali contents in the range 0.50 to 0.75 and 0.76 to 1.00.

Section 2. Designed mixes

2.1 Designed mix

The mix shall be specified by its required performance in terms of a strength grade, subject to any restriction on materials, minimum or maximum cement content, maximum free water/cement ratio and any other properties required. Strength testing shall form an essential part of the assessment of conformity to the specification.

The purchaser shall provide the producer with all pertinent information on the use of the concrete and the specified requirements.

2.2 Selection of grade and materials

The purchaser shall select the grade of concrete, the limiting mix parameters and the constituent materials to satisfy the strength and durability requirements.

NOTE Guidance is provided in BS 5328-1.

Where there are options in a British Standard specification for a material, the purchaser shall specify restrictions where necessary. If none are specified, any of the options permitted in the British Standard specifications for materials and concrete may be used.

2.3 Mix specification

2.3.1 General

The purchaser shall specify the following to the producer:

a) that the mix is a designed mix to be supplied in accordance with the relevant clauses of BS 5328-2, BS 5328-3 and BS 5328-4;

b) the essential items given in **2.3.2**;

c) the optional items given in **2.3.3** as appropriate.

NOTE To aid the task of preparing a specification, form A in Annex A may be freely copied and used.

2.3.2 Essential items

2.3.2.1 The purchaser shall specify the following to the producer:

a) the grade, which shall be one of the values given in Table 1 or Table 2 as appropriate;

b) the required nominal maximum size of aggregate;

c) the permitted type(s) of aggregate;

d) the permitted type(s) of cement;

e) the minimum cement content in kilograms of cement per cubic metre of fresh fully compacted concrete (see table 14 of BS 5328-1:1997);

f) the maximum free water/cement ratio (see table 14 of BS 5328-1:1997);

g) design chemical class, if appropriate (see **5.3.4** of Amendment No. 2 to BS 5328-1:1997);

h) the workability (to be added by the user of the fresh concrete taking into account the intended method of placing and compaction);

i) any quality assurance requirements.

2.3.2.2 The purchaser of the fresh concrete shall inform the producer of the following:

a) the method of placing the concrete;

b) the rate of sampling by the purchaser if higher than one sample for every 50 m^3 or 50 batches, whichever is the lesser by volume.

Table 1 — Compressive strength grades

Grade	Characteristic compressive strength at 28 days N/mm^2 (=MPa)
C7.5	7.5
C10	10.0
C15	15.0
C20	20.0
C25	25.0
C30	30.0
C35	35.0
C40	40.0
C45	45.0
C50	50.0
C55	55.0
C60	60.0

Table 2 — Flexural strength grades

Grade	Characteristic flexural strength at 28 days N/mm^2 (=MPa)
F3	3.0
F4	4.0
F5	5.0

2.3.3 Optional items

Where necessary the purchaser shall specify to the producer:

a) any special requirements for the cement;

b) any limits on the proportion of ground granulated blastfurnace slag (ggbs) or pulverized-fuel ash (pfa) required (see table 7b of BS 5328-1:1997);

c) any special requirements for aggregates;

d) the type(s) of admixture specified or prohibited and the performance or quantity required;

e) the maximum cement content in kilograms per cubic metre of fresh fully compacted concrete;

f) the maximum chloride content of the concrete (see **5.2.2** of BS 5328-1:1997);

Text deleted.

g) the mean total air content of the fresh fully compacted air entrained concrete (see **5.3.3** of BS 5328-1:1997);

h) the maximum and/or minimum temperature of the fresh concrete, if different from or additional to the limits in **4.9** of BS 5328-3:1990;

i) the maximum and/or minimum density of the hardened concrete and the method of test (see **6.2**a of BS 5328-1:1997);

j) what information, if any, is to be provided by the producer (see clause **3** of BS 5328-3:1990);

k) the details of any test procedure(s) and the method(s) of assessing conformity if not specifically covered by this standard;

l) any other requirements.

Section 3. Prescribed mixes

3.1 Prescribed mix

The mix shall be specified by its constituent materials and the properties or quantities of those constituents to produce a concrete with the required performance. The assessment of the mix proportions shall form an essential part of the conformity requirements.

The purchaser shall provide the producer with all pertinent information on the use of the concrete and the specified requirements.

3.2 Selection of materials and mix proportions

The purchaser shall select the materials and mix proportions to satisfy the strength and durability requirements.

NOTE Guidance is provided in BS 5328-1.

Where there are options in a British Standard specification for a material, the purchaser shall specify restrictions where necessary. If none are specified, any of the options permitted in the British Standard specifications for materials and concrete may be used.

3.3 Mix specification

3.3.1 General

The purchaser shall specify the following to the producer:

a) that the mix is a prescribed mix to be supplied in accordance with the relevant clauses of BS 5328-2, BS 5328-3 and BS 5328-4;

b) the essential items given in **3.3.2**;

c) the optional items given in **3.3.3** as appropriate.

NOTE To aid the task of preparing a specification, form B in Annex A may be freely copied and used.

3.3.2 Essential items

3.3.2.1 The purchaser shall specify the following to the producer:

a) the permitted type(s) and standard strength class(es) of cement;

b) the required nominal maximum size of aggregate;

c) the permitted type(s) of aggregate;

d) the mix proportions in kilograms of each constituent;

e) the workability;

f) any quality assurance requirements.

3.3.2.2 The purchaser of the fresh concrete shall inform the producer of the method of testing for conformity to the specification and the rate of sampling by the purchaser if higher than one sample for every 50 m^3 or 50 batches, whichever is the lesser volume.

3.3.3 Optional items

Where necessary the purchaser shall specify the following to the producer:

a) any special requirements for aggregates (e.g. source, grading);

b) the maximum chloride content of the concrete (see **5.2.2** of BS 5328-1:1997);

Text deleted

c) the maximum and/or minimum temperature of the fresh concrete, if different from or additional to the limits in **4.9** of BS 5328-3:1990;

d) what information, if any, is to be provided by the producer (see clause **3** of BS 5328-3:1990);

e) the details of any test procedure(s) and the method(s) of assessing conformity if not specifically given in this standard;

f) any other requirements.

blank

Section 4. Standard mixes

4.1 Standard mix

The mix shall be selected from Table 3, the materials from those given in Table 4 and the mix proportions from those given in Table 5, as applicable. The assessment of the mix proportions shall form an essential part of the conformity requirements.

The purchaser shall provide the producer with all pertinent information on the use of the concrete and the specified requirements.

Table 3 — Standard mixes and related strengths

Standard mix	Characteristic compressive strength at 28 days assumed for structural design N/mm^2 (=MPa)
ST1	7.5
ST2	10.0
ST3	15.0
ST4	20.0
ST5	25.0

4.2 Selection of mix and materials

NOTE Guidance on the specification of standard mixes is given in **8.2.4** of BS 5328-1:1997.

The purchaser shall check that the required quality of concrete for both strength and durability (see BS 5328:Part 1) can be obtained when using the restricted range of materials and mixes listed in Table 3, Table 4 and Table 5.

4.3 Constituent materials

The materials used shall be selected from table 4 as appropriate.

NOTE Admixtures are not permitted in standard mixes.

The purchaser shall be responsible for indicating to the producer any restrictions in the permitted options.

Text deleted.

Where necessary, the purchaser shall specify additional precautions with respect to alkalis from sources external to the concrete (see BRE Digest 330 [1] and Concrete Society Technical Report No. 30 [3]).

The chloride limits in the concrete shall be taken from Table 4 of BS 5328-1:1997.

Mixing water shall be of drinkable quality or free from materials in quantities deleterious to concrete in the fresh or hardened condition.

4.4 Mix specification

The purchaser shall specify the following to the producer:

a) that the mix is a standard mix to be supplied in accordance with the relevant clauses of BS 5328-2, BS 5328-3 and BS 5328-4;

b) the standard mix title and whether the concrete is to be classed as unreinforced or reinforced;

NOTE If the concrete contains any embedded metal it should be classed as reinforced.

c) the permitted type(s) of cement;

d) the permitted type(s) of aggregate;

e) the nominal maximum size of aggregate (see Table 5);

f) the workability;

g) what information, if any, is to be provided by the producer (see clause **3** of BS 5328-3:1990);

h) the maximum and/or minimum temperature of the fresh concrete, if different from or additional to the limits in **4.9** of BS 5328-3:1990;

i) any quality assurance requirements.

NOTE To aid the task of preparing a specification, form C in Annex A may be freely copied and used.

Table 4 — Materials for use in standard mixes

	Standard mixes	
	ST1, ST2, ST3	**ST4, ST5**
Cement		
Portland (PC)	BS 12	BS 12
Portland blastfurnace (PBFC)	BS 146	BS 146
Portland pulverized-fuel ash (PPFAC)	BS 6588	BS 6588
Sulfate-resisting Portland (SRPC)		BS 4027
Low alkali sulfate-resisting Portland (LASRPC)		BS 4027
Portland limestone (PLC)	BS 7583	BS 7583
Combinations manufactured in the concrete mixer from Portland cement and ggbs or pfa	Combination of which the proportions and properties conform to clauses **6** to **9**[1)2)], except **6.3**, of:	
BS 12 in combination with ground granulated blastfurnace slag conforming to BS 6699	BS 146:1996[3)]	
BS 12 in combination with pulverized-fuel ash conforming to BS 3892-1	BS 6588:1996	
Coarse aggregates	BS 882	BS 882
	BS 1047	BS 1047
Fine aggregate	BS 882	BS 882
All-in aggregate	BS 882	Not allowed

[1)] The combination should be subject to a procedure to demonstrate conformity

[2)] For the purposes of demonstrating equivalence, conformity to strength classes 37.5 or 47.5 of BS 6699 is deemed to satisfy strength classes 32.5 or 42.5 of BS 146 respectively.

[3)] As an alternative to conforming to the strength requirements in Clause **7** of BS 146:1996, the combination may conform to the standard strength classes in Table 7 of BS 6699:1992.

Table 5 — Mix proportions for standard mixes

Standard mix	Constituent	Nominal maximum size of aggregate			
		40 mm		20 mm	
		slump 75 mm	slump 125 mm	slump 75 mm	slump 125 mm
ST1	Cement (kg)	180	200	210	230
	Total aggregate (kg)	2010	1950	1940	1880
ST2	Cement (kg)	210	230	240	260
	Total aggregate (kg)	1980	1920	1920	1860
ST3	Cement (kg)	240	260	270	300
	Total aggregate (kg)	1950	1900	1890	1820
ST4	Cement (kg)	280	300	300	330
	Total aggregate (kg)	1920	1860	1860	1800
ST5	Cement (kg)	320	340	340	370
	Total aggregate (kg)	1890	1830	1830	1770
ST1 ST2 ST3	Fine aggregate (percentage by mass of total aggregate)	30 to 45	30 to 45	35 to 50	35 to 50
ST4 ST5	Fine aggregate (percentage by mass of total aggregate)				
	Grading limits C	30 to 40		35 to 45	
	Grading limits M	25 to 35		30 to 40	
	Grading limits F	25 to 30		25 to 35	

NOTE 1 The mix proportions for standard mixes are based on the use of cements of standard classes 42.5 or higher and will normally provide concrete having the characteristic strengths given in Table 3. The mass of cement shall be increased by 10 % when cements of standard strength classes 32.5 and 37.5 are used.

NOTE 2 The cement contents together with the total masses of saturated surface dry aggregates and added water will produce approximately one cubic metre of concrete. The values given are based on typical values of the relative densities of cement and aggregates. For some aggregates having higher or lower relative densities, adjustments may be required to the quantity of aggregates to produce this volume of concrete having the required workability and cement content.

NOTE 3 The values given for aggregate content shall be adjusted to allow also for the characteristics of the aggregates as described in **4.3.2** of BS 5328-3:1990.

NOTE 4 The aggregates for mixes ST1, ST2 and ST3 may be batched by volume.

NOTE 5 When standard mixes are specified with workabilities less than 75 mm slump, the mix proportions are to be taken from the appropriate 75 mm slump column.

blank

Section 5. Designated mixes

5.1 Designated mix

The mix shall be specified by considering the site conditions and then identifying from Table 13 in BS 5328-1:1997 the application for which the concrete is to be used, or the application that most closely resembles it, and citing the corresponding designation. For FND mixes, the purchaser shall be responsible for specifying the designated mix appropriate to the design chemical class after any adjustments to the design chemical class to take account of the additional protective measure "enhanced concrete quality" or selection of the aggregate carbonate range, see BRE Special Digest 1:Part 2 [4].

If for non-typical applications, or for structural or other reasons, a higher than normal designation is required, use shall be made of Table 6 to aid selection of the appropriate designated mix. The purchaser shall also specify:

a) whether the concrete is to be unreinforced, reinforced, reinforced and heated, or prestressed;

b) the aggregate nominal size if it is not 20 mm;

c) whether the concrete is exposed to a chloride-bearing environment;

d) whether the concrete is exposed to severe freezing conditions whilst wet.

The purchaser of the fresh concrete shall specify the workability and inform the producer of the method of placing and finishing. In general, this is all that is required but this section of BS 5328-2 permits some of the specification requirements to be relaxed or restricted and also permits certain options to be selected by the purchaser which shall then be specified.

5.2 Selection of materials

The producer shall use the materials given in **5.4** to make concrete conforming to **5.5** together with any options selected by the purchaser.

5.3 Method of specifying

5.3.1 General

The purchaser shall specify to the producer:

a) the essential items given in **5.3.2**;

b) the optional items given in **5.3.3** as appropriate.

The specification of a designated mix by its designation (see table 6) shall be an instruction to the producer to comply with BS 5328-2, BS 5328-3 and BS 5328-4, as appropriate.

NOTE To aid the task of preparing a specification, form D in Annex A may be freely copied and used.

5.3.2 Essential items

5.3.2.1 The purchaser shall specify to the producer:

a) the appropriate designated mix from Table 13 of BS 5328-1:1997;

b) whether the concrete is to be unreinforced, reinforced, reinforced and heated or prestressed;

NOTE In this context unreinforced concrete which is to contain embedded metal for other purposes should be described as reinforced.

c) the nominal size of aggregate, if 20 mm is not appropriate (see **4.3.2** of BS 5328-1:1997);

d) whether the concrete is exposed to a chloride bearing environment;

e) whether the concrete is exposed to severe freezing conditions whilst wet.

In addition, the purchaser of the fresh concrete shall specify:

f) the required workability (see table 13 of BS 5328-1:1997 for guidance).

5.3.2.2 The purchaser of the fresh concrete shall inform the producer of:

a) the method of placing the concrete;

b) the method of finishing the concrete.

5.3.3 Optional items

Any permitted option the purchaser wishes to exercise shall be specified. Options are given in the following notes 2, 3, 4 and 5, the notes to **5.4.1.1**, in **5.4.3.4**, **5.4.4** and **5.5.7**, and the note to **5.6.2**.

NOTE 1 GEN mixes with relatively low cement contents may not be suitable for obtaining satisfactory cast and direct finished surfaces nor for methods of placing such as pumping, and their suitability should be discussed between the purchaser and the producer.

NOTE 2 All the cements specified in Table 6 have the potential to provide adequate durability if the correct designated mix is specified and the concrete is transported, placed, compacted and cured correctly. However, in a few instances there may be an advantage in selecting a particular type of permitted cement (see BS 5328-1 or technical literature for guidance).

NOTE 3 In very hot weather, or where the rate of handling of the delivered concrete may be slow, the need to specify concrete containing a retarding admixture should be considered (see **7.4.2** of BS 5328-1:1997).

NOTE 4 In cold weather, the need to specify concrete with a higher temperature at delivery, or to specify the use of an accelerating admixture should be considered (see **7.4.1** of BS 5328-1:1997 or technical literature for guidance). In thin unprotected sections, it may be appropriate to specify a lower limit on the proportion of ggbs than that permitted for cements in **5.4.1.1**.

NOTE 5 Guidance is given in BRE Special Digest 1:Part 2 [4] on the extreme conditions where restrictions on the aggregate carbonate range to range C are recommended. In these cases, specify FND4** or FND4M** as appropriate.

Table 6 — Requirements for designated mixes

Mix designation	Characteristic strength N/mm²	Cement or combination group[1]	Minimum cement or combination content[2] kg/m³	Maximum free water/cement ratio	Aggregate carbonate range[3]
GEN 0	7.5	1	120	N/A	Any
GEN 1	10	1	175	N/A	Any
GEN 2	15	1	200	N/A	Any
GEN 3	20	1	220	N/A	Any
GEN 4	25	1	250	0.70	Any
FND 2	35	1[4]	340	0.50	Any
		2, 3	300	0.55	Any
FND 2Z	35	1[4], 2, 3	300	0.55	Any
FND 3	35	2a)	400	0.40	A
	35	2b), 3	380	0.45	A
	35	2, 3	340	0.50	B, C
FND 3*	35	2, 3	380	0.45	B, C[6]
FND 3**	35	2, 3	380	0.45	C
FND 3Z	35	1[4], 2, 3	340	0.50	Any
FND 4	35	2a)	400	0.35	A
	35	2b), 3	400	0.40	A
	35	2, 3	380	0.45	B, C
FND 4*	35	2, 3	400	0.40	B, C[6]
FND 4**	35	2, 3	400	0.40	C
FND 4Z	35	1[4], 2, 3	380	0.45	Any
FND 4M	35	2b)[5], 3	400	0.40	A
	35	3	380	0.45	B, C
FND 4M*	35	3	400	0.40	B, C[6]
FND 4M**	35	3	400	0.40	C
PAV 1[7]	35	1	300	0.60	Any
PAV 2[7]	40	1a)	320	0.45	Any
		1b), c), d), f)[8], g) and h)	340	0.45	Any
RC 30	30	1	275	0.65	Any
RC 35	35	1[9]	300	0.60	Any
RC 40	40	1[8], [9]	325	0.55	Any
RC 45	45	1[8], [9]	350	0.50	Any
RC 50	50	1[8], [9]	400	0.45	Any

[1] See **5.4.1**.
[2] See **5.5.3** and **5.5.4**.
[3] See **5.4.3.6**.
[4] Excluding Portland-limestone cement.
[5] The aggregate carbonate range shall be strictly determined on the basis of carbonate content and not by "declaration".
[6] Where aggregate carbonate range C is used, the concrete will also conform to the double starred class.
[7] The concrete shall contain an air entraining admixture to give a mean total air content by volume of 5.5 %, 4.5 % or 7.5 % with aggregate of 20 mm, 40 mm or 10 mm nominal maximum size respectively.
[8] Portland-limestone cement shall not be used in concrete containing embedded metal where the concrete is exposed to a chloride-bearing environment, e.g. most severe and chloride-bearing very severe environments.
[9] Unless the concrete is air entrained in accordance with note 7 of this table, Portland-limestone cement shall not be used in concrete exposed to conditions of freezing and thawing.

5.4 Permitted materials

5.4.1 Cements

5.4.1.1 *Cement group 1*

Where specified in accordance with table 6, the permitted cements and equivalent combinations shall be as follows:

a) Portland cement conforming to BS 12;

b) Portland blastfurnace cements conforming to BS 146, with not more than 55 % slag by mass of the nucleus unless otherwise agreed by the purchaser (see note 1);

c) high slag blastfurnace cement conforming to BS 4246 with not more than 55 % slag by mass of the nucleus unless otherwise agreed by the purchaser (see note 1);

d) Portland pulverized-fuel ash cements conforming to BS 6588;

e) Pozzolanic pulverized-fuel ash cement conforming to BS 6610;

f) Portland limestone cement conforming to BS 7583 (see note 2);

g) combinations of Portland cement conforming to BS 12 with ggbs conforming to BS 6699 where there is not more than 55 % ggbs by mass of the combination unless agreed otherwise with the purchaser (see notes 1 and 3);

h) combinations of Portland cement conforming to BS 12 with pulverized-fuel ash conforming to BS 3892-1 (see note 4).

NOTE 1 The reason for the limit on slag or ggbs content is to ensure that the properties of the concrete within a specified designated mix are broadly similar in the normally mild or cold climate in the United Kingdom. Where differences in rate of strength gain and finishing time do not matter the purchaser may delete this requirement.

NOTE 2 Portland limestone cement is not permitted in concrete containing embedded metal exposed to a chloride bearing environment. Portland limestone cement is not permitted in severe freezing/thawing conditions unless the concrete is air entrained.

NOTE 3 The combinations should conform to clauses **6** to **9** of either:

— BS 146:1996 (except **6.3**); or

— BS 4246:1996 (except **6.2**).

NOTE 4 The combinations should conform to clauses **6** to **9** of either:

— BS 6588:1996 (except **6.3**); or

— BS 6610:1996 (except **6.2**).

5.4.1.2 *Cement group 2*

Where specified in accordance with Table 6, the permitted cements and equivalent combinations shall be as follows.

a) Portland pulverized-fuel ash cement-B, conforming to BS 6588 and containing not less than 26 % fly ash by mass of the nucleus, pozzolanic pulverized-fuel ash cement containing not more than 42 % fly ash by mass of the nucleus, or combinations of Portland cement conforming to BS 12 with pfa conforming to BS 3892-1 where there is not less than 25 % pfa and not more than 40 % pfa by mass of the combination (see note 1).

b) High slag blastfurnace cement conforming to BS 4246 containing not less than 74 % slag by mass of the nucleus or combinations of Portland cement conforming to BS 12 with ggbs conforming to BS 6699 where there is not less than 70 % ggbs and not more than 84 % ggbs by mass of the combination (see note 2).

NOTE 1 The combinations should conform to clauses **6** to **9** of either:

— BS 6588:1996 (except **6.3**); or

— BS 6610:1996 (except **6.2**).

NOTE 2 The combinations should conform to clauses **6** to **9** of either:

— BS 146:1996 (except **6.3**); or

— BS 4246:1996 (except **6.2**).

Where the alumina content of granulated blastfurnace slag exceeds 14 % the tricalcium aluminate (C_3A) content of the Portland cement shall not exceed 10 %.

5.4.1.3 ***Cement group 3***

Where specified in accordance with Table 6, the only permitted cement shall be sulfate-resisting Portland cement conforming to BS 4027.

5.4.2 Other materials

If pulverized-fuel ash conforming to BS 3892-2 is used, it shall not be regarded as part of the cement content. Pigments or pigmented cement shall not be used.

5.4.3 Aggregates

5.4.3.1 Aggregates from natural sources shall conform to BS 882 and air-cooled blastfurnace slag aggregates shall conform to BS 1047.

5.4.3.2 In PAV 2 mixes, if the coarse aggregate is crushed air-cooled blastfurnace slag it shall be a graded aggregate in accordance with Table 1 of BS 1047:1983.

5.4.3.3 Fine aggregate used in PAV 2 mixes shall have not more than 25 % by mass of acid soluble material as determined by BS 812-119 in either the fraction retained on or the fraction passing the 600 μm sieve.

5.4.3.4 When tested in accordance with BS 812-120, the aggregate drying shrinkage shall not be greater than 0.075 % unless the purchaser has agreed a higher value.

5.4.3.5 Unless specified otherwise, the nominal maximum size of aggregate shall be 20 mm.

5.4.3.6 The aggregate carbonate range shall be determined in accordance with Amendment No. 1 to BS 882:1992.

5.4.4 Admixtures

5.4.4.1 Admixtures shall conform to BS EN 934-2. Where requested, the general chemical name and nominal dosage of the admixture shall be declared by the producer.

5.4.4.2 Calcium chloride or admixtures based on chlorides shall be not used in reinforced or prestressed concrete and their use in unreinforced concrete shall be with the agreement of the purchaser.

5.4.4.3 The purchaser shall declare specifically if the permitted admixtures for normal water reduction (see BS EN 934-2) or for superplasticizing (see BS EN 934-2) are not to be used.

5.4.4.4 An air entraining admixture (BS EN 934-2) shall be used in PAV 1 and PAV 2 (see note 7 to Table 6). Air entraining admixtures shall not be used in any other designated mix unless their use has been agreed with the purchaser.

5.4.4.5 Accelerators and retarders shall not be used unless specified by or agreed with the purchaser.

5.4.5 Water

Mixing water shall be of drinkable quality or conform to the limits set in annex A of BS 3148:1980.

5.5 Concrete mix requirements

5.5.1 Mix proportions

Designated mixes shall be designed and produced so that they conform to the appropriate requirements of this section and with BS 5328-3 and BS 5328-4.

5.5.2 Concrete grade

The characteristic strength of the concrete shall be the value given in table 6 corresponding to the mix designation.

5.5.3 Minimum cement content

The minimum cement content for concrete made with aggregate of 20 mm nominal maximum size shall be that given in Table 6 corresponding to the mix designation and cement group used. The minimum cement content given in Table 6 shall be adjusted for mixes containing aggregates of 40 mm and 10 mm nominal maximum size as given in Table 7, except for FND mixes where no adjustment is required. However, in the cases of PAV 2 and GEN 0, the minimum cement content shall not be reduced when aggregate of 40 mm nominal maximum size is used.

When the minimum cement content is adjusted to take account of aggregate of 40 mm nominal maximum size, the cement content for reinforced concrete shall not be less than 240 kg/m^3.

5.5.4 Maximum cement content

The maximum cement or cement plus ggbs content shall not exceed 500 kg/m^3 and the maximum cement plus pfa content shall not exceed 550 kg/m^3.

5.5.5 Maximum water/cement ratio

The maximum free water/cement ratio shall be the value given in Table 6 corresponding to the mix designation and cement group used.

5.5.6 Maximum chloride content

The maximum chloride content shall be as given in Table 8. The producer shall select the value appropriate to the use of the concrete specified by the purchaser and to the selected cement type.

5.5.7 Alkali—silica reaction

NOTE See **1.4**.

Text deleted.

Table 7 — Adjustments to minimum cement contents for aggregates other than those of 20 mm nominal maximum size

Nominal maximum aggregate size mm	Adjustment to the specified minimum cement content kg/m^3
10	+40
40	−30

Table 8 — Limits of chloride content of concrete

Type or use of concrete	Maximum total chloride content expressed as percentage of chloride ion by mass of cement %
Prestressed concrete. Heat cured concrete containing embedded metal	0.10
Concrete containing embedded metal and made with cement conforming to BS 4027	0.20
Concrete containing embedded metal and made with cement conforming to BS 12, BS 146, BS 4246, BS 6588, BS 6610, BS 7583 or combinations conforming to **5.4.1**	0.40
Other concrete	No limit

5.5.8 Workability

The variation in workability from that specified by the purchaser shall be within the tolerances specified in **3.5** of BS 5328-4:1990.

NOTE GEN mixes with relatively low cement contents may not always be suitable for obtaining cast and direct finished surfaces (see note 1 to **5.3.3**).

5.6 Conformity

5.6.1 Quality assurance

The producer shall hold current product conformity certification based on product testing and surveillance coupled with approval of their quality system to BS EN ISO 9001 by a certification body accredited by the Secretary of State (or equivalent) for the relevant areas of product and systems conformity certification. On request, the technical regulations of the accredited certification body shall be available for examination.

The producer shall inform the purchaser of the status of the concrete plant at the time of tender and immediately if any change in status occurs during the period between the time of tender and completion of supply.

5.6.2 Sampling point

Samples of concrete taken by the producer for continuous monitoring of production shall be taken at the point of discharge from the truck or from the mixer if discharged directly into the purchaser's vehicle.

NOTE This requirement also applies to sampling for the determination of air content and is based on the assumption that differences in the air content between the point of discharge and the point of placing are small. Where the distance between the point of discharge and the point of placing is large or the concrete is pumped, it may be necessary to specify a higher air content (see **7.1** of BS 5328-1:1997).

5.6.3 Acceptance testing by the purchaser

Acceptance testing by the purchaser is not normally necessary but purchasers shall retain the right to carry out such testing based on BS 5328. Sampling, specimen making, curing and testing of fresh concrete shall be certificated as conforming to the appropriate part of BS 1881. Tests for cube strength shall be certificated as conforming to BS 1881-116 and shall be carried out by a laboratory accredited for the test by the United Kingdom Accreditation Service (UKAS).

5.7 Documentation

Before discharging the concrete at the point of delivery, the supplier shall provide the purchaser with a delivery ticket for each batch of concrete, on which is printed, stamped or written the information specified in **4.10.4.4** of BS 5328-3:1990.

In addition, the use of the concrete specified by the purchaser shall be written on the ticket immediately after the mix designation using the following abbreviations (e.g. FND 2 (U)):

U	for unreinforced concrete;
R	for reinforced concrete;
HR	for reinforced concrete that will be heat cured;
PS	for prestressed concrete.

Annex A (informative)
Forms for specifying or scheduling concrete mixes in accordance with BS 5328

Form A should be used when specifying designed mixes, form B when specifying prescribed mixes, form C when specifying standard mixes and form D when specifying designated mixes.

These forms may be freely copied from this standard.

The following abbreviations are used in the forms:

LASRPC	low alkali sulfate-resisting Portland cement;
PBFC	Portland blastfurnace cement;
PC	Portland cement;
PLC	Portland limestone cement;
PPFAC	Portland pulverized-fuel ash cement;
SRPC	sulfate-resisting Portland cement.

Form A. Schedule for the specification requirements of designed mixes required for use on contract					
The concretes below shall be supplied as designed mixes in accordance with the relevant clauses of BS 5328:Parts 2, 3 and 4.					
1. Mix reference					
2. Strength grade					
3. Nominal maximum size of aggregate (mm)					
4. Types of aggregate	Coarse Other Fine Other	BS 882 BS 1047 BS 882	BS 882 BS 1047 BS 882	BS 882 BS 1047 BS 882	BS 882 BS 1047 BS 882
5. Design chemical class (ring if appropriate)		DC-2 DC-2z DC-3 DC-3* DC-3** DC-3z DC-4 DC-4* DC-4** DC-4m DC-4m* DC-4m** DC-4z	DC-2 DC-2z DC-3 DC-3* DC-3** DC-3z DC-4 DC-4* DC-4** DC-4m DC-4m* DC-4m** DC-4z	DC-2 DC-2z DC-3 DC-3* DC-3** DC-3z DC-4 DC-4* DC-4** DC-4m DC-4m* DC-4m** DC-4z	DC-2 DC-2z DC-3 DC-3* DC-3** DC-3z DC-4 DC-4* DC-4** DC-4m DC-4m* DC-4m** DC-4z
6. Cement type(s) or combinations conforming to[1)] (delete those not permitted) BS 12 BS 146 BS 6588 BS 4027 BS 4246[2)] BS 7583[2)] Others		 PC PBFC PPFAC SRPC HSBC PLC	 PC PBFC PPFAC SRPC HSBC PLC	 PC PBFC PPFAC SRPC HSBC PLC	 PC PBFC PPFAC SRPC HSBC PLC
7. Minimum cement or combination content[4)] (kg/m^3)					
8. Maximum free water/cement ratio[4)]					
9. Quality assurance requirements					
10. Rate of sampling intended by the purchaser for strength testing (for information only)					
11. Other requirements (e.g. maximum chloride content etc., where appropriate)					
The following section to be completed by the purchaser of fresh concrete					
12. Workability Slump (mm) Compacting factor Vebe (seconds) Flow (mm) (ring method and give target value)					
13. Method of placing (for information only)					
14. Other requirements by purchaser of fresh concrete (where appropriate)					

1) When these standards have been superseded by European standards, the equivalent European cement will be used.
2) Appropriate for some sulfate-resisting or low-heat applications.
3) Reference should be made to **4.2.4** and footnote 4) to Table 7a) of BS 5328-1:1997 before specifying this cement.
4) Where a design chemical class is ringed and no preference for a cement type or combination is indicated, the minimum cement or combination content and the maximum free water/cement ratio for the cement type to be used shall be in accordance with Table 7a) of BS 5328-1:1997.

Form B. Schedule for the specification requirements of prescribed mixes required for use on contract				
The mixes below shall be supplied as prescribed mixes in accordance with the relevant clauses of BS 5328:Parts 2, 3 and 4				
1. Mix reference				
2. Type(s) and standard strength class(es) of the cement(s) or combination(s)				
3. Nominal maximum size of aggregate (mm)				
4. Types of aggregate Coarse Fine				
5. Mix proportions Cement (kg) Fine aggregate (kg) Coarse aggregate (kg) Admixtures Other				
6. Workability Slump (mm) Compacting factor Vebe(s) Flow (mm) (ring method and give target)				
7. Quality assurance requirements				
8. Method of compliance and rate of sampling (for information only)				
9. Other requirements (e.g. maximum chloride, etc., if appropriate)				

Form C. Schedule for the specification requirements of standard mixes required for use on contract

.....

The mixes below shall be supplied as standard mixes in accordance with the relevant clauses of BS 5328:Parts 2, 3 and 4. Designated mixes agreed as equivalent will be acceptable/unacceptable (delete one) as alternative mixes to those below.

1.	Standard mix (ring those required)	ST1	ST2	ST3	ST4	ST5
2.	Class of concrete (for information only) (ring the appropriate)	unrein-forced	unrein-forced reinforced	unrein-forced reinforced	unrein-forced reinforced	unrein-forced reinforced
3.	Cement type(s) or combinations conforming to (ring as permitted)					
	BS 12	PC	PC	PC	PC	PC
	BS 146	PBFC	PBFC	PBFC	PBFC	PBFC
	BS 6588	PPFAC	PPFAC	PPFAC	PPFAC	PPFAC
	BS 4027[1)]				SRPC	SRPC
	BS 4027[1)]				LASRPC	LASRPC
	BS 7583	PLC	PLC	PLC	PLC	PLC
4.	Nominal maximum size of aggregate	40	40	40	40	40
	(mm) (ring the appropriate)	20	20	20	20	20
5.	Types of aggregate Coarse	BS 882	BS 882	BS 882	BS 882	BS 882
	(ring those permitted)	BS 1047	BS 1047	BS 1047	BS 1047	BS 1047
	Fine	BS 882	BS 882	BS 882	BS 882	BS 882
	All in ST1, ST2, ST3 only	BS 882	BS 882	BS 882		
6.	Workability	Very low				
	Slump (ring as appropriate)	75 mm	75 mm	75 mm	75 mm	75 mm
	(to be completed by the purchaser of the fresh concrete)	125 mm	125 mm	125 mm	125 mm	125 mm
7.	Quality assurance requirements					
8.	Other requirements (if appropriate)					

[1)] Reference should be made to **8.2.4** of BS 5328-1:1997 before specifying these cements.

Form D. Schedule for the specification requirements for designated mixes required for use on contract

.....

The mixes below shall be supplied as designated mixes in accordance with the relevant clauses of BS 5328-2, BS 5328-3 and BS 5328-4. Standard mixes agreed as equivalent will be acceptable/unacceptable (delete as appropriate) as alternative mixes to those below.

1. Mix designation				
2. Use of concrete (ring one only)				
for unreinforced concrete	U	U	U	U
for reinforced concrete	R	R	R	R
for reinforced concrete that will be heat cured	HR	HR	HR	HR
for prestressed concrete	PS	PS	PS	PS
3. Environment (see table 5 of BS 5328:Part 1:1997) (ring as appropriate)				
chloride bearing	CB	CB	CB	CB
non-chloride bearing	NCB	NCB	NCB	NCB
severe freeze/thaw	F/T	F/T	F/T	FT
4. Nominal maximum size of aggregate (mm) (enter 10 or 40, or leave blank for 20 mm)				
5. Other requirements (if appropriate)				
6. Workability	50	50	50	50
Slump (mm) (ring one or give value)	75	75	75	75
Other (to be completed by the purchaser of the fresh concrete)	125	125	125	125
7. Method of placing (for information only)				
8. Method of finishing (for information only)				

List of references (see clause 1.2)

Normative references

BSI publications

BRITISH STANDARDS INSTITUTION. London

BS 12:1996, *Specification for Portland cement.*

BS 146:1996, *Specification for Portland blastfurnace cement.*

BS 812, *Testing aggregates.*

BS 812-119:1985, *Method for determination of acid-soluble material in fine aggregate.*

BS 812-120:1989, *Method for testing and classifying drying shrinkage of aggregates in concrete.*

BS 882:1992, *Specification for aggregates from natural sources for concrete.*

BS 1047:1983, *Specification for air-cooled blastfurnace slag aggregate for use in construction.*

BS 1881, *Testing concrete.*

BS 1881-107:1983, *Method for determination of density of compacted fresh concrete.*

BS 1881-114:1983, *Methods for determination of density of hardened concrete.*

BS 1881-116:1983, *Method for determination of compressive strength of concrete cubes.*

BS 3148:1980, *Methods of test for water for making concrete (including notes on the suitability of the water).*

BS 3892, *Pulverized-fuel ash.*

BS 3892-1:1997, *Specification for pulverized-fuel ash for use with Portland cement.*

BS 3892-2:1996, *Specification for pulverized-fuel ash to be used as a Type 1 addition.*

BS 4027:1996, *Specification for sulfate-resisting Portland cement.*

BS 4246:1996, *Specification for high slag blastfurnace cement.*

BS 5075, *Concrete admixtures.*

BS 5075-1:1982, *Specification for accelerating admixtures, retarding admixtures and water reducing admixtures.*

BS 5075-3:1985, *Specification for superplasticizing admixtures.*

BS 5328, *Concrete.*

BS 5328-1:1997, *Guide to specifying concrete.*

BS 5328-3:1990, *Specification for the procedures to be used in producing and transporting concrete.*

BS 5328:Part 4:1990, *Specification for the procedures to be used in sampling, testing and assessing compliance of concrete.*

BS 6100, *Glossary of building and civil engineering terms.*

BS 6588:1996, *Specification for Portland pulverized-fuel ash cement.*

BS 6610:1996, *Specification for Pozzolanic pulverized-fuel ash cement.*

BS 6699:1992, *Specification for ground granulated blastfurnace slag for use with Portland cement.*

BS 7583:1996, *Specification for Portland limestone cement.*

BS EN 197, *Cement.*

BS EN 197-1:2000, *Composition, specifications and conformity criteria for common cements.*

BS EN 934, *Admixtures for concrete, mortar and grout.*

BS EN 934-2:1998, *Concrete admixtures — Definitions and requirements.*

BS EN ISO 9001:1994, *Quality systems. Model for quality assurance in design, development, production, installation and servicing.*

Informative references

BSI publications

BRITISH STANDARDS INSTITUTION, London

BS EN ISO 9000, *Quality management and quality assurance standards.*

Other publications

[1] BRE Digest 330[1)] Alkali-silica reaction in concrete, 1999

[2] British Cement Association Protocol Testing protocol for greywacke aggregates[2)], 1999

[3] Concrete Society Technical Report No. 30[3)] Alkali-silica reaction — minimizing the risk of damage to concrete, 1999

[4] BRE Special Digest 1:Part 2[1)] Concrete in aggressive ground — Specifying concrete and additional protective measures

[1)] Available from CRC Ltd, 151 Rosebery Avenue, London EC1R 4QX or online from www.brebookshop.com.
[2)] Available from British Cement Association, Century House, Telford Avenue, Crowthorne, Bucks RG45 6YS.
[3)] Available from Concrete Society, Century House, Telford Avenue, Crowthorne, Berkshire RG45 6YS.

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: +44 (0)20 8996 9000. Fax: +44 (0)20 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: +44 (0)20 8996 9001. Fax: +44 (0)20 8996 7001. Email: orders@bsi-global.com. Standards are also available from the BSI website at http://www.bsi-global.com.

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: +44 (0)20 8996 7111. Fax: +44 (0)20 8996 7048. Email: info@bsi-global.com.

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: +44 (0)20 8996 7002. Fax: +44 (0)20 8996 7001. Email: membership@bsi-global.com.

Information regarding online access to British Standards via British Standards Online can be found at http://www.bsi-global.com/bsonline.

Further information about BSI is available on the BSI website at http://www.bsi-global.com.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL