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BRITISH STANDARD

BS 812-102: 1989

Testing aggregates —

Part 102: Methods for sampling

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Cement, Gypsum, Aggregates and Quarry Products Standards Policy Committee (CAB/-) to Technical Committee CAB/2, upon which the following bodies were represented:

Aggregate Concrete Block Association
Association of Consulting Engineers
Association of Consulting Scientists
Association of Lightweight Aggregate Manufacturers
Brick Development Association
British Aggregate Construction Materials Industries
British Cement Association
British Ceramic Research Ltd.
British Civil Engineering Test Equipment Manufacturers' Association
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Mortar Producers Association Limited
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Contents

Foreword

This Part of BS 812 has been prepared under the direction of the Cement, Gypsum, Aggregates and Quarry Products Standards Policy Committee. This is a new edition of this Section of BS 812. This edition introduces technical changes to bring the standard up-to-date but it does not reflect a full review of the standard, which will be undertaken in due course. BS 812-102:1984[1)] was a revision of clauses **3**, **5** and **6** of BS 812-1:1975 and this edition re-introduces, in the form of an appendix, the description of particle shape and surface texture of aggregates previously contained therein. The remainder of the 1975 edition is being revised and as each of the tests, or collection of related tests is revised it is intended to issue it as a separate Part or Section of this standard.

As part of the new approach to harmonization and standards in Europe, work on testing of aggregates will become part of the programme of work to be undertaken by CEN/TC 154, Aggregates. If the methods described in this standard are to be included in that programme then, under the CEN Regulations, they will become subject to standstill. The standstill is an obligation on the part of members of CEN/CENELEC not to publish during a given period a new or revised national standard which is not completely in line with a European Standard (EN) or a Harmonized Document (HD) in existence or in preparation, or to take any other action which could prejudice the intended harmonization. The next edition of this standard could therefore be a dual British/European (EN) Standard.

It is intended that other British Standards should call up BS 812 test methods as the basis of the compliance. Nevertheless, it is *not* intended that all aggregates should be subjected regularly to all the listed tests. Specifications in other standards should call up only relevant test methods.

Some of the tests in other Parts of this standard are of limited application, and advice on the use of simpler tests is given, for example when they can be used for a preliminary sorting of aggregates to see whether more expensive testing is justified.

Reference should be made to BS 812-101 for general guidance on testing aggregates, precision of test methods and variance arising from sampling errors.

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 10, 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.

[1)] Now withdrawn.

0 Introduction

All the stages of sampling leading to the production of proper test portions require skill and care. Problems of several kinds arise.

a) Sampling may expose the operator to difficulty and possible danger. Due considerations should be given to the safety of the operator at all times. Sampling within the body of a vehicle or under chutes pose particular difficulties.

b) Often it is not easy to discern a batch, and thus specifications that rely on this standard should state the maximum quantity that a bulk sample should represent.

c) Aggregates often segregate by size and, ideally, they should be sampled from large quantities during loading or unloading, but this is often impractical.

The general principles of BS 5309-1 and BS 5309-4 should be followed in drawing up sampling plans. The method set out in clause **5** should be used as the basis for tests for compliance with specifications for aggregates.

Materials finer than 75 μm, used as fillers in bituminous mixtures, should be sampled in accordance with BS 4550-1, using procedures appropriate to the type of delivery to produce a laboratory sample having a mass of at least 7 kg.

The definitions of the several stages in the production of the test portions are given in clause **2**. In some cases the bulk sample is inconveniently large to send for testing and has to be reduced. If not, it becomes the laboratory sample.

At the laboratory, the laboratory sample is reduced to the test portions required. If adequate facilities exist at the point of taking the bulk sample, all necessary reduction to the stage of producing the test portions may be done before despatch to the laboratory. If several kinds of tests are to be done, an intermediate stage of reduction is necessary. In other cases, the test portion is reduced directly from the laboratory sample. It is again emphasized that care has to be taken to ensure that the test portions are representative of the bulk sample.

1 Scope

This Part of BS 812 describes methods for obtaining samples of aggregates of the quantity required for carrying out testing in accordance with other Parts of BS 812. The method to be used for recording the nominal description of materials sampled is also given.

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

2 Definitions

For the purposes of this British Standard the definitions of petrological terms in BS 6100-5.2 apply (see also Appendix A) together with the following.

2.1
batch

a definite quantity of some commodity manufactured or produced under conditions which are presumed uniform

NOTE With a continuous process the quantity produced during a specified period should be treated as a batch.

2.2
sampling increment

a quantity of material taken at one time from a larger body of material

NOTE When sampling aggregates, the material taken by a single operation of the scoop should be treated as a sampling increment.

2.3
bulk sample

an aggregation of the sampling increments

2.4
laboratory sample

a sample intended for laboratory inspection or testing

2.5
test portion

the material used as a whole in testing or inspection

NOTE When sampling a batch of aggregates, the aggregation of the sampling increments yields the bulk sample. If the bulk sample is of an appropriate size it is sent to the laboratory as a laboratory sample, otherwise it is reduced by a sample reduction process as described in clause **6** to the laboratory sample. At the laboratory, the laboratory sample is reduced by one or more reduction operations to the quantity required by a particular test method; the quantity of material produced at the final stage of sample reduction is referred to as the test portion. A particular test method may then require several specimens to be made from a test portion.

3 Principle

Unless an explicit statement to the contrary is made in other Parts of this standard, the aim is to obtain a test portion that is representative of the average quality of the batch.

4 Apparatus

4.1 *A small scoop*, to hold a volume of at least 1 L (i.e. about 1.5 kg of aggregate of normal density). This scoop is used for sampling aggregates of nominal sizes less than 5 mm.

4.2 *A large scoop*, to hold a volume of at least 2 L (i.e. about 3 kg of aggregate of normal density). This scoop is used to sample any grading of aggregate, but is required particularly for aggregates of nominal sizes greater than 5 mm.

NOTE A suitable scoop is shown in Figure 1.

4.3 *Containers,* clean and non-absorbent, such as buckets, for collecting the increments of a sample.

4.4 *Containers*, clean and impervious, such as bags made of plastics at least 100 μm thick, for sending samples to laboratories.

4.5 *A sample divider*, appropriate to the maximum size to be handled, e.g. a riffle box such as that illustrated in Figure 2. Alternatively, a flat shovel and a clean flat and hard surface, e.g. a metal tray, for use in quartering.

NOTE For sampling in special circumstances other apparatus may be needed. For example, shovels, spades, picks, etc. may be needed to reach the material to be sampled.

5 Procedure for sampling coarse, fine and all-in aggregates

The quantity of material to be represented by the bulk sample shall be clearly defined and the sample shall be taken by a responsible and experienced person.

Obtain a bulk sample by collecting, in the clean containers, a sufficient number of increments (i.e. scoopfuls) to provide the required quantity of aggregate for all the tests subsequently to be made. However the number of increments shall be not less than those given in Table 1.

Take the increments from different parts of the batch in such a way as to represent the average quality.

When replicate samples are required take each sample as a separate and independent operation.

When sampling from heaps of aggregate, take the required number of increments from positions evenly distributed over the whole surface of the heap. At the required spot for each increment remove as much surface material as necessary to expose aggregate at least 150 mm in from the surface. Take the increment by digging the scoop into this exposed material.

NOTE 1 Aggregates that are badly segregated present problems of varying complexity and in many cases it is better to wait until they are moved.

NOTE 2 Sampling near ground level should be done with care to avoid contamination with, for example, residues of previous materials.

When sampling from material in motion, i.e. when it is being loaded or unloaded, calculate the sampling times to give the required number of sampling increments, ensuring that they are randomly distributed through the batch of aggregate.

When sampling from a falling stream of aggregate, take increments from the whole width of the stream.

NOTE 3 Mechanical samplers, manually or automatically operated, used for sampling from moving streams may be taken as being in accordance with this standard provided that each complete operation of the sampler produces an increment of at least 2 L of coarse or all-in aggregate or 1 L of fine aggregate.

When sampling from conveyor belts, stop the conveyor at the appropriate time and take all the material from a fixed length of conveyor.

CAUTION. Never sample manually from a moving conveyor.

For all methods of sampling, combine all the increments and either despatch the bulk sample or reduce it to a smaller representative sample, acceptable to the tester, by the procedure described in clause **6** and then despatch this smaller sample for testing. The sample despatched to the laboratory is the laboratory sample.

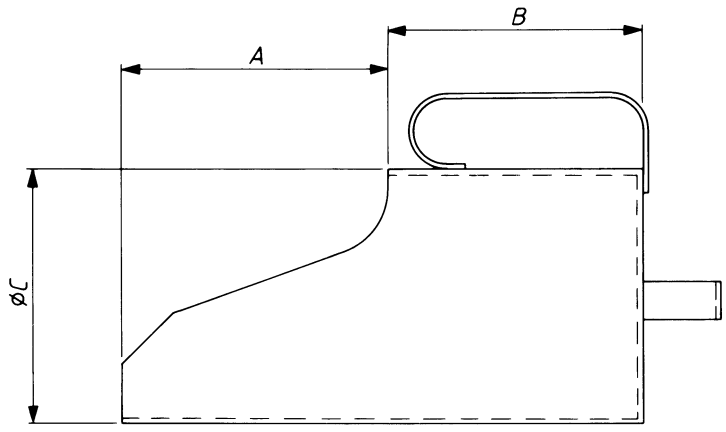
On completion of the sampling process, always make a visual check of the relation of the sample to the material in bulk.

NOTE 4 Whether the bulk is uniform or not, the sample should be seen to contain a similar range of sizes including the maximum and minimum.

NOTE 5 The procedure described in this clause is for obtaining a bulk sample representative of the batch sampled. When sampling is carried out to assess variability within a batch, a number of increments are taken from defined places in the batch and are not combined but tested separately. For routine testing quality control, simplified procedures may be used. Fewer increments may prove satisfactory for this purpose. Where it is necessary to determine the presence and quantity of an occasional contaminant, special measures may be necessary and reference should be made to the appropriate Part of this standard. These and other departures from the method should be recorded on the certificate of sampling.

Table 1 — Minimum number of sampling increments

Nominal size of aggregate	Minimum number of sampling increments		Approximate minimum mass for normal density aggregate
	Large scoop	Small scoop	
			kg
28 mm and larger	20	—	50
5 mm to 28 mm	10	—	25
5 mm and smaller	10 half scoops	10	10



	Small scoop	Large scoop
	mm	mm
A	100	125
B	100	125
C	100 ϕ	125 ϕ

Not to scale

Figure 1 — Sampling scoops

6 Sample reduction

6.1 General. It is sometimes necessary to reduce the mass of the bulk sample substantially. This shall be done in such a way as to preserve at each stage a representative part of the bulk sample. The methods described in **6.2** and **6.3** are acceptable.

6.2 Using a sample divider. The width of the channels of the divider shall be appropriate to the maximum particle size of the aggregate and, in general, not less than 1.5 times the size of the largest aggregate particle. When the aggregate contains material finer than 5 mm it shall be surface dry.

Thoroughly mix and then pass it through the sample divider. Retain one portion; pass it through again and repeat the process as often as necessary to reduce the original sample to the required mass.

6.3 Quartering. Thoroughly mix the sample by heaping it on to a clean, flat and hard surface to form a cone, and turning this over with the shovel to form a new cone, the operation being carried out three times. Form each conical heap by depositing each shovelful of the material on the apex of the cone so that the portions which slide down the sides are distributed as evenly as possible, and so that the centre of the cone is not displaced.

Flatten the third cone by repeated vertical insertion of the shovel across the apex of the cone, lifting the shovel clear of the material after each insertion. Then quarter the flattened heap, which shall be uniform in thickness and diameter, along two diameters intersecting at right angles. Discard one pair of diagonally opposite quarters and shovel the remainder into a heap. Repeat the process of mixing and reduction, until the required mass of sample is obtained.

6.4 Sample reduction to provide replicate samples, When duplicate (or more) laboratory samples are required from a bulk sample, first reduce the bulk sample by the procedure described in **6.2** or **6.3**. Recombine all the excess bulk sample rejected at the individual division stages, mix thoroughly and reduce again to provide a second laboratory sample. Repeat as necessary to provide the required number of laboratory samples.

NOTE This procedure should also be used to provide replicate test portions from a laboratory sample.

7 Nominal description

The nominal description of the material sampled shall be recorded on the certificate (see clause **9**) under the following general headings.

a) *Type.* Use one of the following terms:

1) "crushed rock";

2) "sand" or "gravel". In this case record if the aggregate is crushed or partially crushed and, when known, if it has been obtained by inland or marine working;

3) "artificial". In this case record if the artificial aggregate is slag, synthetic or broken rubble, etc.

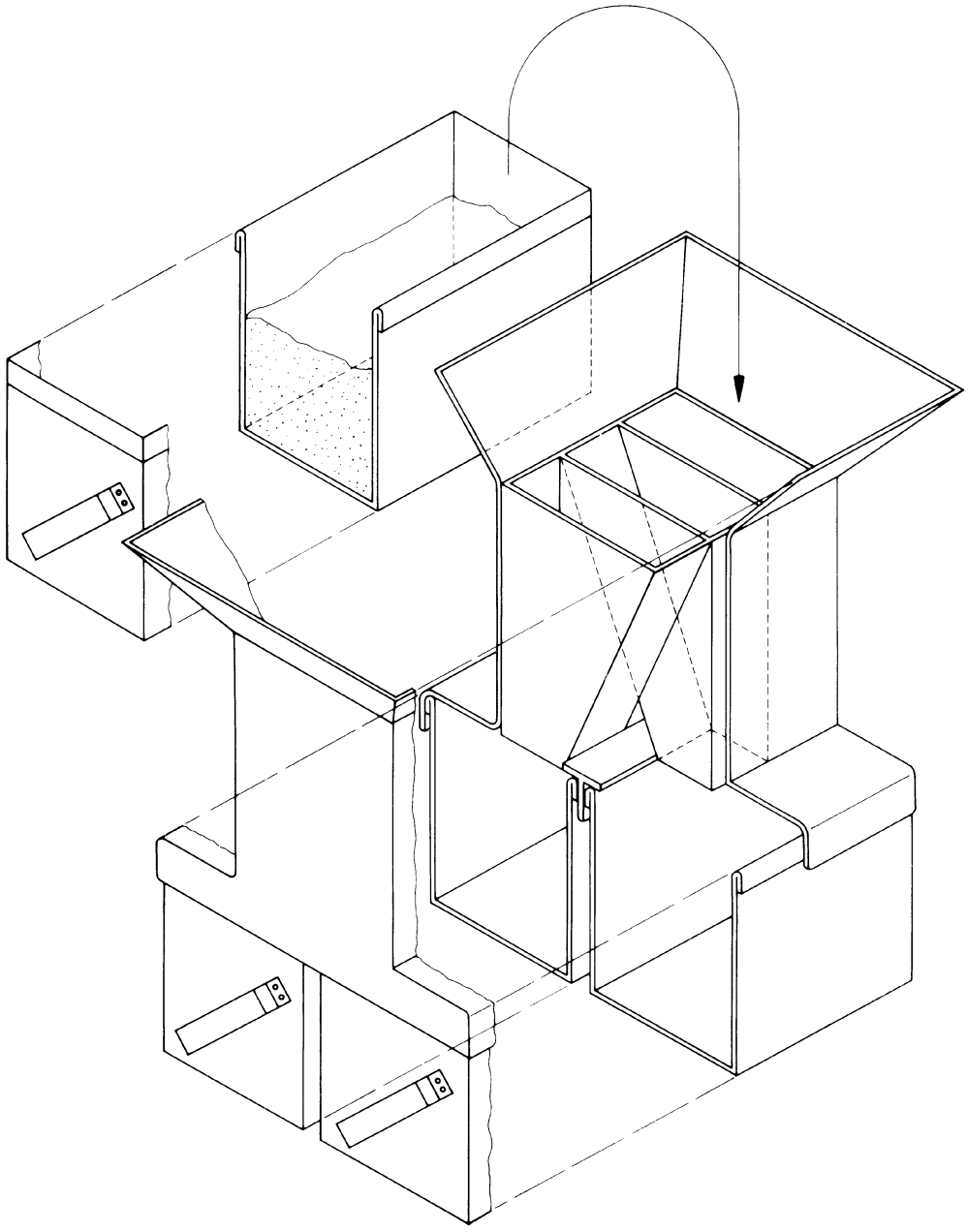
b) *Nominal size*

c) *Other.* References shall be made to the presence of any obvious extraneous pieces in the sample such as clay lumps, organic material, etc.

NOTE 1 When a geological or petrological term is required to describe an aggregate in more detail, it should be provided by a competent person or authority using, whenever possible, a term from Appendix A.

Similarly when a metallurical term is required to describe a slag in more detail, it should be provided by a competent person or authority.

NOTE 2 Appendix C should be used when it is necessary to describe the particle shape and surface texture characteristics.



NOTE The width of the slots should be not less than 1.5 times the diameter of the largest aggregate particle.

Figure 2 — A suitable type of sample divider (riffle-box)

8 Despatch of samples

8.1 Packing samples of aggregates. The samples shall be transferred completely to containers (see **4.4**) which shall then be sealed for despatch. Where necessary, particularly where the aggregate contains crushed particles of the larger sizes, the bags shall be protected against damage in transit by casing in suitable containers.

NOTE Individual packages should preferably not exceed 30 kg.

8.2 Information to be sent with samples. Each package shall contain a card, suitably protected from damage by moisture and abrasion, giving the name and address of the sender and his description of the material.

When several samples are taken from a single source, each individual sample shall be separately identified.

9 Certificate of sampling

Each sample, or group of samples from a single source, shall be accompanied by a certificate, from the person responsible for taking the sample, certifying that sampling was carried out in accordance with this British Standard. The certificate shall include as much as is appropriate of the following information. See Appendix B for a recommended form of certificate.

a) the date, time, place and method of sampling;

b) the name and location of source;

c) sample identification mark (or marks);

d) all the data recorded under nominal description (clause **7**). When a geological, petrological or metallurgical term is used to describe a material, the identity of the competent person or authority responsible for the description shall be recorded;

e) description of the batch;

f) any other information likely to be helpful to the tester (see note 5 to clause **5**);

g) name and signature of sampler.

Appendix A Petrological description of natural aggregates

The aggregate should be described by an appropriate petrological name, preferably selected from the list of terms and definitions given in Table 2, which are taken from BS 6100-5.2. In the event that the aggregate cannot be described adequately by the terms in Table 2, it should be described by another appropriate petrologically accepted term.

In the case of sedimentary rocks such as limestone or sandstone the geological age of the rock should also be given. The geological age requirement is satisfied by using one of the following terms: Precambrian, Cambrian, Ordovician, Silurian, Devonian, Carboniferous, Permian[2)], Triassic, Jurassic, Cretaceous, Tertiary. For example, different types of limestone are described in terms of their age as follows, Carboniferous limestone, Jurassic limestone, Silurian limestone etc. The age of post-Tertiary materials need not be given.

Where the petrological character of an aggregate is intermediate between any of the terms in Table 2, or, where it consists of mixed gravels, the aggregate should be described by combining appropriate terms, e.g. granite/diorite, basalt/dolerite, microgranite/rhyolite, quartzite/granulite, flint/quartzite.

Petrological description does not take account of suitability for any particular purpose, which should be determined in accordance with the appropriate British Standard.

[2)] The term Magnesian Limestone can be substituted for Permian Limestone where appropriate.

Table 2 — Rock types commonly used for aggregates

Petrological term	Description
andesite[a]	a fine grained, usually volcanic, variety of diorite
arkose	a type of sandstone or gritstone containing over 25 % feldspar
basalt	a fine grained basic rock, similar in composition to gabbro, usually volcanic
breccia[b]	rock consisting of angular, unworn rock fragments, bonded by natural cement
chalk	a very fine grained Cretaceous limestone, usually white
chert	cryptocrystalline[c] silica
conglomerate[b]	rock consisting of rounded pebbles bonded by natural cement
diorite	an intermediate plutonic rock, consisting mainly of plagioclase, with hornblende, augite or biotite
dolerite	a basic rock, with grain size intermediate between that of gabbro and basalt
dolomite	a rock or mineral composed of calcium magnesium carbonate
flint	cryptocrystalline[c] silica originating as nodules or layers in chalk
gabbro	a coarse grained, basic, plutonic rock, consisting essentially of calcic plagioclase and pyroxene, sometimes with olivine
gneiss	a banded rock, produced by intense metamorphic conditions
granite	an acidic, plutonic rock, consisting essentially of alkali feldspars and quartz
granulite	a metamorphic rock with granular texture and no preferred orientation of the minerals
greywacke	an impure type of sandstone or gritstone, composed of poorly sorted fragments of quartz, other minerals and rock; the coarser grains are usually strongly cemented in a fine matrix
gritstone	a sandstone, with coarse and usually angular grains
hornfels	a thermally metamorphosed rock containing substantial amounts of rock-forming silicate minerals
limestone	a sedimentary rock, consisting predominantly of calcium carbonate
marble	a metamorphosed limestone
microgranite[a]	an acidic rock with grain size intermediate between that of granite and rhyolite
quartzite	a metamorphic rock or sedimentary rock, composed almost entirely of quartz grains
rhyolite[a]	a fine grained or glassy acidic rock, usually volcanic
sandstone	a sedimentary rock, composed of sand grains naturally cemented together
schist	a metamorphic rock in which the minerals are arranged in nearly parallel bands or layers. Platy or elongate minerals such as mica or hornblende cause fissility in the rock which distinguishes it from a gneiss
slate	a rock derived from argillaceous sediments or volcanic ash by metamorphism, characterized by cleavage planes independent of the original stratification
syenite	an intermediate plutonic rock, consisting mainly of alkali feldspar with plagioclase, hornblende, biotite, or augtite
trachyte[a]	a fine grained, usually volcanic, variety of syenite
tuff	consolidated volcanic ash

[a] The terms microgranite, rhyolite, andesite, or trachyte, as appropriate, are preferred for rocks alternatively described as porphyry or felsite.
[b] Some terms refer to structure or texture only, e.g. breccia or conglomerate, and these terms cannot be used alone to provide a full description.
[c] Composed of crystals so fine that they can be resolved only with the aid of a high power microscope.

Appendix B Recommended form of certificate of sampling

Certificate of sampling in accordance with BS 812-102	Sample identification mark

Date, time, place and method of sampling:

Name and location of source:

Nominal description:
a) type:
b) nominal size:
c) comments on sample:

Coarse or fine aggregate:

Quantity of batch sampled:

Name and signature of sampler:

Appendix C Description of particle shape and surface texture of aggregates

To avoid lengthy descriptions, it is convenient to classify aggregate particle shape and surface texture characteristics under a number of simple headings. The system given in Table 3 and Table 4 has been devised for this purpose.

Typical particle shapes are illustrated in Figure 3 and tests for obtaining quantitative assessments of flakiness and elongation are given in Parts 105.1 and 105.2[3)].

Table 3 — Particle shape

Classification	Description
Rounded	Fully water-worn or completely shaped by attrition
Irregular	Naturally irregular, or partly shaped by attrition and having rounded edges
Angular	Possessing well defined edges formed at the intersection of roughly planar faces
Flaky	Having one dimension significantly smaller than the other two dimensions
Elongated	Having one dimension significantly larger than the other two dimensions
Flaky and elongated	Having three significantly different dimensions, i.e. length significantly larger than width and width significantly larger than thickness

Table 4 — Surface texture

Surface texture	Characteristics
Glassy	Conchoidal (i.e. curved) fracture
Smooth	Water-worn or smooth due to fracture of laminated or very finely grained rock
Granular	Fracture showing more or less uniform size rounded grains
Rough	Fracture of fine or medium grained rock containing no easily visible crystalline constituents
Crystalline	Containing easily visible crystalline constituents
Honeycombed	With visible pores and cavities
NOTE Surface texture has been described under the above six headings. This grouping is broad, being based on the impression which would be gained by visual examination of hand specimens. It does not purport to be a precise petrological classification (see Appendix A). Different specimens of the same rock type may not fall into the same group in Table 4.	

[3)] In preparation.

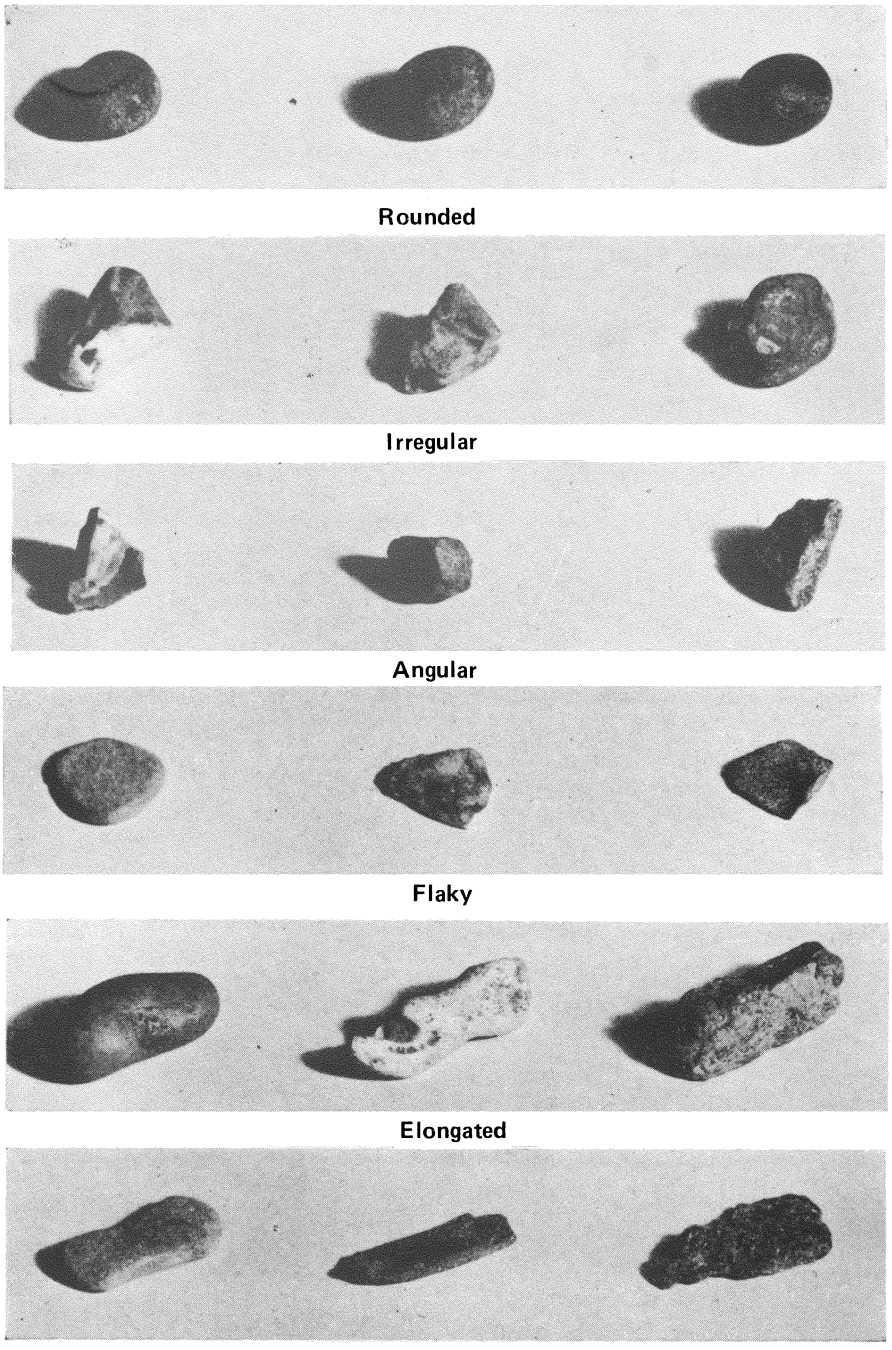


Figure 3 — Typical particle shapes

Publications referred to

BS 812, *Testing aggregates.*
BS 812-101, *Guide to sampling and testing aggregates.*
BS 812-105, *Methods for determination of particle shape.*
BS 812-105.1, *Flakiness index.*
BS 812-105.2, *Elongation index of coarse aggregate*[4)].
BS 4550, *Methods of testing cement.*
BS 4550-1, *Sampling.*
BS 5309, *Methods for sampling chemical products.*
BS 5309-1, *Introduction and general principles.*
BS 5309-4, *Sampling of solids.*
BS 6100, *Glossary of building and civil engineering terms.*
BS 6100-5.2, *Stone.*

[4)] In preparation.

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