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Aggregates —Test methods

Part 3:

Methods for sampling

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Rwanda Standards Board.

P.O Box 7099 Kigali-Rwanda

Tel. +250 252 586103/ 582945/ 582946

Fax + 250 252 583305

E-mail: info@rbs.org.rw

Website:www.rsb.gov.rw

Contents

Page

Foreword

Rwanda Standardsarepreparedby Technical Committees and approved by Rwanda Standards Board of (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by Technical committees are ratified by members of RSB Board of Directors for publication and gazettement as Rwanda Standards.

DRS96-3:2015 was prepared by Technical Committee RSB/TC09, *Building Materials and Civil Engineering*.

In the preparation of this standard, reference was made to the following standard:

ASTM D75/D75M − 14 Standard practice for sampling aggregates

IS 2430 :1986 (Reaffirmed 2005) Methods for sampling of aggregates for concrete

KS 1238-3:2003,*Methods of testing aggregates Part 3:Method for sampling*

The assistance derived from the above source is hereby acknowledged with thanks.

Committee membership

The following organizations were represented on the Technical Committee on *Building Materials and Civil Engineering*(RSB/TC 09) in the preparation of this standard.

University of Rwanda/CST

Rwanda Housing Authority

Ruliba Clays Ltd

IPRC Kigali

Entreprise Mubiligi Paul

Rwanda Public Procurement Authority

Rwanda Standards Board — Secretariat

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 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 method set out in Clause 5 should be used as the basis for tests for compliance with specifications for aggregates.

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 dispatch 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.

Aggregates — Test methods— Part 3:Methods for sampling

1 Scope

This part of DRS 96specifies methods for obtaining samples of aggregates of the quantity required for carrying out testing in accordance with other parts of DRS 96.The method to be used for recording the nominal description of materials sampled is also given.

This standard covers sampling of coarse and fine aggregates for the purpose of preliminary investigation of the potential source ofsupply, control of the product at the source of supply, control of the operations at the site of use, and acceptance or rejection of the materials.

NOTE 1 Sampling plans and acceptance and control tests vary with the type of construction in which the material is used.The quality of the results produced by this standard are dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used.

2 Terms and definitions

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

2.1
aggregates
crushed stone, crushed boulders, gravel, sand, industrial by-products or such other inert material

2.2
fine aggregates
aggregates most of which pass through 4.75 mm sieve and they include natural sand, crushed stone sand,and crushed gravel sand

2.3
coarse aggregates
aggregates most of which are retained on 4.75 mm sieve

2.4
all-in aggregates
material composed of fine aggregates and coarse aggregates

2.5
batch
the quantity of aggregates of the same class, nominal size,source and offered for inspection at one time. The batch may consist of the whole or a part of the quantity ordered fora 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.

2.6
increment
a quantity of aggregates taken by a sampling device at one time from a larger body of aggregates

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

2.7
bulk sample
an aggregation of the sampling increments

2.8
laboratory sample
a sample intended for laboratory inspection or testing

2.9
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 Significance and use

3.1 .Sampling is equally as important as the testing, and the sampler shall use every precaution to obtain samples that show the nature and condition of the materials which they represent.

3.2 Samples for preliminary investigation tests shall be obtainedby the party responsible for development of the potential source. Samples of materials for control of the production at the source or control of the work at the site of use shall be obtained by the manufacturer, contractor, or other parties responsible for accomplishing the work. Samples for tests to be used in acceptance or rejection decisions by the purchaser shall be obtained by the purchaser or his authorizedcompetent representative.

NOTE 2 The preliminary investigation and sampling of potentialaggregate sources and types occupies a very important place in determining the availability and suitability of the largest single constituent entering into the construction. It influences the type of construction from the standpoint of economics and governs the necessary material control to ensure durability of the resulting structure, from the aggregate standpoint.This investigation should be done only by a responsible trained andexperienced person.

4 Securing samples

4.1 General

Where practicable, samples to be tested forquality shall be obtained from the finished product. Samplesfrom the finished product to be tested for abrasion loss shall notbe subject to further crushing or manual reduction in particle size in preparation for the abrasion test unless the size of the finished product is such that it requires further reduction for testing purposes.

4.2 Inspection

The material to be sampled shall be visuallyinspected to determine discernible variations. If any discernible variations are noted, corrective action shall be taken to establish homogeneity in the material prior to sampling. If it is necessary to indicate the degree of variability existing within the main pile, separate samples shall be drawn from separate areas of the pile. The seller shall provide suitable equipment needed for proper inspection and sampling.

4.3 Procedure

4.3.1 Sampling from a flowing aggregate stream (Bins or Belt discharge)

- Select units to be sampled by a randommethodfrom the production.;
- Obtainat least three approximately equal increments, selected atrandom from the unit being sampled, and combine to form afield sample;and
- Take each increment from the entire cross section of the material as it is being discharged. It is usually necessary to have a special device constructed for use at each particular plant. This device consists of a pan of sufficient size to intercept the entire cross section of the discharge stream and hold the required quantity of material without overflowing. A set of rails may be necessary to support the pan as it is passed under the discharge stream. Insofar as is possible, keep bins continuously full or nearly full to reduce segregation.

NOTE Sampling the initial discharge or the final few tons from a bin or conveyor belt increases the chances of obtaining segregated material and should be avoided.

4.3.2 Sampling from the conveyor belt

- Select units to be sampled by a random method fromthe production. Obtain at least three approximately equalincrements, selected at random, from the unit being sampledand combine to form a field sample ;
- Stop the conveyorbelt while the sample increments are being obtained;
- Insert two templates, the shape of which conforms to the shape of the belt in the aggregate stream on the belt and space them such that the material contained between them yields an increment of the required weight;and
- Carefully scoop all material between the templates into a suitable container and collect the fines on the belt with a brush and dust pan and add to the container.

4.3.3 Sampling from stockpiles

Avoid sampling coarseaggregate or mixed coarse and fine aggregate from stockpiles whenever possible, particularly when the sampling is done for the purpose of determining aggregate properties that may be dependent upon the grading of the sample. If circumstances make it necessary to obtain samples from a stockpile of coarse aggregate or a stockpile of combined coarse and fine aggregate, design a sampling plan for the specific case under consideration to ensure that segregation does not introduce a bias in the results. This approach will allow the sampling agency to use a sampling plan that will give a confidence in results obtainedtherefrom that is agreed upon by all parties concerned to beacceptable for the particular situation. The sampling plan shalldefine the number of samples necessary to represent lots andsublots of specific sizes. The sampling plan shall also defineany specialized site-specific sampling techniques or proceduresthat are required to ensure unbiased samples for existingconditions. The owner and supplier shall agree upon the use of any specialized site-specific techniques or procedures.

5 Apparatus

5.1 A small scoop, to hold a volume of at least 1 L (i.e. about 155 kg of aggregate of normal density).This scoop is used for sampling aggregates of nominal sizes less than 5 mm.

5.2 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.

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

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

5.5 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.

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

6.1 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.

6.2 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.

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

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

6.5 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.

NOTE1 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.

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	
28 mm and larger	20	-	50 Kg
5 mm to 28 mm	10	-	25 Kg
5 mm and smaller	10 half scoops	10	10 Kg

6.6 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.

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

NOTE 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.

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

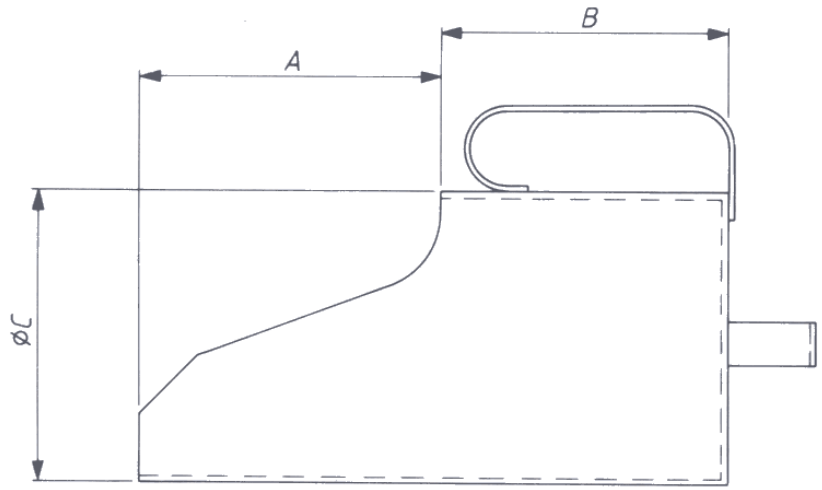
NOTE Never sample manually from a moving conveyor.

6.9 For all methods of sampling, combine all the increments and either dispatch the bulk sample or reduce it to a smaller representative sample, acceptable to the tester, by the procedure described in Clause **7** and then dispatch this smaller sample for testing. The sample dispatched to the laboratory is the laboratory sample

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

NOTE1 Whether the bulk is uniform or not, the sample should be seen to contain a similar range of sizes including the maximum and minimum.

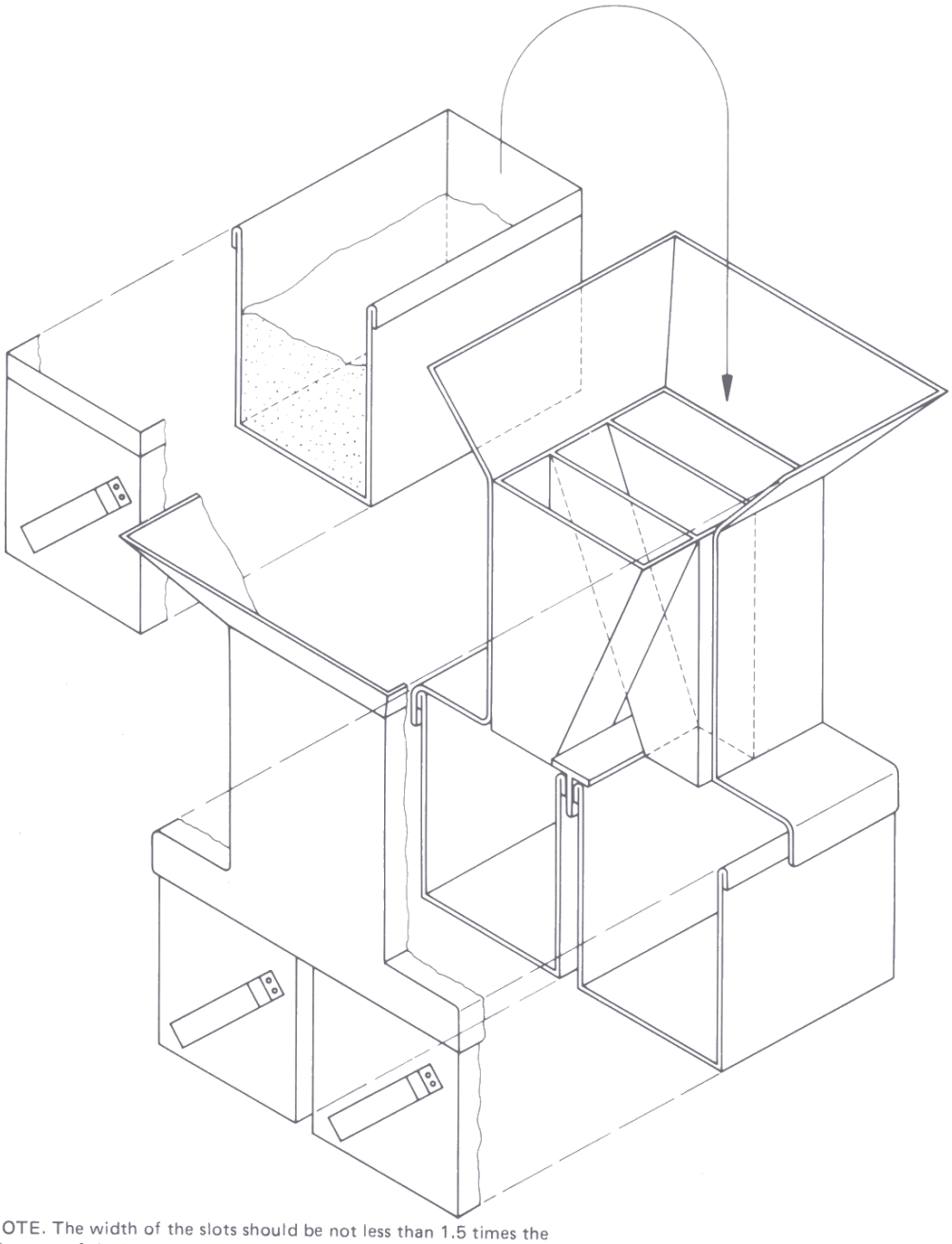
NOTE2 The procedure described in this clause is for obtaining a bulk sample representative of the batch sampled. When sampling is carried out to assess variability within a batch, a number of increments are taken from defined places in the batch and arenot combined but tested separately. For routine 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.



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

Not to scale

Figure 1. Sampling scoops



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)

7 Sample reduction

7.1 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 7.2 and 7.3 are acceptable.

7.2 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.

7.3 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 a 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 center 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.

7.4 Sample reduction to provide replicate samples.

When duplicate (or more) laboratory samples are required from bulk sample, first reduce the bul.sample by the procedure described in 7.2 or 7.3. 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 The procedure should also be used to provide replicate test portions from a laboratory sample.

8 Nominal description

The nominal description of the material sampled shall be recorded on the certificate (see Clause **10**) 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 working; and

3) ‘artificial’: in this case, record if the artificial aggregate is slag, synthetic or broken rubble,etc

b) nominal size; and

c) otherreferences 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 aggregatein more detail, it should be provided by a competent person or authority using, whenever possible, a term from AnnexA.Similarly, when a metallurgical term is required to describe a slag in more detail, it should be provided by a competent person or authority.

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

9 Dispatch of samples

9.1 Packing samples of aggregates

The samples shall be transferred completely to containers (see **5.4**) which shall then be sealed for dispatch. 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.

9.2 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 /her description of the material.When several samples are taken from a single source, each individual sample shall be separately identified.

10 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 standard. The certificate shall include as much as is appropriate of the following information. See Annex 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 tag (or tags);

d) all the data recorded under nominal description (Clause **8**). 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 NOTE2 to paragraph**6.10**); and

g) name and signature of sampler.

Annex A
(informative)

Petrological description of natural aggregates

A.1 The aggregate should be described by an appropriate petrological name, preferably selected from the list of terms and definitions given in Table A.1. In the event that the aggregate cannot be described adequately by those terms, it should be described by another appropriate petrologically accepted term.

A.2 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:

a) precambrian;

b) cambrian;

c) ordovican;

d) silurian;

e) devonian;

f) carboniferous;

g) permian;

h) triassic;

i) jurassic;

j) cretaceous;and

k) 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.

NOTE The term Magnesian Limestone can be substituted for Permian Limestone where appropriate

A.3 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, Example: granite/diorite, basallt/dolerite, microgranite/rhyolite, quartzite/granulite, flint/ quartzite.Petrological description does not take account of suitability for any particular purpose.

Table A1— Rock types commonly used for aggregates

Petrological term	Description
andesite	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†	rock consisting of angular, unworn rock fragments, bonded by natural cement
chalk	a very fine grained Cretaceous limestone, usually white
chert	cryptocrystalline‡ silica
conglomerate	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 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	an acidic rock, consisting predominantly of calcium carbonate
quartzite	a metamorphic rock or sedimentary rock, composed almost entirely of quartz grains
rhyolite	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 fine grained, usually volcanic, variety of syenite
tuff	consolidated volcanic ash

NOTE 1 The terms microgranite, rhyolite, andesite, or trachyte, as appropriate, are preferred for rocks alternatively described as porphyry or felsite.

NOTE 2 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.

NOTE 3 Composed of crystals so fine that they can be resolved only with the aid of a high power microscope.

Annex B
(informative)
Recommended form of certificate of sampling

The form of certificate of sampling is shown in table B1.

Table B1—Form of certificate of samplingTable B1—Form of certificate of sampling

Certificate of sampling in accordance with DRS 96, Part 3
Sample identification tag:
Description of the sample/ batch
Sampling details
(a) Date:
(b) Time:
(c) Place:
(d) Method:
(e) Name and location of source:
(f) Quantity of batch sampled:
Nominal description:
(a) Type:(i) Crushed rock (ii) Artificial (iii) Natural
(b) Nominal size:
(c) Comments on sample:
(d) Coarse or fine aggregate:
Any departure from this standard:
Sampling Organization:
Name and signature of sampler:

Annex C
(informative)
Description of particle shape and surface texture of aggregates

To avoid lengthy descriptions, it is convenient to classify aggregate particles shape and surface texture characteristics under a number of simple headings. The system given in Tables C1 and 2is devised for this purpose.

Table C1 — 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 planer 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 larger than width and width significantly larger than thickness

Table C2— 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 1 Surface texture has been described under the above six headings.This grouping broad, being based on the impression which would be gained by visual examination of hand specimens. It does not purport to be precise petrological classification (see Annex A). Different specimens of the same rock type may not fall into the same group in Table.

ICS 91.100.15