RWANDA STANDARD

DRS 514-2

First edition

2022-mm-dd

Compressed earth blocks —

Part 2: Earth mortars

ICS 91.100.10

Reference number

DRS 514-2: 2022

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Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board (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 gazettment as Rwanda Standards.

DRS 514-2 was prepared by Technical Committee RSB/TC 9, *Civil engineering and building materials*.

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

ARS 670-2-2014, Compressed earth blocks - Part 2: Earth mortars

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

DRS 514 consists of the following parts, under the general title *Compressed earth blocks*:

— *Part 1: Definitions, classifications, specifications*

— *Part 2 Earth mortars*

— *Part 3: Test methods*

— *Part 4: Code of practice for production and construction*

Committee membership

The following organizations were represented on the Technical Committee on *Civil engineering and building materials* (RSB/TC 9) in the preparation of this standard.

A+Construction Group Ltd

Africeramics Ltd

Consultants Engineers Group (CEG) Ltd

D&D Resources Ltd

Dutureheza Ltd

Enabel Rwanda

Greenpack Africa Ltd

Integrated Polytechnic Regional Centre (IPRC) - Musanze

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NP Construction Construction Company (NPCC) Ltd

Road Transport Development Agency (RTDA)

Rwanda Housing Authority (RHA)

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Introduction

The aim of the present standard is to define earth mortars (EMs), to classify them according to their appearance, their conditions of use, and to determine the categories into which they fall as well as their designations.

The definitions, classifications and designations of the present standard are applicable in drawing up all technical, administrative and contractual documents relating to compressed earth block technology, and relate both to public and to private contracts.

The standard applies exclusively to EMs intended for the realisation of simple built structures in common masonry with thick mortar joints (walls, partitions, piers, small lintels, arches, vaults, domes, etc.) and of any similar built structure.

The standard applies only to mortars prepared on site and intended to be used on the spot.

The standard does not apply to EMs used for flooring or tiling, nor does it apply to reinforced masonry.

The standard is not applicable in areas subject to earthquakes, floods or cyclones to an extent that requires the application of appropriate rules in order to avoid major damage.

Compressed earth blocks — Part 2: Earth mortars

1 Scope

This Draft Rwanda Standard defines earth mortars (EMs), classifies them according to their appearance, their conditions of use, and specifies categories into which they fall as well as their designations.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

DRS 546, Clay products for building – Vocabulary

3 Terms and definitions

For the purposes of this standard, the terms and definitions given in DRS 546 and the following apply.

4.1

earth mortar (EM)

mortar used for compressed earth block masonry of a traditional type using thick mortar joints. An earth mortar consists principally of raw earth and water and owes its cohesion in a humid or a dry state essentially to the clay fraction of the earth; an additive and/or filler can, however, be added to the earth to improve or enhance particular characteristics of the mortar

4 Classification of EMs

4.1 Classification according to use

EMs can be classified into two groups according to use:

(i) ordinary EMs; and

(ii) facing EMs.

4.1.1 Ordinary EMs (EM O)

These are EMs used in masonry structures intended to be covered by some form of protection.

4.1.2 Facing EMs (EM F)

These are EMs used in masonry structures intended to remain visible. One can differentiate between:

(i) normal facing EMs (EM NF); and

(ii) fine facing EMs (EM FF).

The difference between these two facing EMs is restricted to their appearance without affecting their other characteristics.

4.2 Classification according to field of use

The fields of use of EMs within masonry structures are classified according to two types of constraint which can occur simultaneously:

(i) mechanical constraints; and

(ii) environmental constraints.

4.2.1 Mechanical constraints

These are defined according to three categories of resistance:

(a) category 1: structural elements which are not load-bearing and structural elements capable of withstanding limited external (live) loads: e.g.: fill-in in a load-bearing structure; boundary wall; a single-storey building made of load-bearing structural elements.

(b) category 2: structural elements capable of withstanding important external (live) loads: e.g.: a two-storey building with accessible terrace made of thin load-bearing structural elements.

(c) category 3: structural elements capable of withstanding high external (live) loads e.g.: a three-storey public building made of thin load-bearing structural elements.

4.2.2 Environmental constraints

These are defined by 4 categories of environment:

(a) category D: structural elements located in a dry environment with no danger of being wet: e.g.: internal partitions; external walls which are not exposed or which are protected from water damage

(b) category R: structural elements capable of withstanding water damage by lateral spraying: e.g.: lateral walls exposed to rain; bathroom walls being splashed

(c) category C: structural elements capable of withstanding water damage by vertical penetration (capillary rise, penetration by gravity, suction or internal condensation): e.g.: external walls unprotected from capillary rise; internal walls unprotected from water leaking through the roof)

(d) category A: structural elements capable of withstanding mechanical abrasion (impact, rubbing or wind damage): e.g.: corners or walls subject to impact; areas subject to rubbing by animals; areas subject to sand storms).

5 Designation of EMs

The designation of earth mortars includes the following indications, to be given in the same order:

a) product designation
— EM for «earth mortar»;
b) designation according to use:
— for «ordinary»
— F for «facing»
— NF for «normal facing»
— FF for «fine facing»;
c) designation according to mechanical constraints
— 1 for «category 1»
— 2 for «category 2»
— 3 for «category 3»;
d) designation according to the constraints of the hygrometric environment
— D for «category C»
— R for «category R»
— C for «category C»;
e) designation according to the constraints of the mechanical abrasion environment:
    — A for «category A».
f) The EM designation may also include the following indications to be given in the same order:
    — colour;
    — any other feature which helps to identify EMs.

Table 1 — Examples of designation

Designation	Description	Example
EM O 1 D	Ordinary earth mortar used as an element in a non-load bearing structure in a dry environment not subject to mechanical abrasion	Internal partition of a single family ground floor house
EM FF 3 RA	Fine facing earth mortar used as an element in a load-bearing structure exposed to rain weathering by lateral spraying as well as to mechanical abrasion	External wall of a 3-storey building of high quality appearance exposed to driving rain and to sand storms

6 Technical specifications for ordinary earth mortars

6.1 General characteristics

The characteristics of ordinary mortars must be compatible with the category of blocks chosen.

6.2 Textural characteristics

The earth must contain at least 90% of grains the dimensions of which are less than 1/3 of the thickness of the joint. 10% of grains with a maximum dimension of between 1/3 and 1/2 of the thickness of the joint is tolerated. The use of an earth mortar, the largest grain size of which is less than or equal to 4 mm is recommended.

6.3 Appearance characteristics

6.3.1 General appearance

Ordinary EMs should display no systematic defects such as cracks or significant chips of a kind likely to jeopardise correct execution and the stability of the masonry.

6.3.2 Cracks

Micro-cracks and macro-cracks can be tolerated on all surfaces but their presence must not be concentrated or systematic over a part or the whole of the built structure.

6.4 Physicochemical characteristics

6.4.1 Pitting

No pitting due to the bursting of expansive materials is tolerated.

6.4.2 Efflorescence

Ordinary EMs must not display any significant and lasting efflorescence covering a large area of the EM. A faint whitish film or a thin band are not taken into account.

6.5 Mechanical, hygrometric and physical characteristics

Table 2 — Mechanical, hygrometric and physical characteristics of ordinary earth mortars

Designation	Environmental constraint category	Mechanical constraint category	f_b dry N/mm²	f_b wet N/mm²	Water absorption %	Abrasion Loss of matter %
EM O 1 D	Dry environment (D)	1	≥0.5	N/A	N/A	N/A
EM O 2 D		2	≥1.5	N/A	N/A	N/A
EM O 3 D		3	≥2.5	N/A	N/A	N/A
EM O 1 R	Effect of water by lateral spraying (R)	1	≥0.5	≥0.5	≤30	N/A
EM O 2 R		2	≥1.5	≥1	≤20	N/A
EM O 3 R		3	≥2.5	≥1.5	≤10	N/A
EM O 1 C	Effect of water by vertical penetration (C)	1	≥0.5	≥0.5	≤30	N/A
EM O 2 C		2	≥1.5	≥1	≤20	N/A
EM O 3 C		3	≥2.5	≥1.5	≤10	N/A

1) N/A = not applicable

2) The use of EMs in R and C category environments requires using a stabiliser if the protection provided is not guaranteed. If the protection provided against water damage is guaranteed, the environment is regarded as category D.

3) If tests to establish water absorption or abrasion are not feasible, or if the results are not available, this deficiency can be compensated by increasing the requirements for the dry and/or wet compressive strength by one category.

4) The values given are the average values obtained from tests carried out on a set of samples.

7 Technical specifications for facing earth mortars

7.1 General characteristics

The characteristics of facing mortars must be compatible with the category of blocks chosen.

7.2 Textural characteristics

The earth should not contain grains larger than 1/3 of the thickness of the joints. The use of an earth mortar, the largest grain size of which is less than or equal to 4 mm is recommended.

7.3 Appearance characteristics

7.3.1 General appearance

Facing EMs should display no systematic defects such as cracks or significant chips of a kind likely to jeopardise correct execution and the stability of the masonry.

7.3.2 Cracks

(a) Micro-cracks: can be tolerated on all exposed faces.

(b) Macro-cracks: Conditions of acceptability for all faces:

(i) they must not exceed 0.5 mm in width;

(ii) they must not exceed 20 mm in length;

(iii) they must not exceed 10 mm in depth;

(iv) the presence of acceptable macro-cracks must not be concentrated or found throughout one part or the whole of the built structure.

7.3.3 Colour

The colour of facing EMs should be uniform throughout the built structure. It may differ from that of the CEBs.

7.4 Physical-chemical characteristics

7.4.1 Pitting

No pitting due to the bursting of expansive materials is tolerated.

7.4.2 Efflorescence

Facing EMs must not display any significant and lasting efflorescence covering a large area of the EM. A faint whitish film or a thin band are not taken into account.

7.5 Mechanical, hygrometric and physical characteristics

Table 3 — Mechanical, hygrometric and physical characteristics of facing earth mortars

Designation	Environmental constraint category	Mechanical constraint category	f_b dry N/mm^2	f_b wet N/mm^2	Water absorption %	Abrasion loss of matter %
EM NF 1 D or EM FF 1 D	Dry environment	1	≥0.5	N/A	N/A	≤15
EM NF 2 D or EM FF 2 D	(D)	2	≥1.5	N/A	N/A	≤10
EM NF 3 D or EM FF 3 D		3	≥2.5	N/A	N/A	≤5
EM NF 1 R or EM FF 1 R	Effect of water by	1	≥0.5	≥0.5	≤30	≤15
EM NF 2 R or EM FF 2 R	lateral spraying	2	≥1.5	≥1	≤20	≤10
EM NF 3 R or EM FF 3 R	(R)	3	≥2.5	≥1.5	≤10	≤5
EM NF 1 C or EM FF 1 C	Effect of water	1	≥0.5	≥0.5	≤30	≤15
EM NF 2 C or EM FF 2 C	by vertical	2	≥1.5	≥1	≤20	≤10
EM NF 3 C or EM FF 3 C	penetration (C)	3	≥2.5	≥1.5	≤10	≤5

1) N/A = not applicable

2) The use of EMs in R and C category environments requires using a stabiliser if the protection provided is not guaranteed. If the protection provided against water damage is guaranteed, the environment is regarded as category D.

3) If tests to establish water absorption or abrasion are not feasible, or if the results are not available, this deficiency can be compensated by increasing the requirements for the dry and/or wet compressive strength by one category.

4) The values given are the average values obtained from tests carried out on a set of samples.

8 Code of practice for the preparation of earth mortars

8.1 Recommendations on earth selection

Selecting a suitable type of earth can take place in the field using parameters which are the fruit of experience acquired in the course of operational practice. If any doubt persists, laboratory identification tests should be carried out.

8.1.1 Granular composition

The granular composition of the earth should preferably fall within the limits of the shaded area on the diagram of texture which follows and should be similar in shape.

The limits of the recommended shaded area are approximate.

Types of earth the granular composition of which fall within the recommended shaded area in most cases give satisfactory results.

Types of earth the granular composition of which fall outside the shaded area may still give acceptable results, but it is recommended that they be subjected to a series of tests enabling their suitability to be assessed.

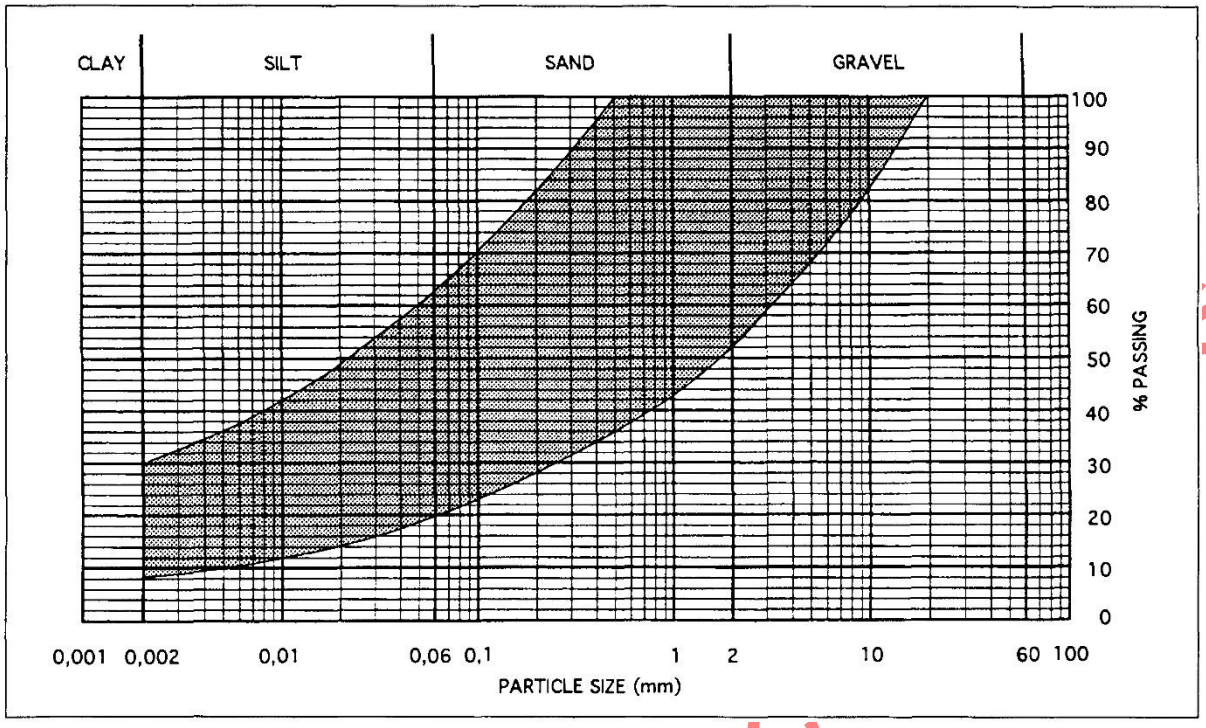

Figure 1 — Diagram of texture

8.1.2 Plasticity

The plasticity of the soil should preferably fall within the limits of the shaded area of the diagram of plasticity which follows.

The limits of the recommended shaded area are approximate.

Types of earth the plasticity of which fall within the recommended shaded area in most cases give satisfactory results.

Types of earth the plasticity of which fall outside the shaded area may still give acceptable results, but it is recommended that they be subjected to a series of tests enabling their suitability to be assessed.

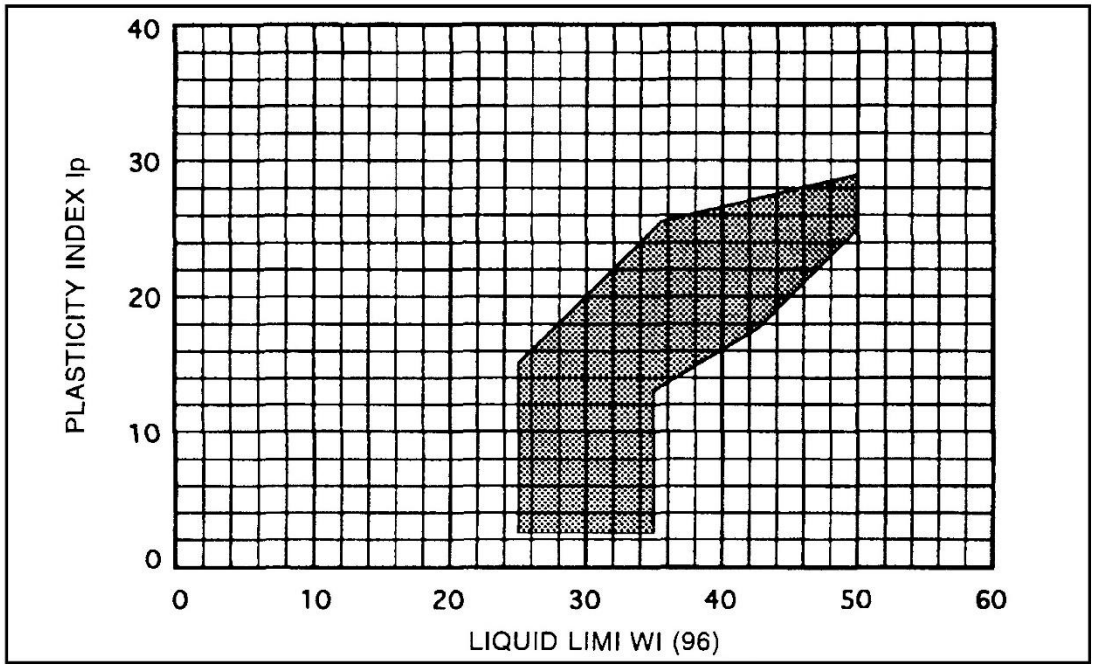

Figure 2 — Diagram of plasticity

8.1.3 Nature

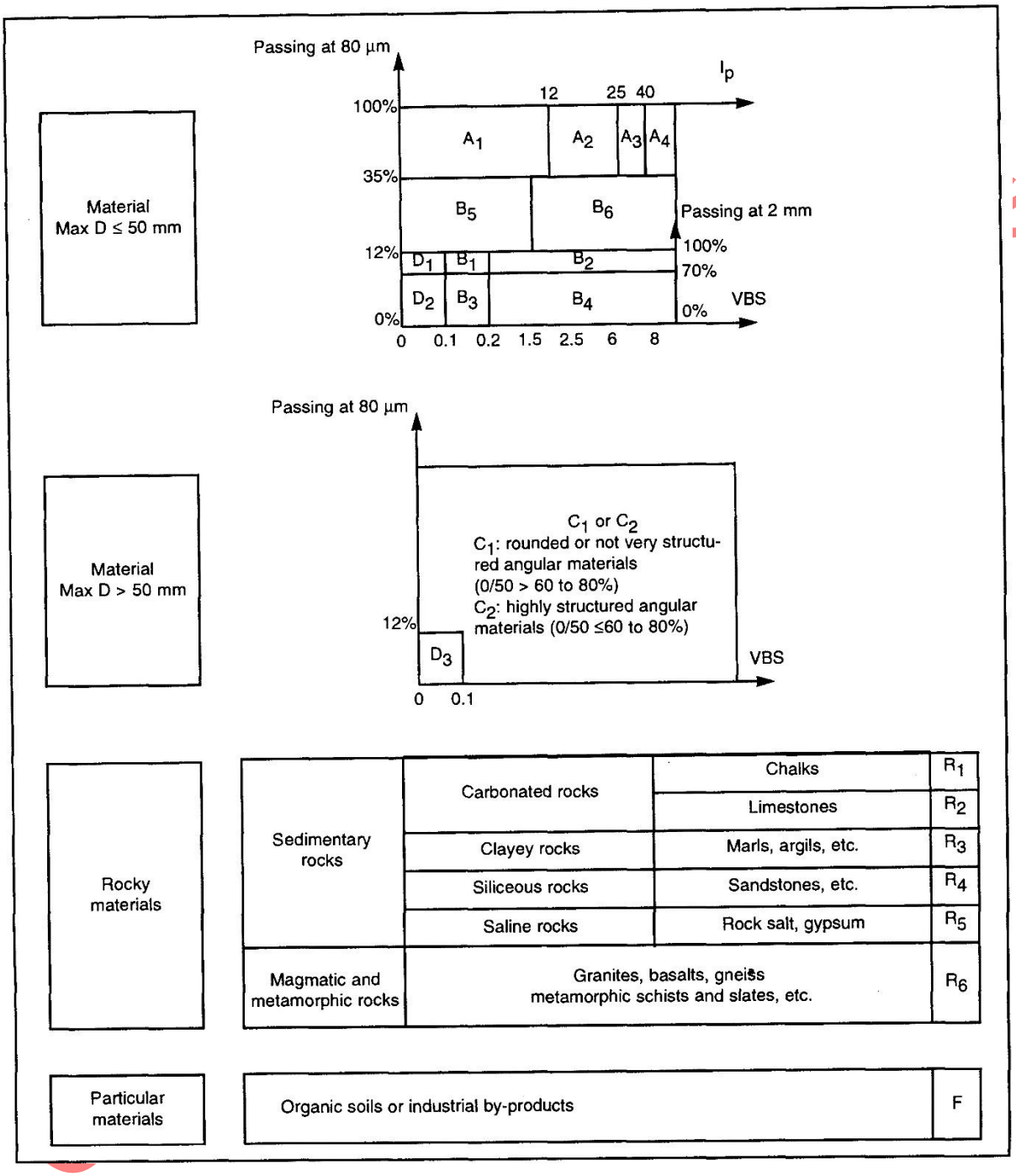

Figure 3 — Classification of materials according to their nature

The nature of types of earth is determined by the combination of values resulting from tests for particle size distribution, plasticity and methylene blue value. The overall suitability of types of earth is as follows:

A1: an acceptable material but with slightly too many fines.

A2: an acceptable material but with too many fines.

A3: an acceptable material but requiring particular care, as it is relatively active.

A4: a material which is difficult to use, as it is very active.

B1: a sandy material requiring fines to be added to make it acceptable.

B2: an acceptable material slightly lacking in fines.

B3: a sandy material requiring a considerable addition of fines to make it acceptable.

B4: an acceptable material lacking in fines.

B5: an acceptable material but slightly lacking in fines.

B6: an acceptable material but slightly lacking in fines.

C1: a material containing too much gravel, which should be sieved to change its nature.

C2: a material containing too much gravel, which should be sieved to change its nature.

D1: a sandy material requiring fines to be added to make it acceptable.

D2: a sandy material requiring a considerable addition of fines to make it acceptable.

D3: A material containing too much gravel, which should be sieved to change its nature and which requires a considerable addition of fines to make it acceptable.

R: unsuitable materials.

F: materials requiring advanced identification tests notably with regard to their chemical analysis and mechanical tests in order to be able to determine their suitability. Testing pre-production stage CEBs should be considered.

8.2 Recommendations for the use of stabilisation additives

8.2.1 Precautions to take when stabilising by adding a physicochemical additive

The presence of certain salts or organic materials can affect the efficacy of stabilising by the addition of an additive. In these cases, some chemical analysis should be therefore be undertaken to determine the presence, the value and the concentration of the following factors:

- pH;
- soluble salts;
- acid salts;
- alkaline salts;
- organic matter or humus;
- carbonates;
- sulphates;
- chlorides.

8.2.2 Cement stabilisation

8.2.2.1 Efficacy and dosage

As earth mortars are used in a plastic state, up to 50 % more cement is sometimes required to obtain the same efficacy as when using the same type of earth, compressed in a humid state, for the manufacture of CEBs.

The efficacy of the dosages depends on the texture and structure of the earth, and on how it is used. 6 to 12% of the weight of the dry earth generally gives good results. Compressive strength remains highly dependent on the dosage.

The dosages indicated are relative to dry weight and are determined in laboratory conditions. Measures for checking in the workshop or on site should take account of the specific hygrometric conditions existing locally.

8.2.2.2 Efficacy parameters

(1) Types of earth

Almost all types of earth can be stabilised with cement. The best results are obtained with sandy types of earth.

(2) Organic matter

This is recognised as deleterious, and as a general rule, an organic matter content in excess of 1% is risky; earth containing more than 2% should not be used.

(3) Sulphates

When dry, calcium sulphates, which are frequently found, are less deleterious than magnesium sulphates. When wet, sulphates are always very deleterious. Sulphates destroy the hardened hydraulic binder matrix and increase the sensitivity to humidity of the clays. A specific study for earth containing more than 2 to 3% total sulphate content is indispensable.

(4) Oxides and metallic hydroxides

Essentially, these are iron and aluminium oxides which are rarely present in excess of around 5% and which in that event have little effect. In types of earth containing more than 5%, stabilisation has been observed to be highly effective with little cement.

(5) Water

In principle one should reject water containing organic matter and salty water: these may cause efflorescence. Water rich in sulphates may be unfavourable.

8.2.2.3 Types of cement

Portland cements or cements of a similar class are very suitable. Composite cements can also be used. However, suitability tests should be carried out to justify using them. There is no point in using high strength cements which give no particular improvement and which are more expensive.

8.2.2.4 Additives

Certain products, added in small quantities to the earth-cement during mixing, can improve certain of its properties.

(1) Reducing sensitivity to organic matter

Slaked lime, used at 2%, can reduce the deleterious effect of organic matter, as can calcium chloride (0.3 to 2 %) which also accelerates the setting of the cement.

(2) Modifying the plasticity of the earth

Slaked lime can also be used to modify the plasticity of the soil and to restrict the formation of nodules.

(3) Rendering the earth water-proof

Bitumens, in emulsion or cut-back, used at 2 % to 4 %, enable mortars to be made impermeable.

8.2.3 Lime stabilisation

8.2.3.1 Types of lime

(1) Non-hydraulic limes

These are produced by calcinating very pure limestone and are the main kinds of lime used in stabilisation.

- Quicklime (CaO): produced directly by calcinating stone containing lime. Its use may be restricted because of the careful storage and handling it requires. Quicklime is highly water absorbent and must be protected from humidity. It is an aggressive material which must be handled with great care: it becomes very hot during the hydration phase (up to 150 °C). Weight for weight, it is more efficient than slaked lime because it contains more calcium ions. When the earth is wet, it can absorb the water required for it to be hydrated.

- Slaked lime $Ca(OH)_2$: this is obtained by hydrating (slaking) quicklime. Used in stabilisation, it does not have the storage and handling disadvantages of quicklime. Slaked limes should not be too finely ground to be effective. Industrial quality slaked limes contain 90 % to 99 % «active lime», whereas those of craft production quality can contain as little as 70 % to 75 % with the remainder being inert material which is either not calcinated or excessively calcinated. Stabilisation dosages should be modified in consequence.

(2) Hydraulic limes

These resemble cements. They should be considered for use only if there are no other qualities of lime available. Natural hydraulic limes are more efficient for stabilisation than artificial hydraulic limes which are not recommended.

(3) Agricultural limes

These are used to modify agricultural types of earth and generally have no stabilising effect.

(4) Dolomite limes

These are suitable for stabilisation, but they set excessively slowly.

8.2.3.2 Efficacy and dosage

By adding 1% quicklime to the earth, the exothermic reaction of hydration dries the earth, removing approximately 0.5 to 1 % moisture. Adding 2 % to 3 % quicklime immediately causes a fall in the plasticity of the earth and breaks down lumps; this reaction is called the lime fixing point. For ordinary stabilisation using slaked lime, dosages of 4 % to 12 % are generally used, equivalent to those used with cement, but it should be noted that with lime, there is an optimal quantity for each type of earth.

The dosages indicated are relative to dry weight and are determined in laboratory conditions. Measures for checking in the workshop or on site should take account of the specific hygrometric conditions existing locally.

8.2.3.3 Efficacy parameters

(1) Types of earth

These should contain a reasonable clay fraction. Results vary depending on the nature of the clay minerals and are good with those which are high in aluminium silicate, in silica, and in iron hydroxide. Natural pozzolanas react quickly and well with lime.

(2) Organic matter

This can prevent ion exchanges in clayey soils, without however, preventing the pozzolanic reaction.

Types of earth containing up to 20 % organic matter can be stabilised with lime but care must be taken.

(3) Sulphates

When dry, calcium sulphates, which are frequently found, are less deleterious than magnesium sulphates. When wet, sulphates are always very deleterious. Sulphates destroy the hardened hydraulic binder matrix and increase the sensitivity to humidity of the clays. A specific study for earth containing more than 2 to 3 % total sulphate content is indispensable.

8.2.3.4 Additives

Certain additives mixed with lime can produce special effects.

(1) Increasing compressive strength

Portland cement or composite cement with a variable dosage which can be up to 100 % of the lime dosage.

(2) Rendering the treated earth water-proof

(a) bituminous products;

(b) other waterproofing agents.

8.2.4 Stabilising using commercial products

Using commercial products other than cement and lime to stabilise the earth with a view to manufacturing earth mortars should be examined beforehand by an approved testing laboratory to establish the genuine efficacy of the product.

8.3 Recommendations for manufacturing parameters

Poor execution of any one of the manufacturing stages will considerably lower the quality of the EMs.

8.3.1 Stocking raw materials

8.3.1.1 Stocking the earth

Earth which has been taken delivery of should be stocked in such a manner as to avoid any pollution from another type of earth or any other material.

The earth should also be protected from accidentally being moistened.

8.3.1.2 Stocking additives

Stocking additives should be arranged so that they are protected from bad weather and so that there is a rapid turnover between delivery and use.

8.3.2 Preparing the mix

At the end of the preparation, the earth should be as dry as possible (water content ≤5 %). No grain or particle should have a diameter in excess of 4 mm and preferably not in excess of 2 mm.

If on completion of the preparation stage, the earth falls outside the recommended zones of texture and plasticity, it should be corrected by adding a filler until it comes back within the recommended zones. If even after correction, the mix is still outside the recommended areas, another type of earth will have to be sought or the suitability of the mix will have to be specifically examined by an approved laboratory.

8.3.2.1 Screening the earth

This operation aims to eliminate all components with a diameter in excess of that required. However, these components can be made up of aggregates or agglomerates made up of fines which will equally be eliminated, whereas they are required to ensure the cohesion of the final product. It is therefore preferable to break down these agglomerates by a pulverisation operation.

8.3.2.2 Pulverising the earth

This is an important operation and must be carried out with great care. The more finely the clay and the silt is broken down, the more homogeneous the earth will be, and in the event of stabilisation, the more efficient the action of the stabiliser. The operation can be a difficult one as clay is highly cohesive. There should not be too great a concentration of fines in agglomerates the size of which should not exceed 4 mm. The presence of 50 % by weight of agglomerates of fines of ≥4 mm in size can reduce compressive strength by half. Certain types of earth still require screening after pulverisation.

8.3.2.3 Mixing

The homogeneity of the material depends on the quality of the mixing. It is important to use dry earth to obtain best mixing conditions.

In wet regions, this may mean drying out the earth beforehand. Mixing can accelerate the drying process and help to break down lumps. The water required for mixing should be sprinkled or sprayed in and only at the end of the mixing process, after a required phase of dry mixing.

The water should be added gradually until a smooth and homogeneous mix has been obtained.

Mixing in an additive should be done dry except in the particular case of products requiring wet mixing. Mixing should continue until a homogeneous mix has been obtained.

The time needed for manual or mechanised mixing depends on the mixing time required to obtain a perfectly homogeneous mix; this can be assessed by its uniform colour, and no streaks should be visible.

8.3.3 Using the EM

8.3.3.1 Retention time of the mix

The earth mortar should be plastic and smooth and should hold on the trowel. Liquid earth mortars should not be used.

Any precautions needed to prevent water evaporation from the EM must be taken in order to maintain the plasticity and the smoothness at the required level.

When the mixing has been with added cement, the EM should be used within half an hour of the beginning of the wet mixing stage.

When the mixing has been with added non-hydraulic lime, the EM can be used after several hours.

Any precautions needed to prevent water evaporation from the mix must be taken in order to maintain the right water content of the mix at the required level.

8.4 Checking procedures

8.4.1 Raw materials

8.4.1.1 Earth

Conditions for taking delivery of earth supplies shall be in accordance with Clause 8.5 of this Standard.

8.4.1.2 Stabilising additives

(1) Procedure

(a) for cements, tests on samples of standard cement mortar;

(b) for lime, chemical composition tests.

(2) Frequency: at each delivery.

8.4.1.3 Water

(1) Procedure: in the case of a manufacturing process with stabilisation using an additive with a physicochemical effect (Portland cement, lime), analysis of the content of salts and of the pH value.

(2) Frequency: once during the «running in» period, then annually.

8.4.2 Preparing the earth

(1) Procedure: wet screening of the prepared earth and calculation of the percentage by weight of grains the diameter of which is in excess of 4 mm.

(2) Frequency: weekly during the start-up period, less frequently once production is established.

8.4.3 Mixing

8.4.3.1 Earth and additive dosage

(1) Procedure: weighing and measuring volume directly or calculating consumption periodically (e.g. the number sacks of stabiliser consumed per number of batches produced).

(2) Frequency: frequently and without warning.

8.4.3.2 Mix

(1) Procedure:

(a) visual examination of the homogeneity of the mix;

(b) timing the average mixing time.

(2) Frequency: weekly or more.

8.4.4 Waiting time before use

(1) Procedure: timing the average waiting time.

(2) Frequency: weekly or more.

8.4.5 Curing

(1) Procedure: visual examination (shrinkage cracks, surface drying out);

(2) Frequency: weekly

8.5 Conditions for taking delivery of earth supplies

8.5.1 General

8.5.1.1 Types of check on taking delivery

There are two types of check on taking delivery:

(a) a simple check, which relates solely to the comparative examination of the appearance, the simplified sedimentation test and the sand equivalent test of the earth supplied compared with the values recorded in the reference earth selected when ordering;

(b) a complete check, which relates to measuring texture and plasticity and the presence of organic matter and sulphates with the values of the sample of reference earth.

8.5.1.2 Choosing the type of check on taking delivery

The buyer is free to choose the type of check on taking delivery.

If the buyer requires that a complete check should be carried out, it is preferable for him to inform the supplier of this in writing on the order document.

Carrying out laboratory tests intended to check product conformity to reference values normally requires a minimum of two weeks.

8.5.1.3 Date and place of taking delivery

Taking delivery occurs at the moment the buyer assumes responsibility for the products, i.e. either at the supplier location or at the delivery location.

If it takes place at the supplier location, the date should be mutually agreed. The buyer should be present or represented.

If it takes place at the delivery location, the date should be indicated to the supplier who has the right to be present at the operations relating to taking delivery, or to be represented there by a person attending on his behalf.

Unless specifically stated, taking delivery can occur at the delivery location only if the supplier is responsible for the transport.

8.5.2 Taking delivery on site

As soon as the earth has been unloaded and before any subsequent handling in the brickworks, the buyer should proceed with an overall examination of the appearance of the earth.

If this examination shows that the earth delivered is not homogeneous in nature, after due hearing of the parties, one may proceed, at the supplier's expense, to sort it with a view to separating the a *priori* acceptable types of earth from the rest of the delivery.

If the earth is homogeneous in nature, one should proceed with the operations for taking delivery properly speaking.

8.5.3 Simple check on taking delivery

8.5.3.1 Samples

For each delivery, take a sample at random and from below the surface of four buckets of earth at four points from the bottom of the pile and two buckets from the upper part of the pile.

Having carried out the simple sedimentation test examination of appearance and that of sand equivalent, these products should be returned to the delivery.

8.5.3.2 Conditions of acceptability

If the results of the examination give values corresponding to the reference values, the delivery should be accepted.

8.5.4 Complete check on taking delivery

8.5.4.1 Examination of appearance

The complete check on taking delivery includes, first, examining appearance as defined above.
Complete checks on taking delivery are carried out in the manner described below.

8.5.4.2 Samples from the lots

8.5.4.2.1 Deliveries of up to or equal to 7 tonnes or 5 m^3

No sample is taken if the delivery is up to or equal to 7 tonnes or 5 m^3 in volume. Consequently, visual examination is sufficient.

8.5.4.2.2 Deliveries of over 7 tonnes or 5 m^3

Split the delivery into lots of maximum 7 tonnes or 5 m^3.

8.5.4.2.3 Particular case of supply occurring on several sites

When delivery is taken on the supplier location, split the complete supply into lots of maximum 21 tonnes or 15 m^3.

When delivery is taken on site where it is common to several sites, the reference site is selected by the entrepreneur, who advises the supplier of this in writing.

8.5.4.2.4 Samples

The samples must be taken on the basis of a sampling process the procedure for which is defined by the standards for testing.

8.5.4.3 Conditions of acceptability

If, for each of the tests carried out, the results conform to the reference values, the delivery should be accepted.

If this is not the case, one may proceed with a counter-expertise for the test which failed to give satisfaction.

If the results of the counter-expertise are still unfavourable, the delivery can be refused. If the result is favourable, the whole delivery should be accepted.

8.5.4.4 Choice of laboratory

Tests are carried out on site, in a workshop or in a laboratory selected by mutual agreement between the supplier and the buyer.

8.5.4.5 Costs of taking delivery

The costs of taking delivery are borne by the buyer if the conditions of acceptability are satisfactory and borne by the supplier if they are not.

8.5.5 Particular case

The preceding arrangements do not preclude, by mutual consent, the buyer and the supplier proceeding with partial checks, relating only to certain reference values.

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[1] Compressed earth blocks. Vol. II. Manual of design and construction. CRATerre-EAG: Guillaud H., Joffroy T., Odul P. Aus der Arbeit von GATE, Friedrich Vieweg & Sohn, Braunschweig/Wiesbaden, Germany, 1995.

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