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Part 7: Determination of water absorption coefficient due to capillary action of hardened mortar

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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 211-7 was prepared by Technical Committee RSB/TC 009, *Civil engineering and building materials.*

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

1) BS EN 998-1: 2016, *Specification for mortar for masonry — Part 1: Rendering and plastering mortar*

2) BS EN 998-2: 2016, *Specification for mortar for masonry — Masonry mortar* BS EN 1015-2:1999+A1: 2006, *Methods of test for mortar for masonry – Part 2: Bulk sampling of mortars and preparation of test mortars*

3) BS EN 1015-3: 1999, *Methods of test for mortar for masonry – Part 3: Determination of consistence of fresh mortar (by flow table)*

4) BS EN 1015-18:2002, *Methods of test for mortar for masonry - Determination of water absorption coefficient due to capillary action of hardened mortar*

5) BS EN 1015-11:2019, *Methods of test for mortar for masonry – Part 11: Determination of flexural and compressive strength of hardened mortar*

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

DRS 211 consists of the following parts, under the general title *Mortar for masonry —Test methods*:

— *Part 1: Determination of particle size distribution (by sieve analysis)*

— *Part 2: Bulk sampling of mortars and preparation of test mortars*

— *Part 3: Determination of consistence of fresh mortar (by flow table)*

— *Part 4: Determination of consistence of fresh mortar (by plunger penetration)*

— *Part 5: Determination of flexural and compressive strength of hardened mortar*

— *Part 6: Determination of adhesive strength of hardened rendering and plastering mortars on substrates*

— *Part 7: Determination of water absorption coefficient due to capillary action of hardened mortar*

Committee membership

The following organizations were represented on the Technical Committee on *and civil engineering and building materials* (RSB/TC 009) in the preparation of this standard.

Advanced Construction Technology Services (ACTS) - Rwanda

CIMERWA

City of Kigali

Green Pact Africa

Rwanda Inspectorate, Competition and Consumer Protection Authority (RICA)

RTDA

Standard Geotechnical Engineering and Construction Ltd (STAGECO Ltd)

SJEC Ltd

UR-CST

Rwanda Standards Board (RSB) – Secretariat

Mortar for masonry — Test methods — Part 7: Determination of water absorption coefficient due to capillary action of hardened mortar

1 Scope

This Draft Rwanda Standard provides a method for determining the water absorption coefficient due to capillary action of hardened mortars containing mineral binders and normal as well as light weight aggregates.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

RS 108, *Mortar for masonry — Specification*

DRS 211-1, *Mortar for masonry — Test methods — Part 1: Determination of particle size distribution (by sieve analysis)*

DRS 211-2, *Mortar for masonry — Test methods — Part 2: Bulk sampling of mortars and preparation of test mortars*

DRS 211-3, *Mortar for masonry — Test methods — Part 3: Determination of consistence of fresh mortar (blow table)*

DRS 211-5, *Mortar for masonry — Test methods — Part 5: Determination of flexural and compressive strength of hardened mortar.*

3 Terms and definitions

No terms and definitions are listed in this document

4 Principle

The water absorption coefficient due to capillary action is measured using mortar prism specimens under prescribed conditions at atmospheric pressure. After drying to constant mass, one face of the specimen is immersed in 5 mm - 10 mm of water for a specific period of time and the increase in mass determined.

5 Apparatus

5.1 **Tray**, of minimum depth of 20 mm and of plan area large enough to contain the specimens to be immersed and fitted with a means of maintaining a constant water level.

5.2 **Four support pads or similar per specimen**, to store the specimen, with a minimum contact area, clear of the base tray and with the specified depth of immersion.

5.3 **Stopwatch**, graduated in seconds.

5.4 **Weighing instrument**, with an accuracy of 0.1 % of the total, dry mass of the test specimen.

5.5 **Ventilated oven**, capable of maintaining a temperature of 60 °C ± 5 °C.

5.6 **Trowel or palette knife.**

5.7 **Absorbent filter papers,** with a specific mass of 200 g/m² ± 20 g/m² and water absorption capacity of 160 g/m² ± 20 g/m²; twelve sheets each with a size of approximately 150 mm x 175 mm.

5.8 **Conditioning chamber or room**, capable of maintaining a relative humidity of 95 % ± 5 %

5.9 **Metal mould and other ancillary apparatus**, to produce 160 mm x 40 mm x 40 mm prism specimens as described in RS 211-5.

6 Materials

6.1 Demineralized or distilled water

6.2 **Sealing material,** e.g. paraffin wax or synthetic reactive resin with a melting point above 60 °C.

7 Sampling and preparation and storage of test specimens

7.1 General

The fresh mortar for this test shall have a minimum volume of 1.5 L or at least 1.5 times the quantity needed to perform the test, whichever is the greater, and shall either be obtained by reduction of the bulk test sample (see RS 211-2) using a sample divider or by quartering or by preparation from water and the other constituents in the laboratory. Three test specimens shall be prepared from the sample of mortar.

7.2 Laboratory prepared mortars

7.2.1 The length of mixing period shall be measured from the moment all the constituents are introduced into the mixer.

7.2.2 The mortar shall be brought to a defined flow value as specified in RS 211-2 determined in accordance with RS 211-3 and reported.

7.3 Mortars, other than laboratory prepared mortars

7.3.1 Ready to use mortars (plant-made wet mortars which are retarded), and pre-batched air-lime/sand wet mortars when not gauged with hydraulic binders, shall be used for specimen preparation within their specified workable life.

7.3.2 Before testing, the batch shall be gently stirred by hand using a trowel or palette knife (see 5.6) for 5 s to 10 s to counteract any false setting etc., but without any additional mixing of the batch.

7.3.3 The flow value of the mortar in the bulk test sample shall be determined in accordance with RS 211-3 and reported.

7.4 Preparation and curing of test specimens

Prepare three test specimen prisms with dimensions 160 mm x 40 x 40 mm according to RS 211-5. Line the base of the metal mould with filter paper and fill with mortar and strike off the surface flush with the top of the mould. Place a layer of filter paper on the mortar surface. Cure the test specimens under the conditions described in Table 1. At the end of the curing period, demould the specimens. Seal the four long faces of the specimens using the specified sealing material, then beak them into two halves.

Table 1 — Curing of test specimens

Type of mortar	Curing time at a temperature of 20 °C ± 2°C in days		
	95 % ± 5 % RH (relative humidity)		65 % ± 5 % RH
	in the mould[a])	with the mould removed	with the mould removed
Lime mortars	5	2	21
Lime/cement mortars in which the amount of lime is greater than 50 % of the total binder weight	5	2	21
Cement and other lime/cement mortar	2	5	21
Mortars with other hydraulic binders	2	5	21
Retarded mortars	5	2	21

a) In some cases an extended period of storage in the mould may be necessary.

7.5 Drying

7.5.1 Dry the test specimens to constant mass in a ventilated oven at a temperature of 60 °C ± 5 °C. Constant mass is reached, if during the drying process in two subsequent weighings with a 24-h interval, the loss in mass between the two determinations is not more than 0.2 % of the total mass.

7.5.2 For renovation mortars only, record the dry mass of each specimen (M3).

8 Procedure

8.1 Place the specimens in the tray (4.1), with the broken faces of the prisms downwards, supported clear of the base of the tray on the four support pads (4.2), immersed in water (6.1) to a depth of 5 mm - 10 mm for the duration of the test (see Figure 1). To ensure full immersion of rough surface textured specimens avoiding trapping air bubbles beneath them, immerse them in a sloping attitude.

8.2 Activate the timing device. Maintain the water level constant throughout the test.

8.3 Cover the tray to avoid evaporation from the wet test specimens.

8.4 If visible wetting occurs on the free surface of the test specimens, stop the test. Break the specimens to ensure that they are fully saturated. If they are saturated then weigh the two pieces together. If not fully saturated, repeat the test with a new specimen.

NOTE If, when the specimen is broken, it is not saturated across the whole area, it can be that the sealing of the long faces was inadequate. Therefore, special attention should be paid to this aspect of preparation of any replacement specimens.

8.5 For mortars other than renovation mortars; remove the specimens from the tray after 10 min, wipe off rapidly surface water with a dampened cloth, weigh the specimen (M1) and replace them immediately into the tray. Repeat the same procedure after 90 min and weigh (M2).

8.6 For renovation mortars only; Remove the specimens from the tray after 24 h and weigh them (M3). Immediately afterwards, split each specimen along its length to give approximately pieces of dimension 80 mm x 40 mm x 20 mm. Measure the height of water penetration in the centre of the specimen parallel to the 80 mm dimension with an accuracy of 1 mm.

Dimensions in millimetres

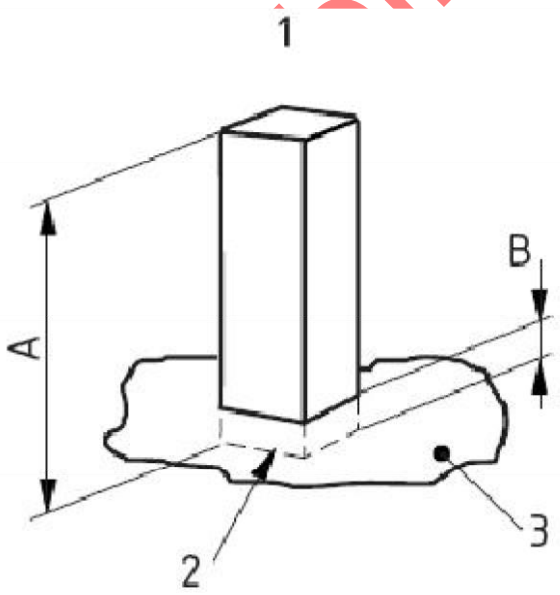

Figure 1 — Render specimens

Key

1 Prism specimen

2 Broken end face of prim

3 Water surface

A Approximately

B Immersion 5 mm - 10 mm

NOTE 10 mm are used if surface is heavily textured.

9 Calculation and expression of results

9.1 For other than renovation mortars the coefficient of water absorption is by definition equal to the slope of the straight line linking the representative points of the measurements carried out at 10 min and 90 min.

9.2 Calculate it on the basis of the following formula:

$$C = 0.1(M_1 - M_2)kg\ (m^2 min^{0.5})$$

where:

M_1 is the mass of the specimen after soaking for 10 min, (g);

M_2 is the mass of the specimen after soaking for 90 min, (g); and

C is the coefficient of water absorption for an individual mortar specimen, (kg/ m^2.$min^{0.5}$) (for mortars other than renovation mortars) or (kg/m^2) (for renovation mortars).

9.3 For renovation mortar only, water absorption is measured in kg/m^2 after 24 h using the following formula:

$$C = 0.625\ (M_3 - M_0)Kg/m^2$$

where

C is the coefficient of water absorption for an individual mortar specimen, (kg/ m^2.$min^{0.5}$) (for mortars other than renovation mortars) or (kg/m^2) (for renovation mortars);

M_3 is (for renovation mortars) the mass of the specimen after soaking for 24 h, (g); and

M_0 is (for renovation mortars) the dry mass of the specimen, (g).

NOTE Water penetration depth is determined in mm.

9.4 Calculate individual values of coefficient of water absorption (C) to the nearest 0.05 kg/ m^2.$min^{0.5}$) or nearest 0.05 kg/m^2 as relevant.

9.5 Calculate the mean value of coefficient of water absorption (C_m) from the individual values to the nearest 0.1 kg/ (m^2. min^{05}) or nearest 0.05 kg/m^2 as relevant.

NOTE C_m is the mean coefficient of water absorption of the sample of mortar due to capillary action, (kg/ (m^2. $min^{0.5}$)) (for mortars other than renovation mortars) or (kg/m^2) (for renovation mortars).

10 Test report

The test report shall contain the following information:

a) the place, date and time of taking the bulk test sample;

b) the method used for taking the bulk test sample (if known) and the name of the organization that took it;

c) the type, origin and designation of the mortar by reference to of RS 108;

d) preparation (mixing, casting) and curing conditions;

e) the date and time of preparation of the specimens for test;

f) the flow value of the test mortar determined in accordance with RS 211-2;

g) the date and time of testing;

h) Individual values of coefficient of water absorption due to capillary action (c) stated to the nearest 0.05 kg/(m^2.$min^{0.5}$) or nearest 0.05 kg/m^2 as relevant, and, for other than renovation mortars, the length of time of immersion of each specimen;

i) the mean coefficient of water absorption due to capillary action (cm) stated to the nearest 0.1 kg/(m^2.$Min^{0.5}$) or nearest 0.05 kg/m^2 as relevant; and

j) remarks, if any.

NOTE 1 The sample taken from the bulk supply that is to be used for all of the tests in RS 211.

NOTE 2 This information is contained on the certificate of sampling (see RS 211-1).

Price based on 6 pages