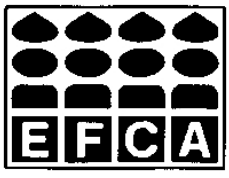
CAA Guidelines

for establishing the suitability of

special purpose concrete admixtures

The sign of
Quality and
Established Suitability



Contents

Foreword

These Guidelines have been prepared by the Technical Committee of the Cement Admixture Association (CAA).

These Guidelines are intended to establish the suitability of special purpose concrete admixtures used in the United Kingdom and that are not covered by BS EN 934-2 Admixtures for concrete, mortar and grout: Part 2 Concrete admixtures – Definitions, requirements, conformity, marking and labelling.

Introduction

These Guidelines cover seven categories of special purpose concrete admixtures that are in widespread use in the United Kingdom but are not covered by BS EN 934-2.

The requirements follow the format established by BS EN 934-2. However, for some of the admixtures there is no internationally agreed laboratory test available to measure their effectiveness in relation to the primary function. In these cases the effectiveness is required to be agreed between the manufacturer and purchaser.

1 Scope

These Guidelines specify definitions and requirements for special purpose admixtures in order to establish suitability for use in concrete complying with BS EN 206-1.

They cover semi-dry concrete admixtures for precast concrete and the following admixtures for plain, reinforced, foamed and prestressed concrete that are used in site mixed or ready mixed concrete.

- underwater concrete admixtures
- shrinkage reducing admixtures
- corrosion inhibiting admixtures
- pumping aids
- segregation reducing admixtures
- foaming admixtures
- semi-dry concrete admixtures

Provisions governing the practical application of admixtures in the production of concrete, i.e. requirements concerning composition, mixing, placing, curing etc. of concrete containing admixtures are not part of these guidelines.

2 Normative references

These Guidelines incorporate by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to these Guidelines only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

BS EN 206-1 *Concrete - Part 1: Specification, performance, production and conformity.*

BS EN 480-1 *Admixtures for concrete, mortar and grout - Test methods - Part 1: Reference concrete and reference mortar for testing*.

BS EN 480-2 *Admixtures for concrete, mortar and grout - Test methods - Part 2: Determination of setting time.*

BS EN 480-6 *Admixtures for concrete, mortar and grout - Test methods - Part 6: Infrared analysis.*

BS EN 480-8 *Admixtures for concrete, mortar and grout - Test methods - Part 8: Determination of the conventional dry material content*.

BS EN 480-10 *Admixtures for concrete, mortar and grout - Test methods - Part 10: Determination of the water soluble chloride content.*

BS EN 480-12 *Admixtures for concrete, mortar and grout - Test methods - Part 12: Determination of the alkali content of admixtures*.

BS EN 934-2: *Admixtures for concrete mortar and grout – Part 2: Concrete admixtures – Definitions, requirements, conformity, marking and labelling.*

BS EN 934-6: *Admixtures for concrete, mortar and grout - Part 6: Sampling, conformity control and evaluation of conformity*.

BS EN 12350-2 *Testing fresh concrete - Part 2: Slump test*

BS EN 12350-5 *Testing fresh concrete – Part 5: Flow table test*

BS EN 12350-6 *Testing fresh concrete – Part 6: Density*

BS EN 12350-7 *Testing fresh concrete - Part 7: Air content - Pressure method*.

BS EN 12390-1:2002 *Testing hardened concrete - Part 1: Shape, dimensions and other requirements for specimens and moulds.*

BS EN 12390-3:2002 *Testing hardened concrete - Part 3: Compressive strength of test specimens.*

BS EN 12620: 2002 *Aggregates for concrete.*

ISO 649-2 *Laboratory glassware - Density hydrometers for general purposes – Part 2: Test methods and use.*

ISO 4316 *Surface active agents - Determination of pH of aqueous solutions - Potentiometric method*.

3 Definitions, symbols and abbreviations

3.1 Terms and definitions

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

3.1.1 General definitions

3.1.1.1
performance
ability of an admixture to be effective in its intended use without detrimental effects

3.1.1.2
compliance dosage
the dosage of an admixture, expressed as percent by mass of cement, stated by the manufacturer, which will meet the requirements of this standard. The compliance dosage is within the recommended range of dosage

3.1.1.3
recommended range of dosage
dosages between limits expressed as percent by mass of cement, which the manufacturer recommends for the product, based on experience in use.

NOTE The use of the recommended dosage does not imply that compliance with this standard will be met over the whole range. Trial tests should be carried out with the materials to be used on site to find the dosage necessary to achieve the required performance.

3.1.1.4
maximum recommended dosage
upper limit of the recommended range of dosage

3.1.1.5
reference concrete and mortar
concrete and mortar composition specified for testing admixtures for conformity with this standard.

3.1.1.6
primary function
a single function of a multifunction admixture designated by the manufacturer.

3.1.1.6

general requirements
characterise the admixture by physical and chemical measurements.

3.1.1.7
specific requirements
characterise the performance of the admixture in a cementitous mix .

3.1.2 Specific definitions

3.1.2.1
admixtures for concrete
materials added during the mixing process of concrete, in a quantity not normally exceeding 5% by mass of the cement content of the concrete to modify the properties of the mix in the fresh and / or hardened state.

3.1.2.2
underwater concrete admixture
admixture that significantly reduces the washout of cement during the underwater placing and hardening of concrete.

3.1.2.3
shrinkage reducing admixture
admixture that, without water reduction, brings about a significant reduction in drying shrinkage.

3.1.2.4
corrosion inhibiting admixture
admixture that reduces the corrosion potential of steel, embedded in concrete.

3.1.2.5
pumping aid
admixture that reduces pumping pressure and/or the tendency for blockages in pump lines.

3.1.2.6
segregation reducing admixture
admixture that modifies the mix viscosity to reduce segregation of concrete.

NOTE segregation reducing admixtures are often called viscosity modifying admixtures (VMA).

3.1.2.7
foaming admixture
admixture that uses air to produce a stable low density concrete or mortar.

NOTE Integral foaming admixtures intended to produce highly air entrained concrete (or mortar) may be tested for compliance with BS EN 934-3.

3.1.2.8
semi-dry concrete admixture
admixture that is incorporated into semi-dry concrete to improve the moulding process and or hardened properties of the mix.

3.2 Symbols and abbreviations

FPC Factory production control

ITT Initial type testing

4 Requirements

4.1 General requirements

All the admixtures defined in these Guidelines shall conform to the general requirements in Table 1.

NOTE The requirements in these Guidelines assume that admixtures are uniformly dispersed in concrete; special attention should be given to the dispersion of powder admixtures.

Table 1 - General Requirements

No	Property	Test method	Requirements
1	Homogeneity	Visual	Homogeneous when used. Segregation shall not exceed the limit stated by the manufacturer
2	Colour	Visual	Uniform and similar to the description provided by the manufacturer
3	Effective component	BS EN 480-6 [a)]	IR spectra to show no significant change with respect to the effective components when compared to reference spectrum provided by the manufacturer
4	Relative density (for liquids only)	ISO 649-2 [a)]	D $\pm$ 0,03 if D > 1,10 D $\pm$ 0,02 if D < 1,10 where D is manufacturer's stated value
5	Conventional dry material content	BS EN 480-8 [a)]	0,95 T $\leq$ X < 1,05 T for T $\geq$ 20 % 0,90T $\leq$ X< 1,10T for T < 20 % T is manufacturer's stated value % by mass X is test result % by mass
6	pH value [c)]	ISO 4316 [a)]	Manufacturer's stated value $\pm$ 1 or within manufacturer's stated range
7	Effect on setting	BS EN 480-2	Report results at the compliance dosage in reference mortar with CEM 1 cement
8	Water soluble chloride (Cl^-)	BS EN 480-10	Either $\leq$ 0,1 0 % by mass [b)] or not above the manufacturer's stated value
9	Alkali content (Na_2O equivalent)	BS EN 480-12	Not above the manufacturer's stated maximum
	NOTES [a)] The manufacturer may recommend an alternative test method for both ITT and FPC. [b)] Where the chloride content is $\leq$ 0,10 % by mass the admixture may be described as "chloride free". [c)] Liquid admixtures only.		

4.2 Information to be provided by the manufacturer

The following information shall be documented and provided on request by the manufacturer.

- Recommended range of dosage;
- limit of segregation for homogeneity;
- description of colour;
- relative density – liquids only;
- conventional dry material content;
- pH value;
- Report the setting time at the compliance dosage;
- maximum water soluble chloride content;
- maximum alkali content.

4.3 Requirements for specific types of admixture

The specific requirements of these guidelines cover performance in a cementitous mix where suitable laboratory tests are available.

NOTE: In some cases suitable laboratory tests are not available or the performance of the primary function is specific to the materials and equipment used on site and can only be demonstrated by purchaser trials. In this situation, effectiveness for purpose is required to be established by agreement

between the manufacturer based on trials and performance information provided by the manufacturer for the admixture.

The admixtures shall conform to the following specific requirements:

Underwater concrete admixtures	Table 2
.	
Shrinkage reducing admixtures	Table 3
Corrosion inhibiting admixtures	Table 4
Pumping aids	Table 5
Segregation reducing admixtures	Table 6
Foaming admixtures	Table 7
Semi-dry concrete admixtures	No suitable laboratory tests are available. Performance can only be demonstrated by purchaser trials.

Table 2 – Specific requirements for underwater concrete admixtures
(at equal w/c)

No	Property	Reference concrete	Test method	Requirement
1	Consistence [a)]	BS EN 480-1 reference concrete 1[b)]	Slump BS EN 12350-2	Control 70 ± 10 mm Test mix ≥ 170 mm [a]
2	Washout	BS EN 480-1 reference concrete 1[b)]	Annex A	Loss of weight ≤ 15%
3	Compressive strength	BS EN 480-1 reference concrete 1[b)]	BS EN 12390-3	At 7 and 28 days Test mix ≥ 75% of control mix
4	Plastic Density	BS EN 480-1 reference concrete 1[b)]	BS EN 12350-6	Test mix ± 150 kg/m^3 of control
	NOTES [a)] If the manufacturer recommends the separate addition of a superplasticiser to give the required consistence in the test mix, this is permitted but the quantity and type shall be recorded in the ITT test result document. [b)] The cement content of reference concrete 1 shall be increased to 450 ± 20 kg/m^3			

Table 3 – Specific requirements for shrinkage reducing admixtures
(at equal w/c ratio [a)])

No	Property	Reference concrete	Test method	Requirement
1	Shrinkage reduction	BS EN 480-1 reference concrete 1	Annex B	At 28 days from start of drying test mix shrinkage ≤ 70% of the control mix.
2	Compressive strength	BS EN 480-1 reference concrete 1	BS EN 12390-3	At 7 and 28 days test mix ≥ 80% of control mix
3	Air content of fresh concrete	BS EN 480-1 reference concrete 1	BS EN 12390-7	Test mix ≤ 2% above control mix
	NOTES [a)] The water content of the test mix shall be reduced by the volume of the admixture, even if the admixture is not aqueous.			

Table 4 – Specific requirements for corrosion inhibiting admixtures
(at equal consistence)

No	Property	Reference concrete	Test method	Requirement
1	Compressive strength	BS EN 480-1 reference concrete 1	BS EN 12390-3	At 7 and 28 days Test mix ≥ 90% of control mix
2	Setting time	BS EN 480-1 reference mortar	BS EN 480-2	Initial set: test mix within – 30 min and + 90 min of control mix
3	Air content of fresh concrete	BS EN 480-1 reference concrete 1	BS EN 12390-7	Test mix ≤ 2% above control mix
NOTE Laboratory tests for corrosion inhibiting admixtures have not been agreed. The potential effectiveness shall be agreed with the purchaser, based on chemical composition and / or in-house testing.				

Table 5 – Specific requirements for pumping aids
(at equal consistence)

No	Property	Reference concrete	Test method	Requirement
1	Compressive strength	BS EN 480-1 reference concrete 1	BS EN 12390-3	At 7 and 28 days Test mix ≥ 80% of control mix
2	Air content of fresh concrete	BS EN 480-1 reference concrete 1	BS EN 12390-7	Test mix ≤ 5% above control mix
NOTE Laboratory testing for pumping is not viable. The manufacturer and purchaser shall agree on the performance of the product, based on site testing.				

Table 6 – Specific requirements for segregation reducing admixtures
(at equal consistence)

No	Property	Reference concrete	Test method	Requirement
1	Segregation	reference concrete C.2	Annex C	Slump flow segregation width ≤ 20 mm
2	Compressive strength	reference concrete C.2	BS EN 12390-3	At 7 and 28 days test mix ≥ 90% of reference mix

Table 7 – Specific requirements for foaming admixtures

No	Property	Reference mortar	Test method	Requirement
1	Foaming	Annex D2	Annex D	Initial wet density 1300 ± 100 kg/m^3
2	Foam stability	Annex D2	Annex D	Density after 1 hour standing, initial density ± 100 kg/m^3
3	Air dry, hardened density at 7 days	Annex D2	Annex D	Hardened density ≤ 100 kg above the density after 1 hour standing.
4	Air dry, 7 day strength	Annex D2	BS EN 12390-3	No specific requirement but strength and density of sample to be reported.

5 Sampling

Sampling shall be in accordance with BS EN 934-6.

6 Conformity control

6.1 Initial type testing

Requirements for when ITT shall be performed are given in BS EN 934-6
The results of ITT shall be documented by the manufacturer and shall include the following:

a) Manufacturers stated values for general requirements;
b) actual general requirement test values obtained;
c) any variation from the test method detailed in table 1;
d) source and type of cement and aggregates for specific admixture tests;
e) dosage of admixture used (compliance dosage);
f) the control and test mix values for each test, (individual and average if applicable);
g) the test result along side the requirement with a statement on compliance;
h) date of testing.
i) Any other information required by this and supporting standards.

6.2 Factory production control

Factory production control shall be in accordance with table 9 and BS EN 934-6.

7 Evaluation of conformity

Evaluation of conformity shall be in accordance with BS EN 934-6.

8 Marking and labelling

8.1 General

When admixtures for concrete are supplied in containers, they shall be clearly marked with the information listed in **8.2** and **8.3** of this standard. When the material is supplied into a bulk container at the point of delivery, the information in **8.2** shall be provided in writing at the time of delivery but can give reference to a separate sheet detailing the information required by **8.3**.

8.2 Designation and traceability

The following information shall be provided on the label or in writing at the point of delivery:

a) The manufacturer's trade name for the admixture;
b) the type of admixture, e.g. pumping aid;
c) a code traceable to the admixture batch, production control records and retained sample.

8.3 Additional information

The following information shall be provided on the label or in writing.

a) A summary of storage requirements;
b) storage life including the words; this admixture shall not be taken to comply with this standard after DD MM YYYY;
c) instructions for homogenisation before use, when necessary;
d) the manufacturer's recommended range of dosage;
e) the maximum water soluble chloride ion content;

f) any special instructions for use;
g) health and safety data.

Table 9 – Minimum frequency of test for FPC

Tests	Underwater concrete admixtures	Shrinkage reducing admixtures	Corrosion inhibiting admixtures	Pumping aids	Segregation reducing admixtures	Foaming admixtures	Semi-dry concrete admixtures
Homogeneity/colour	B	B	B	B	B	B	B
Relative density	B	B	B	B	B	B	B
Conventional dry material content	B	B	B	B	B	B	B
pH value	B	B	B	B	B	B	B
Water soluble chloride	1	1	1	1	1	1	1
Alkali content	1	1	1	1	1	1	1
Washout	A						
Compressive strength	1	1	1	1	1	1	
Shrinkage reduction		A					
Air content of fresh concrete		1	1	1	1		
Setting time			1				
Segregation					A		
Foaming						A	
Foam stability						A	

Numbers in this table indicate frequency of test per year spread according to production. If production is less frequent every batch has to be tested.

A means a test every 1000 t produced with a maximum of 3 tests per year and a minimum of once per year provided at least one batch of the product is produced.

B means test every batch.

pH value is for liquid admixtures only.

NOTE Effective component (infra red analysis) and effect on setting time at compliance dosage only have to be included in ITT.

Annex A: Determination of washout

(Normative)

A.1 Principle

This test method is designed to evaluate the ability of fresh concrete to resist wash-out of fine material during placing underwater. A known weight of reference concrete containing the admixture is placed in a standard, open mesh basket and the basket allowed to free fall through a column of water. After 5 drops, the weight of concrete lost from the basket is determined, as a percentage of the original weight.

A.2 Apparatus

A 1.9 ± 0.02 m length of rigid, impermeable tube, internal diameter (190 ± 10) mm, wall thickness approximately 3 mm, held vertically, sealed at the base and filled with tap water to a height of (1.5 ± 0.02) m.

Cylindrical wire basket with an external diameter equal to the pipe internal diameter less (42 ± 5) mm, height (130 ± 5) mm, made from hexagonal mesh (Expamet Hex 2 from the Expanded Metal Company, or similar), the diamond or hexagonal shaped openings in the mesh shall have an open area of not less than 70% and centre to centre dimensions of approximately 25 mm long by 12 mm wide.

A 2.5 m length of non-absorbent cord.
A balance with 10 kg capacity, accurate to ± 1 g.
A suitable container in which to stand the wire basket when it is on the balance.

A.3 Test Procedure

Condition the apparatus and water column to (20 ± 2) ^{o}C

Place the wire basket in the container (dry) and record the total weight in grams. Then remove the basket and carefully place (4500 ± 50) g of the reference concrete (**table 2**) into the wire basket. Allow to stand for two minutes then carefully remove any paste or aggregate which has flowed through the sides of the basket. Place the basket back in the container and weigh. Ensure that the weight of concrete is (4500 ± 50) g, top up if necessary, then immediately record the initial weight of concrete in grams. (Total weight less container and basket weight.)

Remove the basket from the container, attach the non-absorbent cord and lower the basket into the water column in the pipe until the water is level with the top rim of the basket. Allow the basket to fall freely to the bottom of the water column and then raise the basket at a constant rate over a period of 5 s till the water is again level with the top rim of the basket.

Repeat the free fall and raising a total of five times. Withdraw the basket and allow the water to drain from the concrete for 15 to 20 s, remove the cord, place the basket containing the concrete into the container and record the concrete weight after immersion in grams. (Total weight less container and basket weight).

Refill the basket with fresh concrete from the same mix and repeat the test.
The whole test shall be completed within 30 min of the completion of mixing.

A 4 Calculation

The wash-out, expressed as the percentage loss of material after five immersions is calculated as follows:

$$\text{Wash-out} = \frac{\text{Initial weight of concrete} - \text{weight of concrete after immersion} \times 100}{\text{Initial weight of concrete'}} \ \%$$

Calculate the average result for two tests.

A 5 Test report

This shall include the following:

a) Trade name and description of the admixture(s);
b) admixture dosage(s);
c) type and mass of cement used in reference concrete;
d) individual and average results for washout calculated in accordance with **A.4**.

Annex B: Determination of the drying shrinkage of concrete
(Normative)

B 1 Principle

This test method is designed to evaluate the relative drying shrinkage of concrete with and without a shrinkage reducing admixture. It is carried out over 28 days at 20 ^{0}C and 50 % RH on a cast concrete prism following a period of seven days moist cure.

B.2 Apparatus

Prism moulds of nominal size (75 x 75 x 250) mm with provision for casting in steel inserts compatible with the length measuring equipment.

Controlled environment room or cabinet, maintained at a temperature of (20 ± 2) ^{0}C and (50 - 65) % RH. The temperature and relative humidity shall be measured and recorded continuously or at least once on each of five out of every seven days. A fan is used to provide a uniform airflow across the specimens, which are supported so that there is free air movement on all faces.

Measuring equipment to measure the length of the concrete prism between the steel inserts, relative to a calibration rod. The gauge shall read changes with a precision ≥ 0.002mm.

B.3 Test Procedure

Using reference concrete in accordance with EN 480-1, cast three prisms using the reference mix and three prisms using the test mix all on the same day. Maintain the specimens at (20 ± 2) ^{0}C and ≥ 90 % RH for one day, then demould and wet cure in lime saturated water at (20 ± 2)^{0}C for six days.

At seven days after casting, remove the specimens from water and wipe dry. Make and record the initial comparative length reading to the nearest 0.002 mm and the overall length of the concrete prism to the nearest 1.0 mm for all the specimens.

Place the specimens in the controlled environment room or cabinet and leave for 28 days from the start of drying. At 28 days after the start of drying, make and record the final comparative length reading.

B.4 Calculation

Calculate the drying shrinkage S of each specimen as follows:

$$S = \frac{GRD\ (final) - GRD\ (initial) \times 100}{PL}\ \%$$

Where: S = length change of the specimen at 28 days as a percent of the initial prism length.
GRD = the difference in length between the gauge reading of the specimen and the reading for the reference bar in mm.
PL = Initial prism length in mm.

Calculate and record the average drying shrinkage of the test specimens as a percentage of the average shrinkage of the reference specimens.

B.5 Test report

This shall include the following:

a) Trade name and description of the admixture;
b) admixture dosage;
c) type of cement used in the reference concrete;
d) individual and average results of shrinkage at 28 days calculated in accordance with **B.4**.

Annex C: Determination of segregation in concrete
(Normative)

C.1 Principle

A reference concrete detailed in clause C.2 is produced at a slump of (120 ± 20) mm.

A control concrete is made at the same W/C ratio as the reference mix. The consistence of the control concrete is increased by the addition of a superplasticiser to a level where segregation of the coarse aggregate occurs.

A test concrete is made to the same mix as the control concrete and to which is added the segregation reducing admixture, followed if necessary by further superplasticiser to achieve a consistence equal or greater than that of the control mix.

C.2 Materials and Apparatus

Reference concrete mix to C.2.1
Superplasticiser complying with EN 934-2 T3.2
Slump test apparatus to BS EN 12350-2.
Slump Flow test apparatus to clause C5
Compressive strength moulds to BS EN 12390-1

C.2.1 Reference concrete mix

CEM 1 Cement	215 Kg/m3
GGBS	215 kg/m3
Sand	920 Kg/m3
20 mm Crushed Aggregate	590 Kg/m3
10 mm Crushed Aggregate	250 Kg/m3

C.3 Test Procedure

Make a Reference concrete mix as detailed in clause C.2.1 with sufficient water to give a slump of (120 ± 20) mm. Record the slump and W/C ratio. Make 6 specimens for compressive strength testing, 3 at 7 and 3 at 28 days.

The control concrete is made at the same W/C ratio as the reference concrete. By the addition of a superplasticiser the consistence is increased to a level where segregation occurs. The slump flow and segregation width shall be measured in accordance with clause C.5. If the slump flow segregation width is less than 50 mm, the test shall be repeated, using additional superplasticiser to increased consistence*. Record the W/C ratio, slump flow and the slump flow segregation width.

*NOTE: if the slump flow segregation width is still less than 50 mm it may be necessary to repeat the reference mix, increasing the W/C ratio.

For the test concrete use the same mix as the control concrete but add the segregation reducing admixture. If necessary, add sufficient additional superplasticiser to give a slump flow equal to or greater than that of the control mix. The slump flow and segregation width shall be measured in accordance with clause C.5.
Record the W/C ratio, slump flow and the slump flow segregation width. Make 6 specimens for compressive strength testing, 3 at 7 and 3 at 28 days.

C.4 Test report

This shall include the following:

a) Trade name, description and dosage of the segregation reducing admixture;
b) Trade name, description and dosages of the superplasticising admixture;
c) Reference mix: slump, water:cement ratio, hardened density and compressive strength;
d) Control mix: slump flow, water:cement ratio, slump flow ring segregation width;
e) Test mix: slump flow, water:cement ratio, slump flow segregation width, hardened density and compressive strength;

C.5 Segregation Measurement

C.5.1 Equipment

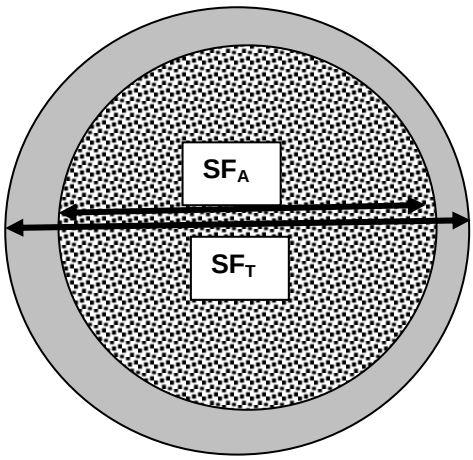
- slump cone conforming to EN 12350-2
- base plate of a flat, stiff non absorbing material, at least 800mm square,

C.5.2 Procedure for slump flow and segregation width

Moisten the base plate and inside of the slump cone.
Place the base plate on level stable ground and the slump cone centrally on the base plate. Hold down firmly.
Fill the cone with the concrete in one layer. Do not tamp, simply strike off the concrete level with the top of the cone.
Remove any surplus concrete from around the base of the cone.
Raise the cone smoothly and vertically, allowing the concrete to flow out freely.

Measure the final diameter of the concrete in two perpendicular directions.
Calculate the average of the two measured diameters. (This is the slump flow in mm **SF_T**).
Also record the diameter to the outer limit of coarse aggregate in two perpendicular directions.
Calculate the average of the two measured diameters. (This is the aggregate slump flow in mm **SF_A**).
The difference between the aggregate slump flow and the total slump flow average diameters is divided by two and recorded as the slump flow segregation width.

Slump Flow Segregation Width = SF_T - SF_A / 2



Annex D: Stability of foamed concrete
(Normative)

D.1 Principle

By repeated measurement of density, this test evaluates the stability before and during hardening, of a cementitous mix that has been foamed with a prefoam produced from the admixture under test. The prefoam may be produced using a planetary mixer or with a foam gun.

D.2 Apparatus and materials

A mortar mix consisting of two parts oven dry sand and one part cement by mass using the following materials:

Cement: CEM I conforming to BS EN 480-1 clause 3.1
Sand: Natural sand conforming to BS EN 12620 grading 0/2 or 0/1(FP)

A planetary mixer of any size but of the type described in BS EN196-1 and/ or a rotating drum mixer.

Commercially available foam producing equipment that the manufacturer recommends for use with his admixture.

A density pot, of known weight and volume, made from any suitable non absorbent rigid material, having a volume at least 1 litre.
A balance with 10 kg capacity and accurate to $\pm$ 1 g.

Compressive strength test moulds (BS EN 12390-1).

D.3 Test Procedure

D.3.1 Standard (reference) procedure

Using a planetary mixer of the type described in 196-1 or a rotating drum mixer, mix the mortar in the proportions in D.2 adding sufficient water to give a consistence suitable to accept the prefoam.

Use a planetary mixer of the type described in 196-1 with a whisk attachment to mix water and foaming agent, at the manufacturers recommended dilution, for 5 minutes to create a prefoam. Allow this to stand for 1 minute before use.
Alternatively, produce the prefoam using commercially available foam producing equipment in accordance with the manufacturer's written instructions.

Add the prefoam to the test mortar in a quantity sufficient to achieve an initial density of 1300 $\pm$ 100 kg/m^3, mixing until a uniform cementitous foam has been obtained. Measure and record the initial density at the end of the mixing sequence.
Transfer the foamed mix to a suitable container and allow to stand for 1 hour. Re-measure the density and make three compressive strength test specimens. Cover the specimens and allow them to harden for 24 h at (20 $\pm$ 2) ^{o}C then cure at (20 $\pm$ 2) ^{o}C and > 90% RH.
7 days from casting, measure the density and compressive strength.

D.4 Test report

This shall include the following:

a) trade name and description of the admixture;
b) admixture dosage/ dilution;
c) type of prefoam equipment.
d) type of cement used in the reference concrete;
e) sand type, source and designation;
f) initial density;
g) density after 1 hour standing
h) average mortar density at 7 days;
i) average compressive strength at 7 days.