BRITISH STANDARD

BS EN
12272-3:2003

Surface dressing — Test method —

Part 3: Determination of binder aggregate adhesivity by the Vialit plate shock test method

The European Standard EN 12272-3:2003 has the status of a British Standard

ICS 93.080.20

National foreword

This British Standard is the official English language version of EN 12272-3:2003.

The UK participation in its preparation was entrusted by Technical Committee B/510, Road materials, to Subcommittee B/510/2, Surface dressing, sprays and slurry surfacing, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

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Enduits superficiels - Méthode d'essai - Partie 3: Détermination de l'adhésivité liants-granulats par mesure de la cohésion Vialit

Oberflächenbehandlung - Prüfverfahren - Teil 3: Bestimmung des Adhäsionsvermögens von Bindemitteln und Gesteinskörnung mit dem Schlagprüfverfahren

This European Standard was approved by CEN on 21 November 2002.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This document (EN 12272-3:2003) has been prepared by Technical Committee CEN/TC 227 "Road materials", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2003, and conflicting national standards shall be withdrawn at the latest by April 2005.

This European Standard is one of a series of standards as listed below:

EN 12272-1, *Surface dressing — Test method — Part 1: Rate of spread and accuracy of spread of binder and chippings.*

prEN 12272-2, *Surface dressing — Test method — Part 2: Visual assessment of defects.*

EN 12272-3, *Surface dressing — Test method — Part 3: Determination of binder aggregate adhesivity by the Vialit plate shock test method.*

Annexes A, B, C and D are informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

The adhesion between binder and chippings is the basis of successful surface dressing. It is important that this bond can be obtained, initially, at the moment of construction and be ensured in cool conditions when the adhesivity problems become dominant binder with damp or dry and dusty chippings. A knowledge of adhesivity enables the choice of a binder and aggregate type for minimum risk, especially for early and late season work.

1 Scope

This European Standard specifies the measurement of the binder aggregate adhesivity, and the influence of adhesion agents or interfacial dopes an adhesion characteristics as an aid to design binder aggregate systems for surface dressing. It is not intended that this method is used on site for quality control.

This European Standard specifies methods of measurement of:

- the mechanical adhesion of the binder to the surface of the aggregate;
- the active adhesivity of the binder to the chippings;
- the improvement of the mechanical adhesion and active adhesivity by adding an adhesion agent either into the mass of the binder or by spraying the interface between binder and chippings;
- the wetting temperature of the binder to the aggregate;
- the variation of adhesivity below the fragility temperature.

This test method is suitable for:

- all the hydrocarbon binders used for surface dressings (e.g. conventional or polymer modified binders, fluxed or cut-back binders or, conventional or polymer modified bituminous emulsions);
- all the aggregate types used for surface dressings;
- following aggregate product sizes:
  - set 1: 2/5 mm, 5/8 mm, 8/11 mm and 11/16 mm;
  - set 2: 2/6 mm, 4/6 mm, 6/10 mm and 10/14 mm.

NOTE Further information concerning the purpose of the test may be found in annex D.

2 Normative references

This European Standard incorporates 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 this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

ISO 48, *Rubber, vulcanized or thermoplastic — Determination of hardness (Hardness between 10 IRHD and 100 IRHD).*

3 Terms and definitions

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

3.1
active adhesivity
necessary to bond damp chippings in their natural state

3.2
mechanical adhesion
necessary to bond the dry chippings with their natural dust or fines making an inhibiting screen

3.3
wetting temperature
lowest temperature of the binder on the plate, just prior to applying the chippings, at which the number of all the stained chippings either bonded to the plate or fallen, after the shock test, is at least 90 % of the chippings

3.4
fragility temperature
lowest test temperature at which 90 % aggregates remain bonded to the plate

3.5
test temperature
temperature at which the plates with the binder and the chippings are conditioned before the shock test

4 Active adhesivity and mechanical adhesion

4.1 Description

The required quantity of binder is heated to spraying temperature and spread evenly an a steel plate. The test is performed at (5 ± 1) °C.

50 or 100 graded chippings are laid down on the binder and rolled if a hot binder is used.

The prepared plate is turned over and put on 3-pointed supports.

A steel ball is made to fall 500 mm three times onto the plate within a 10 s period.

The adhesivity value is determined as the sum of number of chippings remaining bonded to the plate and the number of fallen chippings which are stained by the binder.

NOTE If the chippings are treated chemically or washed on site or an interfacial adhesion agent (dope) used in construction, then this should be simulated in the test method. If polymer modified binders are used which need special site conditions, e. g. road temperatures > 10 °C or heated chippings, then again the test should reflect these constraints and the report modified accordingly, e. g. increase temperature of chippings to 10 °C.

4.2 Apparatus

4.2.1 Flat steel plates (see Figure 1)

Flat steel plates with a rim of 2 mm to 3 mm height and with following dimensions:

¾ side (200 ± 1) mm (200 ± 1) mm;

¾ thickness (2,0 ± 0,2) mm.

The plates should be flat manufactured with a tolerance of 0,2 mm across the total length in any direction. The maximum tolerance after usage shall be 0,5 mm.

Dimensions in millimetres

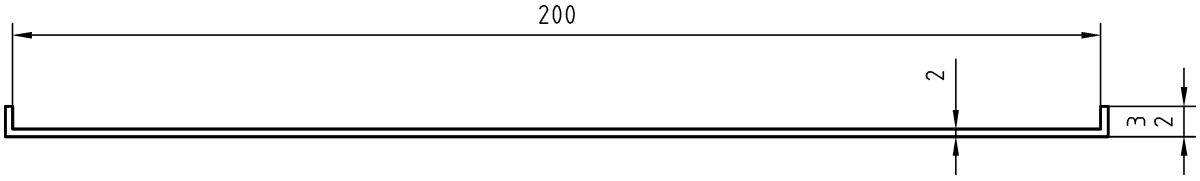
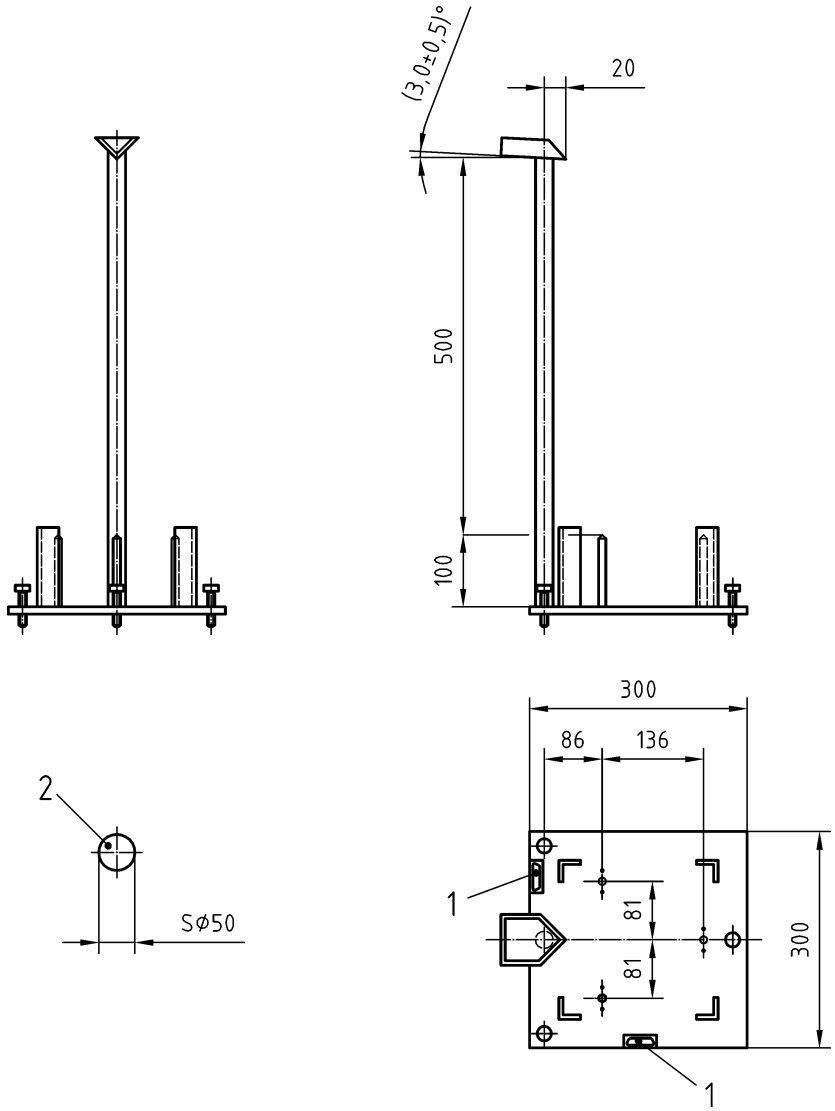


Figure 1 — Flat steel plate

4.2.2 3-pointed supports

A device composed of a rigid base with 3-pointed supports, a vertical support ending in a lightly angled slide (3,0 ± 0,5)° to launch the ball, see Figure 2.



Key
1 Level
2 Ball

Tolerances ± 1 mm, except for
— the supports: ± 0,2 mm
— the ball: ± 0,5 mm

Figure 2 — 3-pointed supports

4.2.3 Steel ball

Mass (510 ± 10) g, diameter (50,0 ± 0,5) mm.

4.2.4 Rubber wheel roller (see Figure 3)

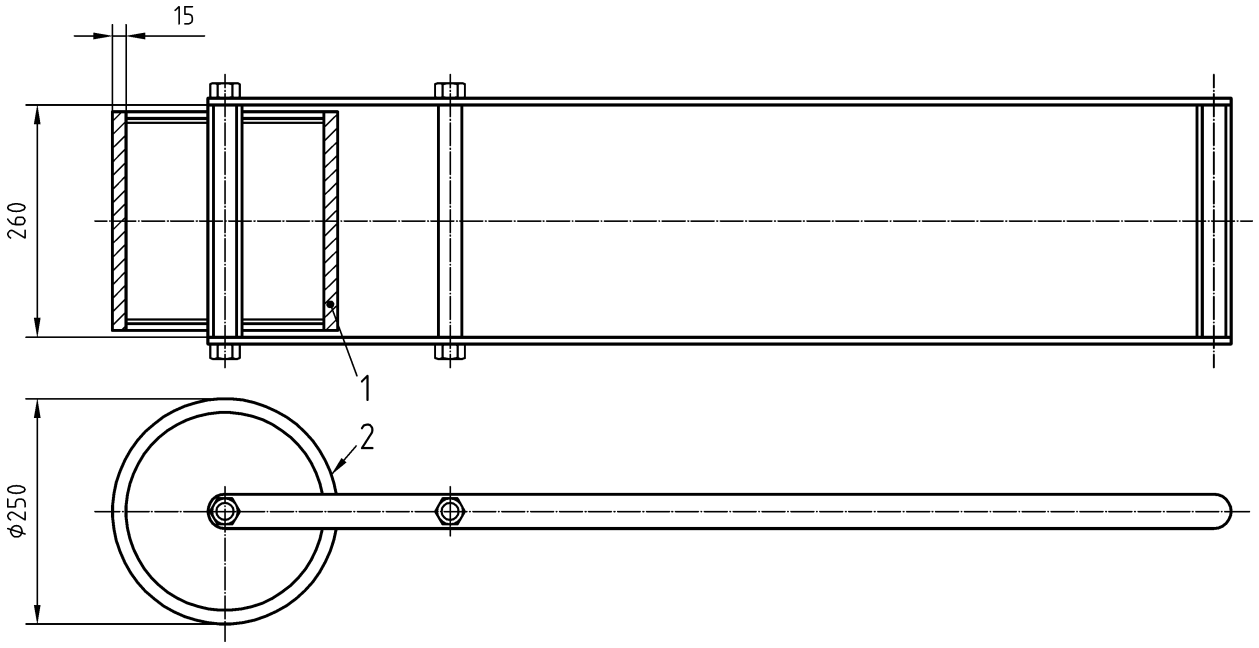
Thickness of the hard rubber: (15 ± 2) mm;

mass: (25 ± 1) kg;

useful width: (260 ± 10) mm (see Figure 3);

hardness of the rubber shall be Shore 40/150 in accordance with ISO 48.

Dimensions in millimetres



Key
1 Rubber thickness (15 2) mm
2 Roller mass (25 1) kg

Figure 3 — Rubber wheel roller

4.2.5 Sprayer

For applying adhesion agent (dope) as an interfacial layer between binder and chippings if required.

4.2.6 Hygrometer

Accurate to 5 % at 90 % humidity.

4.2.7 Balance

Accurate to 0,1 g, range at least 1 000 g.

4.2.8 Climatic chambers

Capable of maintaining temperatures of the samples to cover the range (30 ± 1) °C to (-25 ± 1) °C and a humidity greater than 90 %.

4.2.9 Oven

Capable of heating chippings or binder e. g. (50 ± 5) °C to (170 ± 5) °C.

4.2.10 Auxiliary items

¾ Spatula;

¾ metallic box which can be hermatically sealed;

¾ basket made of a metallic gauze;

¾ timing device of accuracy to ± 1 s.

4.3 Procedure

4.3.1 Preparation of the binder

4.3.1.1 Quantity

The binder rate of spread used for the test shall be:

¾ 0,7 kg/m^2 when the chipping size is 4/6 mm;

¾ 1,0 kg/m^2 when the chipping sizes are 5/8 mm, 6/10 mm or 8/11 mm;

¾ 1,3 kg/m^2 when the chipping sizes are 10/14 mm or 11/16 mm.

When a bitumen emulsion is tested, the above quantities apply to the residual binder after breaking and total evaporation of the water content.

4.3.1.2 Temperature

At least 0,5 kg of binder shall be warmed up to spraying temperature typically used on site to obtain an even spread.

4.3.2 Preparation of the chippings

4.3.2.1 Quantity

¾ 100 chippings shall be used with the sizes 4/6 mm, 5/8 mm, 6/10 mm or 8/11 mm;

¾ 50 chippings shall be used with the sizes 10/14 mm or 11/16 mm.

When choosing chippings for the sample, any obviously oversized, undersized or flaky chippings shall be rejected.

4.3.2.2 Treatment for mechanical adhesion test

Put the chippings with their dust and fines in a carton and place it in a ventilated oven at (50 ± 1) °C for (24 ± 1) h.

Put the carton containing the chippings into a box which is then hermatically sealed and placed in a temperature controlled chamber at (5 ± 1) °C for (24 ± 1) h.

4.3.2.3 Treatment for active adhesivity test

Put the chippings with their dust and fines in a basket made of a metallic gauze and place it in a climatic chamber at (5 ± 1) °C with relative humidity greater than 90 % for (24 ± 1) h.

4.3.3 Preparation of the plates

Clean and dry the plates before each test.

Weigh out the required quantity of binder warmed up to the spraying temperature and apply it to the plate uniformly with a spatula after checking with a spirit-level that the support is horizontal.

To obtain a uniform thickness of the binder film, the plate may be heated to a maximum temperature of 50 °C, for a maximum period of 5 min.

Put the plate with the binder in a climatic chamber at (5 ± 1) °C, close by the samples, for (20 ± 2) min.

4.3.4 Spreading and rolling (binders excluding emulsions)

Take the chippings from the climatic chamber and place them evenly on the binder.

If an interfacial adhesion agent (dope) is used, spray it just prior to the application of the chippings.

Carry out the rolling with the rubber roller by three passes in one direction and three passes in a crosswise direction.

4.3.5 Spreading (emulsions)

Take the chippings from the climatic chamber and place them gently and uniformly onto the emulsion before any breaking of the emulsion occurs; rolling shall not be carried out.

Put the plate with the emulsion and chippings in a forced draft ventilated climatic chamber at room temperature (between 20 °C and 30 °C) for (24 ± 1) h.

The water content is totally evaporated when constant mass is achieved. Constant mass is deemed to be achieved when the difference between successive weighings at half hourly intervals does not exceed 0,1 % of the mass.

4.3.6 Temperatures setting

Take the plates with the binder or residual binder of the emulsion and the chippings, and put them in a climatic chamber at (5 ± 1) °C, close by the samples, for (20 ± 2) min.

4.3.7 Implementation

Each test shall be carried out within 1 min under the same conditions and, successively, with three different plates to obtain three measurement values. The apparatus shall be placed on a hard base.

Check, using a spirit-level that the 3-pointed support is level. Adjust, if necessary, by means of the three levelling screws in the base.

Remove the plate from the climatic chamber and place it upside down an the 3-pointed supports so that the chippings are underneath.

Place the metallic ball in the holder, let the ball drop three times within 10 s.

After the third shock, examine the plate and count the chippings as follows:

¾ number of fallen chippings unstained by the binder a';

¾ number of fallen chippings stained by the Binder b';

¾ number of chippings bonded to the plate c'.

Verify the sum:

$a' + b' + c' = 100$ or $a' + b' + c' = 50$ according to the chipping size.

a, b and c are the mean values of three measurements for each number.

4.4 Expression of results

Adhesivity between the binder and the chippings under test occurs if bitumen is bonded to the chippings.

Therefore, the adhesivity value is expressed by the total number of all the stained chippings either bonded to the plate or fallen after the shock test.

¾ Adhesivity value: $b + c$ if 100 chippings are used;
$2 \quad (b + c)$, if 50 chippings are used.

4.5 Test report

The results shall be transferred on to a test report. An example of a test report is shown in annex B.

The test report shall refer to this European Standard and contain:

a) type of the test: mechanical adhesion, active adhesivity, wetting temperature, fragility temperature;

b) nature and definitive type of the binder used;

c) quantity of binder or residual binder in case of emulsion, in kilogram per square metre (kg/m^2);

d) temperature of binder when applied, in degree Celsius (°C);

e) nature and rate of spread of the interfacial adhesion agent (dope) if used;

f) nature, granular size and quantity of the chippings used;

g) treatment of chippings: natural, dry or damp, washed or unwashed;

h) temperature of test implementation, in degree Celsius (°C);

i) results according to 4.4;

j) date of test;

k) remarks;

l) name and signature of person responsible for test.

5 Wetting temperature

5.1 Description

The required quantity of hot bituminous binder is heated to spraying temperature and spread evenly on the steel plates. 50 or 100 graded chippings are dried at (5 ± 1) °C.

The plates with the binder are set at various temperatures from 5 °C, increasing by 5 °C steps, i.e. 5 °C, 10 °C, 15 C, 20 °C and 25 °C.

The chippings are placed on the binder and rolled. The test is performed at (5 ± 1) °C after setting.

Each prepared plate is turned over and put an the 3-pointed supports. A steel ball is made to fall 500 mm three times onto each plate within a 10 s period.

The wetting temperature is determined as the lowest binder temperature used when spreading the chippings on the plate, which results in 90 % of the chippings being stained by the binder.

Bitumen emulsions are not used for this wetting temperature test. This is really only applicable to fluxed or cut-back bitumen or modified binders (all being anhydrous binders).

NOTE If the chippings are treated chemically or washed on site or an interfacial adhesion agent (dope) is used in construction, then this should be simulated in the test method. If polymer modified binders are used which need special site conditions, e. g. road temperatures > 10 °C or heated chippings, then again the test should reflect these constraints and the report modified accordingly, e.g. increase temperature of chippings to 10 °C.

5.2 Apparatus

As described in 4.2.

5.3 Procedure

5.3.1 Preparation of the binder

As described in 4.3.1.

5.3.2 Preparation of the chippings

As described in 4.3.2, however damp chippings are not used.

5.3.3 Preparation of the plates

As described in 4.3.3, however the plates with the binder are placed in an climatic chamber at various temperatures from 5 °C, increasing by 5 °C steps, i. e. 5 °C, 10 °C, 15 °C, 20 °C and 25 °C, for (20 ± 2) min.

5.3.4 Spreading and rolling

As described in 4.3.4.

5.3.5 Temperatures setting

As described in 4.3.6.

5.3.6 Implementation

As described in 4.3.7.

5.4 Expression of results

The wetting temperature is the lowest temperature of the binder on the plate, just prior to applying the chippings, at which the number of all the stained chippings either bonded to the plate or fallen, after the shock test, is at least:

¾ $b + c$ 90, if 100 chippings are used;

¾ $b + c$ 45 if 50 chippings are used.

5.5 Test report

As described in 4.5, except results according to 5.4.

6 Fragility temperature

6.1 Description

The required quantity of binder is heated to spraying temperature and spread evenly on the steel plates.

50 or 100 graded chippings are dried at (5 ± 1) °C for each plate used. The plates with the binder are set at various temperatures from 5 °C, decreasing by 5 °C steps, i.e. 5 °C, 0 °C, -5 °C, -10 °C, -15 °C, -20 °C and -25 °C.

The chippings are laid down on the binder and rolled.

The test is performed at (5 ± 1) °C.

Each prepared plate is turned over and put on 3-pointed supports.

A steel ball is made to fall 500 mm three times onto each plate within a 10 s period.

The fragility temperature is the lowest test temperature at which 90 % aggregates remain bonded to the plate.

NOTE If the chippings are treated chemically or washed on site or an interfacial adhesion agent (dope) is used in construction, then this should be simulated in the test method. If polymer modified binders are used which need special site conditions, e.g. road temperatures > 10 °C or heated chippings, then again the test should reflect these constraints and the report modified accordingly, e.g. spreading at 20 °C instead of spreading at 5 °C or increase temperature of chippings to 10 °C

6.2 Apparatus

As described in 4.2.

6.3 Procedure

6.3.1 Preparation of the binder

As described in 4.3.1.

6.3.2 Preparation of the chippings

As described in 4.3.2.

6.3.3 Preparation of the plates

As described in 4.3.3.

6.3.4 Spreading and rolling (hot bituminous binders)

As described in 4.3.4.

6.3.5 Spreading (emulsions)

As described in 4.3.5.

6.3.6 Temperature setting

Take the plates with the binder or residual binder of the emulsion and the chippings, and put them in a climatic chamber at various temperatures from 5 °C, decreasing by 5 °C steps for (45 ± 2) min each one, i. e. (+5 ± 1) °C, (0 ± 1) °C, (-5 ± 1) °C, (-10 ± 1) °C and (-15 ± 1) °C.

6.3.7 Implementation

As described in 4.3.7.

6.4 Expression of results

When the test temperature is decreased, the fragility temperature is the lowest test temperature at which the number of the chippings bonded to the plate after the shock test, is at least:

¾ $c > 90$, if 100 chippings are used;

¾ $c > 45$ if 50 chippings are used.

6.5 Test report

As described in 4.5, except results according to 6.4.

Annex A
(informative)

Summary of the preparation of the plates before testing

BINDER (all tests)

- Rate:
  - 0,7 kg/m^2 with 4/6 mm chippings;
  - 1,0 kg/m^2 with 6/8 mm, 6/10 mm and 8/11 mm chippings;
  - 1,3 kg/m^2 with 10/14 mm and 11/16 mm chippings.
    In case of emulsion, the above quantities apply to the residual binder after breaking and total evaporation of the water content.
- Laying temperature:
  - Temperature required for spraying on site.

CHIPPINGS

- Mechanical adhesion:
  - Preparation: drying (and washing if carried out in practice): 50 °C for 24 h;
  - temperature (5 1) °C for (24 1) h.
- Active adhesivity:
  - Preparation: damping (and washing if carried out in practice).
- Fragility temperature:
  - Preparation: washing and drying (50 °C for 24 h);
  - temperature (5 1) °C for (24 1) h.
- Wetting temperature:
  - Preparation: drying (50 °C for 24 h);
  - temperature (5 1) °C for (24 1) h.

PLATES (with binder)

- Mechanical adhesion:
- Active adhesivity:
- Fragility temperature:
  - — Temperature (5 1) °C for (20 2) min.
- Wetting temperature:
  - Variable temperature by 5°C step for (20 2) min each one.

DOPE

When necessary, spray the interfacial adhesion agent (dope) on the binder surface prior to applying the chippings. In case of emulsion, dope is not used.

SPREADING the chippings

Place the chippings on the binder, these two components being respectively in the above mentioned temperature conditions for each test.

In case of emulsion, spread the chippings before the emulsion breaks.

ROLLING

Roll three times in one direction and three times in a crosswise direction.

In the case of emulsion, do not roll.

TEMPERATURE SETTING for the test plates

- Mechanical adhesion:
- Active adhesivity:

} — Temperature (5 1) °C for (20 2) min.

- Fragility temperature: — Variable temperatures decreasing for (45 ± 2) min each one from 5 °C by 5 °C step.
- Wetting temperature: — Temperature (5 1) °C for (20 2) min.

Annex B
(informative)

Tables of results

B.1 Overall adhesivity test

Type of the test: Adhesivity - Wetting temperature

Binder

Nature:.....

Type:.....

Quantity per m^2: .....

Laying temperature:

Chippings

Nature:.....

Granular class: .....

Natural state: .....

Washed: .....

Dry: .....

Spreading temperature: (5 1) °C

Dope

Nature: .....

Quantity per m^2: .....

Plate — Temperatures before spreading chippings (for wetting temperature test)

T_1:..... T_2:..... T_3:..... T_4:..... T_5: .....

Test — Temperature for adhesivity or wetting temperature : .....(5 ± 1) °C

— Temperatures for fragility test:

T_1:..... T_2:..... T_3:..... T_4:..... T_5: .....

Test	Fallen unstained a'	Fallen stained b'	Bonded c'	
1				
2				
3				
Mean value	a	b	c	

Adhesivity value: For 100 chippings: ..... $b + c =$.....

For 50 chippings: ..... 2 $(b + c) =$.....

Wetting temperature, adhesivity value at

T_1: ..... T_2:: ..... T_3: ..... T_4: ..... T_5:.....

Fragility temperature, adhesivity value at

T_1: ..... T_2: ..... T_3: ..... T_4: ..... T_5:.....

Date:..... Remarks: .....

Name of Operator: ..... Signature: .....

B.2 Fragility temperature test

Binder

Nature:.....

Type: .....

Quantity per m^2: .....

Laying temperature: .....

Chippings

Nature:.....

Granular class: .....

Natural state:.....

Washed: .....

Dry:.....

Damp:.....

Dope

Nature: .....

Spreading temperature: (5 1) °C

Quantity per m^2: .....

Adhesivity value at the test temperature t_1: ..... t_2:..... t_3:..... t_4:..... t_5:.....

(measurements according to B.1)

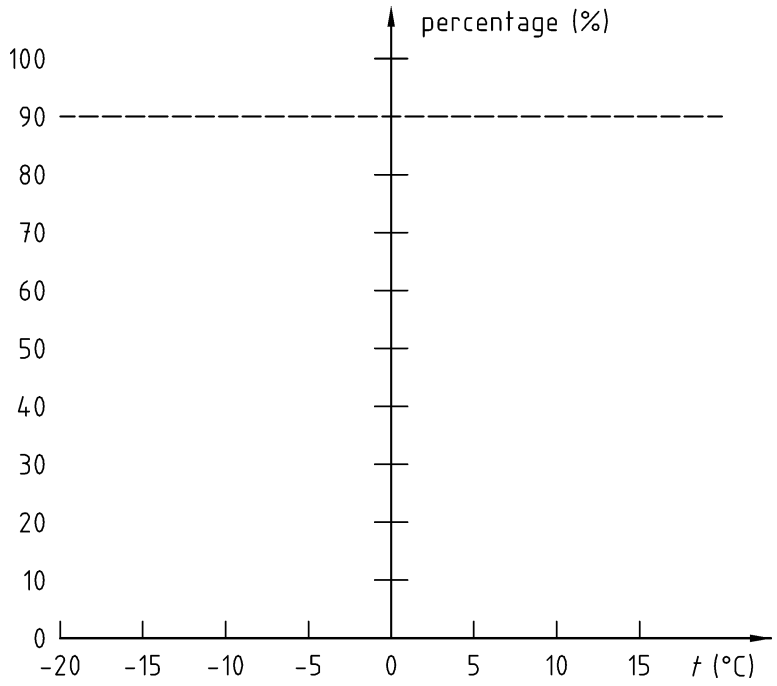


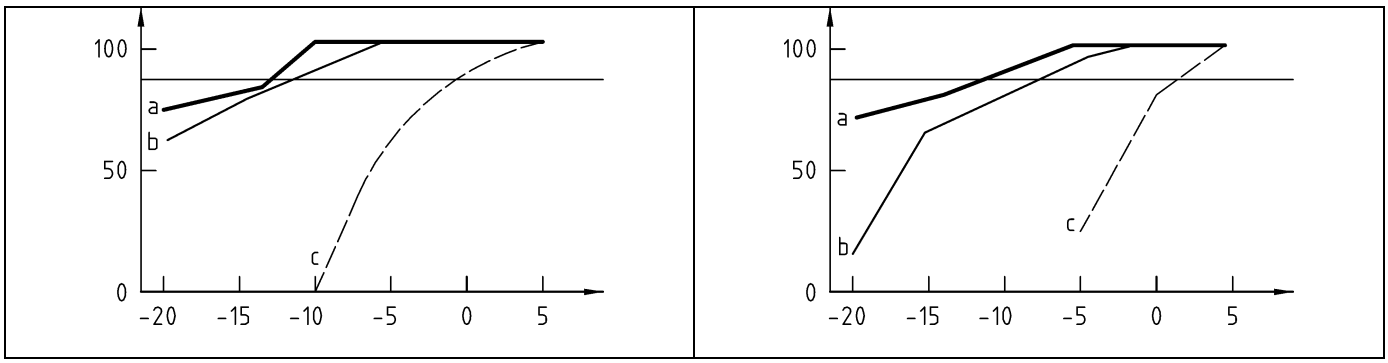
Figure B.1 — Fragility histogram

Annex C
(informative)

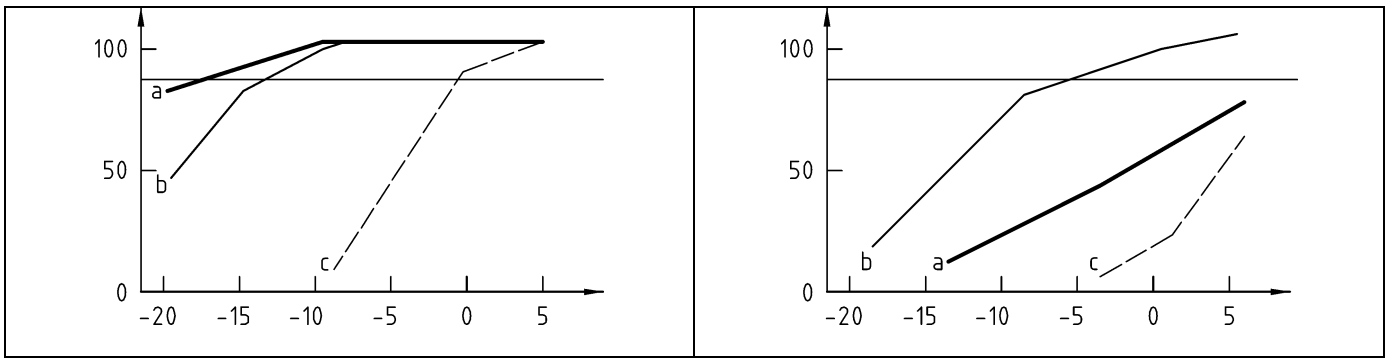
Measures of the fragility temperature

Results (Examples with binders a, b and c)

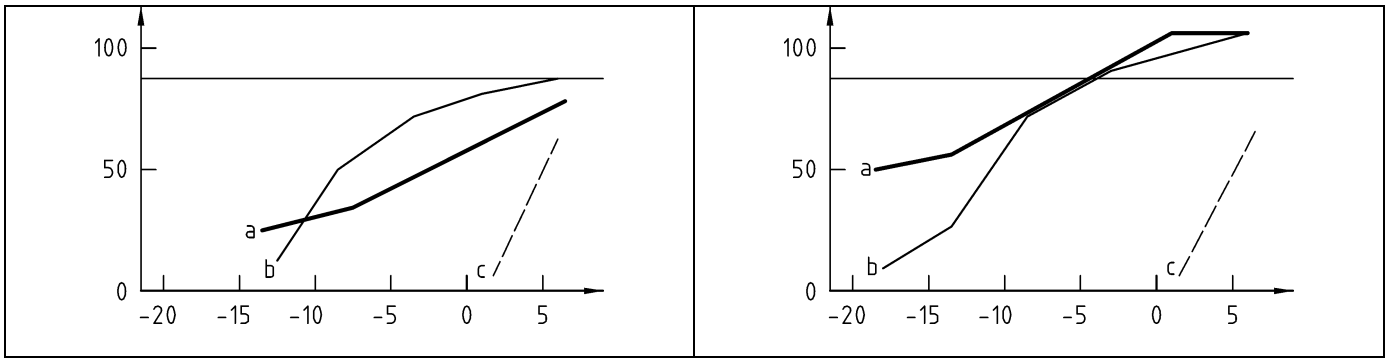
1. Quartzite10/14



2. Diorite 10/14



3. Flint 10/14



Key
1 Spreading at 20 °C
2 Spreading at 5 °C

Figure C.1 — Measures of the fragility temperature

Annex D
(informative)

Purpose of the Vialit plate shock test

A contractor who carries out a surface dressing with a given binder and aggregate system, needs to ensure that a good adhesion occurs between binder and chippings, at the time of laying, with the ambient road conditions on site.

The vialit plate shock test provides a method to assess the active adhesivity of the binder to the chippings to be used in conditions which are very close to the actual site conditions. This test method can be used with any type of binder or chippings.

This test can also be used to determine whether special treatments to binders and chippings are necessary, to improve the adhesivity, e.g. adhesion agent added to the binder, cleaning or washing of the chippings, doping the Binder chippings interface, etc.

Adhesivity is not part of an end performance specification, but knowledge of it is essential to correct design and to ensure durability of surface dressings.

Therefore, this test should appear in the Quality Control Plan drawn up by the contractor and may be required to be audited by the client.

Other existing tests deal with the breaking resistance of adhesion between binder and aggregate after implementation. Generally, these tests include some element of cohesion. Moreover, the conditions of test and especially the procedure applied to the preparation of the aggregates make these tests unrepresentative of the on site conditions experienced in practice, when surface dressing.

blank

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