SLOVENSKI STANDARD
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Preskusi splošnih lastnosti agregatov - 6. del: Definicije ponovljivosti in primerljivosti

Tests for general properties of aggregates - Part 6: Definitions of repeatability and reproducibility

Prüfverfahren für allgemeine Eigenschaften von Gesteinskörnungen - Teil 6: Definitionen von Wiederholpräzision und Vergleichpräzision

Essais pour déterminer les propriétés générales des granulats - Partie 6: Définitions de la répétabilité et de la reproductibilité

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ICS:

01.040.91	Gradbeni materiali in gradnja (Slovarji)	Construction materials and building (Vocabularies)
91.100.15	Mineralni materiali in izdelki	Mineral materials and products

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EUROPEAN STANDARD

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Tests for general properties of aggregates - Part 6: Definitions of repeatability and reproducibility

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This European Standard was approved by CEN on 16 April 1999.

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 Central Secretariat 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 Central Secretariat 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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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 154 "Aggregates", the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by November 1999, and conflicting national standards shall be withdrawn at the latest by December 2003.

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, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This standard forms part of a series of tests for general properties of aggregates. Test methods for other properties of aggregates will be covered by parts of the following European Standards:

EN 933   Tests for geometrical properties of aggregates
EN 1097   Tests for mechanical and physical properties of aggregates
EN 1367   Tests for thermal and weathering properties of aggregates
EN 1744   Tests for chemical properties of aggregates
EN 13179   Tests for filler aggregate used in bituminous mixtures

The other parts of EN 932 will be:

Part 1: Methods for sampling
Part 2: Methods for reducing laboratory samples
Part 3: Procedure and terminology for simplified petrographic description
Part 5: Common equipment and calibration

1 Scope

This European Standard gives definitions of repeatability and reproducibility adapted from ISO 5725-1 to the specific situation of sampling and testing aggregates.

These adjustments have been made because test portions or test specimens of aggregates are usually not identical to each other as specified in ISO 5725-1.

2 Definitions

For the purposes of this European Standard, the following definitions apply :

2.1. Sampling and sample reduction definitions

2.1.1 test portion: Sample used as a whole in a single test.

2.1.2 test specimen: Sample used in a single determination of a property when a test method requires more than one determination of a property.

2.1.3 sampling error: Difference between the properties of a batch and a bulk sample that arises during the process of taking a bulk sample from the batch.

2.1.4 bulk sample reduction error: Difference between the properties of a bulk sample and a laboratory sample that arises during the process of reducing the bulk sample to a laboratory sample.

2.1.5 laboratory sample reduction error: Difference between the properties of a laboratory sample and a test portion that arises during the process of reducing the laboratory sample to a test portion.

2.1.6 between-laboratory testing variation: Variation that arises between test results from different laboratories because of differences between operators, apparatus, reagents, calibrations and environments.

2.1.7 within-laboratory testing variation: Variation that arises between test results from the same laboratory when the operator, apparatus, reagents, calibrations and environments are not changed.

2.1.8 variation between single determinations: Variation that arises between single determinations that are used to calculate one test result.

2.2 Repeatability definitions

2.2.1 critical range W_c: Value less or equal to which the range of n single determination a_1, ..., a_n made to obtain a test result is expected to lie within a probability of 95 % (see figure 1).

> NOTE: This is the range when a test method requires n single determinations of a property, the test result being the average of n single determinations. The single determinations can be averaged to the test result if their range does not exceed the critical range W_c.
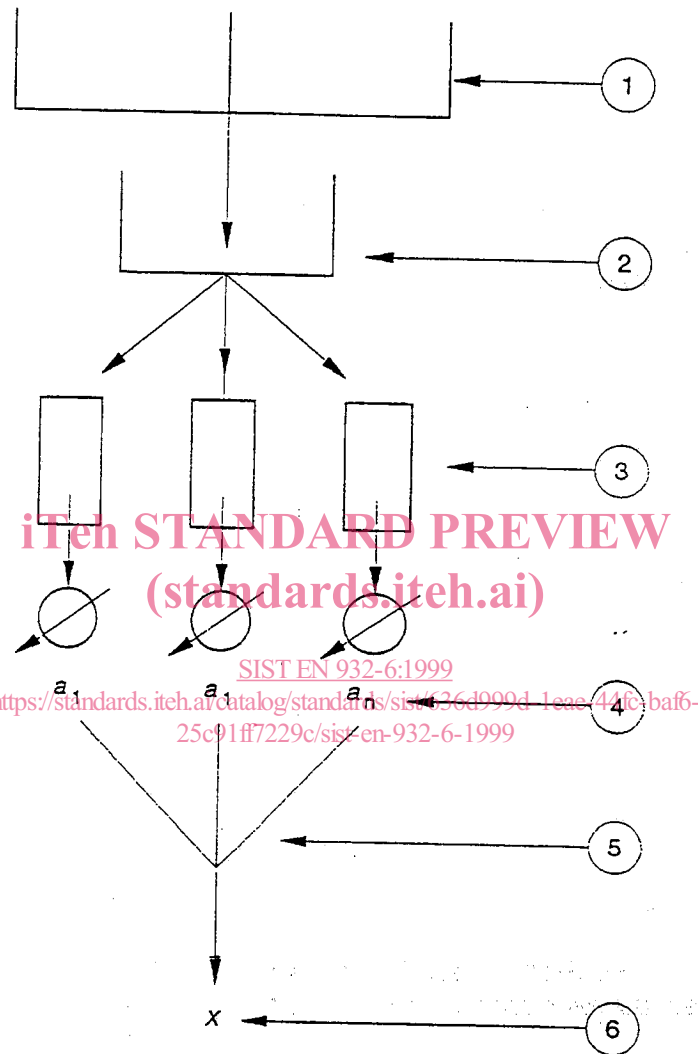
W_c is calculated by the following equation:

$$W_c = f(n) \cdot \sigma_a$$

where:

$f(n)$ is a factor the values of which are given in table **1**;
σ_a is the standard deviation of single determinations

1 Laboratory sample
2 Test portion
3 Test specimens
4 Determinations
5 Averaging determinations
6 Test result

NOTE: The determinations can only be averaged to a test result

$$X = \frac{(a_1 + \ldots\ldots a_n)}{n} \quad \text{if } (a_{max} - a_{min}) \leq W_c = f(n) \cdot \sigma_a$$

Figure 1: Calculation of a test result from n determinations $a_1, \ldots a_n$

Table 1: Values for $f(n)$

n	$f(n)$
2	2,8
3	3,3
4	3,6
5	3,9
6	4,0

2.2.2 repeatability r conditions: Conditions where test results are obtained with the same test method on identical test portions of aggregate, in the same laboratory, by the same operator, using the same equipment and within short intervals of time.

> NOTE 1: For repeatability r conditions to be achieved in practice a number of identical test portions of aggregate should be manufactured.

> NOTE 2: "The same operator" - it is acceptable if a team of operators works together, each taking on the responsibility for a particular stage of a test.

> NOTE 3: "A short interval of time" - with aggregate tests that take weeks or months to complete, test results are obtained under repeatability conditions if the tests start within a short interval of time of each other and finish within a short interval of time of each other.

2.2.3 repeatability r_1 conditions: Conditions where test results are obtained with the same test method on different test portions of the same laboratory sample of aggregate, in the same laboratory, by the same operator, using the same equipment and within short intervals of time (see figure **2**).

> NOTE 1 : The subscript "$_1$" is added to indicate that the laboratory sample reduction error contributes to the variations measured under r_1 conditions. Laboratory sample reduction error always occurs in practical situations when test portions are obtained from laboratory samples so that then r_1 conditions, not r conditions, apply.

> NOTE 2: "The same operator" - it is acceptable if a team of operators works together, each taking on the responsibility for a particular stage of a test.

> NOTE 3: "A short interval of time" - with aggregate tests that take weeks or months to complete, test results are obtained under repeatability conditions if the tests start within a short interval of time of each other and finish within a short interval of time of each other.
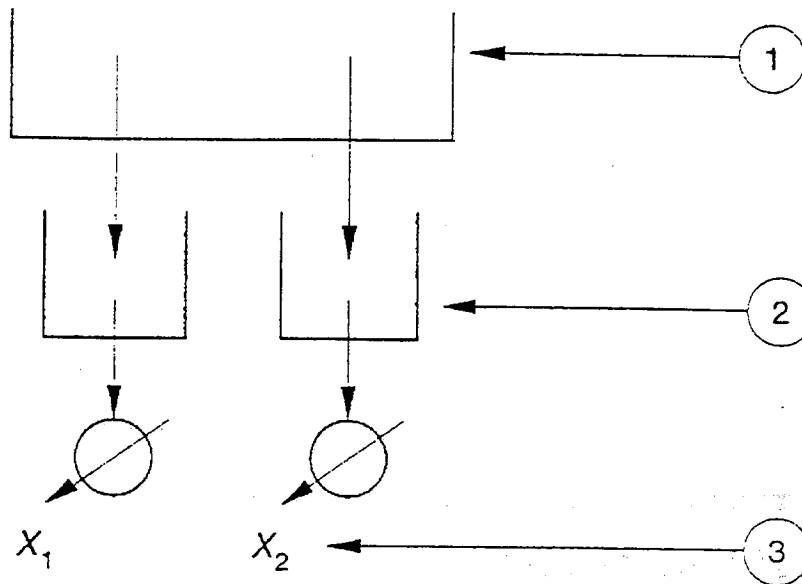
1 Laboratory sample
2 Test portions
3 Test results

NOTE: X_1 and X_2 are compatible and can be averaged if $(X_1 - X_2) \le r_1$.

Figure 2: Repeatability r_1 conditions

2.2.4 repeatability r or r_1 standard deviation: Standard deviation of test results obtained under repeatability r or r_1 conditions denoted by σ_r or σ_{r1}.

NOTE 1: The different sources of variation contained in σ_r or σ_{r1} are given in table **2**.

NOTE 2: σ_{r1} measures the within-laboratory testing variation and additionally the laboratory sample reduction error

2.2.5 repeatability value r or r_1: Value less or equal to which the absolute difference between two test results, obtained under repeatability r or r_1 conditions, is expected to be within a probability of 95 %.

2.3 Reproducibility definitions

2.3.1 reproducibility R conditions: Conditions where test results are obtained with the same test method on identical test portions of aggregate, in different laboratories, by different operators using different equipment.