International Standard 6782

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Aggregates for concrete — Determination of bulk density

Granulats pour béton — Détermination de la masse volumique en vrac

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 6782 was developed by Technical Committee ISO/TC 71, *Concrete, reinforced concrete and pre-stressed concrete*, and was circulated to the member bodies in January 1980.

It has been approved by the member bodies of the following countries :

Australia	Germany, F.R.	Poland
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Chile	Italy	Spain
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The member bodies of the following countries expressed disapproval of the document on technical grounds :

Bulgaria
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Aggregates for concrete — Determination of bulk density

1 Scope and field of application

This International Standard specifies a method for the determination of the buik density[1] of dry or moist aggregates (normal or lightweight) for concrete, in either loose or compacted condition.

2 Reference

ISO 4847, *Concrete — Sampling of normal weight aggregates.*[2]

3 Definition

bulk density : The ratio of the mass of an aggregate sample filling a given container to the volume of the container.

It is expressed as mass per unit volume, i.e. kilograms per cubic metre (kg/m³).

4 Apparatus

4.1 Cylindrical container, having a smooth inside and the approximate dimensions given in the table appropriate to the size of aggregate, and fitted with handles.

The container shall be watertight, of sufficient rigidity to retain its form under rough usage, and shall be protected against corrosion. The top rim shall be smooth and plane to within 0,25 mm, and parallel to the base within 0,5°.

Table — Dimensions of container and number of compacting strokes (see 6.3.1)

Capacity dm³	Maximum nominal size of aggregate mm	Number of strokes per layer	Height-diameter ratio	Minimum thickness of metal	
				bottom mm	wall mm
1	5	20	1 to 1,5	5	2,5
3	10	20			
10	31,5	30			
30	80	50			

4.2 Balance, accurate to 0,2 % of the mass of the material to be weighed, and of adequate capacity (depending on the size of the container used).

4.3 Straight metal tamping rod, of diameter approximately 16 mm and length approximately 600 mm, with rounded ends.

4.4 Suitable shovel or **scoop.**

5 Sampling

Sample the aggregate in accordance with ISO 4847.

If the determination is to be carried out on dry aggregates, dry the sample to constant mass at 105 ± 5 °C and mix thoroughly.

If the determination is to be carried out on moist aggregates , determine the moisture content, as a percentage of the dry mass, and state this in the test report.

1) In some countries, the terms "unit mass", "unit weight" and "density" are used.

2) At present at the stage of draft.

If the uniformity of a fraction is to be checked, the oversize and undersize aggregate shall be eliminated by sieving.

6 Procedure

6.1 Calibration of container

Calibrate the container by filling it with water at 20 ± 2 °C, covering it with a glass plate in such a way as to eliminate bubbles and excess water, and determining the mass of water with an accuracy of 0,2 %. The actual volume of the container, in cubic metres, is then obtained by dividing the mass of water, in kilograms, by 1 000.[1)]

6.2 Uncompacted bulk density

Fill the container with the thoroughly mixed aggregate by means of the shovel or scoop (4.4), the aggregate being discharged from a height not exceeding 50 mm above the top of the container. Exercise care to prevent, as far as possible, segregation of the particle sizes of which the sample is composed. Fill the container to overflowing and remove the surplus aggregate by rolling the tamping rod (4.3) across and in contact with the top of the container, any aggregate which impedes its progress being removed by hand, and add aggregate to fill any obvious depressions. For 5 mm aggregate or smaller, the surface may be struck off, using the tamping rod as a straight-edge. Weigh the aggregate and container with an accuracy of 0,2 %.

6.3 Compacted bulk density

6.3.1 Compaction by rodding

Transfer aggregate to the container, operating as described in 6.2, until it is about one-third full. Level the surface by hand and rod the layer of aggregate with the required number of strokes of the tamping rod evenly distributed over the surface (see the table). Place more aggregate in the container until it is about two-thirds full and again level and rod as before. Finally, fill the container to over-flowing, and again rod as before. In rodding the first layer, do not allow the rod to strike the bottom of the container forcibly. In rodding the second and third layers, use only enough force to cause the tamping rod to penetrate the previous layer of aggregate. Any damage to the aggregate shall be avoided. Finally, level the surface of the aggregate and weigh the aggregate and container with an accuracy of 0,2 %.

6.3.2 Compaction by other methods

Other methods of compaction, such as vibration or jigging, may be used to compact the aggregate in the container and if used shall be described in detail in the test report.

7 Expression of results

The bulk density, ϱ_b, in kilograms per cubic metre, is given by the formula

$$\varrho_b = \frac{m_2 - m_1}{V}$$

where

m_1 is the mass, in kilograms, of the empty container;

m_2 is the mass, in kilograms, of the container filled with the aggregate;

V is the volume, in cubic metres, of the container, determined as described in 6.1.

Report the result to the nearest 10 kg/m³ for bulk densities greater than 1 000 kg/m³, to the nearest 5 kg/m³ for bulk densities between 500 and 1 000 kg/m³, and to the nearest 1 kg/m³ for bulk densities less than 500 kg/m³.

8 Test report

The test report shall include the following information :

a) identification of the sample;

b) type and maximum size of aggregate;

c) moisture content of the sample when tested;

d) dimensions of the container;

e) method of compaction, if any;

f) the result and the method of expression used.

1) If the water temperature deviates substantially from 20 ± 2 °C, an appropriate correction factor should be used.