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Methods of test for density and
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aggregates

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Foreword

This Japanese Industrial Standard has been revised by the Minister of Land, Infrastructure, Transport and Tourism through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Concrete Institute (JCI) with a draft being attached, based on the provision of Article 12, paragraph (1) of the Industrial Standardization Act applied mutatis mutandis pursuant to the provision of Article 16 of the said Act. This edition replaces the previous edition (**JIS A 1110:2006**), which has been technically revised.

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NOTE Based on Article 9 of the Supplementary Provisions to the Unfair Competition Prevention Act etc., any submission of proposal, or employment of procedures such as deliberation by the Japanese Industrial Standards Committee under the previous Industrial Standardization Act shall be deemed to have been conducted pursuant to the provision of Article 12, paragraph (1) of the revised Industrial Standardization Act.

Methods of test for density and water absorption of coarse aggregates

Introduction

This Japanese Industrial Standard has been prepared based on **ISO 6783:1982**, Edition 1, with some modifications of the technical contents.

The dotted underlines indicate changes from the corresponding International Standard. A list of modifications with the explanations is given in Annex JA. The comparison table between previous and current editions of this Standard on technically significant revisions is given in Annex JB.

1 Scope

This Standard specifies a method for the determination of the density and the water absorption of coarse aggregates¹⁾. The test method for lightweight coarse aggregates for structural concrete where aggregates in oven-dry condition are immersed in water for 24 h is specified in **JIS A 1135**.

Note ¹⁾ For determination of density and water absorption of coarse aggregates using a pycnometer, **JIS A 1109** may be referred to.

NOTE The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 6783:1982 *Coarse aggregates for concrete—Determination of particle density and water absorption—Hydrostatic balance method* (MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS A 1109 *Methods of test for density and water absorption of fine aggregates*

JIS A 1135 *Methods of test for particle density and water absorption of lightweight coarse aggregates for structural concrete*

JIS A 1158 *Method for reducing samples of aggregate to testing size*

JIS Z 8801-1 *Test sieves—Part 1: Test sieves of metal wire cloth*

NOTE Corresponding International Standard: ISO 3310-1:2000 *Test sieves—Technical requirements and testing—Part 1: Test sieves of metal wire cloth*

3 Apparatus and equipment

3.1 Balance, with a scale interval not more than 0.02 % of the sample mass. It shall permit the basket containing the sample to be suspended with metal wire hangers not thicker than 3 mm and weighed in water.

3.2 Metal wire basket, for containing the coarse aggregate sample, of mesh 3 mm or smaller, about 200 mm in diameter and about 200 mm in height.

3.3 Absorbent cloth, dry and soft, used for removing the water films on the surface of the coarse aggregate particles.

3.4 Oven, provided with an exhaust vent, and thermostatically controlled to maintain a temperature of $105\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.

4 Sample

Sampling and preparation of sample shall be as follows.

- a) The minimum mass of sample used for one test of normal aggregate shall be 0.1 times the maximum particle size (in millimetres) of coarse aggregate, expressed in kilograms. For lightweight aggregate, calculate the approximate sample mass according to the following formula:

$$m_{\min} = \frac{d_{\max} \times D_e}{25}$$

where, $m_{\min}$: minimum mass of sample (kg)

$d_{\max}$: maximum particle size of lightweight coarse aggregate (mm)

D_e : estimated density of lightweight coarse aggregate (g/cm^3)

- b) Obtain sample so as to represent the aggregate under test, and pass it through a sieve of metal wire cloth with a nominal aperture of 4.75 mm specified in **JIS Z 8801-1**.
- c) Reduce the sample retained on the sieve in the above procedure according to the method specified in **JIS A 1158** until not less than the minimum mass used for one test is obtained. Prepare two such samples.
- d) Thoroughly wash the sample to remove all finer particles, particularly dust, and immerse in water at $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ for 24 h.
- e) Remove the sample from water, and after allowing it to drain, place it on an absorbent cloth. Using the absorbent cloth, remove all visible films of water on the sample surface until the sample is in the saturated surface-dry condition²⁾.

Note ²⁾ Even in the saturated surface-dry condition, aggregate has a damp appearance. In the case of surface-drying the aggregate particles one by one, care should be taken for excessive dryness of particles.

5 Test method

The test method shall be as follows.

Each weighing shall be performed to within 0.02 % of the sample mass.

- a) Weigh the sample (m_1) in saturated surface-dry condition obtained according to 4 e).
- b) Suspend a metal wire basket containing the sample in water at $20\text{ °C} \pm 5\text{ °C}$, and jolt the sample and the basket to remove the air adhering to the aggregate particle surface as well as the air between aggregate particles. Weigh the sample and the metal basket in water (apparent mass, m_2), and also measure the water temperature. Use tap water or other clean water for this purpose.
- c) Suspend only the metal wire basket in water ensuring that it is immersed to the same depth as the procedure in b), and weigh (apparent mass, m_3).
- d) Remove the sample from water, and dry it at $105\text{ °C} \pm 5\text{ °C}$ to constant mass. Allow the dried sample to cool to room temperature, and weigh (m_4).
- e) For determination of density and water absorption, carry out this test once on each of the two portions of sample obtained in 4 c).

6 Calculation

The calculation shall be as follows.

- a) Calculate the density in saturated surface-dry condition, density in oven-dry condition, and water absorption according to the following formula, and round the results to two decimal places. The value of water density shall be selected from Table 1 according to the water temperature.

- 1) **Density in saturated surface-dry condition** Use the following formula:

$$D_s = \frac{m_1 \times \rho_w}{m_1 - m_2 + m_3}$$

where, D_s : density in saturated surface-dry condition (g/cm^3)
 m_1 : mass of sample in saturated surface-dry condition (g)
 m_2 : apparent mass of sample and metal wire basket in water (g)
 m_3 : apparent mass of metal wire basket in water (g)
 ρ_w : density of water (g/cm^3)

Table 1 Density of water

Water temperature (°C)	15	16	17	18	19	20	21	22	23	24	25
Density (g/cm^3)	0.999 1	0.998 9	0.998 8	0.998 6	0.998 4	0.998 2	0.998 0	0.997 8	0.997 5	0.997 3	0.997 0