AS/NZS 4456.9:2003
(Incorporating Amendment Nos 1 and 2)

Australian/New Zealand Standard™

Masonry units, segmental pavers and flags—Methods of test

Method 9: Determining abrasion resistance

This Standard incorporates Amendment No. 1 (August 2004) and Amendment No. 2 (September 2009). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

1 SCOPE

This Standard sets out the method for determining the abrasion resistance of dry segmental pavers and flags when subjected to the impact and rolling action of steel ball bearings.

2 PRINCIPLE

The specimens are secured, with their wearing faces inwards, over openings provided in a rectangular container holding a specified number and size of steel balls. The container is then rotated in one direction at 60 revolutions per minute for 3600 revolutions. During this time, the specimens are subjected to the impact and rolling action of the steel balls through the apertures in the sides of the container.

The mass loss of each specimen is then determined by difference, and converted to an 'abrasion index' by dividing by the bulk density of the specimen. The mass loss is corrected for any change in mass, may arise through uptake of moisture from the atmosphere during the test.

3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

4456	Masonry units, segmental pavers and flags—Methods of test	
4456.0	Part 0:	General introduction and list of methods
4456.1	Method 1:	Sampling for testing
4456.2	Method 2:	Assessment of mean and standard deviation

4 DEFINITIONS

For the purpose of this Standard, the definitions given in AS/NZS 4456.0 apply.

5 NOTATION

The following notation is used in this Standard:

m_1 = mass of test specimen before test, in grams

m_2 = mass of test specimen after test, in grams

m_3 = mass of specimen after soaking in water, in grams

m_4 = mass of specimen under water, in grams

m_5 = mass of the control specimen before test, in grams

m_6 = mass of the control specimen after test, in grams

$\overline{m}_5$ = mean of the m_5 values

$\overline{m}_6$ = mean of the m_6 values

C = correction, in grams

V_a = abrasion index

B_d = bulk density, in kilograms per cubic metre

Δm = mass loss

ρ = density of water, assumed to be 1000 kg/m^3

6 APPARATUS

The following are required:

(a) A well-ventilated drying oven with a cubic capacity not less than 3 times the total volume of specimens being dried and capable of maintaining a temperature of 110 ±8°C or, if used for dimensions stone, 65 ±5°C.

(b) Balance(s) that shall consist of the following:

(i) A balance of adequate capacity and accurate to within 0.1 g.

(ii) A balance of adequate capacity and accurate to within 1 g. This balance shall have a hook to which can be attached a loop of fine nylon, or a suitable non-absorbent saddle or basket, to enable a specimen to be suspended and covered with water during immersion weighing.

(c) A vessel to hold the immersion water, of a size that will fit under the balance hook, and that will allow a test specimen and saddle to be totally immersed and not come in contact with the vessel during weighing.

(d) A tumbler assembly consisting of the following:

(i) A container comprising a rectangular steel container of dimensions specified in Figures 1 and 2.

The ends shall be secured through their centres to a steel axle shaft that projects from the ends and is supported so that it can rotate freely about its longitudinal axis.

The four sides of the container shall have centrally placed openings (see Figure 1).

Angle plates shall be fitted to each corner of the interior of the container, forming a 45 ±1° angle at the intersection of plate and container. The angle plates shall be steel of Brinell hardness grade 360-400. The angle plates shall finish flush with the external surface of the container.

The container's axle shall be kept in an exact horizontal position (0 to 0.5° to the horizontal) throughout the test.

(ii) Cover plates of 8 mm thick hardened steel plate, to cover the four sides of the container, each having four tapering holes (see Figure 1) and provided with at least three locating pins to ensure their accurate placement over the openings of the box. The cover plate shall be steel of Brinell hardness grade 360-400.

The holes shall be offset from the axial centre in the direction of the rotation of the container.

When the cover plates are clamped to the sides, it shall be ensured that—

(A) an imaginary line tangential to the four openings at the reverse side of the plate would be parallel with the axis of the drive shaft; and

(B) sufficient space exists between the container and the cover plates to allow dust to escape. When measured at 8 equi-spaced points around the perimeter of each cover plate, the average gap shall be >2 mm.

NOTES:

1 Distortions caused by use and those existing from manufacture would normally satisfy the requirements of Items (A) and (B) above.

2 When the cover plates fit so tightly as to not satisfy this requirement, a placement of 2 mm thick washers around the locating pins will provide an adequate gap.

(iii) Clamping plates that shall be so designed as to ensure that the test specimens are firmly secured to the cover plate for the duration of the test without causing damage. Two timber packing blocks shall be used per specimen between the cover plate and the specimens (see Figure 2).

(iv) A revolution counter that shall be fitted to the tumbler.

(v) A suitable driving mechanism capable of rotating the tumbler at a rate of 60 ±1 rpm.

The tumbler drive shall only be able to rotate the tumbler in the direction of the offset of the holes in the cover plates.

(vi) Six hundred steel ball bearings, each of 15.9 ±0.1 mm diameter and weighing 16.2 ±0.2 g. The ball bearings shall be replaced when either their mass or their dimensions fall outside the specified limits.

A2 NOTE: Chrome steel balls with a diameter in imperial measurement of $^{5}/_{8}$ inch (15.875 mm) have been found to be satisfactory.

(e) A vacuum cleaner with hand brush attachment.

(f) A timing device capable of being read to the nearest second.

(g) A desiccator of sufficient size to hold 18 specimens (optional), with sufficient quantity of active desiccant such as dried silica gel.

(h) Absorbent paper or cloth.

7 PREPARATION OF SPECIMENS

Specimens accumulated from continuous sampling shall be deemed to meet the requirements of this method, provided that the number of specimens accumulated is at least 18. For assessment of an individual lot, 18 units shall be selected in accordance with AS/NZS 4456.1

These specimens may be full units or cut from larger specimens and shall each have a test face of sufficient size to fully cover a hole in the cover plates.