Appendix U.6.2 – C&CI TM 7.11 (wire-brush)

Generic Name of Test	*Sliding* Wire brush : Abrasion Test
Principle of Test	The bristles of the rotating wire brush slide over the specimen
Historic Development of Test	The test apparatus was developed by NBRI (National Building Research Institute) and modified by PCI (now C&CI) to take a wire brush with water replacing the grit in the funnel. The brush test was developed when it became apparent that the rigid disk and grit test used in the NBRI test essentially evaluated the quality of the course aggregate. In 1990 acceptance criteria were set out in an 'in-house' test method. This became *C&CI TM.7.11 Methods for assessing the abrasion resistance of concrete using a wire brush or silicon carbide grit* in 1995 [Doulgaris (1995)]
Apparatus and Abrasives	Figures U.6.2.1 - U.6.2.3 show the apparatus, which consists of a 60mm diameter wire brush with 20mm long bristles, which is attached to a motorised shaft. A 165N force is applied with the wire brush on the concrete specimen. No abrasive is used but water is used to keep the wire brush cool.

Figure U.6.2.1 NBRI Abrasion Tester

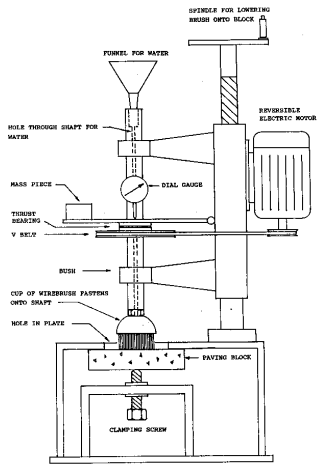

Figure U.6.2.2 Details of Test Apparatus

Figure U.6.2.3 Wire Brushes

Note: A special undercarriage has been fitted for rapid positioning of specimens

Test Method	The concrete specimens are pre-soaked in water for 24 hours prior to testing. The wire brush is then rotated on the wet concrete specimen at 400 rpm under a constant load of 165N. Water is passed down the bore of the shaft and onto the wire brush to reduce its temperature. The test duration is 4 minutes with the direction of rotation reversed every 30 seconds. [C&CI TM.7.11]
Abrasion Wear	A dial gauge mounted on the apparatus provides readings for the depth of wear. Intermediate in-flight depth-of-wear measurements may be read directly off the dial. Abrasion wear may also be measured using synthetic modelling clay of known specific gravity to calculate the abraded volume.
References	Author — Comment Addis (1989) — Source document Doulgaris (1995) — Source document C&CI TM 7.11 — Source document

APPENDIX U.6.2

Wear Mechanisms according to Authors

(i) Addis (1989): Wear is believed to be a combination of direct abrasion by tires when accelerating, slewing or breaking, and abrasion by grit particles between tyres and concrete. These mechanisms result in a probing action which concentrates wear on weaker micro-areas and plucks out aggregate particles when sufficient of the surrounding matrix has been removed.
Doulgeris (1995): The abrasive action is one of scratching and cutting
(iii) Visual Effects: It may bee seen from figure U.6.2.4 and U.6.2.5 that the appearance of the wire-brushed specimen is similar to that of an abraded-by-traffic paver.

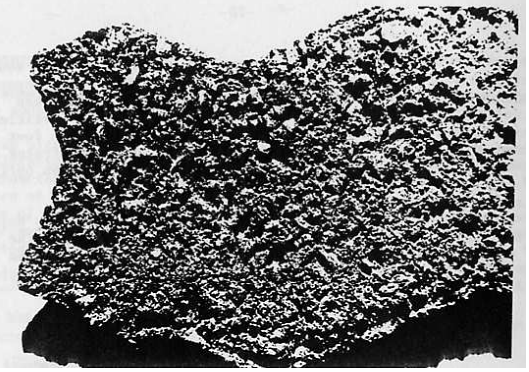

Figure U.6.2.4 Surface of paving block worn by traffic [Addis (1989)]

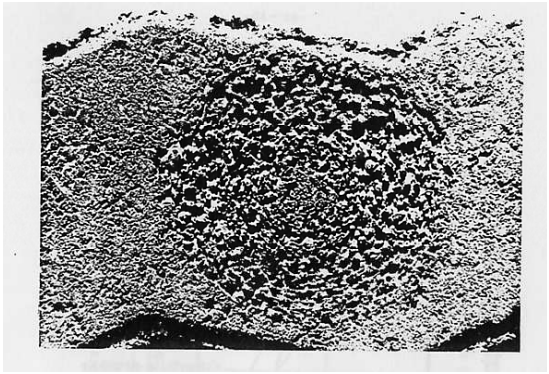

Figure U.6.2.5 Surface after testing with wire brush [Addis (1989)]

Wear Mechanisms according to writer [R1 S2 I0]

(i) Sliding: The bristles of the rotating wire brush slide over the surface of the concrete. This sets up localised tangential shear forces at the contact points resulting in scraping, scratching, cutting and generally the removal of asperities as shown in figure U.6.2.6. The bristles, being flexible, are able to gouge out the relatively softer paste, and this eventually leads to the harder aggregate particles being dislodged.

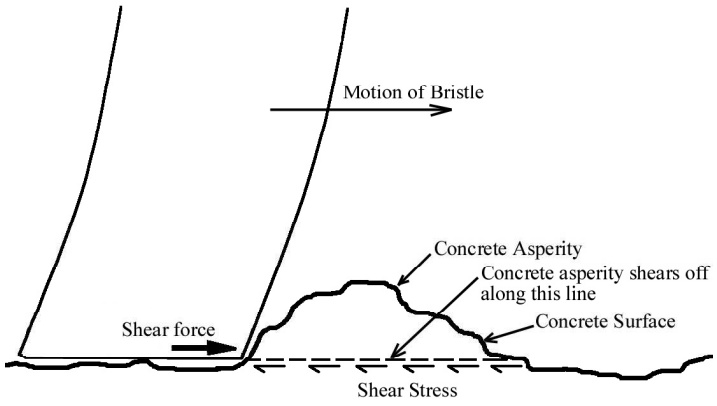

Figure U.6.2.6 Magnified view of Sliding wear mechanism

(ii) Adhesion and deformation: See note 1 in introduction to appendix U