Appendix U.3.9 – ASTM C944

Generic Name of Test	*Rolling* Dressing Wheels : Abrasion Test
Principle of Test	Loaded dressing wheels orbiting on surface.
Historic Development of Test	*ASTM C944-95 Test Method for Abrasion Resistance of Concrete or Mortar Surfaces by the Rotating Cutter Method* is essentially the follow on of a US Corps of Engineers test, CRD-C52-54 *US Corps of Engineers Method of Test for Resistance of Concrete or Mortar Surfaces to Abrasion*. The only difference appears to be an increase in load from 10lbs (4.4 kg) to 10kg. Note that CRD-C52-54 was in all probability a derivative of Smith's rotating cutter test - which evidently predates 1958.
Apparatus and Abrasives	The apparatus illustrated in figure U.3.9.1 consists of a rotating cutter mounted in a modified drill press or similar device. The rotating cutter consists of 24 No. 1 Desmond Huntington dressing wheels mounted on a common axle. A continuous load of 98N is placed directly on the spindle that turns the cutter. [ASTM C944]

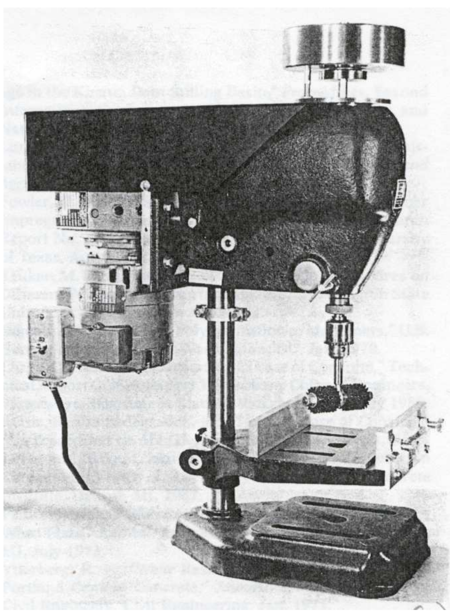

Figure U.3.9.1 Rotating-cutter drill press [ASTM C944]

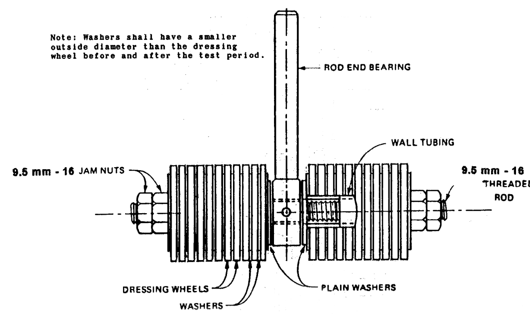

Figure U.3.9.2 Typical rotating cutters [ASTM C944]

Test Method	The spindle holding the rotating cutter is rotated on the concrete specimen at 200 rpm under a constant load of 98N for 2 minutes. The surface is then cleaned by blowing the dust off the test specimen. The minimum test schedule requires three 2-minute tests on three separate areas of the test specimen. [ASTM C944]. Some authors (Dahir 1981) have used a constant spay of water to simulate the effect of rain-water on .
Abrasion Wear	The abrasion wear is determined by measuring loss of surface in grams or the depth of wear in millimetres. [ASTM C944]

References

Author	Comment	Author	Comment
ASTM C944	Source document	Dahir (1981)	Source document
Liu (1991)	Source document	Robertson (1991)	Source document
Alexander (1984)	Source document		
Shi (1997)	Source document		

APPENDIX U.3.9

Wear Mechanisms according to Author

(i) Alexander (1984): Abrasion is produced by impact, sliding-friction and high local stresses due to the steel dressing wheels.

(ii) Robertson (1991): The rotating cutter is likely to involve plucking of aggregate particles and shear of aggregate and matrix. The degree of abrasion wear will be influenced by the aggregate-paste bond

(ii) Visual Effects: See figure U.3.9.3

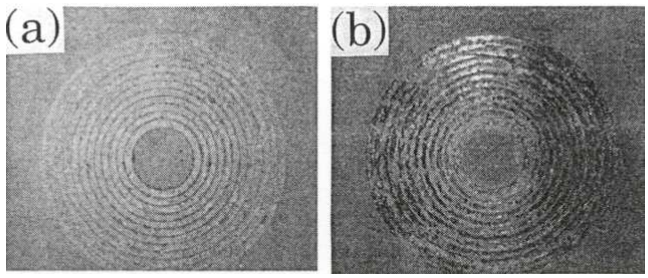

Figure U.3.9.3 Abrasion path of (a) plain mortar, (b) mortar with latex [Shi (1997)]

Wear Mechanisms according to writer [R3 S3 I3]

(i) Rolling and Sliding: As the dressing wheels rotate, their high points will be pressed into the face of the concrete and at the same time slip or slide somewhat relative to the surface. There will therefore be crushing and shearing effects of the concrete asperities (see figure U.3.9.4) as well as some sub-asperity cracking (see figure U.3.9.5).

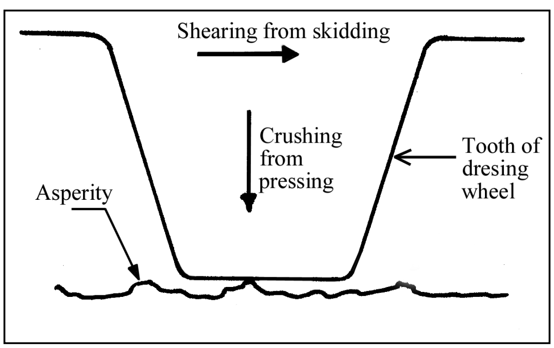

Figure U.3.9.4 Wear mechanism beneath the tooth of a dressing wheel

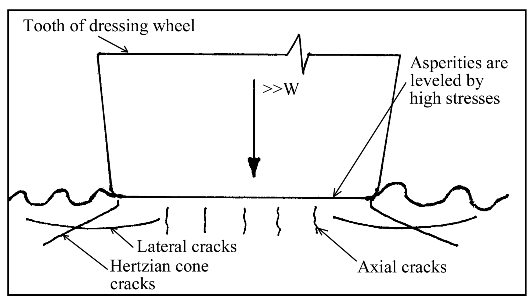

Figure U.3.9.5 Wear mechanism beneath a dressing wheel - severe loading case

(ii) Impact: Vibration and bouncing effects occur owing to the toothed shape of the dressing wheels and this becomes more pronounced as the wear path becomes rougher. This impact may result in a degree of sub-asperity cracking as indicated in figure U.3.9.5. The various forms of cracking that are possible include Hertzian cone cracks, lateral cracks, or axial cracks (discussed in more detail in chapter 3). Cracks result in an accelerated wear process.

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