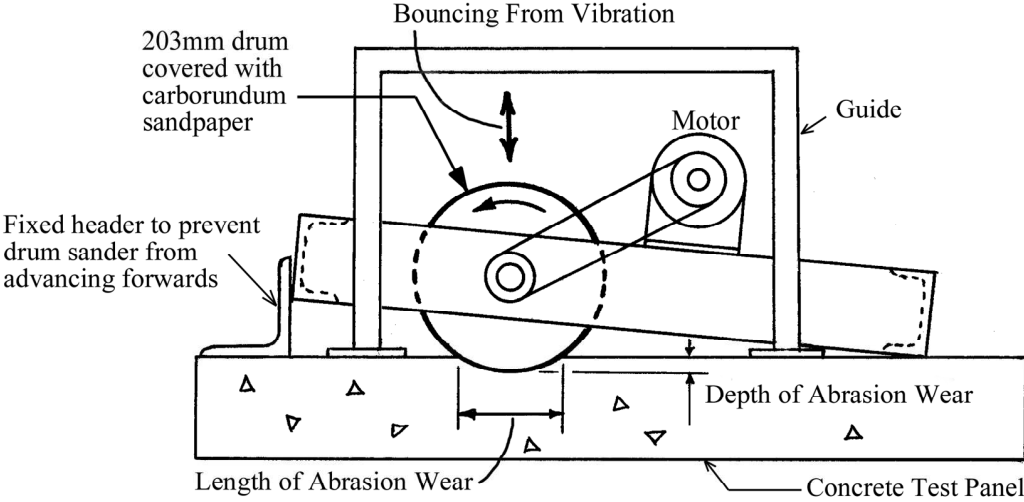


## Appendix U.5.18 – Drum Sander

<b>Generic Name of Test</b>	<i>Impact Fine Abrasive : Abrasion/Erosion Test</i>						
<b>Principle of Test</b>	Sandpaper fastened to revolving steel drum bounces and slides on specimen						
<b>Historic Development of Test</b>	This test method was devised by Simons to approximate the constant bumping, grinding and digging of rocks of stilling basins, resulting in significant shear and impact forces. ASTM C944 and ASTM C418 were considered to have too mild an impact and to test too small an area. [Actually Abrams' 1916 test, shown in figure U.2.1, would have been a perfect simulation and it is not known why Simons did not use it or even refer to it.]						
<b>Apparatus and Abrasives</b>	The apparatus (see figure U.5.18.1) consists of a drum sander (203 mm diameter) using 20 grit Carborundum sand paper. The sanding drum is positioned between 2 guides clamped onto the concrete and is free to move in a vertical direction. [Simons (1992)]						
 <p><b>Figure U.5.18.1</b> Envisaged reconstruction of drum sander according to the description given in the text [Simons (1992)]</p>							
<b>Test Method</b>	The drum sander is run on the concrete for a period of 8 hours, with the sandpaper changed every 30 minutes. [Simons (1992)]						
<b>Abrasion Wear</b>	The width and depth of the abraded groove is measured. [Simons (1992)]						
<b>References</b>	<table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: left;"><u>Author</u></th> <th style="text-align: left;"><u>Comment</u></th> </tr> </thead> <tbody> <tr> <td>Simons (1992)</td> <td>Source document</td> </tr> <tr> <td>Hutchings (1992)</td> <td>Source document</td> </tr> </tbody> </table>	<u>Author</u>	<u>Comment</u>	Simons (1992)	Source document	Hutchings (1992)	Source document
<u>Author</u>	<u>Comment</u>						
Simons (1992)	Source document						
Hutchings (1992)	Source document						

**Wear Mechanisms according to Author**

(i) Simons (1992): Sandpaper simulates the horizontal shearing action of the aggregate particles and rocks moving in a stilling basin, while the bouncing of the drum sander simulates the more severe impact effects that occur.

(ii) Visual Effects: None available

**Wear Mechanisms according to writer [R1 S3 I4]**

The drum rotates and bounces causing shearing, crushing and impact. These mechanisms are considered in more detail below.

(i) Impact: The abrasion wear  $Q$  arising out of the impact of the bouncing drum against the concrete may be quantified by the expression  $Q \propto \frac{m.U^2}{H} .f(\theta)$  ( $\text{mm}^3$ ) [Hutchings (1992)]. Clearly the velocity  $U$  is the most

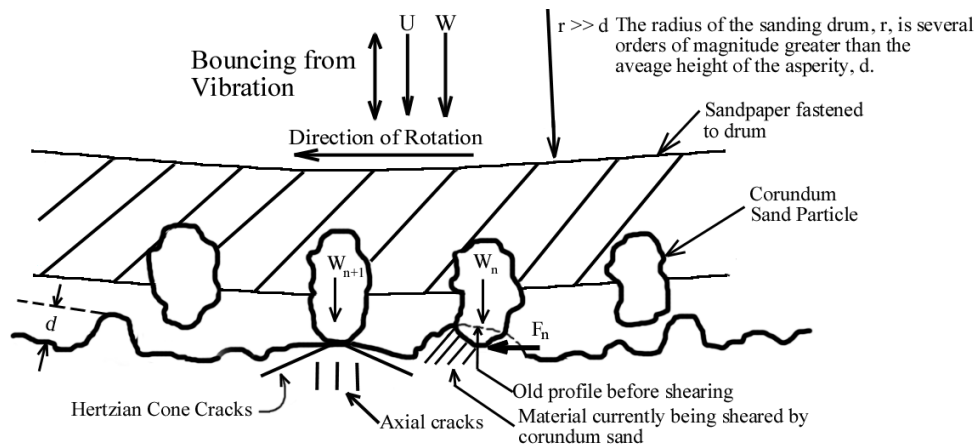
sensitive factor and is related to the height of bouncing. The mass of the drum,  $m$ , the hardness of the concrete,  $H$ , and a factor  $f(\theta)$  based on the angle of impact  $\theta$  ( $90^\circ$  in this case) are also important. Cracking may be anticipated in the asperities and also in the deeper sub-asperity zone. These may take the form of Hertzian cone cracks, and even axial cracks will develop at the impact points, illustrated in figure U.5.18.2

(ii) Sliding: The abrasion wear corresponding to sliding of the rotating sanding drum may be quantified by the expression:

$$Q_{\text{Shearing}} \propto F_{\text{Total}} = \mu W \quad \text{where } F_{\text{Total}} = \Sigma F_n$$

$Q_{\text{Shearing}}$  represents the loss of material owing to shearing (see figure U.5.18.2) where contact is made.  $F_{\text{Total}}$  is the overall frictional drag, and  $\mu$  is the coefficient of friction between concrete and sandpaper.  $W_{\text{Total}}$  in this case is the effective or 'dynamic' weight, and is greater than the weight of the drum owing to the bouncing effect.

Severity: The combination of impact and sliding is particularly abrasive. The sliding abrasive particles rapidly remove cracked asperities, and possibly even the 'core' concrete, making a new front to be crushed/cracked.



**Figure U.5.18.2** Presentation of impact, and sliding related abrasion

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