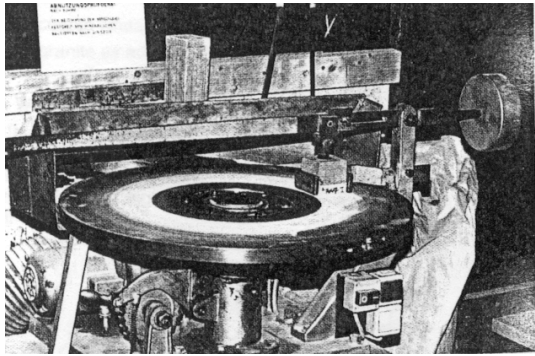
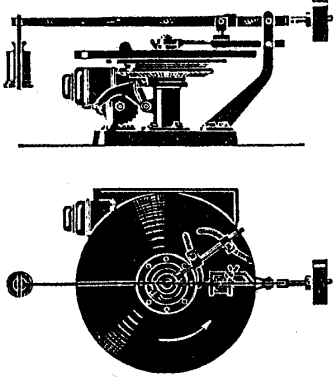


Appendix U.5.3 – NBN 269

Generic Name of Test	<i>Sliding Fine Abrasive : Abrasion Test</i>										
Principle of Test	Large revolving steel disc causes the abrasive to slide/roll beneath loaded specimens.										
Historic Development of Test	The abrasion test of the Belgian National Standard NBN 269 utilises the Amsler apparatus. The name of this apparatus derives from the Swiss firm Alfred J. Amsler, which built abrasion machines according to the Böhme principle. Böhme's principle is that the sample is held under a certain pressure onto a cast iron disc, rotating in the horizontal plane. An abrading agent is applied to the disc. The loss of thickness is measured after a certain number of rotations of the disc. The number of revolutions is converted into the total wear path. [v.d. Klugt (1989)]										
Apparatus and Abrasives	The NBN 269 test apparatus is similar to that shown in figures U.5.3.1 and U.5.3.2 and consists of a horizontally rotating cast iron disk against which 2 specimens may be held. Dune sand is used as abrasive grit between the specimen and plate. A simple lever system applies a constant force to the test specimens. [v.d. Klugt (1989)]										
 <p data-bbox="272 1276 751 1331">Figure U.5.3.1 Amsler apparatus similar to that used in the NBN 269 test. [Pickel (1997)]</p>	 <p data-bbox="906 1293 1312 1402">Figure U.5.3.2 Böhme disc. Note the simple lever system for applying a controlled pressure. Two specimens are used in the NBN 269 test [Pickel (1997)]</p>										
Test Method	Test specimens are prepared to a size of 70 x 70mm and are tested dry using dune sand as an abrasive. The specimen remains stationary and is not rotated for the duration of the test, which may be either 500m or 3000m. The 3000m test takes approximately 50 minutes to complete [v.d. Klugt (1989)]										
Abrasion Wear	This is expressed as the average depth of abrasion wear, which is measured as the loss of thickness of the test specimen. [v.d. Klugt (1989)]										
References	<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>Alexander (1984)</td> <td>Source document</td> </tr> <tr> <td>v.d. Klugt (1989)</td> <td>Source document</td> </tr> <tr> <td>Pickel (1997)</td> <td>Source document</td> </tr> <tr> <td>Hendrix (1994)</td> <td>Source document</td> </tr> </tbody> </table>	<u>Author</u>	<u>Comment</u>	Alexander (1984)	Source document	v.d. Klugt (1989)	Source document	Pickel (1997)	Source document	Hendrix (1994)	Source document
<u>Author</u>	<u>Comment</u>										
Alexander (1984)	Source document										
v.d. Klugt (1989)	Source document										
Pickel (1997)	Source document										
Hendrix (1994)	Source document										

APPENDIX U.5.3

Wear Mechanisms according to Author

- (i) v.d. Klugt (1989): No comments of the mechanism of abrasion wear
- (ii) Alexander (1984): The abrasive action is that of rubbing and grinding and cutting and sliding of the grit. (Similar to DIN 52108)
- (iii) Hendrix (1994) mentions abrasion limits of 2.5mm for individual pavers and 2.0 as an average for blocks ≥ 80 mm, and similarly 3.0mm and 2.5mm for paver thickness < 80 mm.
- (iv) Visual Effects: None shown

Wear Mechanisms according to writer [R2 S2 I0]

(i) Rolling and Sliding: The mechanism of wear is shown in figure U.5.3.3 and is one of microscopic crushing and shearing at the contact points, as the sand is made to move laterally beneath the specimen. Lateral displacement of the sand is caused primarily by the movement of the grinding table, but rotation of the sample also contributes to a degree. The sand will be made to both slide and roll. The predominant action in the case of sliding will be shearing in the form of scratching, scraping and cutting of the asperities. In the case of rolling, sharp points are likely to generate high compressive stress, resulting in microscopic crushing in very localised areas. The corresponding abrasion wear for the 2 cases may be referred to as:

$$Q_{\text{Crushing}} \propto W_{n+1}$$

$$Q_{\text{Shearing}} \propto F_n = \mu W_n$$

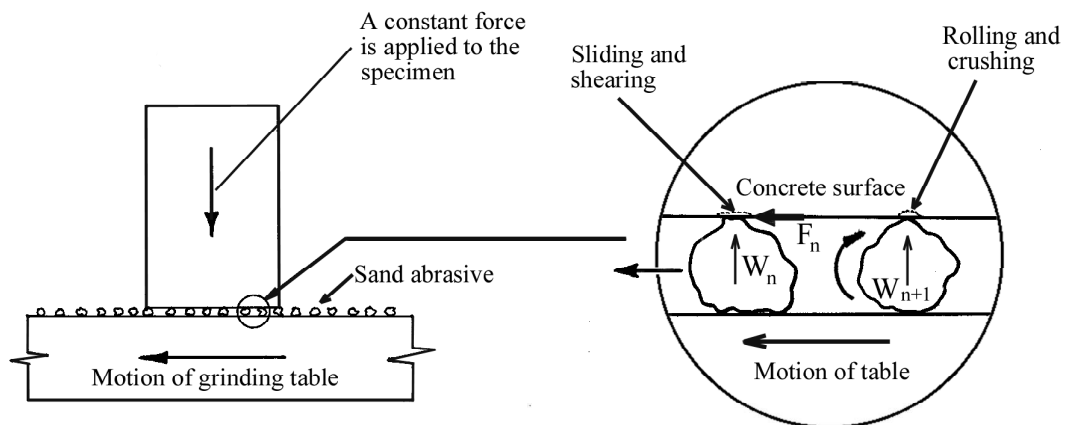


Figure U.5.3.3 Rolling and sliding wear mechanisms

Note: This test does not measure the aggregate/paste bond. The aggregate particles that are loosened during the abrasion process are unable to 'escape'. In effect they contribute to an unrealistically high 'abrasion resistance' result, whereas in practise they would be plucked out of the matrix by traffic etc. The size of loose aggregate that is in effect 'trapped' will depend on the gap between the test sample and the grinding table, and this in turn is determined by the size of the abrasive particles.

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