Appendix U.4.2 – NT BUILD 044

Generic Name of Test	*Rolling* Steel Wheels : Abrasion Test
Principle of Test	Loaded 125mm diameter wheels can caster in 2 directions.
Historic Development of Test	This abrasion test determines abrasion resistance according to *Nordic Test Method NT BUILD 044 (SFS 3839, SS 923507).* No further information is given by Siro (1991) on the development of the test.
Apparatus and Abrasives	The apparatus consists of a single steel wheel of width 40mm and diameter 125mm. The wheel is supported on bearings and rotates about a vertical axis as it casters. The concrete specimen is mounted on a mechanical table that can move in 2 directions at right angles to each other. [Siro (1991)]

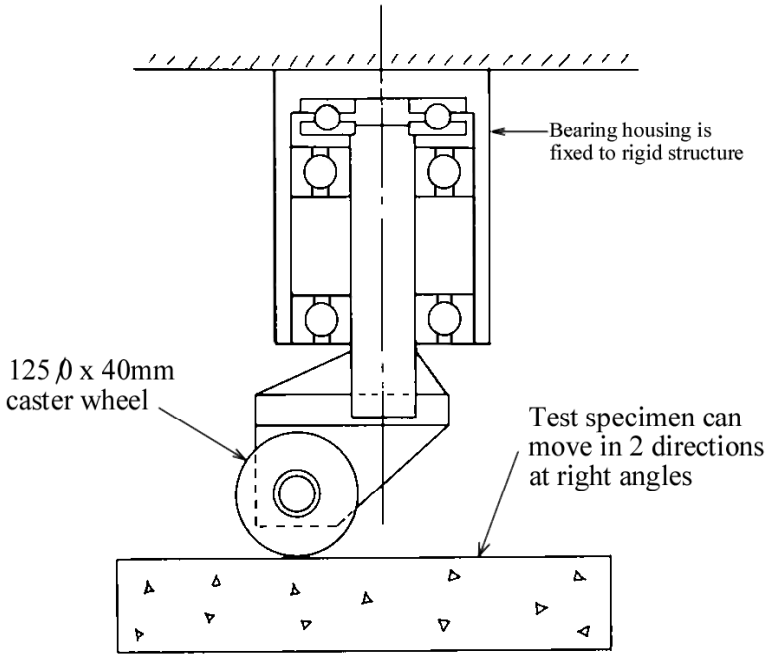

Figure U.4.2.1 Envisaged reconstruction of a section through the apparatus, according to description given in text. Note that the concrete specimen can be moved in two directions, at right angles to each other.

Test Method	A 600x600mm test specimen is moved in 2 directions while a load of 2kN is placed on the wheel. According to Hertzian theory, this imposes a 100MPa stress on the surface of the test specimen. [Siro (1991)]
Abrasion Wear	Unknown, presumably the depth of wear is measured.
References	Author — Comment Siro (1991) — Source document

APPENDIX U.4.2

Wear Mechanisms according to Author

(i) Siro (1991): Small hard wheels are used to give as good an indication of the actual wear as possible. Stresses on the concrete are the combinations of total wheel load, surface pressure from the wheel, skidding of the wheel and impact of the wheel when the surface becomes uneven. Heavy wheel loads break particles loose from the surface more effectively than a small load, even at the same wheel surface pressure, since the larger load has a deeper stress field into the concrete as shown in fig U.4.2.2 The surface pressure at the wheel's point of contact is high. Computed using the Hertz formula, it is reported to be 100 MPa.

(ii)Visual Effects:

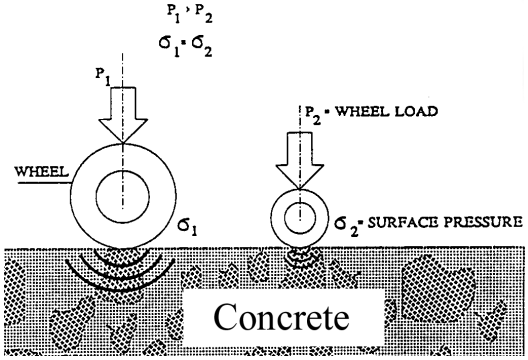

Figure U.4.2.2 Heavy wheel load breaks particles loose from surface more effectively than a small load, even at the same wheel surface pressure [Siro (1991)]

Wear Mechanisms according to writer [R4 S3 I2]

(i) Rolling and Sliding: As the loaded wheel rolls over the surface, the concrete asperities beneath the wheel will be subject to crushing effects. There is also tangential shear as a result of slip that occurs beneath the wheel during a direction change.

The compressive force is shown as W in figure U.4.2.3, while the tangential sliding/slewing effect is shown as F, where $F = \mu.W$, and μ is the coefficient of friction between the slewing wheel and concrete.

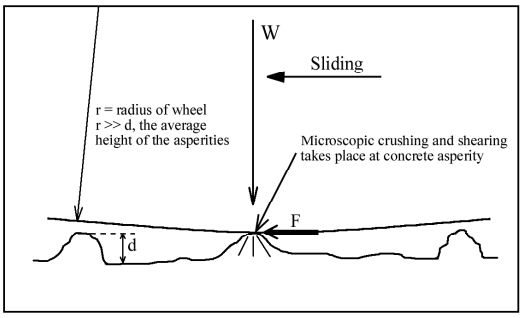

Figure U.4.2.3 Microscopic wear effects on the concrete induced by the steel wheel.

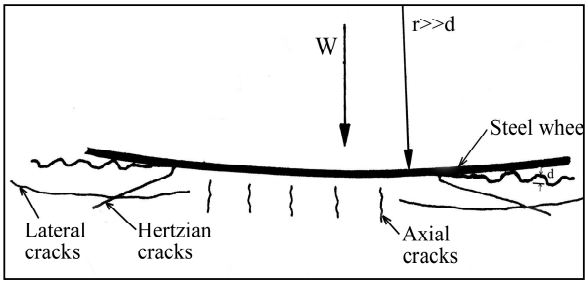

Figure U.4.2.4 Cracking wear mechanisms from large loads **and** high contact pressures

Relative Severity: Given the high Hertzian contact pressure of 100MPa, and the high wheel load of 2kN the asperities will be substantially flattened, so that the severe wear mechanisms indicated in figure U.4.2.4 will occur in addition to than those shown in U.4.2.3. The concepts set out in figure U.4.2.2 and U.4.2.4 are similar.

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