Appendix U.5.22 – Water Sandblast

Generic Name of Test	*Impact* Fine Abrasive (and Water) : Abrasion / Erosion Test
Principle of Test	Water borne sand is propelled against the surface
Historic Development of Test	This Modified version of ASTM C418 was used by Ramezanianpour (2000) in his tests on the abrasion resistance of concrete which would be exposed to abrasion / erosion in hydraulic structures.
Apparatus and Abrasives	The apparatus (see figure U.5.22.1) is reported to be "nearly similar" to ASTM C418 and consists of a blast nozzle with an aperture of unknown diameter. A clamping arrangement holds the specimen securely at a distance of 75mm from the nozzle. The type of abrasive sand used is not given. [Ramezanianpour (2000)]

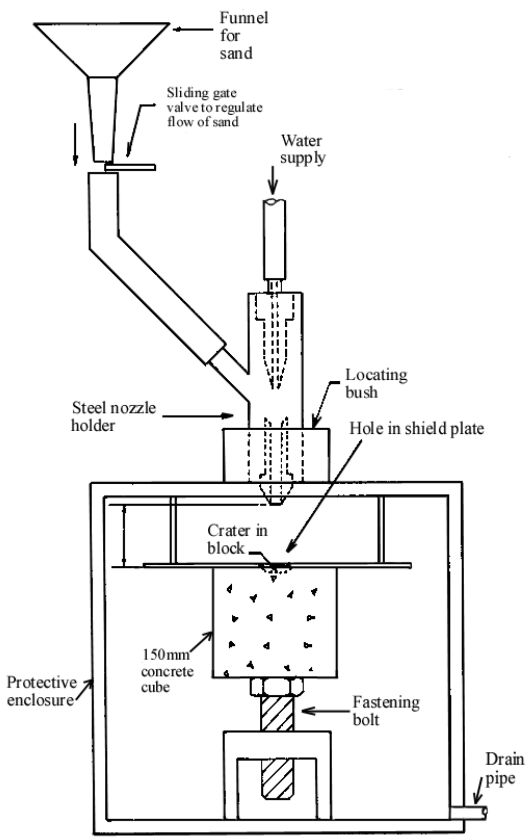

Figure U.5.22.1 Apparatus for water-sandblasting as envisaged from authors text

Test Method	The test specimen (150mm cube) is secured and blasted with the water sand mixture at a pressure of 150atm. The flow of the abrasive is at a rate of 7200 grams/minute. The duration of the test is not given. [Ramezanianpour (2000)]
Abrasion Wear	Presumably the mass loss or the volume of the crater formed was measured. This was compared to that of the 'control' mix and on this basis the % increase in abrasion resistance was reported.
References	Author: Ramezanianpour (2000) — Comment: Source document

APPENDIX U.5.22

Wear Mechanisms according to Author

(i) Ramezanianpour (2000): Abrasion erosion damage results from the abrasive effects of waterborne silt, sand, gravel, rocks and other debris being circulated over a concrete surface during operation of a hydraulic structure.

(ii) Visual Effects: None available

Wear Mechanisms according to writer [R0 S2 I2]

(i) Impact: A sand particle of mass m, and considerable initial velocity U, strikes a surface at angle θ. This results in impact wear Q_{impact} (mm^3) such that $Q_{impact} \propto \frac{m.U^2}{H}.f(\theta)$ where H is the indentation hardness of the surface material, and $f(\theta)$ is a function of the angle of impact, generally a maximum at 90^0 in brittle materials [Hutchings (1992)]. On impact, crushing and shearing (in the form of cutting, scraping and scratching) of asperities will take place, as indicated in figures U.5.22.2 and U.5.22.3 while sub-asperity cracking (in the form of 'Hertzian cone cracks' or 'axial cracks') will only occur superficially given the low mass of the sand particles.

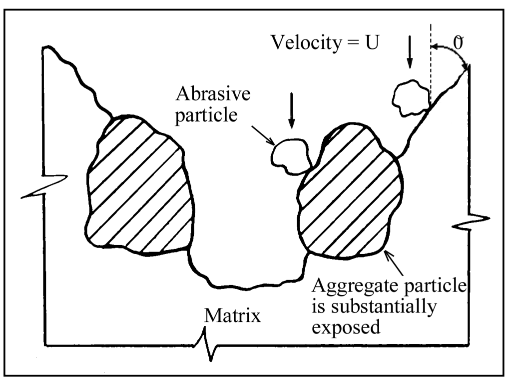

Figure U.5.22.2 Cross section of a typical crater. Abrasion wear of the matrix of paste and fine aggregate occurs at a far greater rate than for the course aggregate. The course aggregate becomes progressively more exposed until it is eventually dislodged and washed out.

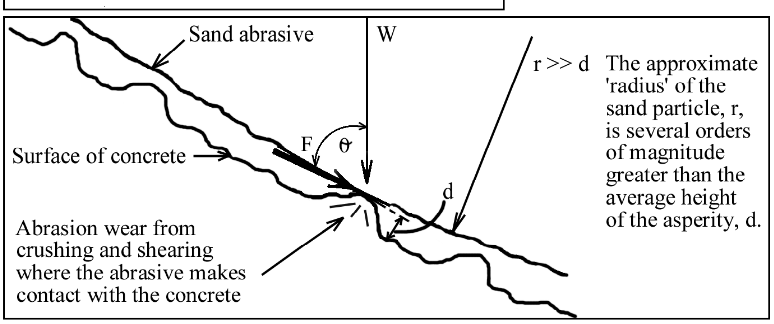

Figure U.5.22.3 Microscopic wear mechanism of a water-sandblast test. W and F are respectively the crushing and shearing forces from the impact of the sand abrasive against the concrete's surface

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