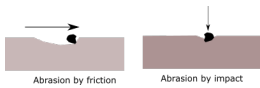


Degradation Of Concrete By Abrasion

written by Nirmal Raj Joshi | October 27, 2024

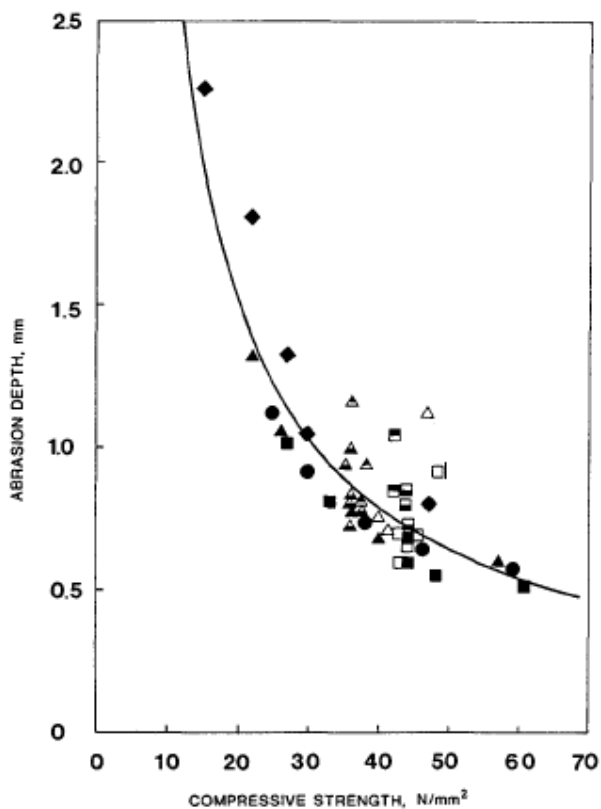


Abrasion of concrete is progressive loss of concrete mass due to mechanical degradation such as friction, grinding action, impact, overloading and local crushing. Vehicular movement and pedestrian traffic causes abrasion. The worst effect of abrasion is caused by vehicle with studded/chain tyres. Similarly, in industrial buildings, the concrete floors are subjected to impact load and scratching effects.

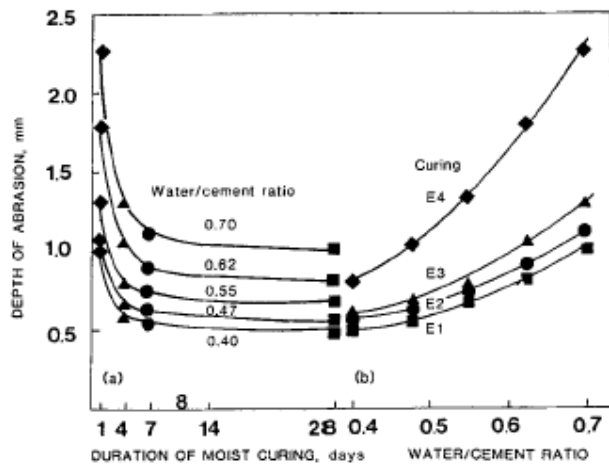
Factors affecting abrasion

The abrasion resistance of concrete depends upon the paste hardness, aggregate hardness and the bonding between paste and aggregate.

In general, higher the compression strength of concrete, higher will be its abrasion resistance (see figure below). But strength alone can not be taken as the parameter to estimate the abrasive behaviour.

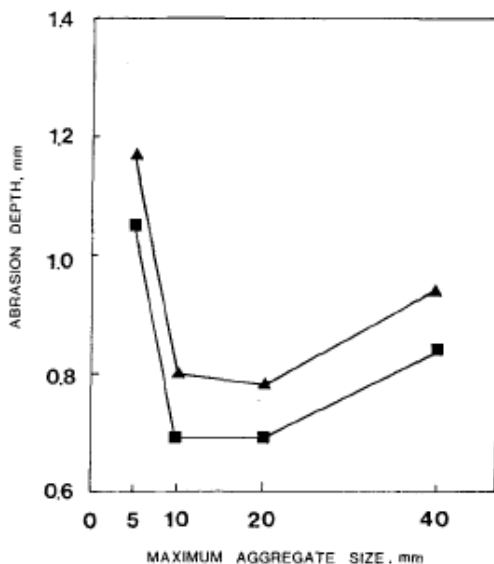


Relation between abrasion depth and compressive strength



Effect of w/c ratio and duration of moist curing on abrasion depth

In an extensive study made by Dhir, the size of aggregate and curing time were observed to be dominant variables besides the compression strength (or w/c ratio). It was observed that the size of aggregate plays an important role for rate of abrasion (mainly in the case of impact loading). Due to higher stiffness of smaller aggregates, they are less prone to damage in impact loading, however, it is unclear why very small particles could be damaged easily.



Variation of abrasion depth with aggregate size

The porosity of top layer is another main factor controlling the abrasion of concrete (Sadegzadeh, 1987). A dense, well cured surface has higher hardness. It is also common practice to coat the abrasion prone surface with resistant material. For example, in bridge a flexible material (bitumen) is used while in industries a harder surface is made with addition of finer particles (e.g. silica). Other methods to achieve abrasion resistant surface are as follows :

- Surface finishing
- Extensive curing
- Aggregate proportioning
- Cement proportioning
- Addition of fly ash upto 30% has been found to increase abrasion resistance
- Addition of fibres (steel, polypropylene)

Abrasion tests

Abrasion test in concrete can be done by adopting the procedure of following codes:

- EN 13892= BS 8204 Part 2
- ASTM C418, C779 and C944
- BS-8204 Part 2 (BIS 1999c)

Reference

R. K. Dhir, P. C. Hewlett, and Y. N. Chan, "Near-surface characteristics of concrete: abrasion resistance," *Materials and Structures*, vol. 24, no. 2, p. 122, Mar. 1991.

S. Benjamin D. and Md. Safiuddin, "Abrasion Resistance of Concrete – Design, Construction and Case Study," *Concrete Research Letters*, vol. 6, no. 3.