



CNR ANTI-WEAR TESTS

THE CACOH* MATERIALS ENGINEERING LABORATORY

analysis of hydraulic structures

behavioural

Center for the



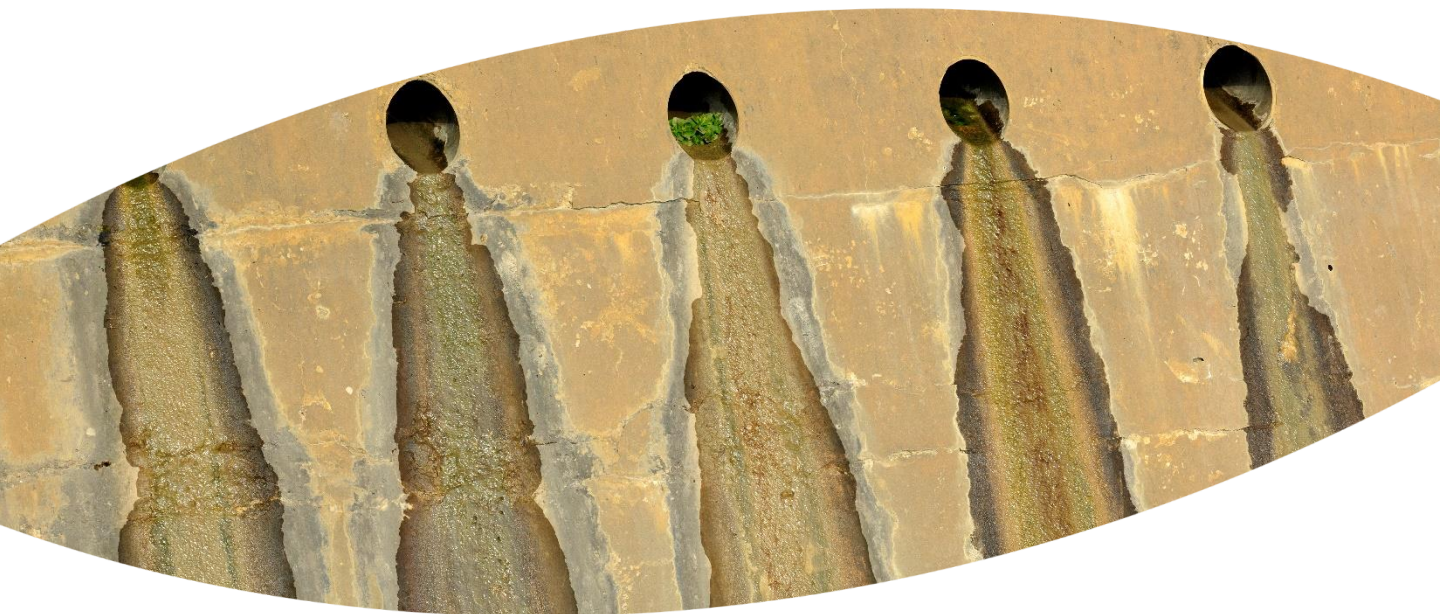


What is hydraulic abrasion?

Hydraulic abrasion is the phenomenon of wear that affects the parts of structures exposed to flows of water transporting erosive particles (sand, gravel, etc.).

Over time, abrasion causes damage in the culverts through which water flows at high speed (3 m/s and more) and downstream of the energy dissipation structures (spillways, heads, weirs, dams, etc.).

The most exposed parts of the structures must be protected by anti-wear coatings. These anti-abrasion products are improving constantly and must be adapted to each type of use.



CNR, 60 years of experience as designer and operator

CNR, holder of a concession entrusted to it by the State, built 19 mobile gate dams between 1948 and 1986, which it still manages. Considerable energy is dissipated in these structures and the content of solid material transported by the water is high.

With its 60 years of experience, CNR has learned to protect the aprons of its dams efficiently with less and less costly and increasingly tough artificial coatings that are also increasingly easy to implement.



CNR's abrasion and impact test bench, the reference in France

CNR has developed an original test bench for its structures, designed to test the abrasion resistance of a sample of material.

Since 1986 this test bench has been made available to external clients. With its highly precise operating procedure, it has been used to test **more than a 1,000 samples of materials** for **more than 60 different clients** in the sectors of hydraulic structures and drainage.

This experience has made the **CNR test the French reference** for assessing the resistance of materials to hydraulic abrasion. Although not standardised, it features in the annex of the NF 95103 standard relating to the repair of concretes and the draft of the standard relating to UHPFRC.



CNR ABRASION TEST TECHNICAL DESCRIPTION

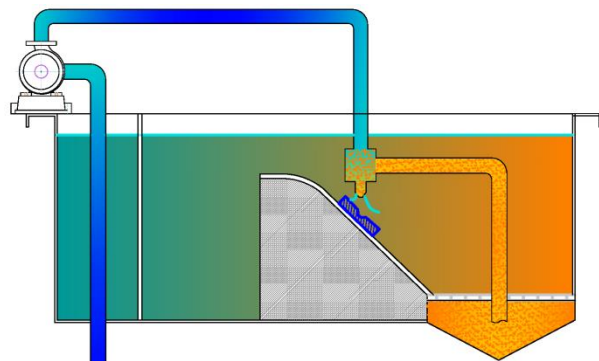




Abrasion test of anti-wear protections

The test bench operates as follows:

- the test piece is submerged in a basin. It is subjected to a jet of water loaded with sand impinging at 45°
- the duration of the test is generally 75 min. but can be reduced to 15 min.
- the test on the material is conducted between two calibration tests on glass to take into account the wear of the sand and the injection nozzle
- the abrasion is characterised by the volume of each imprint, determined by photogrammetry.



This device is used to assess the resistance of the material tested to wear by abrasion, with an abrasion index :

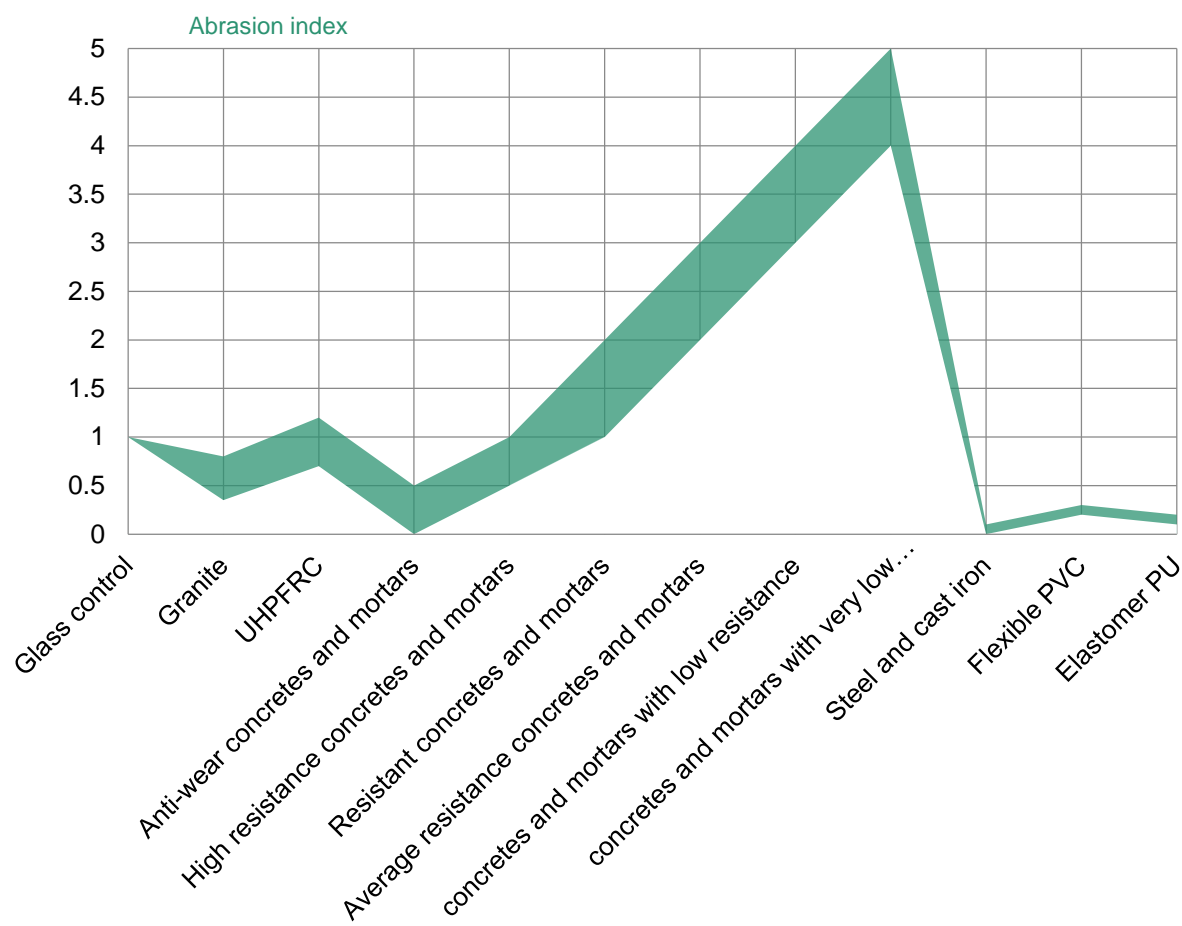
$$I = \frac{V}{V_0} \left[\begin{array}{l} V = \text{volume of the imprint on the material} \\ V_0 = \text{the average volume of the imprint on glass} \end{array} \right]$$

The lower the abrasion index, the higher the resistance of the material to wear is. It can vary within a range of values between several tenths for the most resistant and 5 or 10 for the least resistant.





Values indicating the abrasion index



CNR IMPACT TEST TECHNICAL DESCRIPTION





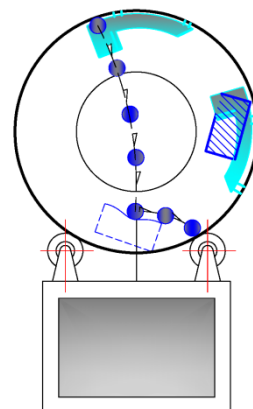
Impact test

The test device developed and used by CNR is designed to reproduce in the laboratory the conditions of impacts encountered in hydraulic structures.

A metal ball of fixed weight and diameter falls from a constant height on the test piece. The test comprises a total of 2,700 impacts.

The test consists in:

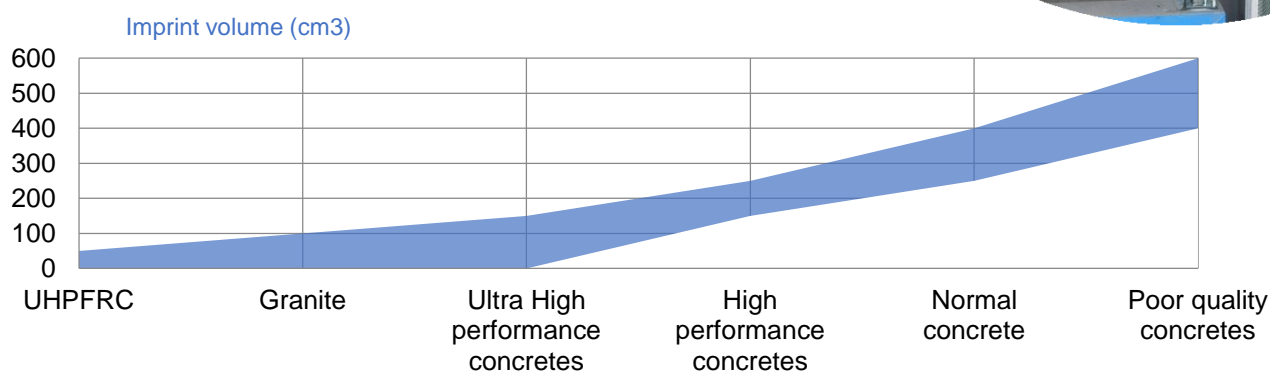
- measuring the volume of the imprint on the test piece in the case of rigid materials (of sufficient hardness)
- determining the loss of cohesion and adhesion characteristics in the case of flexible materials.



Résultats :

The lower the characteristic value of the impacts, the higher the resistance to wear is. It can vary within a range of values between several tenths of a cm³ for the most resistant materials and more than 5,000 cm³ for the least resistant.

Indicative values of results



CNR ABRASION AND IMPACT TESTS FINANCIAL OFFER





When should anti-wear tests be carried out?

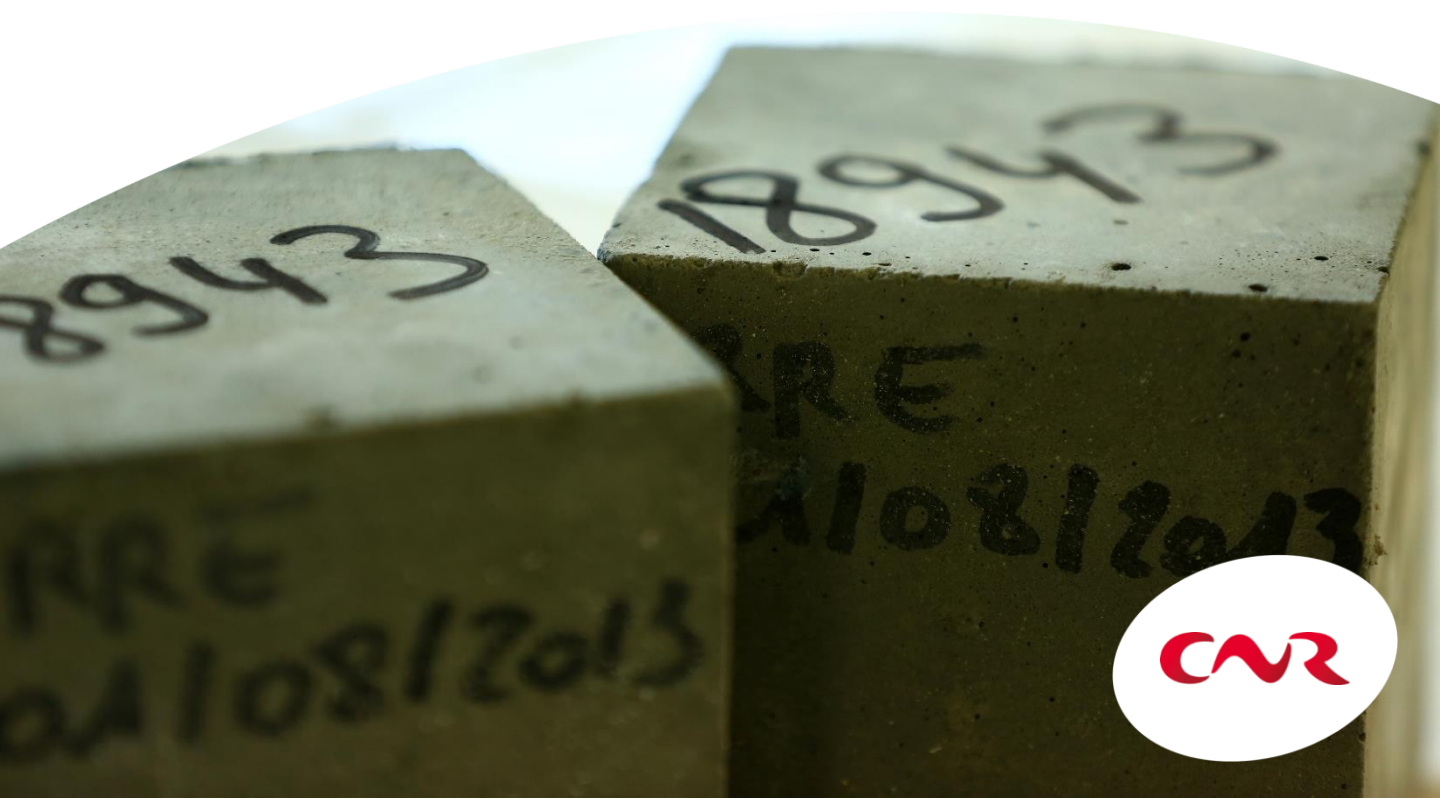
- During studies to qualify a non-referenced product
- Before carrying out works to check that the product and the means for implementing it conform to the specifications
- During the works to ensure that the product is applied correctly.

How can anti-wear tests be carried out?

- By sending three test pieces to the CNR laboratory. They must be cubic with sides of 100 mm for the abrasion test and oblong with sides of 250x250x125 mm for the impact test. To ensure that the test is representative, the material must be tested using three test pieces.
- For qualification testing or specific applications, by contacting the CNR laboratory which will make an offer for carrying out customised studies or tests.

For what price?

- The cost of a minimum series of 3 tests on the same material amounts to €550 ex tax for an abrasion test and to €1,350 ex tax for an impact test (2016 price).



CNR

Direction du Patrimoine Fluvial - laboratoire
4 rue de Chalon-sur-Saône
69007 LYON
FRANCE

CONTACT COMMERCIAL

Mikaël DUMAS
m.dumas@cnr.tm.fr
Tél. : +334 78 61 60 00

cnr.tm.fr

Energy is our future, so save it!

