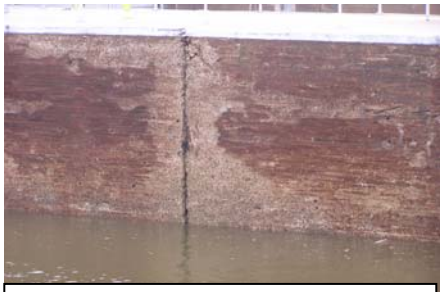
US Army Corps of Engineers®
Engineer Research and Development Center

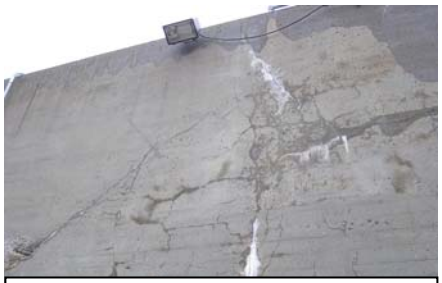
New Technologies to Maximize the Forensic Value of Cores Extracted from Concrete Structures

Description

A key to improved monitoring and condition evaluation of mass concrete structures is the improvement of forensic characterization capabilities and practices surrounding coring. This work involves the development, evaluation, and refinement of a suite of field and laboratory techniques and systems aimed at improving technology and practices regarding field coring, laboratory core analysis, and long-term monitoring. The goal is to improve the forensic value of concrete coring by addressing data collection during coring, cutting edge laboratory analysis methods, and "Smart" grouting materials for core-hole based long-term sensors. Engineered, controlled, and known samples are being used to compare and correlate performance of various laboratory methods. Computed tomography, petrography, new Nonlinear Elastic Wave Spectroscopy methods, and linear high-frequency ultrasonics will all be evaluated. Other laboratory inspection methods such as accelerated chemical reactions, microscope/chemical analysis, controlled exposure, and alternate mechanical tests will be addressed in the testing guidance documents.



Deterioration at Lock & Dam 21



Deterioration at Lock & Dam 22

Issue

The Corps' concrete infrastructure spans a tremendous range in terms of age, designs, environments, and problems. Improved in-situ based condition inputs are critically needed for both life-cycle analysis and maintenance operations. When warranted, inspectors will collect concrete cores, which are then used for nondestructive testing (NDT) correlation, petrographic/laboratory analysis, and most commonly mechanical testing. The coring of mass concrete structures represents a necessary evil as it is the primary tool for developing NDT correlations and the only way to directly assess the in situ concrete material. Typically cores are examined visually, sometimes chemically, and then almost always destroyed in some destructive mechanical test.

Users

Corps Districts, infrastructure owners and operators.

Products

- Complete specifications and instructions for an instrument core drill capable of characterizing concrete changes during coring.
- Guidance and details necessary to select and execute leading-edge methods for imaging and analysis of specific properties of concrete core specimens.
- Smart material technology and guidance for using core holes as new high-performance long-term strain sensors in the depth dimension (previously unattained).
- Damage estimation model using structural geometry, sampled material properties, and historical climate data.

Commercialization and technology transfer paths will be pursued. Papers, workshops, EM/ER updates, STTRs and other methods will be used for technology transfer.

Benefits

These methods and systems will improve the value of collecting concrete cores and will capture previously undetermined defects and changes, both microscopic and macroscopic, within sampled specimens. The improved capability to assess and monitor material/structural conditions will improve the Corps' ability to optimize maintenance operations and allocate resources.

Corps Program

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