INTERNATIONAL
Journal *of* 3R' s

Vol.1, No.1, 2010, 2-11

DURABILITY OF CONCRETE REPAIR AND RESEARCH : SOME RANDOM THOUGHTS

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A B S T R A C T

Improved performance of concrete structures will depend on the willingness and ability of all partners in the repair field to cooperate in creating scientifically based technology.

Sixty-six years ago a strong plea was published in the ACI Journal to "shorten the lag between research and practice", on the basis that the time lag was too great between the findings of research and their acceptance and application by engineering practitioners. The engineer is really the person expected to bridge the gap and "shorten" the "lag". But the engineer in the concrete repair field, unfortunately, does not have anything to bridge and shorten. Research is not occupying its time-honored place well ahead of practice, and in some areas it is lagging behind.

So, what are the problems? What has to be resolved?

The paper addresses the issues of durability and service life of repaired concrete structures, shortcomings in scientific input in areas of electrochemical activities, service life prediction, and dimensional compatibility of repair materials with existing concrete substrates.

The paper is not providing recipes for concrete repairs with an appropriate "long-term" service life. Rather, it will explain why several issues considered herein are critically important for further improvements in the concrete repair field.

INTERNATIONAL
Journal *of* 3R' s

Vol.1, No.1, 2010, 12-21

SELF-HEALING CONCRETE: SUITABILITY OF DIFFERENT HEALING AGENTS

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ABSTRACT

Self-healing of cracks in concrete would be highly desirable as this material is very sensitive to cracking and large costs are involved in concrete repair. Self-healing properties may be obtained when encapsulated healing agents are dispersed through the concrete matrix. When cracks appear, the capsules break and the glue is released into the crack binding the crack faces together. In this research, the efficiency of different types of glue is investigated by comparing the amount of regain in strength due to autonomous crack healing. When the polyurethane Meyco MP 355 1K was used as healing agent, 45-70% of strength regain was obtained. It was also shown that encapsulation of this type of glue could lead to a 1000 times lower water permeability coefficient compared to cracked reference samples.

INTERNATIONAL
Journal *of* 3R' s

Vol.1, No.1, 2010, 22-26

USE OF PETROGRAPHY IN FIRE DAMAGE INVESTIGATION OF CONCRETE STRUCTURES

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ABSTRACT

Investigating a fire damaged concrete structures requires a meticulous and systematic approach in collecting relevant information and deciphering evidences on site. The extent of soot staining and damages to the finishes such as the paint and plaster layer on the surface of the concrete may give a false impression on the severity of the damage, often leading to an over-estimation of the extent. On the other hand, overly reliance on the duration of the fire can also mislead as a moderate heating over a long duration may under estimate the depth of damage. Whilst there are several techniques that can be used to investigate the damage caused by a fire incident such as non-destructive tests, extraction of concrete cores for laboratory analysis is always unavoidable. However in many cases, the extracted cores were merely subjected to compressive strength test. This may not effectively provide any indication on the condition of the concrete after the fire incident, especially for large or thick concrete members where the surfaces of the concrete cores are trimmed off before the test. It must be appreciated that the effect of fire on concrete results in a layered damage with the surface, being exposed to the greatest heat suffering from the most severe damage. Thus, almost always, the compressive strength of the core, taken away from the surface fails to show any sign of strength reduction. It is often critical in any fire investigation, to establish the temperature achieved at different depths in the concrete and hence the condition of that element. This paper illustrates the use of petrography as an indispensable technique in fire damage investigation of concrete structures.

INTERNATIONAL
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Vol.1, No.1, 2010, 27-32

DETERMINING THE COMPOSITION OF REPAIR MORTARS FOR HISTORIC MASONRY : A CASE STUDY

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A B S T R A C T

In this case study the elements playing a role regarding the determination of the composition of a repair bedding mortar and a repair repointing mortar for historic masonry are elaborated.

First, damage occurring in the masonry is analyzed with a view to evaluating the quality of the materials used in the past, the effects of the environmental conditions of the durability, the presence of salts, and the workmanship with which the former restorations were executed.

Then, before focusing on the technical requirements attention is paid to important restoration concepts such as compatibility and retreatability. It is shown that technical requirements stemming from these concepts often are in conflict with durability requirements, so that compromises in the choice of the composition of the repair materials are often unavoidable.

Finally choices with respect to the composition of bedding and repointing mortars are made based on hygric and mechanical characterisation of the existing material, taking into account the salt load and environmental conditions of the masonry.

INTERNATIONAL
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Vol.1, No.1, 2010, 33-41

MONITORING TECHNIQUES AND PREVENTIVE MEASURES FOR REBAR CORROSION IN CONCRETE - A REVIEW

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ABSTRACT

Corrosion of steel is a serious durability problem in reinforced concrete (RC) structures. A large number of reinforced concrete structures are being affected by reinforcement corrosion. It is of great concern while considering the safety and serviceability of concrete structures. In this review paper, an introduction to rebar corrosion in concrete is presented, wherein the importance of corrosion, its causes and effect on service life are enumerated. In addition a review of different corrosion monitoring techniques adopted for diagnosis of rebar corrosion is also presented. Further the preventive measures to decrease reinforcement corrosion are also briefly presented.

INTERNATIONAL
Journal *of* 3R' s

Vol.1, No.1, 2010, 42-48

ASSESSMENT OF CONCRETE'S RESISTANCE TO CHLORIDE PENETRATION

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ABSTRACT

Resistance to chloride ion penetration is perhaps the most important characteristic defining the durability of concrete, as it dictates the performance of concrete in aggressive marine environments. A number of durability test methods are used to quantify the chloride penetration resistance of concrete. However, there is lack of clarity in understanding whether the test methods address the correct mechanisms involved in the process. Furthermore, the interdependence between different methods has not been addressed sufficiently in literature. This study reports on the evaluation of different grades of concrete using the chloride ponding test, the rapid chloride permeability test, and the chloride conductivity test. Interrelationships between these testing methods are explored and discussed.

INTERNATIONAL
Journal *of* 3R' s

Vol.1, No.1, 2010, 49-50

POINT OF VIEW

FOOD FOR THOUGHT : IS IT ALKALI RESISTANCE OR EFFLORESCENCE RESISTANT THAT YOU REALLY NEED?

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A B S T R A C T

Have you ever wondered why you can use the best quality paints and a good alkali resistant primer on a masonry building and it still fails quickly in South East Asia? It may simply be that you are not addressing the correct problem. The problem is poor efflorescence resistance and not poor alkali resistance. The problem is compounded further by the use of low cost skim coats or renders that are loaded with free lime and Ca^{++} ions. In this discussion I attempt to propose formulation ideas which should remedy this situation.