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TechNote

Cracks in a Repair

Keywords: cracking; cracks; durability; repair.

Question

Should cracks in a repair be of concern?

Answer

Irrespective of their cause (for example, shrinkage, temperature, loads, reflection), cracks are of concern in repairs. First, cracking provides direct avenues for the ingress of water and aggressive agents into the repair; therefore, cracking is always a concern from a durability point of view. Cracks may also adversely affect the performance of repairs designed to carry load. Finally, cracking may be of concern from an aesthetic point of view.

Discussion

Concrete repairs can be broadly classified into structural and nonstructural. Structural repairs are designed to participate in carrying load and to protect the underlying concrete and embedded reinforcing steel from deterioration and corrosion. Nonstructural repairs are repairs designed for protection and/or aesthetic purposes only.

The presence of cracks may adversely affect the load-carrying behavior of the repaired structure. Thus, cracks in repaired portions of the structure may not be acceptable. In such cases, the effect of cracking on structural performance of the repaired structure should be evaluated by the licensed design professional.

Both types of repairs are intended to mitigate the ingress of potentially deleterious elements, such as water, chlorides, carbon dioxide, and sulfates, into the repair as well as into the existing concrete (Fig. 1). Cracking is probably the biggest single factor in the overall durability of the repair, especially in harsh environments. From a durability point of view, an ideal repair would have no cracks; however; in practice, the goal should be to minimize the amount and width of the cracks.

Guidance on tolerable crack widths in concrete structures is presented in reports from ACI Committee 224, Cracking.[1-3] While these documents were developed for cracking in new concrete structures, the recommendations can be applied to concrete repairs. Guidance on achieving crack-resistant repairs can be found in documents prepared by the American Concrete Institute,[4] International Concrete Repair Institute[5,6] and U.S. Army Corps of Engineers.[7]

Summary

Cracking in a repaired portion of a concrete structure may affect the repair ability to perform its intended function and may reduce the service life of the repaired structure. The outcome largely depends on the extent, depth, and width of cracks.

References

1. ACI Committee 224, "Control of Cracking in Concrete Structures (ACI 224R-01)," American Concrete Institute, Farmington Hills, MI, 2001, 43 pp.

2. ACI Committee 224, "Causes, Evaluation, and Repair of Cracks in Concrete Structures (ACI 224.1R-93 [Reapproved 1998])," American Concrete Institute, Farmington Hills, MI, 1993, 22 pp.

3. ACI Committee 224, "Joints in Concrete Construction (ACI 224.3R-95 [Reapproved 2001])," American Concrete Institute, Farmington Hills, MI, 1995, 44 pp.

4. ACI Committee 546, "Guide for the Selection of Materials for the Repair of Concrete (ACI 546.3R-06)," American Concrete Institute, Farmington Hills, MI, 2006, 34 pp.

5. ICRI, "Guidelines for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion (ICRI 310.1R-2008)," International Concrete Repair Institute, Rosemont, IL, 2008, 7 pp.

6. ICRI, "Guidelines for Selecting and Specifying Concrete Repair Materials (ICRI 320.2R-2009)," International Concrete Repair Institute, Rosemont, IL, 2009, 36 pp.

7. Vaysburd, A. M.; Emmons, P. H.; McDonald, J. E.; Poston, R. W.; and Kesner, K. E., "Performance Criteria for Concrete Repair Materials Summary Report," *Technical Report*, REMR-CS-62, U.S. Army Corps of Engineers, Vicksburg, MS, 1999.

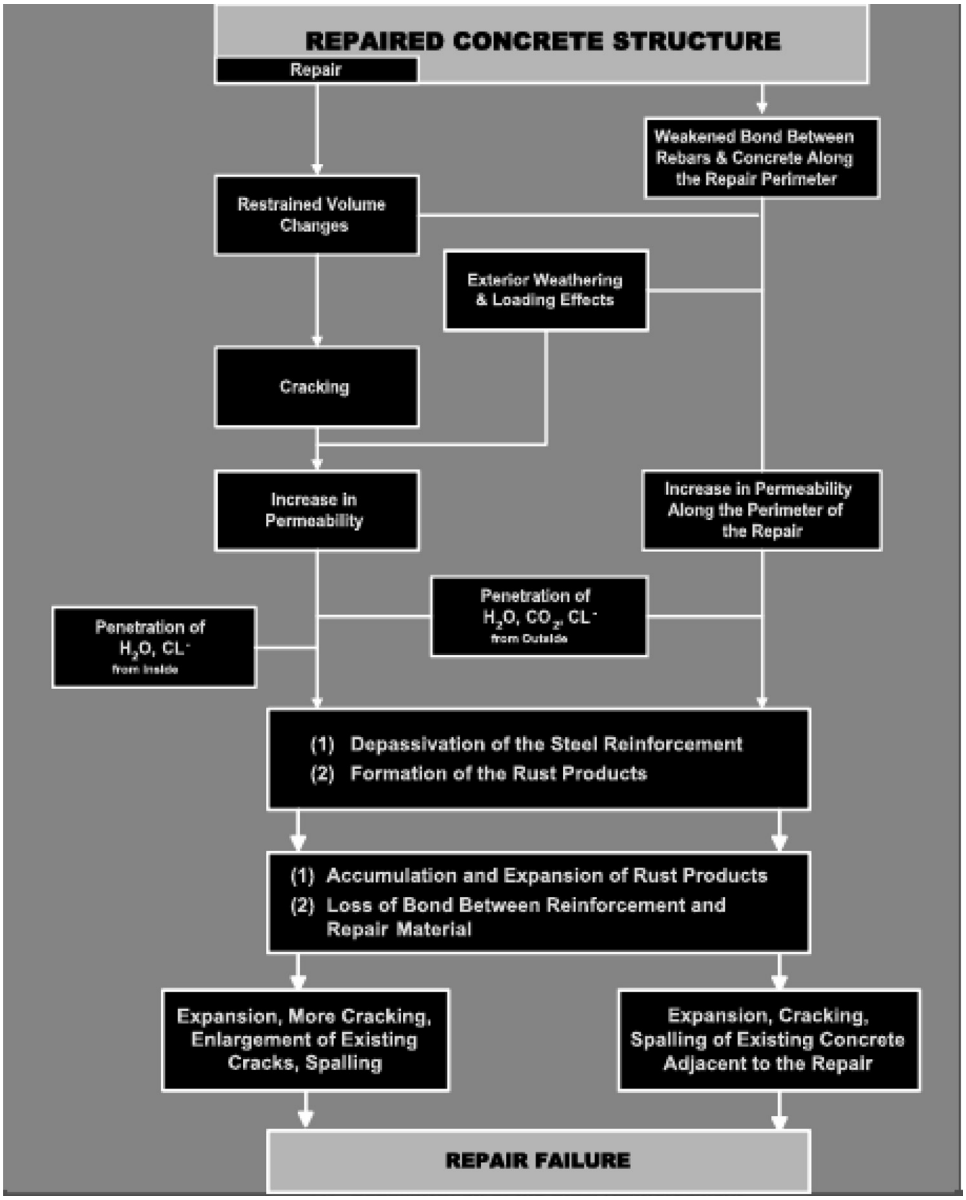

Fig. 1: Concrete repair cracking-failure interaction model (courtesy of Vaycon Consulting).

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For additional copies, please contact:
American Concrete Institute, 38800 Country Club Drive, Farmington Hills, MI 48331
Phone: 248-848-3700, Fax: 348-848-3701,
www.concrete.org