

Best Practices for Preparing Concrete Surfaces for Repairs and Overlays

Providing guidance for effective concrete repairs

Bottom Line

This research developed performance criteria for surface preparation of existing concrete prior to repair and overlay.

Better, Faster, Cheaper

The more effective preparation, the better and more long lasting the concrete repair will be.

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More Information

Bissonnete, B., A.M. Vaysburd, and von Fay, K., 2012. *Best Practices for Preparing Concrete Surfaces Prior to Repairs and Overlays*. Reclamation, Report No. MERL 12-17.

Problem

Repair and strengthening of existing concrete structures are among the biggest challenges civil engineers face today and will face in the years to come. Concrete repair can prolong the useful service life of a deteriorated or distressed structure, restoring the load carrying capacity and strengthening the structure. To be successful, the repair and the substrate need to act as one unit. Repair material cracking and debonding from the concrete substrate is one of the biggest problems impacting the long-term performance of concrete repairs and bonded overlays.

Despite the relatively large pool of theoretical knowledge, the practical issues related to surface preparation of existing concrete to achieve a long lasting bond are still inadequately addressed. Thus, repairs and overlays continue to perform poorly.

Solution

To promote more effective concrete repairs, this Science and Technology Program study identified the key physical characteristics of a concrete substrate needed to ensure successful, long-term repairs and overlays. In conjunction with our research partners, we developed practical guidelines in the form of a Suggested Guide Specification based on results of the International Research Project, "Development of Specifications and Performance Criteria for Surface Preparation Based on Issues Related to Bond Strength," a review of best practices, and the authors' knowledge of concrete repair.

These guide specifications contain recommendations for surface preparation of concrete prior to repair and overlay. The document summarizes current knowledge, best practices, and results of research concerning the surface preparation of concrete prior to application of repair/overlay materials.

Results

In addition to verifying some standard industry practices, we identified other factors for successful concrete repair, including:

Planning the Repair

The success of concrete repairs depends on determining the cause and extent of concrete distress or deterioration, establishing realistic repair objectives, and developing a repair strategy to address repair needs.

Properly Removing the Concrete

The effectiveness of various concrete removal techniques may differ for unsound and sound concrete, and a combination of techniques may be necessary. Success depends on:

- Removing unsound (and, if necessary, sound) concrete and foreign materials that inhibit bonds from the concrete and reinforcement surfaces, opening the concrete pore structure, and preparing and repairing damaged reinforcement.

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- Avoiding the use of methods to remove concrete or to prepare the concrete and reinforcement to receive the repair material that weakens the remaining sound concrete and reinforcement.
- Reviewing the effect of concrete removal on the structural integrity of a structure prior to removal of existing concrete.
- Monitoring concrete removal to ensure minimal impact on the surrounding environment. Primary issues are noise, dust, and flying debris.

Treating Reinforcing Steel

Corrosion of embedded reinforcing steel is the most frequent cause of concrete deterioration. Proper evaluation of the condition of reinforcing steel exposed in the repair area and proper reinforcement treatment steps will ensure that the repair will not fail prematurely. Site welding of reinforcement should be avoided if alternative methods of repair are available. Repairs of corrosion-related concrete deterioration are usually performed in the areas where the corrosion activity is at its worst—at “hot spots.” After these areas are repaired, the “hot spots” can move to the areas adjacent to repair areas. To protect such areas, consider using sacrificial galvanic anodes.

Preparing the Surface

Surface preparation is important to remove deteriorated concrete and to create a good interface texture. Adhesion depends as much on good surface preparation as on repair material characteristics. Regardless of the cost, complexity, and quality of the repair material and application method selected, the care with which concrete is removed and concrete reinforcement surfaces are prepared will often control whether a repair project will be successful.

Concrete removal methods may leave the surface to receive the repair material too smooth, too rough, too irregular, and without open pores. In these cases, procedures specifically intended for surface cleaning are necessary, including secondary cleaning in some cases.

Place repair materials as soon as possible after concrete removal and cleaning is completed or protect the cleaned and prepared concrete and reinforcement surfaces from contamination. If too much time passes after cleaning and before placing the repair, additional cleaning to remove the carbonated surface may be needed.

Future Research

These Guide Specifications should be modified by the results of further research and field trials. Investigating different substrate concretes, interface textures, and various repair materials would be helpful. In addition, further research will be necessary to develop a practical methodology for optimum moisture conditioning of the concrete substrate’s surface prior to repair.

“Regardless of the cost, complexity, and quality of repair material and application method employed, the quality of the surface preparation of the substrate prior to repair will often determine whether a repair project is a success or a failure, and whether a repaired structure meets the design objectives.”

Vaysburd, A.M., G.M. Sabnis, P.H. Emmons, and J.E. McDonald, “Interfacial Bond and Surface Preparation in Concrete Repair,” *Indian Concrete Journal*, No. 15, January 2001, 27-33.

