

## Western Water and Power Solution Bulletin

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### Preparing concrete before repairs and overlay

*New surface preparation guide for concrete repairs saves time and money and leads to longer-lasting repairs.*

#### What Is The Problem?

The primary goal of a concrete repair is to bond the damaged substrate and the new repair layer so that they act together for the life of the structure. This prolongs the useful service life of a deteriorated structure—restoring the load-carrying capacity and strengthening the structure. However, the success of thin repairs (less than 6 inches thick) is difficult to predict. Most repairs last only 2 to 5 years. Many times these repairs crack prematurely, requiring expensive re-working much sooner than planned. The problem with thin repairs and overlays, while universal, is a particular issue for Reclamation due to the age and condition of our older concrete structures.

One approach to improving the success of thin repairs is to make the repair layer thicker by first removing more of the underlying structure. However, this is a time-consuming and costly approach. By developing better methods for thin repairs, significant money and time can be saved. A key factor is to effectively prepare the substrate surface before applying repair materials—no matter what repair material and application method is used.

#### What Is The Solution?

In this Science and Technology Program project, we developed performance criteria for successful surface preparation of existing concrete prior to a repair or overlay. We considered a number of factors: roughness, porosity, absorptivity, strength of the substrate's skin, chemical status, moisture content, temperature, and the hydration dynamics of the repair material. We then prepared concrete slabs, installed repair overlays, and conducted pull off tests to test the bond between the repair and substrate. We found that:

- Using International Concrete Repair Institute profile chips to assess surface textures before repairing is the most effective method. This method is as effective as digitally matching surfaces—and costs significantly less.
- Rougher surfaces are slightly stronger in shear than smoother surfaces; thus, repairs for shear loads should use rougher surfaces.
- Tests using pull offs are not affected by slight variations in the test apparatus' alignment.
- Surfaces do not need to be treated again within 24 hours of repair because carbonation of the surface does not affect repairs, as originally believed.

#### Who Benefits?

A guide specification, replacing the current Concrete Repair manual, will be issued soon. Reclamation managers and operations and maintenance staff can use these results to save time and money and to streamline repair schedules. Moreover, the concrete repair industry will also benefit from these findings to more effectively repair concrete while saving time, labor, and money.



**Concrete replacement repairs to damaged concrete surfaces removed by hydroblasting.**

#### Future Development Plans

These findings will be incorporated into our guide specifications. We plan to issue a general report summarizing all the results and recommendations by the end of the year and a new concrete repair manual within the next 2 years.

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#### Partners

To help address and quantify these factors, Reclamation joined with Laval University, Quebec (QC), Canada; University of Liege, Liege, Belgium; Warsaw University of Technology, Warsaw, Poland; Vaycon Consulting, Baltimore, Maryland and US Navy/Port Hueneme to develop performance standards for the surface preparation of concrete prior to repair or overlay.