



Market

Water Industry

Application

Concrete Repair and Protection

Focus

**Cracked Surfaced Spalls and
Failed Joints**

Project: Sutro Reservoir, San Francisco
Owner: San Francisco Public Utilities Commission
Specifier: SFPUC
Contractor: Lotus General Contractors
Year: 2003

The Problem

The Sutro Reservoir is owned and operated by the San Francisco Public Utilities Commission (SFPUC). Completed in 1952, the reservoir contains approximately 32 million gallons of potable drinking water for the City of San Francisco. The reservoir is built into the side of Mount Sutro and is essentially a buried tank consisting of a concrete liner, forty foot high walls, a sloped floor mirroring the grade of the mountain and a dividing wall creating two separate compartments of equal size within this large structure. After decades of use and exposure, signs of distress became evident.



A comprehensive investigation was conducted by SFPUC to determine the extent of the deterioration and devise a repair and protection system to extend the service life of the structure. The top of the lid had numerous deficiencies including failure of the expansion joints, cracking of the concrete deck, which in some instances went through the entire depth of the slab, delamination of the concrete including full depth in some locations and exposed, corroded reinforcing steel. Furthermore, it was determined that approximately 20% or 60,000 sq. ft. of concrete on the underside of the lid (beams and deck) had either delaminated or spalled.

Spalling of the concrete was caused by corroding reinforcing steel. This problem was accelerated due to insufficient cover and constant damp conditions. The failed expansion joints were attributed to weathering and age of the material. The extensive cracking was determined to be caused primarily by plastic and long-term drying shrinkage. The latter of which was exacerbated by the thin deck construction and inefficient joints within the deck. The cracking worsened over time due to regular seismic activity in the area.

The Sika Solution

This case study focuses on the work related to repairing and protecting the top side and underside of the 300,000 sq. ft. lid of the reservoir.

To address the spalling due to corrosion and insufficient cover SikaArmatec 110 EpoCem was applied to all exposed reinforcing steel during the repair process.



SikaTop 123 and 111 Plus were hand applied and poured respectively to repair spalls, to the topside of the lid. SikaRepair SHB with Sika Latex R was hand-applied and sprayed to repair spalls to the underside of the lid. Failed joints were repaired using the Combiflex strip and seal system. Construction joints were routed then sealed with SikaFlex 2c SL. Sikadur 55 SLV was used to gravity feed the plastic and long-term drying shrinkage cracks. This super low-viscosity, moisture tolerant epoxy resin, crack healer can penetrate down to cracks that are 0.004" in thickness. Finally, Sikadur 22 Lo Mod was used to protect the concrete lid and provide a durable wearing surface. Sikadur 22 Lo



Mod is a 100% solids, moisture-tolerant, epoxy resin binder. For this project, a custom blend of sand was chosen as the broadcast medium into the binder for both aesthetics and because the top surface would now serve as public tennis courts.

Anti-Corrosion Primer and Bonding Bridge

Sika Armatec® 110 EpoCem® - protects rebar in areas of inadequate cover.

High-Performance Repair Mortars

SikaTop® PLUS - two-component, polymer modified mortar containing Sika FerroGard 901 corrosion-inhibitor.

Sikacem mortars are machine-applied by dry-spray equipment for large scale repairs.

Problem Joints/Cracks Sealing System

Sikadur® Combiflex® - a unique strip and seal system used to seal problem joints and cracks, even those undergoing extreme movement.

Hard Wearing Epoxy Overlay

Sikadur® 22 Lo-Mod epoxy resin will provide decorative hard wearing, slip resistant, overlay systems for balconies not requiring a crack bridge membrane.

Joint Sealing

Sikaflex®, High Performance Sealants - are premium-grade polyurethane joint sealants that are fully compatible with Sika's concrete repair systems.

Anti-Carbonation Coatings

Sikagard® 550W and 670W - protect concrete facades from the damaging effects of carbon dioxide (carbonation), water and pollutants. Either crack-bridging (550W) or rigid (670W), both are high-performance protection coatings, available in a variety of decorative colors.

Epoxy Injection and Bonding

Sikadur® - epoxy resins help restore structural integrity by injection into cracks and voids. The most comprehensive range of epoxy products for structural bonding and grouting.

Structural Strengthening Systems CFRP

Sika CarboDur® - a proven system of external strengthening using epoxy-bonded Carbon Fiber Reinforced Polymer (CFRP) laminate strips. Stronger than steel, yet lightweight and non-corrosive, this system can solve unique strengthening problems in a variety of concrete structures.

SikaWrap® - Carbon and Glass Fiber Fabrics wrap around concrete and masonry structures for repair and strengthening.



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