



CASE STUDY

POINT ARENA LIGHTHOUSE

Owner: Point Arena Lighthouse keeper, Inc., Point Arena, CA.

Project Engineer/Designer: JZMK Partners, Irvine, CA

Repair Contractors: Alpha Restoration & Waterproofing, South San Francisco, CA
F.E. Gates Co., Division of Blakely Corp., Indianapolis, IN

Material Supplier/Manufacturer: Sika Corporation, Lyndhurst, NJ, D.M. Figley, Menlo Park, CA



ICRI Award Winner
Award of Merit
Historic Category

BUILDING TRUST



The Problem

Point Arena Lighthouse is located in Mendocino County along the Pacific Coast of California, northwest of San Francisco. The original lighthouse was erected in 1870 with brick and mortar type construction common to most construction of this era. After a devastating earthquake in 1906, the lighthouse was demolished and rebuilt to withstand future earthquakes. The company chosen to rebuild the lighthouse normally built factory smokestacks and therefore the final design featured steel reinforced concrete, the first lighthouse of its kind.

In 2005, portions of the lighthouse were closed to the public because sections of the concrete and the corbel supporting the balcony were falling to the ground from corrosion and water intrusion. The harsh marine environment was a major contributor to the acceleration of concrete degradation. Another contributor to water intrusion and concrete failure was inadequate waterproofing and poor slope-to-the-exterior architecture of the tower gallery and observation deck. Over the years of exposure to the marine environment, chlorides had accumulated near the concrete surface due to the wet environment causing a wetting and drying effect. A concentration of chlorides diffused toward the reinforcement steel causing corrosion and delamination in the concrete cover. The great majority of spalled concrete was not much deeper than the rebar. In some areas there was total loss of original reinforcement steel. Approximately 200 feet of new steel reinforcement was corroded beyond acceptable limits and was required to be replaced.



Concrete cornice with delaminated concrete



A cornice support before and after protective coating applied

The Sika Solution

The main goal of the project was the preservation of the lighthouse and protection from future harm. A cementitious, anti-corrosion coating, Sika® Armatec® 110, was applied to the existing and new steel reinforcement. Sika® Galvashield® XP+ cathodic protection anodes were connected at key locations for large spalls and random areas based on square foot coverage. The repair areas were formed and a two-component, polymer-modified mortar, SikaTop® 123+, was trowel applied over the repair area. A polymer-modified, cementitious resurfacing compound, SikaTop® 121+, was also trowel applied over the entire face of the tower to fill small pores to prohibit water intrusion. A low pressure sprayer was used to topically apply a surface penetrating, corrosion inhibiting coating, Sika® FerroGard® 903, over the entire structure in order to inhibit corrosion caused by chlorides and carbon dioxide.. This was applied at the end of the first phase which protected the exposed concrete until it was scheduled to be parged at the beginning of the second phase of the project. For the second phase, the SikaTop® 123+ structural resurfacing compound was once again trowel applied over the entire face of the tower. All surfaces of the tower were then primed with a one component, penetrating, adhesion promoter, Sikagard® 552W, specific for priming concrete and other masonry surfaces prior to the application of acrylic emulsion coatings. Sikagard® 550W Elastocolor, an elastomeric, crack-bridging, anti-carbonation, acrylic protective coating, was applied for protection of aggressive gas ingress. This coating also enhanced the aesthetic appearance of the structure while having both UV resistance and water vapor permeability.

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

Sikadur® 22 Lo-Mod - an epoxy resin that provides a hard wearing, slip resistant wearing surface. This overlay system seals the concrete and provides waterproofing protection.

Sika® FerroGard® 903 - as a dual action corrosion inhibitor, will reduce corrosion currents by penetrating through the concrete and forming a protective coating on the embedded steel bars.

Sikagard® 550W Elastocolor 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.

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

SikaTop® Plus Mortars - two component polymer modified materials containing Sika® FerroGard® 901 corrosion inhibiting admixture.

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.