

Alcatraz Quartermaster Building Restoration Project

SAN FRANCISCO, CA
SUBMITTED BY SIKA CORPORATION

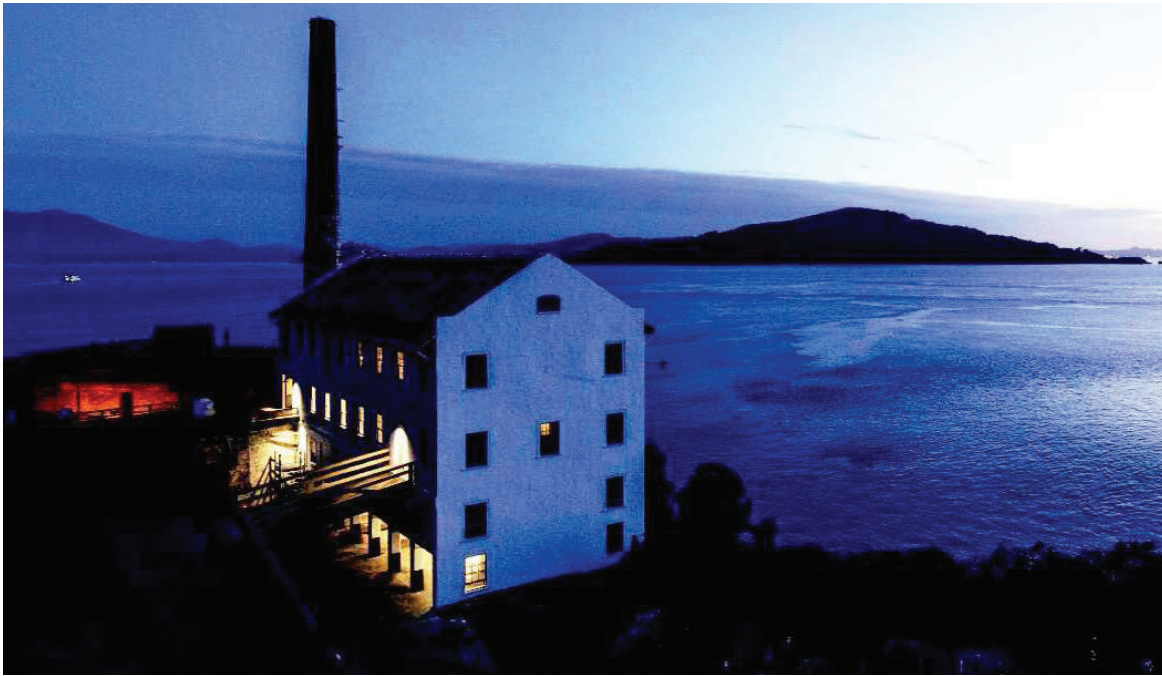


Fig. 1: View of Quartermaster warehouse on Alcatraz island

The rich history of Alcatraz is a world of information in itself. A structure as old as this, which was transformed and repurposed for use, is a fascinating example of sustainability at its best. Civil War fortress, infamous federal prison, bird sanctuary, first lighthouse on the West Coast, and the birthplace of the American Indian Red Power movement—these are just a few of the fascinating stories of the Rock. Alcatraz Island is a designated National Historic Landmark for its significant contribution to the nation's history.

Alcatraz prison is one of the most famous penal facilities in the world. Constructed in 1909 as a military prison, it became a maximum-security federal prison in the early 1930s. The 22 acre (8.9 hectare) island, which is situated about 1.2 miles (1.9 km) from San Francisco, is home to many structures that were built for different reasons over different periods of time.

The Quartermaster Warehouse is a reinforced concrete structure with two upper floors over a mezzanine and basement (Fig. 1 and 2). It was originally constructed as a multi-use building by the US Army in 1921, and remains in active use as a storage, office and workshop facility (Fig. 3).

The majority of the Quartermaster Warehouse structure consists of reinforced concrete. The exterior board-formed concrete walls are covered with a thin cement parge coat throughout. Interior columns are reinforced concrete at the basement, mezzanine, and first floor, with wood at the second floor. Floor slabs are concrete at the upper two floors, and wood frame at the mezzanine level.

In 1963, Alcatraz prison was classified as surplus government property, and the unused structure was placed under the stewardship of the General Services Administration. In 1972, the island and prison became part of the newly formed Golden Gate National Recreation Area administered by the National Park



Fig. 2: Map of Alcatraz island (red circle identifies location of Quartermaster warehouse)



Fig. 3: Quartermaster Building, west elevation, circa 1935 (photo courtesy of NPS, Golden Gate National Recreation Area, Water Collection)



Fig. 4: Deteriorated Quartermaster Building, circa 2013 (prior to restoration)

Service. In 1986, Alcatraz Island became a National Historic Landmark District, with the Quartermaster Warehouse identified as a contributing feature.

This article will detail the process undertaken in recent years to perform repair, restoration and historical preservation on the Quartermaster Building. It includes the means and methods to determine the root cause of concrete degradation, corrosion mitigation of steel reinforcement, concrete repair, and upgrading and strengthening to meet today's seismic building code—all while preserving the rich history of Alcatraz.

EXISTING CONDITIONS

While the Quartermaster Building remained in use as a storage and workshop space, the hostile marine environment of the San Francisco Bay took a significant toll on the structure by the late 20th century.

By 2010, deterioration was visible at nearly all concrete elements, including large spalls and exposed corroded reinforcing steel at the walls, beams, columns, and floor slabs (Fig. 4, 5 and 6). Deterioration was most severe at the exterior walls, but also visible throughout the interior. In many cases, rebar was observed very close to the surface at cracks and spalls.

Starting in the late 1990s, a series of assessments evaluated the building's structural systems, which were inadequate under current seismic and structural codes. Additional strengthening was designed in the form of new shotcrete at select interior walls and Fiber-Reinforced Polymer (FRP) reinforcement at walls and some floor slabs. For the new strengthening systems to succeed, extensive concrete repairs were also necessary.

REPAIR STRATEGY

Concrete repair systems were evaluated based on their compatibility with the existing historic concrete and finish system. Conditions were typically either severe or good—there was very little small-scale or shallow repair. For example, there were large areas of severely deteriorated concrete, with large surface spalls, crumbling concrete substrate, and heavily corroded exposed rebar, but just a few feet down the wall the concrete would be completely intact and undamaged. For these reasons, a comprehensive repair system that could be used for all levels of repair and coatings was sought. In addition, the repair system needed to be able to blend with the historic concrete finishes, and cost was a concern due to the large volume of repairs needed.

A repair system, consisting of a large-repair concrete mix product, small-scale repair mortar, repair mortar for the parge coat, bonding agents, and a series of protective finish coatings, was used to create a comprehensive repair strategy (Fig. 7).

CHALLENGES

In addition to the historic preservation requirements of the project, a number of other special conditions, both anticipated and unanticipated, added to the complexity of the project.

Cold Joint

It is assumed that the Quartermaster Warehouse was constructed using Army prison labor, and the building's original craftsmanship was accordingly low in quality. During demolition of the deteriorated concrete and parge coat, it was discovered that the building's four stories had been placed in separate lifts and were not structurally connected to each other. The discovery of these cold joints (Fig. 8) required the modification of repair details, including the addition of FRP reinforcement at each horizontal joint (Fig. 9). The FRP was ultimately concealed behind the new parge coat, allowing for repair without any visual change to the historic façade.

The engineer selected Glass Fiber-Reinforced Polymer (GFRP) in the design in two areas, first applied on the top side (walking surface) of elevated concrete floor decks to function as structural chord and collector elements carrying seismic lateral forces. Installed in this manner, these GFRP zones on the floor areas were completely concealed in the fully installed and finished condition by feathering these elements into the surrounding floor area with leveling compounds. At the top level, where there is no roof level concrete diaphragm, the same function was provided by installation of a GFRP band provided at the top of the full perimeter of the exterior wall. This GFRP was similarly concealed by inclusion in the polymer-modified parge coat overlaid on the perimeter wall. The surface selected for application of the GFRP (top vs. bottom, interior vs. exterior) was for the purpose of avoiding penetration of beams or columns.

NPS Working Constraints

In addition to the difficulties posed by working on an island without a permanent water connection, the National Park Service (NPS) restricted work on the exterior to protect nesting birds. The east side of the building is located next to a steep slope that extends down to the San Francisco Bay, creating an ideal nesting area for wildlife. Per NPS requirements, exterior



Fig. 5: Deteriorated Quartermaster building in 2016 (prior to restoration)



Fig. 6: Exterior concrete deterioration in 2016 (prior to restoration)



Fig. 7a: Interior area before restoration

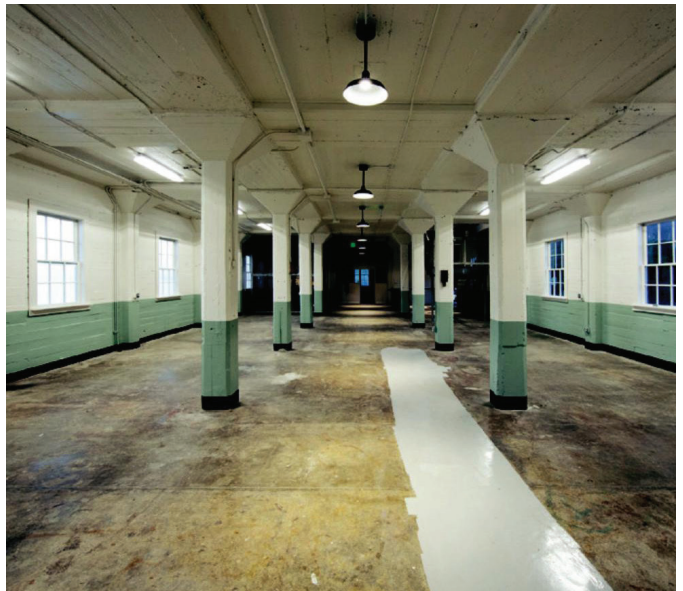


Fig. 7b: Interior area after restoration

construction had to be coordinated to prevent disruptions during water bird breeding season, which lasts from February 15 until all young in the area have fledged, typically around September 15.



Fig. 8: Cold joint revealed during parge coat demolition



Fig. 9: Repair application of FRP at horizontal joint prior to new parge coat



Fig. 10: Deteriorated conditions at locations of political statement in 2014 (prior to repairs)

HISTORIC GRAFFITI

In November 1969, a small group of Native Americans crossed the bay in boats and landed on Alcatraz Island. Soon, many other Native Americans joined them, including students and families, in what became known as the Alcatraz Occupation. Citing the 19th century Treaty of Laramie, which stipulated that unused Federal lands could be returned to Native Americans, the occupiers offered \$24 in exchange for Alcatraz Island. To promote their cause and solidarity, occupiers painted political statements (also referred to as graffiti) with surplus paint found in prison buildings onto building walls, signs, and water towers. The Alcatraz occupation became a symbol of the Native American struggle for autonomy and was covered in the national press.

The Quartermaster Warehouse has several painted political statements throughout the building. Most significantly, on the east elevation, the words “Indian Land” are written in yellow paint. The concrete substrate that the political statement was painted on was deteriorated and needed to be included in the concrete repair project (Fig. 10 and 11). The NPS maintains an agreement to work with a council of Native Americans when rehabilitation could impact the painted political statements, and they were consulted as part of the repair project.

In addition to the concrete deterioration, the painted words were fading. Working directly with the Native Americans, the NPS proposed three alternatives:

1. Preserve and protect the failing painting in place;
2. Remove the painting for display in the Alcatraz museum collection; or
3. Restore the painting by repairing the concrete and parge finish and repainting the Political Statement.

Alcatraz Quartermaster Building Restoration Project

SUBMITTED BY
Sika Corporation
Lyndhurst, NJ

OWNER
**Dept. of the Interior - NPS - Golden Gate
National Parks Conservancy**
San Francisco, CA

PROJECT ENGINEER/DESIGNER
AECOM
Oakland, CA

REPAIR CONTRACTOR
SST Pullman Services - The Structural Group
Benicia, CA

MATERIALS SUPPLIER/MANUFACTURER
Sika Corporation
Lyndhurst, NJ

The decision was unanimous, to restore the painting after repair of the exterior wall surface. The Political Statement was recorded with a full size tracing of the lettering created with the support of a decorative painter. After repair of the wall surface, the tracing was transferred to the wall surface by the Contractor for the rehabilitation project (Fig. 12). In March 2016, Native Americans from various tribes gathered to complete the painting. The political statement is now more visible and rests on a stable, repaired concrete substrate.

CONCLUSION

Alcatraz is at the intersection of building technology and culture: the evolution of concrete, reinforcement, and historical preservation. A project like this is the best advertisement of how concrete repair is a synonym for sustainability. With the knowledge and technology, we are able to protect, re-purpose and maintain an almost 100-year-old structure (Fig. 13). As an industry, we have to be proud of this achievement. ■



Fig. 11: Close-up view of deterioration at location of political statement in Figure 10



Fig. 12: New tracings of political statements on repaired concrete substrate



Fig. 13: View of Quartermaster Building after restoration the project to identify efficient and effective solutions to the planned repairs and unforeseen conditions