National Park Service
U.S. Department of Interior

NPS Cosco Busan Recreational Use Program

Repair Retaining Wall on McDowell Avenue at Fort Mason
Final Programmatic Report

April 2024

Recipient Park Unit:	Golden Gate National Recreation Area
Project Location:	Fort Mason, San Francisco, CA
Date Approved:	January 8, 2013
Project Period:	October 2013 – November 2016
Award Amount:	$1,041,600
Funding Allocations:	FY2013 $167,200
	FY2015 $874,400
Total Expended:	$991,805
Funds Returned:	$49,795
Project Number:	PHP0173060

1. Summary of Accomplishments

McDowell Avenue at Fort Mason serves as a major San Francisco Bay Trail link for bicyclists and pedestrians between Fishermen's Wharf, San Francisco Maritime National Historical Park and the Alcatraz Embarkation Pier to the east, and Crissy Field, Fort Point National Historic Site and the Golden Gate Bridge to the west. This project replaced a 75-foot section of collapsed retaining wall and roadway atop an eroded coastal bluff, enabling over a million visitors a year to continue to safely use the trail.

2. Project Activities & Outcomes

McDowell Avenue was constructed along the northern San Francisco shoreline in the 1870s to provide access from Fort Mason to the newly constructed Quartermaster Pier (no longer in existence having been replaced by Muni Pier and Alcatraz Embarkation Pier). The collapsed wall was constructed as a mortared rubble stone wall serving as both a guardrail and a retaining wall for the outboard edge of the road along the top of the bluff. Sometime after 1911 the wall received a cement and sand grout coating that created the appearance of a cement wall. Both the road and the retaining wall are contributing features to the Fort Mason Historic District, a National Register property. The site of the road is on a natural bluff subject to erosion from wave action on the bay. The bluff itself is one of the last remaining natural coastal interfaces along the San Francisco shoreline in San Francisco Bay.

While vehicular use of the road is restricted to service vehicles, this section of the San Francisco Bay Trail is heavily used by bicyclists, pedestrians and joggers traveling between Fisherman's Wharf, San Francisco Maritime National Historical Park and the Alcatraz Embarkation Pier to the east, and the Presidio, Fort Point National Historic Site, and the Golden Gate Bridge to the west. Over a million visitors a year travel through the site, enjoying the dramatic views of Alcatraz Island, San Francisco Bay and the Golden Gate Bridge. Waysides along the trail describe the significance of the San Francisco Port of Embarkation National Historic Landmark District, which can be seen on the waterfront below.

Investigations in 2008 revealed that 134 feet of the retaining wall and 264 feet of the roadway were vulnerable to collapse where the bluff had eroded under the cut and fill portions of the roadway, causing the retaining wall to crack and lean out while the roadway was settling adjacent to the wall. Following a period of heavy rainfall in March of 2011, a 30-foot section of the retaining wall and the adjacent outer edge of the roadway collapsed and fell into the bay below. While the width of roadway undermined was minimal, cracking of the roadway was significant. Future erosion of the slope and subgrade materials made additional pavement loss inevitable. Funds had never been available to make the intended repairs. The park installed a temporary chain link fence inboard of the failed retaining wall and roadway to protect visitors.

The Cosco Busan project focused on the failed section of the wall and roadway, as well as the most vulnerable adjacent areas. Cosco Busan funded development of construction documents and construction to replace 75 linear feet of failed retaining wall with a cast-in-place wall supported by drilled concrete piers. The new cast-in-place retaining wall was designed to match the appearance of the adjacent existing wall to maintain the historic integrity of the site. In addition, approximately 100 feet (330 square yards) of asphalt roadway was replaced, necessitating rerouting of utilities around the work including installation of new ducting and manholes. Site lighting in the affected area was also restored.

The San Francisco Bay Trail is a series of connected walking and cycling paths that ring the San Francisco and San Pablo bays. The Bay Trail, currently more than 350 miles in length, connects communities, parks, open spaces, schools and transit. It provides space for recreation and active transportation to work, school and other destinations in the community.

3. Benefits

This project provided permanent repairs to the bluff edge of McDowell Avenue, which serves as a critical portion of the San Francisco Bay Trail and as a service road for maintenance vehicles. To ensure the road remains safe, the project design took into consideration the site geology as well as the need to withstand seismic loads. Given that the service road sits on a natural bluff subject to erosion from wave action on the bay, the project addressed the risk of further collapse by drilling piers into the rock strata, providing an improved foundation to the retaining wall which also better supports the existing slope. The service road continues to support park operations. The concrete retaining wall and roadway repairs have a life expectancy of over 100 years.

The remaining 95 feet of retaining wall, although cracked in various locations, is in better condition but is likely to require repairs at some point in the future.

4. Lessons Learned

The contracting method for the project endeavored to obtain the lowest price with a technically acceptable design and construction outcome. A Choosing-By-Advantage (CBA) process was used to select the preferred alternative and considered the following attributes that protect natural and cultural resources, provide for visitor enjoyment, improve efficiency of park operations, and provide cost effective, environmentally responsible, and otherwise beneficial development for the NPS:

- Cost
- Similarity to historic existing features
- Life cycle costs
- Ease of future expansion to include all of McDowell Avenue
- Traffic control, access delays, duration of construction
- Further erosion of cliff face

Two alternatives received the same high score through the CBA analysis and the less costly of those 2 alternatives was selected as the final preferred alternative for design and construction. The least costly alternative was rejected since its advantages were significantly lower than the other 2 alternatives.

The McDowell Avenue project unexpectedly encountered live, but defunct, high voltage electric lines within the project area, even though historic documents and utility infrastructure locations had been researched. Additional utilities verification is critical in former military installations and areas with long historic occupancy prior to more modern-day record-keeping. The NPS was fortunate in that it was able to partner with the Presidio Trust High Voltage Team to deactivate and remove the defunct high voltage lines from the project area.

The project originally intended, for convenience, to maintain public and service vehicle access to the project area during much of the construction, with a detour in place for periods of closure. Due to unforeseen circumstances (e.g. encountering the high voltage lines) and to reduce overall construction duration, full closure of the project site was required for a longer period than anticipated. Partial versus full closure during construction resulted in tradeoffs between convenience and efficiency.

5. Funding acknowledgement

Funding for this recreational use restoration project was provided by the Cosco Busan Trustee Council comprised of the California Department of Fish and Wildlife, the California State Lands Commission, the National Oceanic and Atmospheric Administration, and the Department of the Interior through the U.S. Fish and Wildlife Service and the National Park Service.

Additional partners engaged in this project included numerous NPS and Golden Gate National Parks Conservancy staff, the Presidio Trust High Voltage Team, and San Francisco Water, Power and Sewer that has utilities in the immediate vicinity of the project.

6. Figures

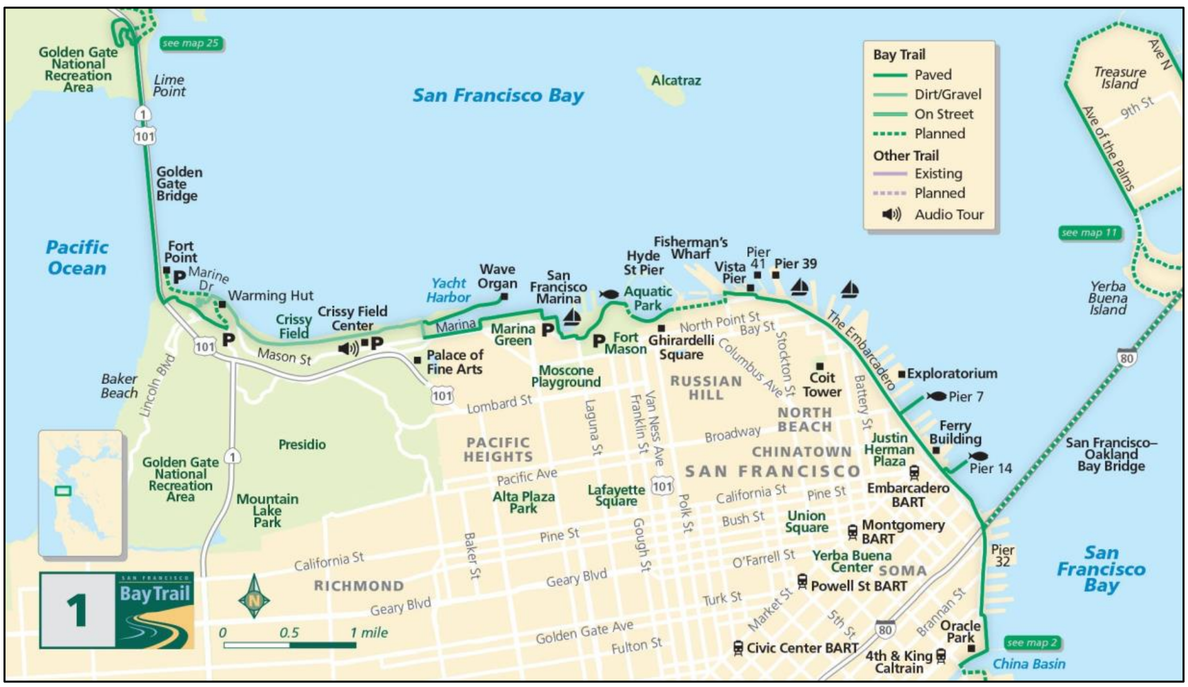

Figure 1. Bay Trail – San Francisco and Northern Waterfront section.

Figure 2. McDowell Avenue Retaining Wall Repair Project Location.

Figure 3. View of the landslide that undermined McDowell Avenue
from Pier 3 at Lower Fort Mason.

Figure 4. McDowell Avenue retaining wall showing a portion of the collapsed section.

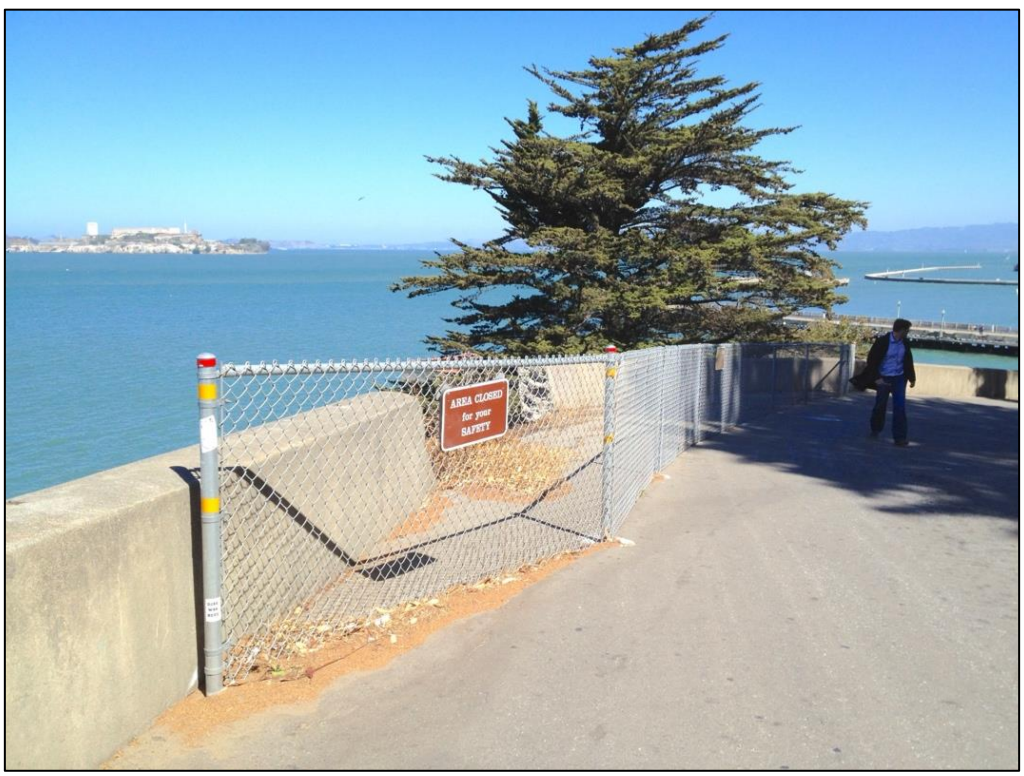

Figure 5. A more permanent chain link fence was installed for safety.

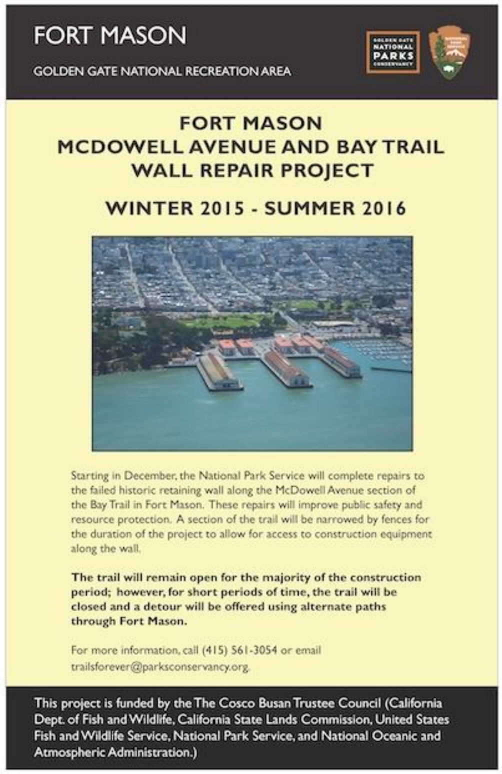

Figure 6. The poster installed on a wind-master sign board to inform the public about the upcoming construction project.

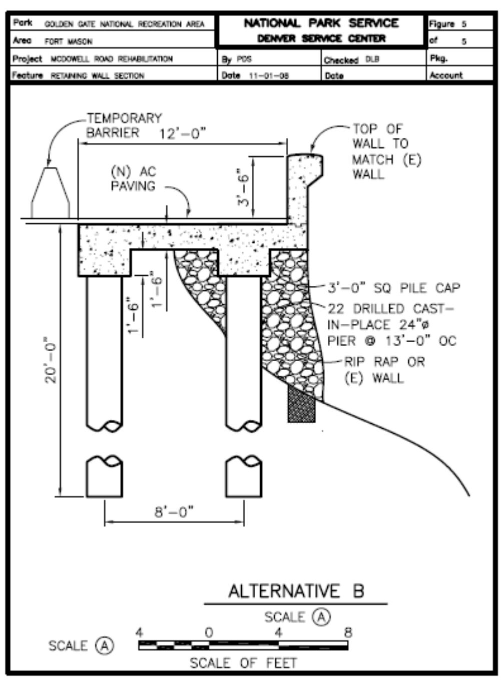

Figure 7. Engineering drawing of the drilled cast-in-place piers installed to support the repaired concrete wall, roadway and trail.

Figure 8. Drilling for the cast-in-place 24” piers.

Figure 9. Constrained site where the drilled piers are being installed.

Figure 10. Slab reinforcement for the repaired roadway and concrete wall.

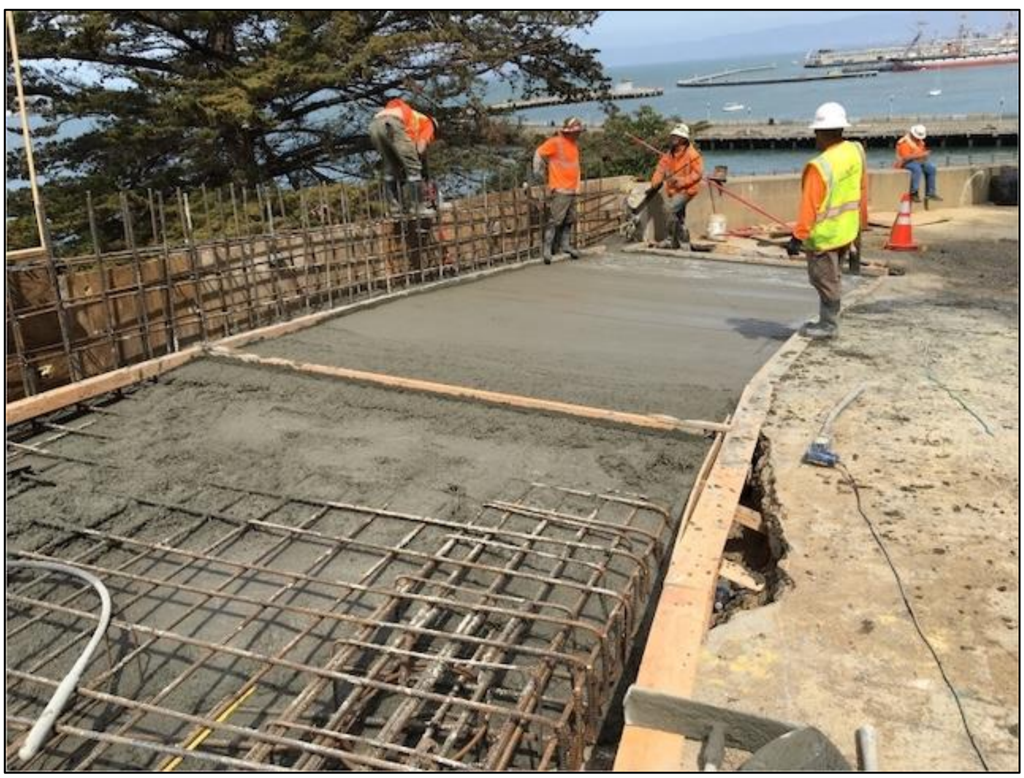

Figure 11. Concrete placement in the roadway.

Figure 12. Finish work on the top of the concrete wall to match the historic wall.

Figure 13. Trenching for the new utility duct bank.

Figure 14. Preparing the roadway surface for asphalt overlay.

Figure 15. Project complete and Bay Trail segment reopened to the public in June 2016.