

Super Bulkhead Wharf

Seismic Adaptation Measure



SHORELINE STABILIZATION



TYPE: Structural

SHORELINE LOCATION:



Nearshore



Example of piles installed to support new wharf structure ©SGH

DESIGN LIFE

75+ years

ADAPTABILITY

Medium

IMPACT ON THE WATERFRONT

Moderate Waterside Intervention

CONSTRUCTION COST

High

SEISMIC HAZARDS MITIGATED:

Lateral Spreading



Liquefaction



SEISMIC PERFORMANCE IMPROVED:

Structures



Utilities and Transportation



MEASURES COMPATIBILITY:

Flood

Raised Marine Structures

Seismic

Liquefaction Mitigation | Utility Retrofit

DESCRIPTION:

New robust wharf structure that would replace the existing bulkhead wall & wharf and be strong and stiff enough to stabilize the rock dike. This will reduce lateral spreading ground displacements to The Embarcadero, but will not stop liquefaction of the Embarcadero fill.

CONSIDERATIONS:

- The quantity and diameter of the piles would be defined by the depth of the Young Bay Mud and bedrock which varies along the waterfront.
- Measure is less effective in areas of medium to deep Young Bay Mud.

ADVANTAGES:

- Less construction impact to the Embarcadero and Promenade compared to landside shoreline stabilization measures.
- Replaces deteriorated wharf structures. Can elevate wharf for future sea level rise protection.

DISADVANTAGES:

- Construction would require closure of waterfront buildings and relocation of tenants when the work occurs at an occupied pier.
- Construction duration likely longer than other shoreline stabilization measures.
- Does not mitigate liquefaction-induced settlements.

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CONSTRUCTION IMPACTS TO THE PUBLIC:

- Construction would require temporary relocation of waterfront buildings to allow demolition and reconstruction of the wharf below.
- Impacts would be most noticeable to the occupants of the affected pier.
- Most construction work would be done from the water-side of the seawall.
- Impacts to users of the promenade and the Embarcadero would be limited.

SEA LEVEL RISE ADAPTATION OPPORTUNITIES:

- New wharf could be placed at a higher elevation and could support a flood barrier at the wharf edge.
- New wharf can be designed to be raised in the future.

DESIGN CONSIDERATIONS:

- The quantity and diameter of the piles would be defined by the depth of the Young Bay Mud which varies along the waterfront.
- Measure is not effective in areas of medium to deep Young Bay Mud.
- Seismic joint needed at finger piers and shed.
- Consider combining with Drilled Shaft measure to create a hybrid scheme.

SITE-SPECIFIC CONSIDERATIONS:

- This measure is likely limited to the Fisherman's Wharf area and the northern end of the Embarcadero where the Young Bay Mud is shallow.

URBAN DESIGN CONSIDERATIONS:

- Rebuilt wharf structures can be designed with improved materials and uses.

HISTORICAL RESOURCE CONSIDERATIONS:

- Demolition of historic bulkhead wharves and portion of piers is required, loss of resources.
- Historic pier-supported buildings would need to be removed temporarily during construction and replaced once the work is complete.

INSTALLATION AND CONSTRUCTABILITY CONSIDERATIONS:

- Driving large steel piles through rock dike may require pre-drilling.
- Pile driving through rock dike can be noisy.