SIMPSON GUMPERTZ & HEGER

Engineering of Structures and Building Enclosures

Brooklyn Basin Wharf Repair and Seismic Retrofit

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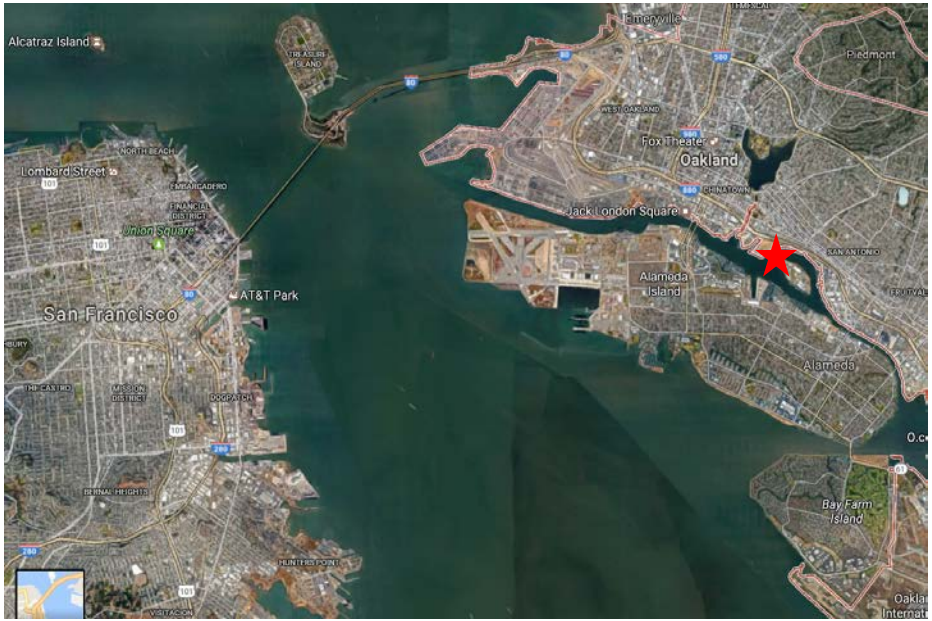
Outline

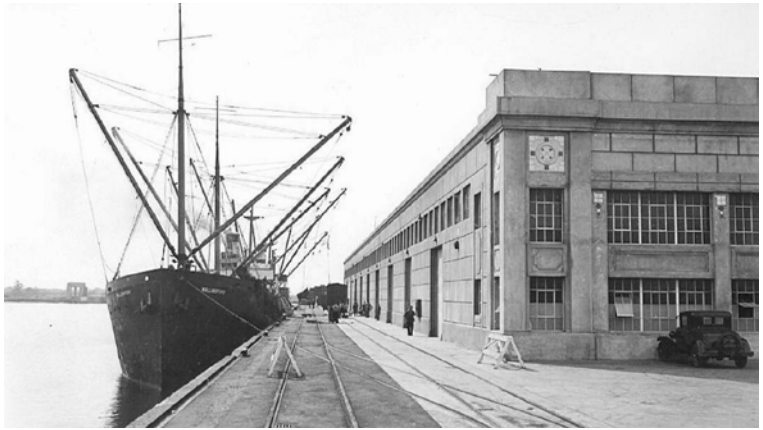
- Project Introduction
- Pile Inspection and Assessment
- Structural Slab Overlay to Ensure Life Safety under Seismic Loading
- Top-side Wharf Crack Repair Strategies
- Seismic Retrofit of Existing Warehouse

Project introduction

- Former Port of Oakland Shipping Terminal
- 10 acre Shoreline Park
- Existing Structures built between 1930 - 1950
  - 1000 ft. Warehouse
  - 1200 ft. x 225 ft. wharf

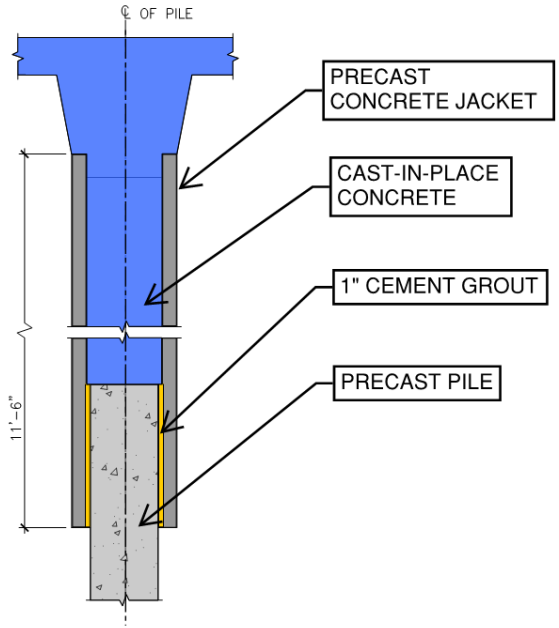


Project Introduction - Background



Project Introduction – Existing Conditions

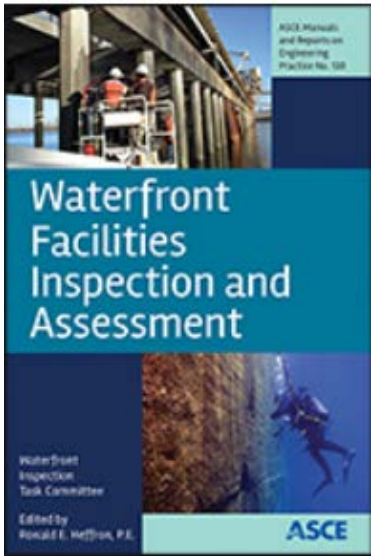
Project Introduction- Piles



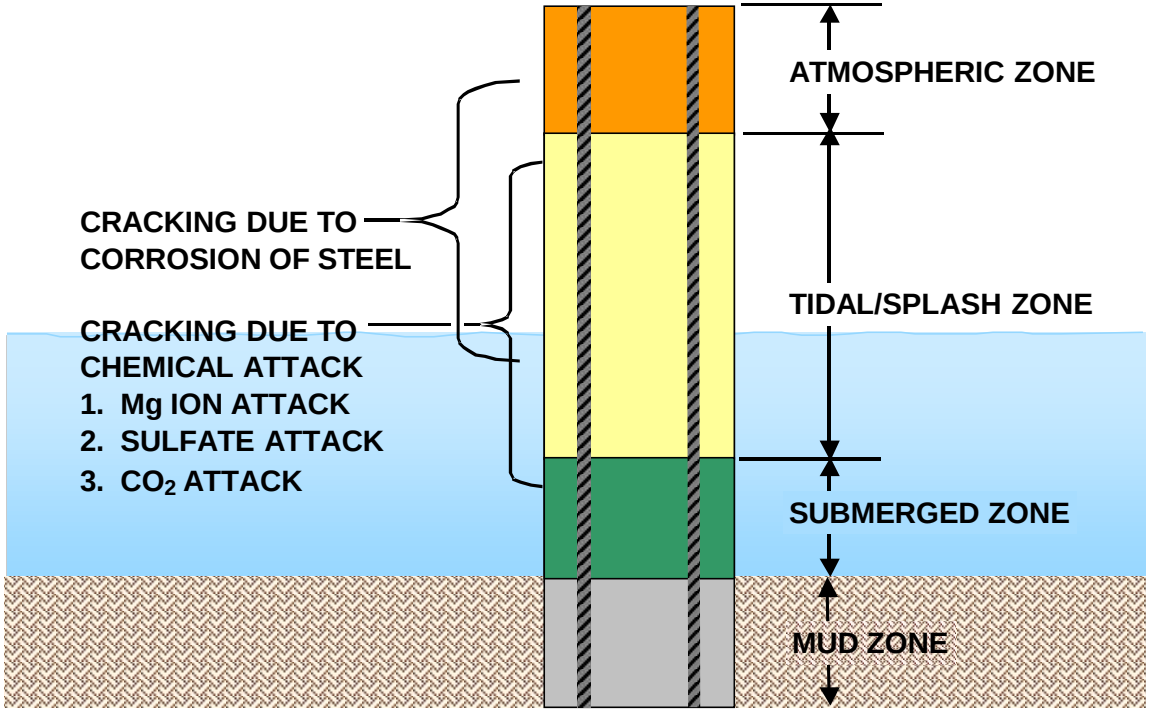
Wharf Evaluation – Inspection

- Concrete Core Testing of Wharf Deck, Pile Jackets, and Piles

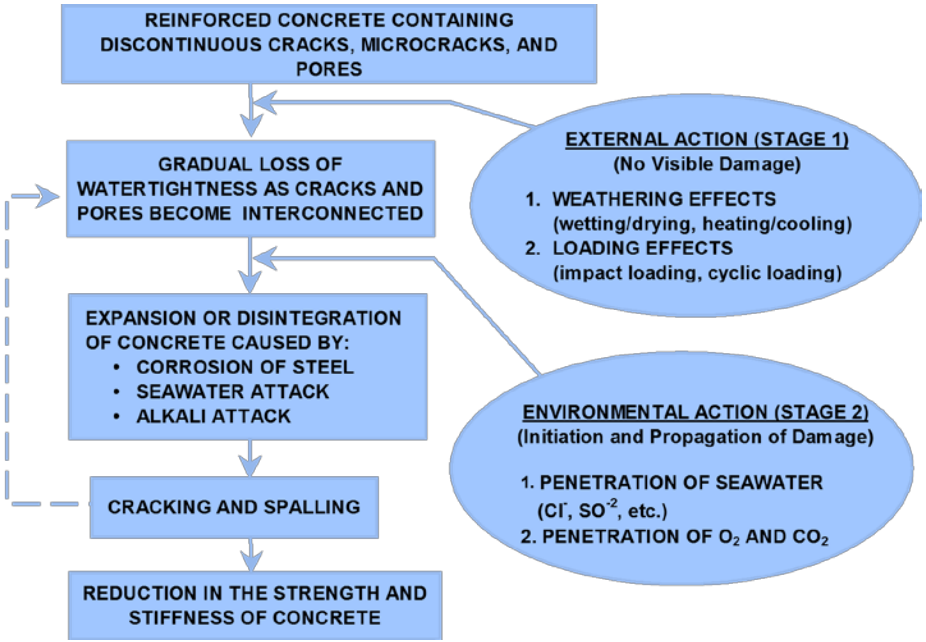
- Pile and Wharf Visual Inspection
  - ASCE Manual of Practice 130:
    Waterfront Facilities Inspection and Assessment



Wharf Evaluation – Typical Cracking in Marine Piles



Wharf Evaluation – Deterioration Mechanism in Marine Environment



Wharf evaluation – Test data

- Carbonation depth
- Chloride content
- Concrete compressive strength
- Petrographic Examination

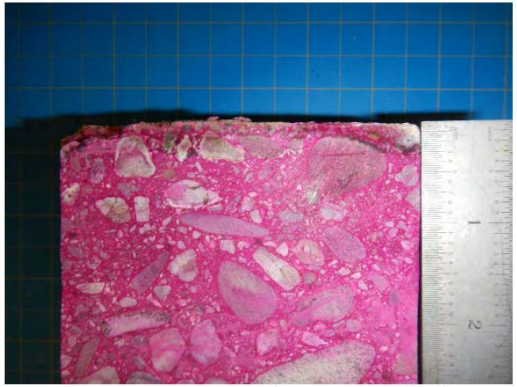
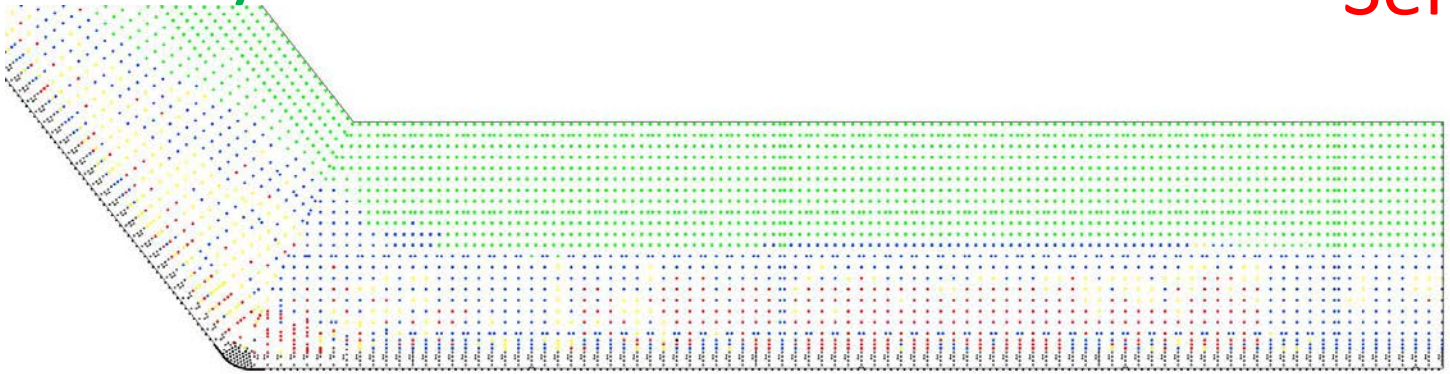


Photo #1– Depth of carbonation on sample P109G-B

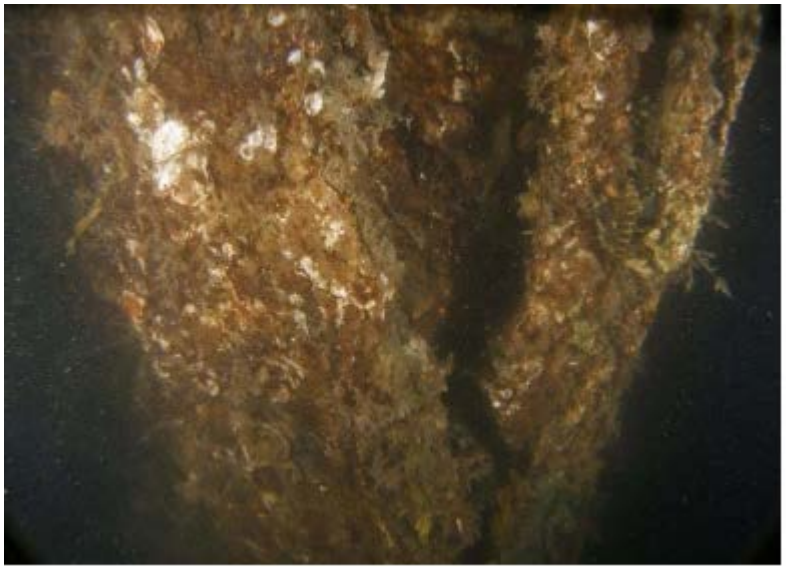


Satisfactory Fair Poor Serious



Wharf evaluation – Pile inspection

Pile Jacket Deterioration



Pile concrete spall and section loss

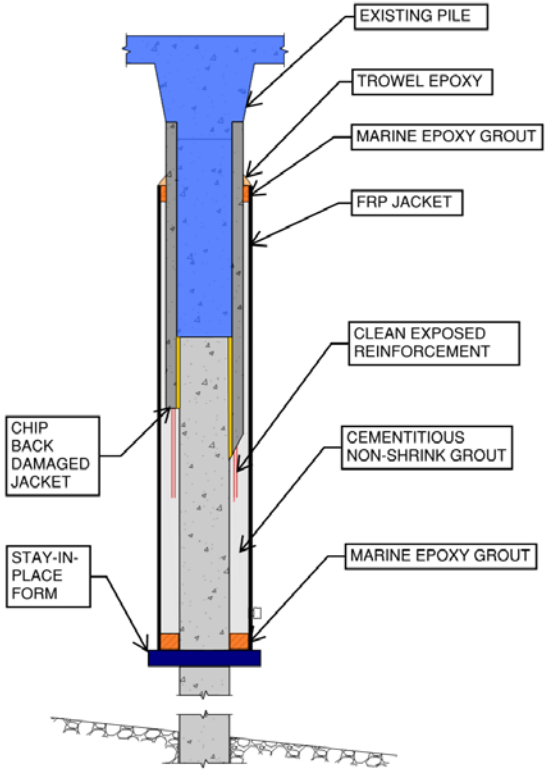
Wharf evaluation – Pile repair

Procedure:

- Chip away damaged concrete and clean exposed reinforcement

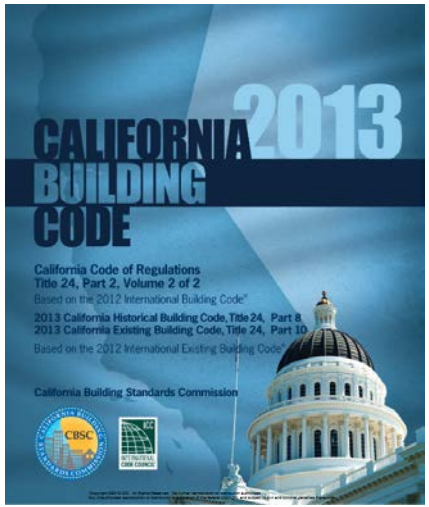
- Install bottom form and Fasten FRP Jacket into place with or without new reinforcement

- Place epoxy materials into Jacket
  - Marine Epoxy Grout
  - Cementitious Non-shrink Grout
  - Trowel Epoxy

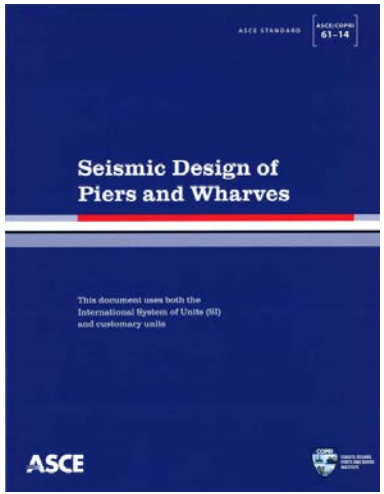


Wharf retrofit design criteria

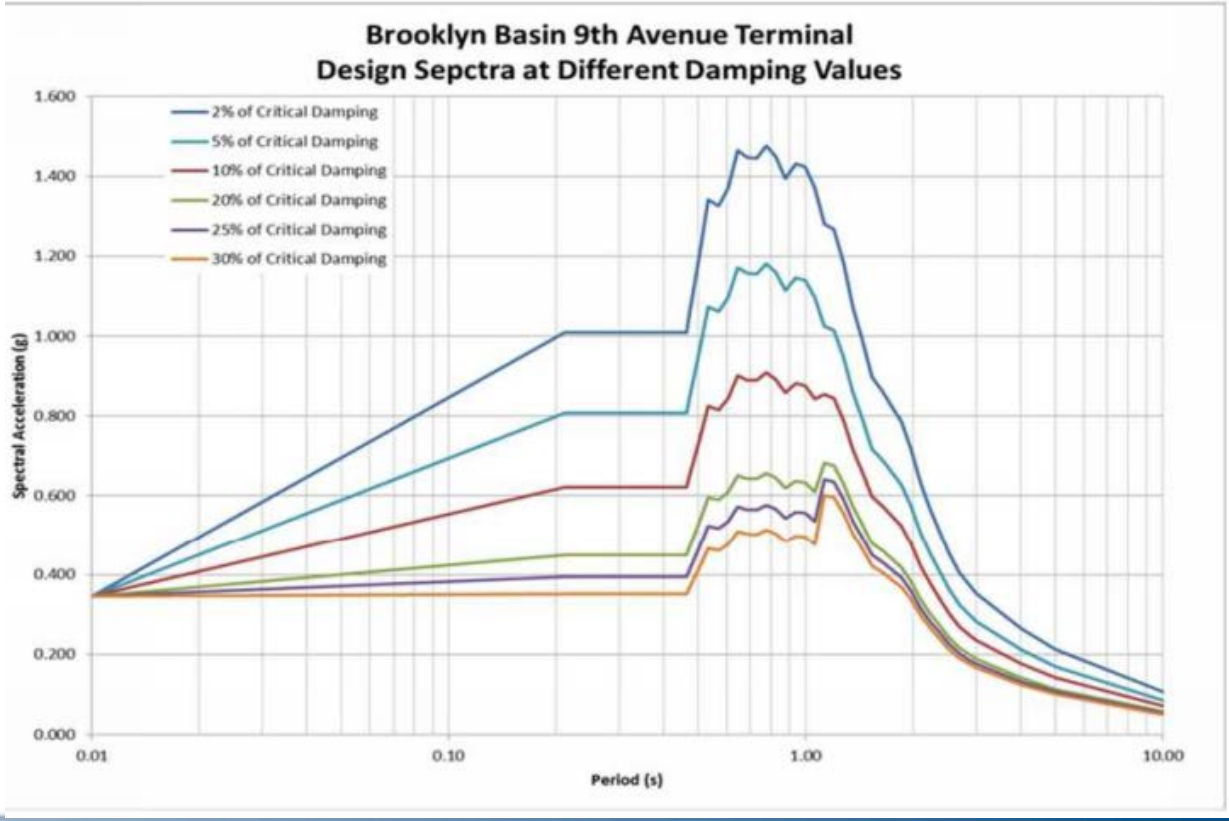
- California Building Code Chapter 31F
  - Marine Oil Terminals (MOTEMS)



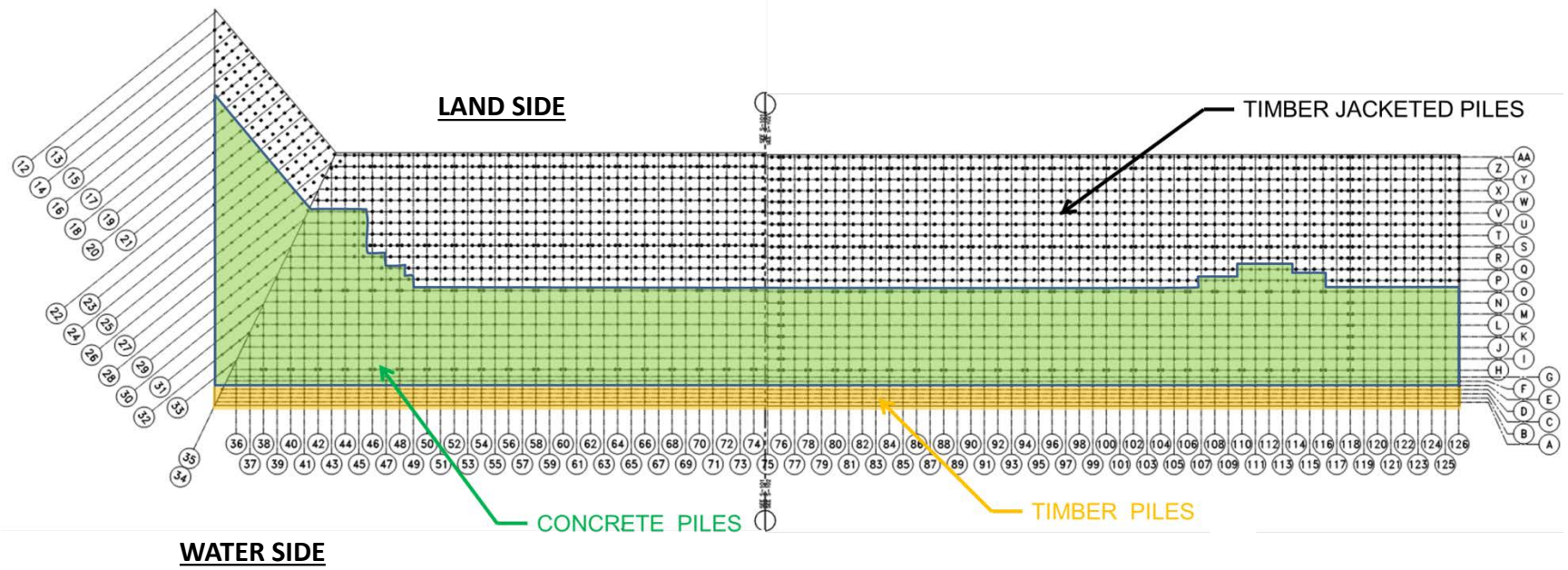
- ASCE 61-14
  - Seismic Design of Piers and Wharves



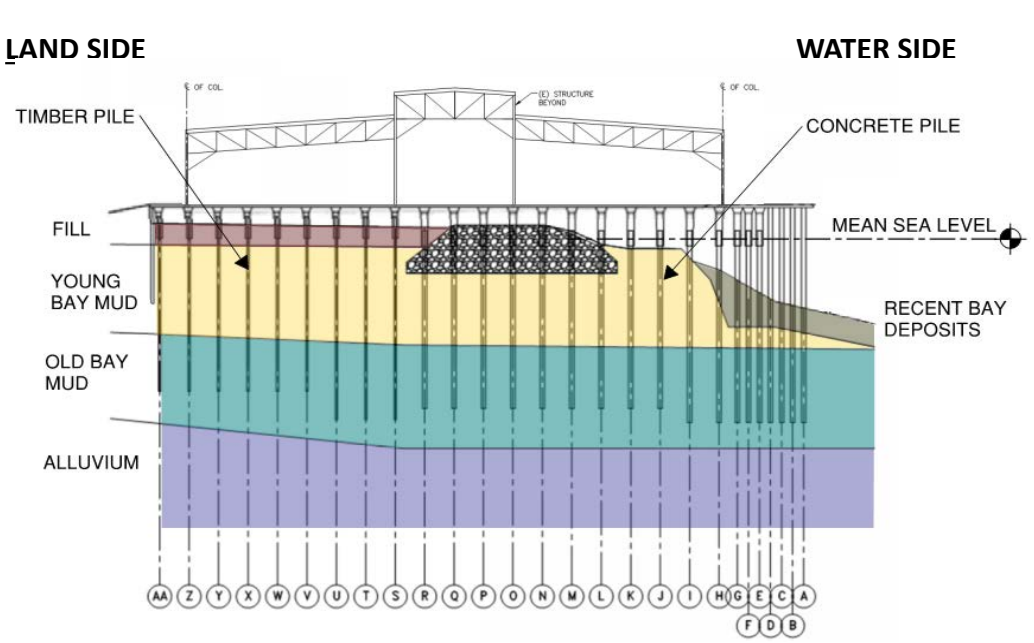
Site Specific Spectra



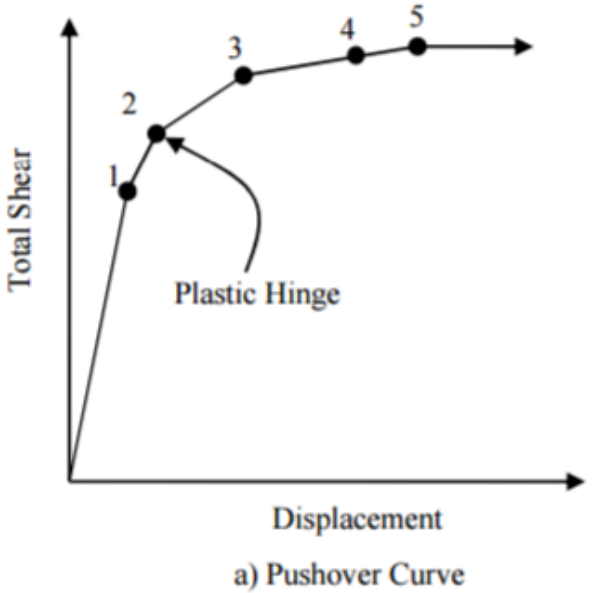
Wharf evaluation - Overview



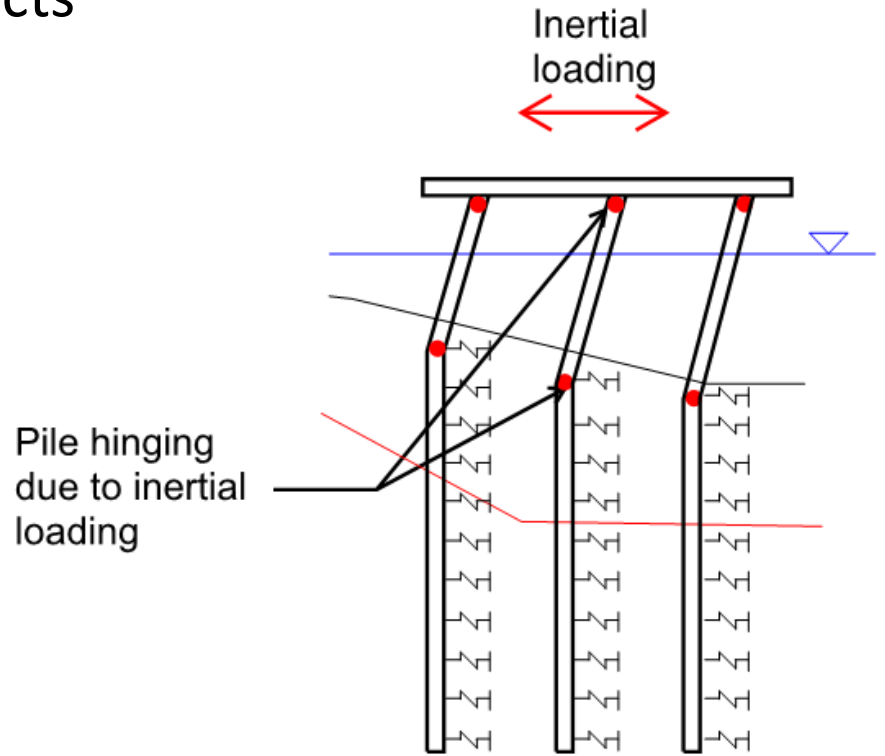
Wharf Evaluation – Existing rock dike



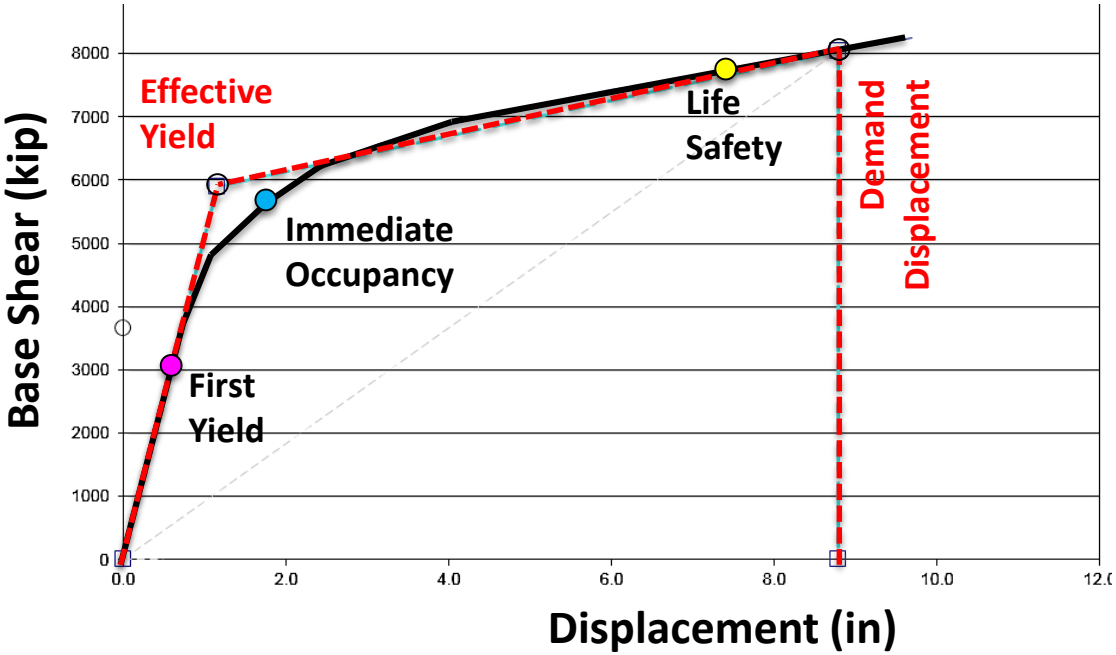
Wharf evaluation – Inertial effects

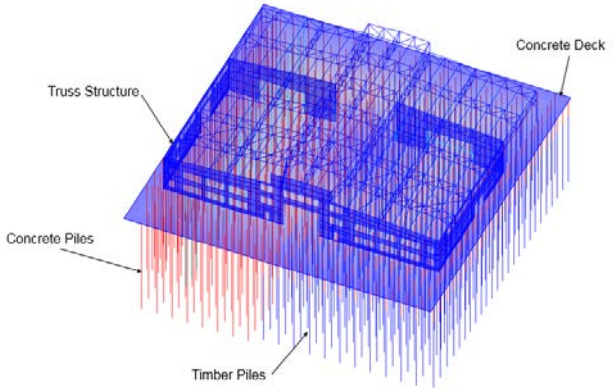


a) Pushover Curve

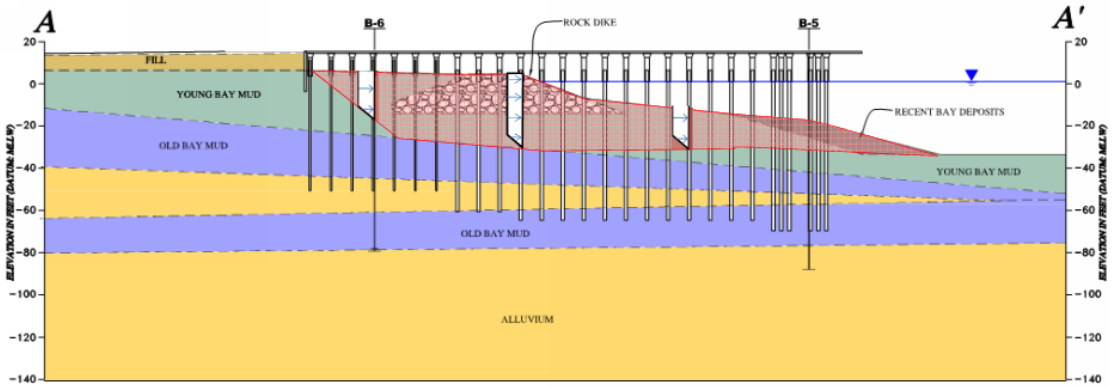


Wharf Evaluation – Pushover Analysis

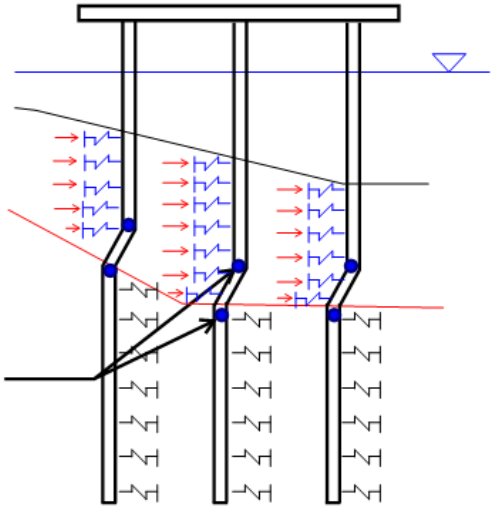




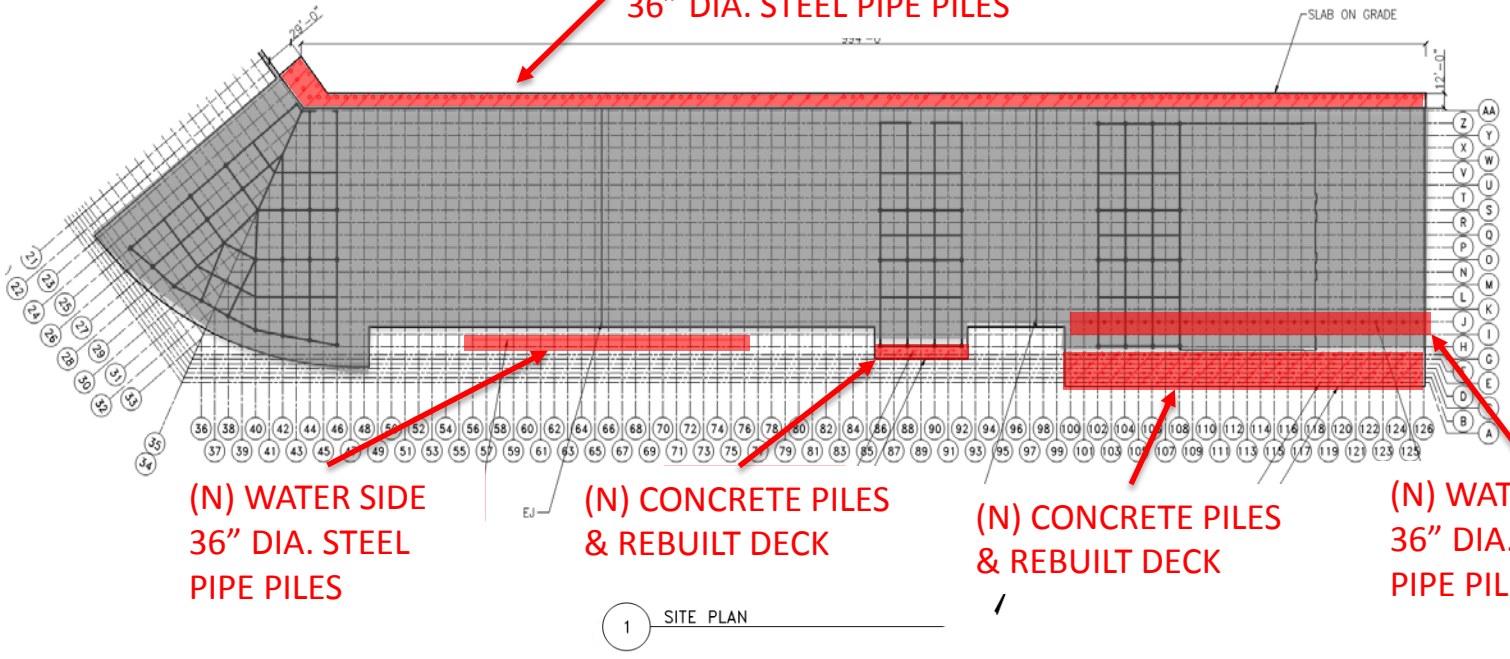
Wharf evaluation – Kinematic Effects



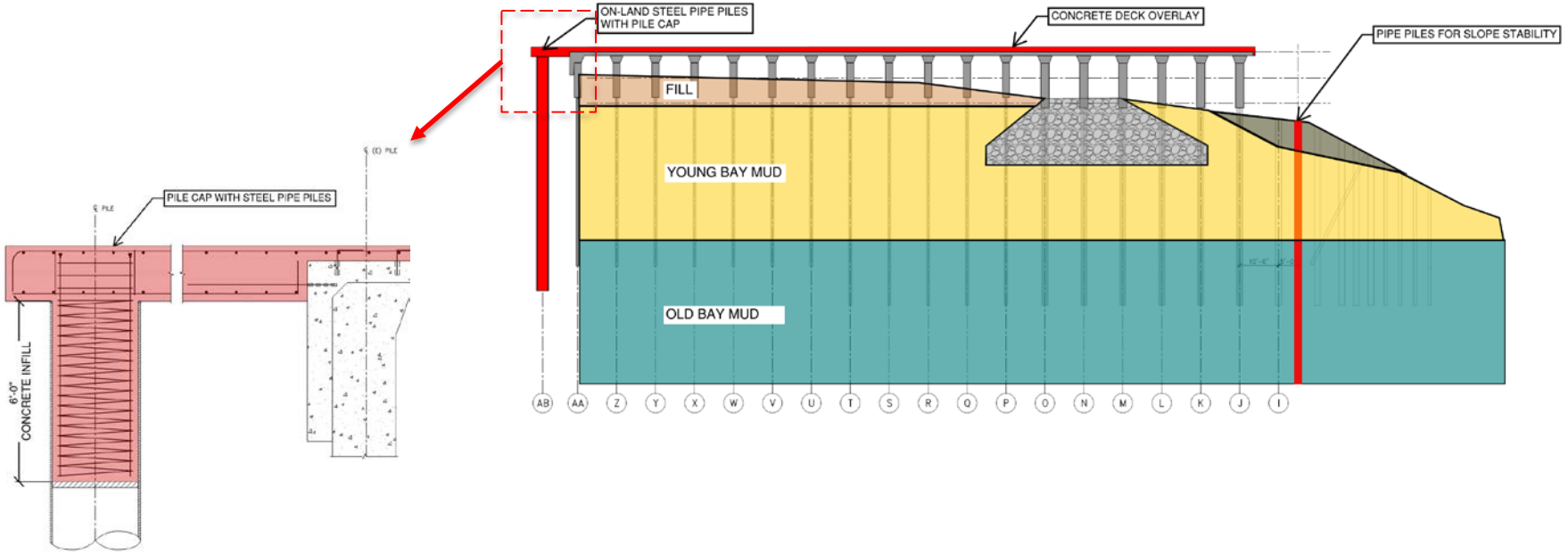
Pile hinging due to kinematic loading



Wharf retrofit

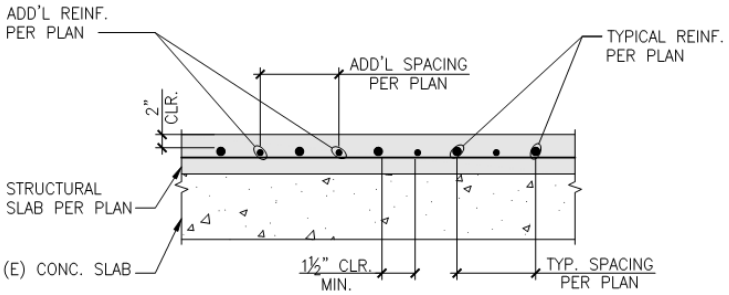


Wharf retrofit



Wharf Retrofit – Overlay

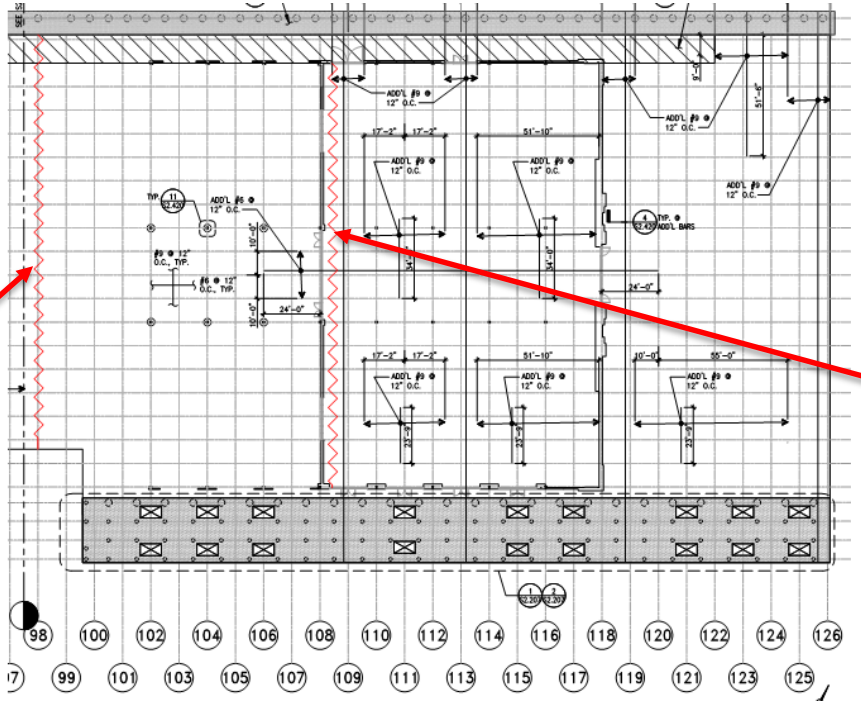
- Repair any existing temperature and shrinkage cracks in existing slab
- Roughen top surface of the concrete deck
- Remove contaminants



Z_ADD'L REINF.PLACEMENT

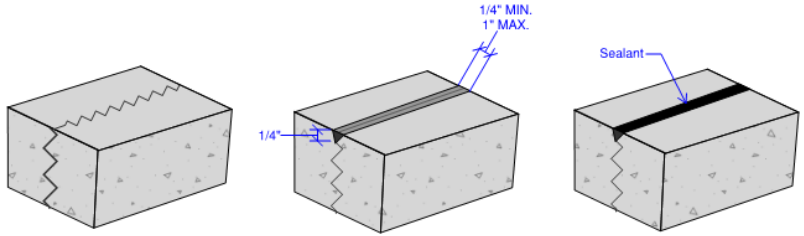
4 ADDITIONAL SLAB REINFORCEMENT DETAIL

Wharf Retrofit – Slab Installation



Wharf Retrofit – Overlay

- To repair the cracks, groove cut the crack with a saw or chipping tool
- After the routed crack is cleaned and allowed to fully dry, apply the sealant to the crack.
- Sealants are polyurethane materials

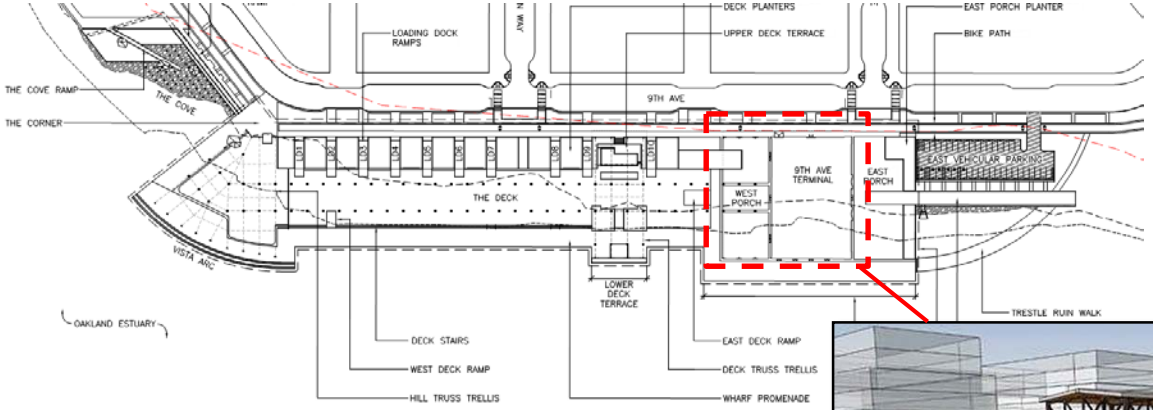


1) Existing Condition

2) Rout crack and clean surface of any dust or contaminants. Allow the surface to fully dry.

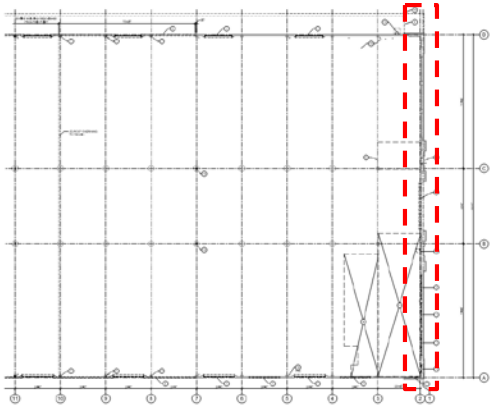
3) Apply sealant to the surface.

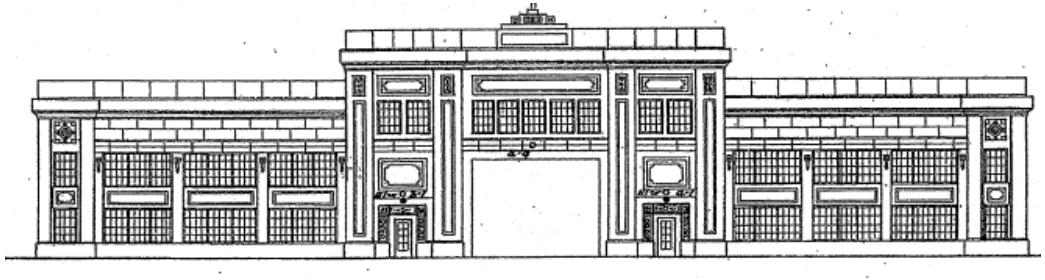
Terminal Building Retrofit – Overview



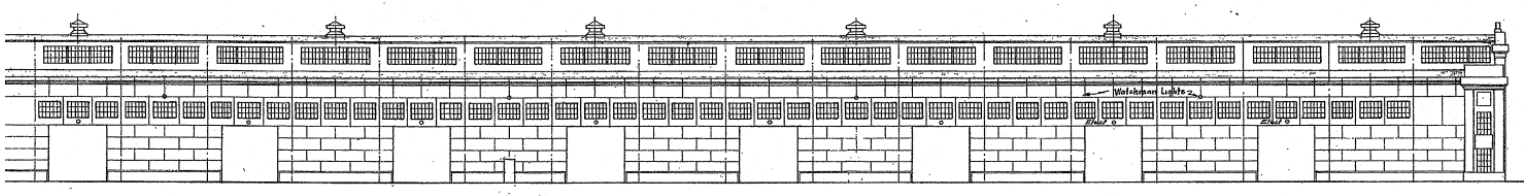
- 180 ft. Wide x 192 ft. Long -
- Steel Trusses with Concrete Walls
- Large Door Openings with New Large Window Openings

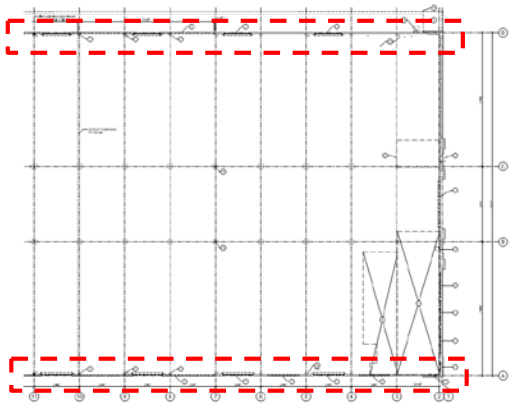
Terminal Building Retrofit – East Wall





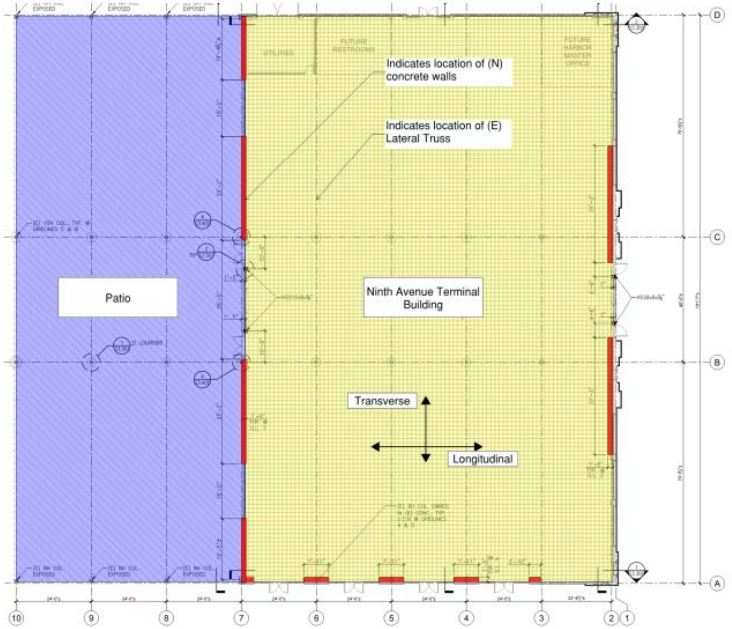
Terminal building Retrofit – North and South Walls





Terminal building Retrofit – Strategies

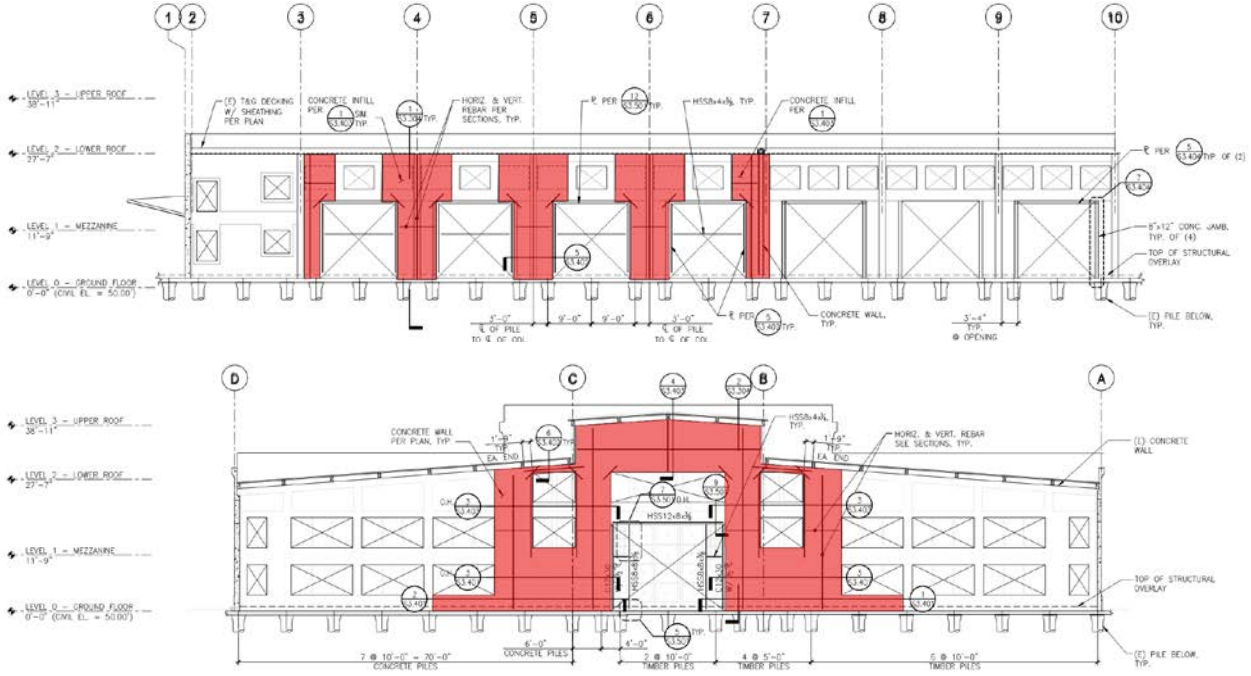
- Shotcrete Wall Strengthening at East and South
- New West Wall
- Wall Anchorage



Terminal Building Retrofit – Shotcrete Walls

South wall

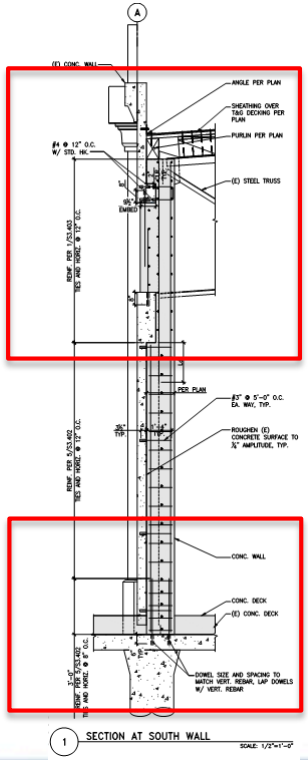
East wall

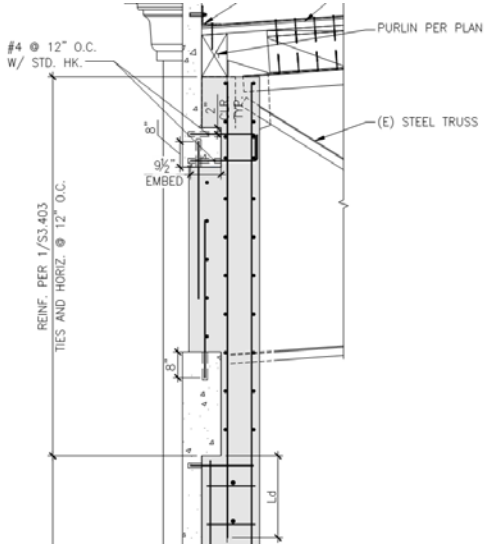


Terminal Building Retrofit – South Wall Elevation

1

2





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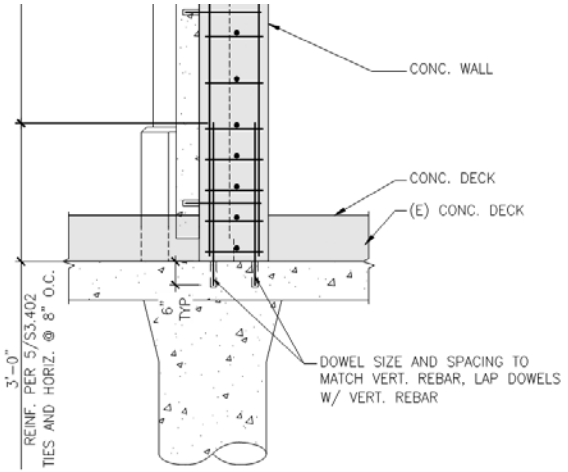
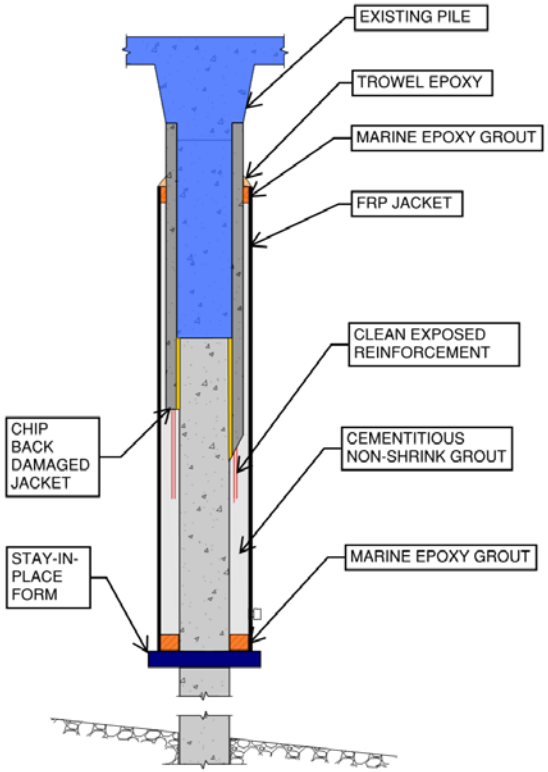


2

Summary

- **Existing Piles and deck repaired**
- New Structural Overlay
- New Steel Pipe Piles
- Terminal Building Retrofit



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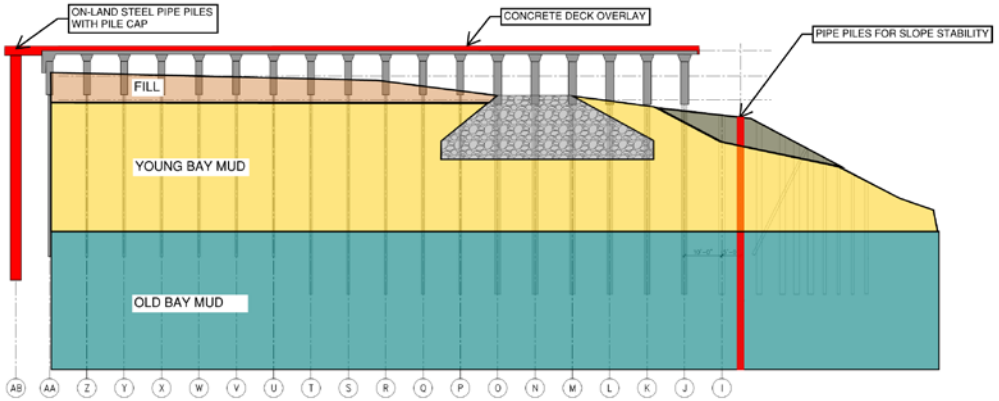

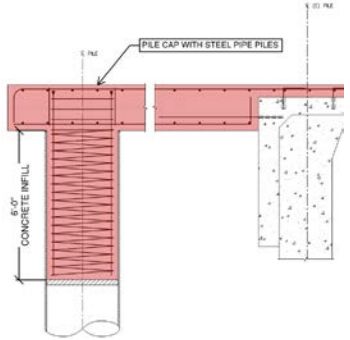

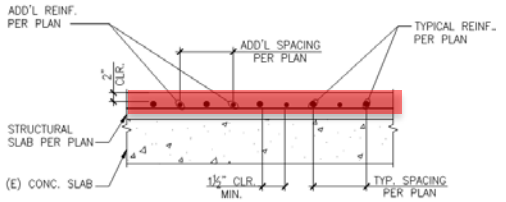

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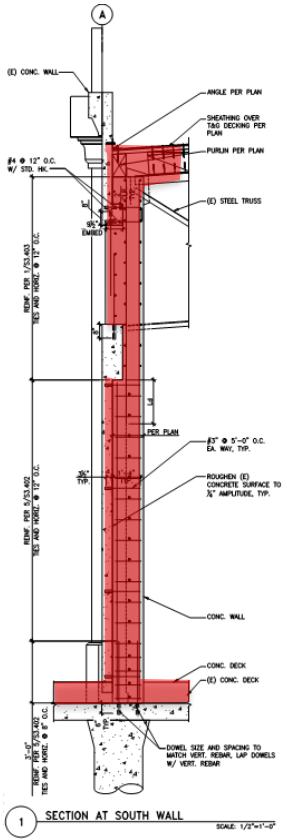
- **Terminal Building Retrofit**



Construction Updates

Construction Updates

Questions


CITYLIFE INSPIRED
BY THE SEA
THE NEIGHBORHOOD
PORT OF OAKLAND
9TH AVE. TERMINAL