
# Summary Report On Interim Inspection, Testing, and Preliminary Analysis of Alameda Piers 1, 2, and 3

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SGH Project 167543

SIMPSON GUMPERTZ & HEGER

Engineering of Structures and Building Enclosures

## PREPARED FOR:

City of Alameda
950 West Mall Square
Alameda, CA 94501

## PREPARED BY:

500 12th Street, Suite 270
Oakland, CA 94607
Tel: 510.457.4600
Fax: 510.457.4599

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and Rehabilitate

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# 1. INTRODUCTION

## 1.1 Purpose

This report provides a summary of the field inspection, engineering investigations, preliminary analyses, and assessments of Alameda Point Piers 1, 2, and 3 in accordance with the scope of work in the Service Provider Agreement with City of Alameda dated 20 July 2016. The work is intended to ensure adequacy in permanently mooring the MARAD Ready Reserve Fleet. The engineering assessment is intended to identify any issues pertaining to the structural capacity of the piers and mooring system and to assist the budgeting and planning of the City.

## 1.2 Scope of Work

The City of Alameda retained Simpson Gumpertz & Heger Inc. (SGH) to perform an interim inspection, testing, preliminary analyses, and reporting for rehabilitation of Alameda Piers 1, 2, and 3. The work includes the following services:

- An above and below-water inspection of Piers 1, 2, and 3.
- Material tests gathered from select locations within the project.
- Geotechnical investigation of Piers 1, 2, and 3 for purposes of structural assessment.
- Preliminary analysis of Piers 1, 2, and 3 which includes mooring and structural assessment.
- Repair and replacement recommendations for applicable piers.
- A report documenting findings and summary of the project.

The report herein is meant to provide a structural condition assessment and recommended improvements to Piers 1, 2, and 3 at Alameda Point for the purpose of adequately mooring the MARAD Ready Reserve Fleet.

The analyses and assessment of the facility were performed in accordance with the MARAD lease requirements (Appendix H), UFC 4-152-01, “Unified Facilities Criteria, Design: Piers and Wharves,” and UFC 4-159-03, “Unified Facilities Criteria, Design: Moorings.” These documents were used as the basis for determining fitness-of-purpose of the piers at Alameda Point.

## 2. DESCRIPTION OF FACILITY

### 2.1 General

Piers 1, 2, and 3 were originally constructed in the 1940's as part of the Alameda Naval Air Station. All piers were oriented in an east-west direction, with the head of the piers at the west end. The inner 1,000 ft of Pier 2 was initially constructed around 1940. Construction of Pier 3 followed soon after in 1943. Pier 1 was constructed about three years after Pier 3, in 1946.

Pier 2 was extended by 210 ft in 1977. At that time the mooring dolphin at the head of Pier 2 was also constructed. In 1980, Pier 1 was substantially rebuilt. Other minor construction and utility modification projects have been done on the piers since their original construction.

The Navy berthed carriers and other vessels at the piers from 1940 to 1995. Piers 2 and 3 served as carrier piers. Pier 1 is smaller and we understand this pier served smaller vessels. The carrier pier designation signifies that they provide more utilities and utility capacity including steam. Also, the carrier pier designation implies that the piers were originally designed for heavy vehicle, crane and deck live loads, and large mooring forces. The piers have been subjected to the marine environment for many years and, as a consequence, have deteriorated to some extent.

In the mid-1990s as part of the Base Realignment and Closure (BRAC), the Navy ceased operations in Alameda and vacated the Naval Air Station.

#### 2.1.1 Pier 1

Pier 1 is a cellular type sheet pile pier that is approximately 660 ft long by 53 ft wide. The rebuilding of the pier in 1980 consisted of constructing a system with king piles with infill concrete panels exterior to the existing cellular panels. Concrete was placed between the new and existing structures. The south side of the pier consists of king piles nominally spaced 6 ft-8 in. o.c. with profiled precast concrete panels between. The north side consists of king piles with the same 6 ft-8 in. spacing supporting flat concrete panels. The king piles on opposing sides are connected with a 3 in. diameter tie rod. The interior of Pier 1 is filled with sand.

The deck is typically made out of 7-1/2 in. thick concrete slab panels about 20 ft wide by 20 ft long. There is an existing pile cap with an additional newer pile cap from 1980 over the

king piles and precast panels. A rubble mound breakwater extends west from the west end of the pier but was not assessed within this report.

### 2.1.2 Pier 2

Pier 2 is a typical concrete pile and deck pier. The original pier was about 1000 ft long by 80 ft wide. The original pier consisted of an 8 in. concrete slab supported by transverse concrete bents spaced 12 ft o.c. The bents are supported by 20 in. square precast piles with eight piles per bent. The extension is an additional 210 ft long by 80 ft wide with bents being supported by 18 in. square precast, prestressed piles. The lateral support is provided by precast concrete batter piles where the load path goes from the mooring hardware to the deck, from the deck to the pile cap, and from the pile cap to the batter piles. Through the length of the pier, there are two batter piles per bent excluding the end of the addition, where there are four batter piles per bent. There are approximately 858 plumb piles and 216 batter piles total.

A mooring dolphin is located approximately 150 ft west of the pier. The dolphin is supported by thirty-eight 24 in. square precast, prestressed concrete vertical and batter piles total.

### 2.1.3 Pier 3

Pier 3 is a typical concrete pile and deck pier. The pier is approximately 1100 ft long by 150 ft wide. The reinforced concrete slab is 26 in. thick at the outer most region thinning to 10 in. thick at the center. The deck is supported by 20 in. square precast concrete piles with 28 in. square jackets covering the top 13 ft of the pile. Rows of nineteen and eight piles alternate every 6 ft along the length of the pier. The lateral support is provided by precast concrete batter piles where the load path goes from the mooring hardware to the deck, and from the deck directly to the batter piles.

## 2.2 Mooring Hardware

Pier 1 mooring hardware consists of large bollards with horns and 42 in. cleats located throughout the pier with varying spacing. The south side has nine bollards and eight cleats, alternating between the two. The north side has two bollards and eight cleats. The mooring hardware is located on the innermost (original construction) concrete cap with the exception of two bollards, one on the north side and one on the south side being placed on the newer concrete cap.

Pier 2 and 3 mooring hardware is typically located between bents, spaced three bents apart, or 36 ft. The arrangement consists of one bollard for every two cleats, placing the bollards about 108 ft apart. Additional bollards are placed as necessary in several locations along the north and south side of Pier 2.

The nominal capacity of the bollards and cleats are calculated to be 70 kips and 40 kips respectively. These calculated capacities are consistent with UFC 4-159-03 Table 6-11 as well as the values in the previous condition report “Condition Assessment Report for Pier 1, Pier 2, & Pier 3” by Moffat & Nichol.

## 3. ABOVE AND BELOW WATER PIER INSPECTION

### 3.1 Above Water Inspection

SGH performed a multiday inspection including visual inspection of all structural components accessible for Piers 1, 2, and 3. The team was led by Rune Iversen, P.E. in the period between July and December 2016. We recorded and documented damage to pile caps, piles, soffit, and exterior deck facing overall assessment of the facility. We assigned pile ratings to visually inspected piles above water to accompany any ratings assigned in the underwater inspection. We utilized the extents of the damage to evaluate the structure in the preliminary analysis. SGH conducted a topside inspection as well for all piers to inspect mooring hardware and surface damage to the deck and curbs. The mooring hardware was assessed and rated in accordance with UFC 4-159-03 “Unified Facilities Criteria, Design: Mooring”.

### 3.2 Below-Water Inspection

Shoreline Engineering, Inc. (Shoreline) provided an underwater engineering inspection of Piers 1, 2, and 3. The inspection consisted of a Level I inspection for 100% of accessible piles. A rating was assigned to every pile inspected with the deficiencies noted for the given pile. A Level II inspection was conducted for specific piles which were chosen representative of the overall pile conditions of the pier. A Level II inspection consisted of marine growth being removed at three elevations of the piles and concrete panels. Thickness measurements of the steel piles and sheet piles were within the Level II inspection scope as well and conducted as stipulated. Level III inspection of a select few Level II locations were chosen to perform further investigation. Level III consisted of concrete cores being taken at eleven piles above the waterline, at mid-water depth, and 3 ft below the mudline from Pier 2 and one pile at three similar elevations for Pier 3.

### 3.3 Inspection Summary

From the inspection, SGH came to the following conclusions:

Pier 1 is in satisfactory condition, but should have maintenance performed to ensure it retains the intended capacity of the structure. The maintenance should include cleaning and recoating of the king piles and repair of the sheet pile bulkhead towards the apron.

The conditions of Pier 2 vary from satisfactory to severe, depending on the structural components and areas. Many piles in Bents 19 to 54 are in poor condition, while the concrete deck and piles outside of Bents 19 to 54 are generally in satisfactory condition. Repairs and maintenance should be considered for piles within Bents 19 to 54 for future long term mooring of the vessels. Load restrictions should be considered until repairs have been completed. Mooring hardware rated Severe should be avoided until repairs have made.

Pier 3 is in satisfactory condition with a limited number of piles showing deterioration. Accessibility of the piles was limited and therefore the condition was assessed from inspected piles. Mooring hardware rated Severe should be avoided until repairs have been made.

There were multiple cracks and spalls of concrete decks of the three piers. Although the cracks and spalls at the present time do not noticeably affect the structural capacity of the piers, we recommend that maintenance repair be conducted for long term durability and operations of the piers.

Appendix A provides detailed inspection results.

## 4. MATERIAL TESTING

SGH performed material testing of the piers to understand the state of the concrete in both the piles and deck of the piers and to identify the deterioration mechanism in the piles. A bulk of the pile concrete damage was located at Pier 2, therefore a majority of the pile concrete core samples were taken from Pier 2. The concrete cores were taken from the following structural components of the piers:

- We selected eleven piles in Pier 2 that represent the overall conditions of the piles at the pier. The current conditions of these piles range from the most deteriorated to moderately deteriorated to good piles. Three concrete cores were taken from each selected pile at varying elevation: one at the splash zone, one within the water column, and one below the mudline.

- We took three concrete cores from one selected pile (i.e., Pile 30-A) in Pier 3 for comparison with those in Pier 2. The three cores were taken from the pile at varying depth in the splash zone, water column, and below the mudline.

- Two samples were taken from both sides (i.e. east end and west end) for each pier deck to be representative of the deck.

The concrete cores were taken to an independent concrete testing laboratory at Applied Materials & Engineering, Inc. (AME) in Oakland. AME conducted the following tests on every core sample:

- Concrete compressive strength tests per ASTM C42.

- Chloride content analyses at varying depths of the concrete cores to determine the extent of the chloride penetration into the concrete piles.

- Petrographic analyses using microscopic examination in order to determine the causes and extent of damages to the concrete piles of Pier 2.

The concrete test results are reported in Appendix B. The following sections provide a summary of the test results and conclusions.

### 4.1 Concrete Compressive Strength

The concrete strength of the cores from the piles ranges from 5990 to 11350 psi with an average compressive strength of 7924 psi. The concrete strength of the cores from the deck of Pier 2 ranges from 3870 psi to 6260 psi with an average compressive strength of 4992 psi. In general, the test data indicated that the concrete strength meets and exceeds the design requirements.

### 4.2 Chloride Content in Piles

Chloride ions (salts) were measured in 1/2 in. increments up to 4 in. from the pile surface. The test indicated that salts in the concrete exceed the threshold value to initiate corrosion of reinforcing steel bars in the piles in all of the cases that AME tested. The chloride content within the piles is most significant in the splash zone above the water line.

### 4.3 Deterioration Mechanism of Piles in Pier 2

The piles in Pier 2 were subjected to significant seawater attack. As a result, the concrete surface softened and cracks extended to concrete depths of approximately 5 in. These cracks made the concrete more permeable to penetration of seawater, which led to two additional deterioration mechanisms, i.e., alkali-silica reaction between the aggregates in the concrete pile and alkalis in seawater, and sulfate attack on the concrete. All these chemical reactions caused more cracks in the concrete and disintegrated the concrete near the surface, although the concrete away from the surface of the piles still has high strength. The concrete deterioration of the piles in Pier 2 is most significant in the water column, less in the splash zone above the water line, and even lesser in the pile segment below the mudline.

## 5. GEOTECHNICAL INVESTIGATION

### 5.1 Pier 1

SGH evaluated Pier 1 for geotechnical capacity due to the construction of the structure being a segmental cofferdam. The retention of fill within the pier and uneven soil elevations between the north and south sides justify investigation for stability and bearing capacity. The soil on the south side of the pier was dredged for berthing of large vessels, therefore creating a difference of 15 ft from the north side. When lateral load calculations were investigated for the pier, the tie-rod was checked with internal soil pressures from the soil fill within the cofferdam. Analyses were conducted for both Mean Low Low Water (MLLW) and Mean High High Water (MHHW), with MHHW controlling. All relevant analysis can be seen in Appendix C for Pier 1 calculations.

### 5.2 Piers 2 and 3

ENGEO provided a geotechnical report of the soil in the project area to accurately model the soil in relation to the piles. The report permitted SGH to input proper soil springs for the model of Piers 2 and 3. ENGEO provided the ultimate tension capacities of the piles for different soil regions to check for pile pullout under mooring loads. The ENGEO report can be found in Appendix C.

### 5.3 Geotechnical Results

The geotechnical evaluation of Pier 1 indicated the structure was sufficient both in sliding and overturning stability. The factor of safety for sliding stability after evaluation was 6 while the factor of safety for overturning was 4. The bearing capacity factor of safety was 2.28, within the acceptable range. The geotechnical evaluation of Pier 2 and 3 indicated the ultimate tension capacity of the 1980 Pier 2 addition provides the least capacity. In accordance with UFC 3-220-01 which supersedes UFC 3-220-01A, the pier requires a safety factor during extreme events of 1.7. Pier 2 at the lowest capacity section under extreme conditions provides a tension safety factor of 1.75, exceeding the minimum required factor of safety.

# 6. PRELIMINARY ANALYSIS

## 6.1 Mooring Assessment

SGH utilized OPTIMOOR Version 6.2.9 (Catenary & Dynamic Model) for all mooring analyses presented herein. This program is a proprietary product developed and distributed by Tension Technology International, Inc. of Weston Massachusetts. OPTIMOOR is well accepted in the marine structures industry as a tool for mooring analyses and is based on OCIMF recommendations and procedures.

The mooring analysis was conducted under the Facility Design Criteria for Mooring Service: Type IV in accordance with UFC 4-159-03. A Type IV designation is reserved for permanently moored vessels and the facility is evaluated for a 100 year return event.

### 6.1.1 Environmental Conditions

#### 6.1.1.1 Wind

Wind data was obtained from the National Oceanic and Atmosphere Administration (NOAA) data base for the station located at the former Alameda Naval Air Station (station ID GHCND:USW00023239). The station provided wind data from 1948 – 1990 allowing for a probabilistic analysis to be performed. Through statistical analysis, wind loads in a 100 year storm was attained in accordance with UFC requirements for a permanently moored vessel. For the dynamic mooring analysis, SGH used a frequency domain model incorporating the Davenport spectrum to develop a time history of wind velocities that would fluctuate around the 1 hour averaged storm wind velocity. The time history would allow instantaneous velocities to reach peak wind speeds of 70.5 mph, equal to gusts with a 100 year return period. The time history was created for a 15 min. in duration to allow for adequate time to develop all possible loads. This wind time history was then used in OPTIMOOR to perform the dynamic mooring analysis.

For comparison, a static mooring analysis was performed as a back-check. For the static analysis, the 30 second time averaged velocity (60.8 mph) was used in the assessment of the mooring conditions.

#### 6.1.1.2 Current

Due to the sheltering nature of the piers location, no currents were included in the mooring analysis.

#### 6.1.1.3 Wave

Due to the sheltering nature of the piers location, no wave spectrum was included in the mooring analysis.

#### 6.1.1.4 Tide

During the analysis, wind was the predominant factor in loading. Therefore, tide was neglected and the draft was set constant over the time domain analysis.

### 6.1.2 Mooring Load Cases

Variables considered for the mooring analysis of each of the five vessel included the combinations of the following:

- Zero current within the facility.
- Constant tide level during storm.
- Nested vessels, both two and three together when applicable.
- All wind directions (at 5-degree increments).
- Static and dynamic analyses for determined worst case direction.

### 6.1.3 Mooring Arrangements

SGH used possible schematics of mooring arrangements and line information provided by MARAD. We completed the analysis with the information provided as well as field verification to represent accurate mooring conditions. The field verification included line type, fairlead, and winch locations on the vessel as well as the cleat and bollard locations at the berths. These mooring configurations, including number and type of lines, are provided in Appendix D for all vessels considered.

### 6.1.4 Moored Vessel Parameters

The MARAD Ready Reserve Fleet currently reside in five berths along Piers 1, 2, and 3. The north face of Pier 3 is occupied by the museum vessel the U.S.S Hornet. Eight MARAD vessels are currently moored and expected in the remaining berths. At both Piers 2 and 3, nested mooring arrangements are used with two and three vessels being moored together at one berth.

Vessel parameters for the moored vessels considered were obtained from numerous sources including the project Request for Proposal, the Naval Vessel Register, and correspondence with MARAD.

A brief description of each vessel follows:

- Cape Orlando – A 20,731 DWT Roll-on/Roll-off cargo vessel (593 ft length between perpendiculars (LBP) by 92 ft beam) with a maximum draft of 30 ft. For analysis purposes, the vessel was modelled with the observed draft of 19 ft-4 in. from site visits. The mooring lines used comprised of three separate types of lines with varying circumferences: SuperDan lines with a breaking strength of 181,000 lbs, Jetkore lines with two circumferences and breaking strengths of 120,000 lbs and 211,000 lbs, and a smaller line, Plasma lineswith a breaking strength of 221,000 lbs.

- Algol & Capella – Each vessel is an identical 32,295 DWT Roll-on/Roll-off cargo vessel (880 ft LBP by 105.5 ft beam) with a maximum draft of 37 ft. Due to dredged depth limitations at the berths, a draft of 26 ft-6 in. was observed. The primary mooring lines used for these vessels are 12 Strand Dacron lines with a breaking strength of 249,000 lbs. There were several lines observed to be parallel braid and nylon that were modelled with 218,000 lbs and 103,000 lbs breakings strength respectively.

- Admiral William M. Callaghan – A 13,717 DWT Roll-on/Roll-off cargo vessel (626.5 ft LBP by 92 ft beam) with a maximum draft of 29 ft. The observed draft was 20 ft-6 in. from site visits. The primary mooring lines were 8 Strand poly-blend with a breaking strength of 217,000 lbs. A smaller line, an Esterlin 8 braid line with a breaking strength of 217,000 lbs was used sparingly.

- The Gem State, Grand Canyon State, and Keystone State – Three identical 17,729 DWT Crane Ship (633 ft LBP by 76.8 ft beam) with a maximum draft of 34 ft. The observed draft at berth was taken as 18 ft. The primary mooring lines used are

8 Strand Nylon plaited rope with a breaking strength of 225,000 lbs. Smaller Proton-8 lines were used as well with a breaking strength of 156,000 lbs.

- Cape Henry – A 32,956 DWT Roll-on/Roll-off cargo vessel (650 ft LBP by 105.8 ft beam) with a maximum draft of 35 ft. The observed draft of the vessel upon site visits was 19 ft-8 in. The primary mooring line used was a plaited polypropylene line with a breaking strength of 156,000 lbs. A smaller variant of the polypropylene was used with a breaking strength of 123,000 lbs.

- Cape Mohican – A 39,026 DWT Barge Ship (721.5 ft LBP by 106 ft beam) with a max draft of 39 ft. Due to the Mohican not currently being berthed in Alameda, the draft was assumed to be similar to Cape Henry at 19 ft-8 in. The primary mooring lines are varying circumference Samson double braided polyester line with a breaking strength of 343,000 lbs and 470,000 lbs.

All vessel information can be found in Appendix D within the Vessel Data section for each configuration.

## 6.2 Structural Assessment

### 6.2.1 Structural Loads

The facility is required to meet all requirements presented specified in the MARAD lease requirements. The lease stipulates the following criteria be evaluated for the facility:

- 425 psf live load.
- HS20-44 truck load.
- Local fire truck load.
- 4000 lb. fork lift.
- Safe working load of mooring equipment.

The requirements herein presented all pertain to the scope of work with evaluating the facility for structural adequacy for lay berthing of the Ready Reserve Fleet.

#### 6.2.1.1 Vertical Loads

The vertical loads considered for structural analysis of the piers were self-weight dead load, 425 psf live load, and a standard HS20-44 truck described in Appendix E. A local fire truck of the City of Alameda was considered, but after investigation, the HS20-44 prompted larger loads to the pier and would be the governing live load. A 4000 lb forklift is specifically designated as a live load under MARAD lease requirements, but the load demand produced by a HS20-44 surpasses the loads by the forklift. The truck axial load was then placed to induce the largest stress on the system.

#### 6.2.1.2 Horizontal Loads

The MARAD lease states that mooring hardware be maintained to work at safe working loads, therefore, the maximum working load of the bollard and cleats, 70 kips and 40 kips respectively, were used in the analysis. We assumed the mooring load to be supported between the two surrounding bents, therefore the load evenly distributed to two bents for analysis. Currents and waves were neglected due to the project site being located within a breakwater protected region with little to no current present. The waves within the harbor are long duration, small amplitude waves and therefore do not provide noticeable loading. Wind load on moored vessels was considered. Breasting loads were evaluated for the various vessels and though local breasting loads were high, globally applying the maximum working load of the mooring equipment governed the analysis. Seismic loading was not considered in the analysis of the structure in accordance with the contract scope of work.

#### 6.2.1.3 Load Combinations

Using UFC 4-152-01, load combinations were assessed to provide governing cases for facility assessment. Table 1, which is provided in UFC 4-152-01, provides load combinations for situations when the pier is vacant, berthing, and mooring. The loading combinations identified as critical were Vacant 2(b), Mooring 5(e), and Mooring 7(g). The aforementioned cases were selected due to the weighting of Live Loads and Wind Loads on Vessels.

**Table 1: Load Combinations per UFC 4-152-01**

**Table 3-6 Load Combinations – LRFD**

| VACANT | 1(a) | 2(b) | 3(c) | 4(d) | 5(e) | 6(f) | 7(g) | 8(h) |
|---|---|---|---|---|---|---|---|---|
| D | 1.4 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 0.9 | 0.9 |
| L | 0 | 1.6 | 1 | 0 | 1 | 1 | 0 | 0 |
| B | 1.4 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 0.9 | 0.9 |
| Be | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 1.4 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 0.9 | 0.9 |
| Cs | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E | 0 | 1.6 | 0 | 0 | 0 | 0 | 1.6 | 1.6 |
| EQ | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| W | 0 | 0 | 0 | 0.8 | 1.6 | 0 | 1.6 | 0 |
| Ws | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| RST | 0 | 1.2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ice | 0 | 0.2 | 0 | 0 | 1 | 0 | 1 | 0 |

| BERTHING | 1(a) | 2(b) | 3(c) | 4(d) | 5(e) | 6(f) | 7(g) | 8(h) |
|---|---|---|---|---|---|---|---|---|
| D | | 1.2 | 1.2 | | 1.2 | 1.2 | | |
| L | | 1.6 | 1 | | 1 | 1 | | |
| B | | 1.2 | 1.2 | | 1.2 | 1.2 | | |
| Be | | 1.6 | 1 | | 1 | 1 | | |
| C | | 1.2 | 1.2 | | 1.2 | 1.2 | | |
| Cs | | 0 | 0 | | 0 | 0 | | |
| E | | 1.6 | 0 | | 0 | 0 | | |
| EQ | | 0 | 0 | | 0 | 1 | | |
| W | | 0 | 0 | | 1.6 | 0 | | |
| Ws | | 0 | 0 | | 0 | 0 | | |
| RST | | 1.2 | 0 | | 0 | 0 | | |
| Ice | | 0.2 | 0 | | 1 | 0 | | |

| MOORING | 1(a) | 2(b) | 3(c) | 4(d) | 5(e) | 6(f) | 7(g) | 8(h) |
|---|---|---|---|---|---|---|---|---|
| D | 1.4 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 0.9 | 0.9 |
| L | 0 | 1.6 | 1 | 0 | 1 | 1 | 0 | 0 |
| B | 1.4 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 0.9 | 0.9 |
| Be | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 1.4 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 0.9 | 0.9 |
| Cs | 1.4 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 0.9 | 0.9 |
| E | 0 | 1.6 | 0 | 0 | 0 | 0 | 1.6 | 1.6 |
| EQ | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| W | 0 | 0 | 0 | 0.8 | 1.6 | 0 | 1.6 | 0 |
| Ws | 0 | 0 | 0 | 0.8 | 1.6 | 0 | 1.6 | 0 |
| RST | 0 | 1.2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ice | 0 | 0.2 | 0 | 0 | 1 | 0 | 1 | 0 |

(a) *ASCE 7-02 Min Design Loads for Bldgs and Other Structures*, 2.3.2 Eqn 1
(b) *ASCE 7-02 Min Design Loads for Bldgs and Other Structures*, 2.3.2 Eqn 2
(c) *ASCE 7-02 Min Design Loads for Bldgs and Other Structures*, 2.3.2 Eqn 3a
(d) *ASCE 7-02 Min Design Loads for Bldgs and Other Structures*, 2.3.2 Eqn 3b
(e) *ASCE 7-02 Min Design Loads for Bldgs and Other Structures*, 2.3.2 Eqn 4
(f) *ASCE 7-02 Min Design Loads for Bldgs and Other Structures*, 2.3.2 Eqn 5
(g) *ASCE 7-02 Min Design Loads for Bldgs and Other Structures*, 2.3.2 Eqn 6
(h) *ASCE 7-02 Min Design Loads for Bldgs and Other Structures*, 2.3.2 Eqn 7

### 6.2.2 Load Resisting System

#### 6.2.2.1 Vertical Loads

The structural analysis of Piers 1, 2, and 3 consisted of SGH investigating each component of the load resisting system to ensure sufficient capacity. The vertical loads sustained by the deck were analyzed for bending and shear. All piles were checked for tension and compression. The structural system was then evaluated for adequate capacity during vertical loads with varying scenarios of pile failure. Schematics of the analysis scenarios for Pier 2 can be observed in Appendix E.

In Pier 1, the additional pile cap overlaying the king pile connects to the existing pile cap which distributes the load from the deck to the full system. The deck directly rests on interior soil and

therefore can accommodated large vertical loads. The bearing capacity of the structure was taken as the entire footprint of the system.

Pier 2 includes a pile cap which transfers the deck load to the pile cap to the piles. The pile cap was evaluated for vertical resistance before the load was transferred to the plumb piles.

The deck for Pier 3 reduces in thickness from the outer regions toward the center requiring investigation for both deck thicknesses. There is no pile cap and therefore the deck load is transferred directly to the piles.

#### 6.2.2.2 Horizontal Loads

The horizontal loads on the structural system start from the loads being placed on the mooring hardware. The mooring hardware was assumed to take the total load without failure. The anchoring bolts were then evaluated to take the maximum working load considered for the bollard or cleat as this would be the source of failure. The load would then be transferred from the anchors to the deck. Due to locations of the mooring hardware, the load was anticipated to be distributed between two bents, though load is possibly transferred further.

In Pier 1, the lateral load is not transferred to the deck but rather stays within the exterior pile cap and transferred to the interior tie-rods that connect the king piles. To be conservative, we assumed the load to be completely taken by the tie-rod and not within the cofferdam sheet piles. It was assumed if the tie-rod adequately withstood the complete load with a large factor of safety, the system, including the sheet piles, would be sufficient. Pier 2 transferred the load to the pile cap before the batter piles were engaged. Pier 3 directly transferred the load to the batter piles.

## 6.3 Results

### 6.3.1 Mooring Assessment

The mooring analysis shows that the safe working loads of the mooring hardware at the piers are below the calculated load demands from a 100-year storm in all the mooring configurations analyzed in this study. A summary of the total loads on the vessels as well as the maximum loads on the mooring points for each vessel configuration is given in Appendix D. The maximum mooring point loads range from 156 kips for the 3 State Class vessels moored together to 449 kips for the Cape Henry.

It is apparent from observation of the mooring arrangements that the maximum mooring point loads could be reduced with an optimization of the mooring arrangements, as well as by use of the same type and strength of mooring lines for each vessel. However, it is beyond the scope of this analysis to develop fully optimized mooring arrangements for the vessels. It should also be noted that the loads considered for this analysis are extreme storm loads, and that the mooring arrangements seem to be functioning adequately under more normal conditions. The structural analysis also shows that all piers are able to support higher loads than the safe working loads of the current mooring hardware when deteriorated structural components are repaired or replaced per recommendations of this report. An upgrade of the mooring hardware to stronger units is therefore a viable option for increasing the mooring capacity of the piers.

### 6.3.2 Structural Assessment

After analysis was concluded for Piers 1, 2, and 3, it was determined that all undamaged sections would be acceptable under the MARAD lease requirements. The sustained loads imposed on each pier was well below the allowable load the pier can sustain.

Pier 1, in current condition, is satisfactory for future operations with large vessels. Cosmetic damage to several bases of the mooring hardware as well as delamination to patches of the exterior pile cap face are present but do not result in lowered capacity of the structure. The lateral and vertical load resisting system provided sufficient Demand to Capacity ratios (DCRs) with conservative assumptions in-place. The sheet piles provide additional lateral capacity that was not accounted for allowing for mooring under harsher conditions to be possible.

A range of scenarios were evaluated for Pier 2 due to the severity of the piles upon inspection. The scenarios included changing which pile had failed and whether the bent would still have sufficient capacity with the applied loads. The modelled possibilities can be seen for Pier 2 in Appendix E. Pile failure was assumed to be zero capacity of the pile. We concluded that when pile failure resulted in consecutive large spans (i.e., 16+ ft), the pile cap could not sustain the resulting tributary forces. A single long span with adjacent short spans is capable of withstanding the loads. Pile capacities were checked with model results to confirm adequate capacity when undamaged. Under modelled loads, piles with moderate to no damage are adequate for MARAD requirements. The structural capacity of Pier 2 when incorporating lateral loads was done under the assumption that batter piles were contributing full capacity.

Our structural inspection of Alameda Piers concluded that Pier 3 is in satisfactory condition with all of the bents meeting the failure criteria. Spalling of the curbs due to corrosion of conduit and

reinforcing steel, and occasional deck spalls were evident but did not reduce the functionality of the pier or prove to be critical to the structural capacity. Pier 3 was evaluated for several pile failure scenarios and checked against the design criteria. Our structural analyses indicated that the pier would maintain its functionality even if individual piles fail. We cannot identify a realistic failure scenario at Pier 3. Therefore, the pier should remain adequate for future use of large vessels.

## 7. CONCLUSIONS AND RECOMMENDATIONS

Pier 1 is in satisfactory condition with no structural repairs required to continue to berth the MARAD Ready Reserve Fleet apart from an upgrade and reassessment of the mooring system on the Pier. Slight cosmetic damage was noted during the inspection of the pile cap, but the damage does not structurally compromise the system. Mooring hardware pedestals had signs of deterioration but did not compromise the anchoring system. Most of the steel piles lost protective painting in the splash/tidal zone, we therefore recommend that a protective coating with proven performance records for marine applications in splash/tidal zone of steel piles, such as Interzone 954 (Appendix G), be applied to the steel piles.

From the inspection, SGH noted Pier 2 contains regions of heavily damaged plumb and batter piles within the midsection of the pier. Due to a wide range of damage, it is not possible to accurately predict the remaining capacity of these sections and therefore we modelled the piles rated Severe with no capacity. Repair or replacement of plumb piles to restore capacity to meet the MARAD requirements are highly advised. The analysis of the pier for lateral capacity shows a need for repair of batter piles rated Severe in locations where bents are near a bollard. The distribution of load to multiple bents is only permissible when surrounding bent's batter piles are intact. The current system will not withstand maximum working loads on the mooring equipment without a properly working lateral load resisting system. Therefore, selected bents in close proximity of bollards should be targeted as a higher priority for repairs.

Pier 3 is in satisfactory condition for mooring of MARAD vessels. In only two instances, a batter pile in immediate proximity to a bollard is damaged and should be replaced if heavy use is expected. The overall structure is in acceptable working condition for future mooring of vessels including heavy deck loads.

### 7.1 Pier 2 Repair Options

Table 1 presents several repair options developed by SGH for Pier 2. These repair options are presented in elevation and plan view in Appendix F. All options include batter piles only in proximity to bollards and the associated plumb pile regardless of Major or Severe rating. In calculating the option cost, a market nominal fee of mobilization and demobilization has been assigned to all options. All options have been assigned a 45% contingency as well for any unseen circumstances. Cost assumptions and calculations can be viewed in Appendix F.

**Table 1: Pile Repair Options**

| No. | Description | # of Piles | Cost |
|---|---|---|---|
| Option 1 | Repair All Piles to Retain Original Capacity (neglecting rail load piles) | 339 | $13,235,200 |
| Option 2 | Repair Severe Piles to Retain Original Capacity | 256 | $10,062,400 |
| Option 3 | Repair All Piles (except Pile Rows C and F) | 167 | $6,568,600 |
| Option 4 | Repair All Severe Piles (except Pile Rows C and F) | 139 | $5,539,300 |
| Option 5 | Repair All Southern Piles (except Pile Row F) | 73 | $2,873,600 |
| Option 6 | Repair All Severe Southern Piles (except Pile Row F) | 60 | $2,407,500 |

**Figure 1: Pile Repair Jacket Option**

### 7.2 Replacement Option

An alternative option to repairing the existing piles is to replace the piles completely with new piles strategically located. This option would include opening the deck near the existing pile cap, driving a new 24 in. octagonal precast concrete pile, then tie the new pile into the existing pile cap. Replacing piles is ideal when the bent is severely damaged and requires complete restoration. Twenty nine (29) instances of five (5) evenly distributed piles at 18 ft for a single bent for Pier 2 will sustain the required loads and bring the bent back to safe working capacity. Thirty two (32) piles in addition to the bent replacement will require replacement to ensure sufficient capacity throughout the pier. Replacing piles to restore the pier to original capacity has been determined to cost approximately $9.9M. This includes batter piles only in proximity to bollards and the associated plumb pile regardless of Major or Severe rating. In calculating the option cost, a market nominal fee of mobilization and demobilization has been assigned as

well as environmental/ regulatory support fees. The total has been assigned a 45% contingency as well for any unseen circumstances. A replacement plan view of Pier 2 as well as calculation assumptions can be seen in Appendix F.

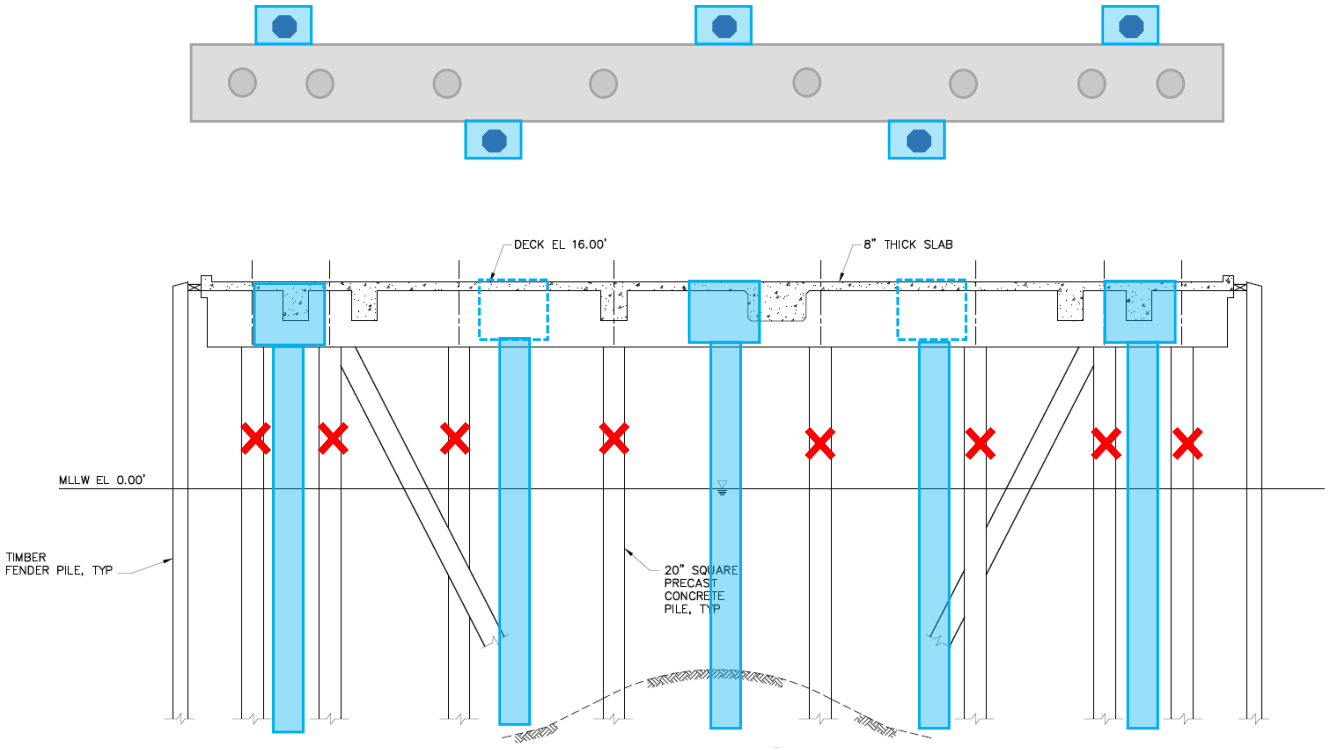


**Figure 2: Pile Replacement Schematic**

### 7.3 Upgrading Mooring Bollards

To increase the mooring capacity of the piers, new bollards can be installed. New 100 MT mooring bollards can be installed for a cost of approximately $21,000 each. SGH recommends replacement of mooring hardware should include locations where the mooring hardware is in use and rated Severe. Locations of severe hardware are provided in Appendix A in the form of tables and figures.

## 8. SUMMARY

Based upon the inspection, tests, condition assessment, and preliminary engineering analysis of Alameda Point Piers 1, 2, and 3, we reached the following conclusions:

Pier 1 is generally in satisfactory condition to meet the MARAD lease requirements. The current mooring hardware on the pier does not meet the structural design requirement for the mooring of Cape Orlando at the pier during a 100-year storm, although it is capable of supporting mooring loads under less demanding conditions. The pier is capable of withstanding the required deck loads from the MARAD lease requirements. Maintenance of the king piles such as cleaning and new coating is recommended to retain the capacity and durability of the pier for future operations. SGH recommends that the pier be inspected on a five (5) year interval and be reevaluated at that time.

Certain regions of Pier 2 are not capable of meeting MARAD lease requirements due to concrete pile deterioration. The damaged regions are within Bents 19 – 54 of the pier. The test of concrete core samples from the piles showed that concrete deterioration in many piles is in advanced stage, resulting in weakening and spalling of the concrete. However, the concrete deterioration is generally limited to a few inches from the surface of concrete, and the internal concrete at the core of piles still maintains reasonably strong strength. Repair or replacement of piles will be necessary for continued operations of the pier for the MARAD lease. The current mooring hardware on the pier does not meet the structural design requirement for the mooring of the MARAD vessels currently moored at the pier during a 100-year storm, although it is capable of supporting mooring loads under less demanding conditions. In addition, damaged mooring hardware should be avoided until repairs are conducted. SGH recommends the damaged region within bents 19-54 be inspected every two (2) years until maintenance has been provided. Upon completion of repair or replacement, the pier can be elevated to a satisfactory rating and be inspected on a five (5) year interval.

Pier 3 is in satisfactory condition from the inspection. The current mooring hardware on the pier does not meet the structural design requirement for the mooring of the Cape Henry currently moored at the pier during a 100-year storm, although it is capable of supporting mooring loads under less demanding conditions. The pier is capable of withstanding the required deck loads from the MARAD lease requirements. Slight pile deterioration was noted, but it does not structurally compromise the overall structural capacity for the anticipated operational loads. Damaged mooring hardware should be avoided until repairs are conducted. Further detailed

inspections of the pier and maintenance should be considered to fully establish the condition of the pier.

There were multiple cracks and spalls of concrete decks of the three piers. Although the cracks and spalls at the present time do not noticeably effect the structural capacity of the piers, it is recommended that maintenance repair be conducted for long term durability and operations of the piers. SGH believes the piers may handle the mooring of the MARAD Ready Reserve Fleet under current mooring hardware through optimization of line arrangement.

In general, the Alameda Point Piers are in a condition that reflects the age of the facility. The future intended uses will dictate the extent of damage repair. Proper maintenance of the piers should be considered and implemented to prolong the integrity and durability of the structures for future uses.

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# APPENDIX A

# Above and Below-water Investigation Report

## 1. INTRODUCTION AND SUMMARY

The structural inspection of Alameda Point Piers 1, 2, and 3 is part of a larger effort to evaluate the Piers for compliance with MARAD's lease requirements for the site. As the evaluation of the piers is limited to the structural capacities of the piers, the inspection was focused on the various structural elements. Worth noting is that the fender system was not a part of the inspection or evaluation of the piers.

The evaluation of the capacities of the piers is focused on the ability to resist two types of loads: vertical loads from vehicles on top of the piers and lateral loads from mooring and breasting forces from the vessels moored at the piers. The vertical capacity is defined by the deck, pile caps, and plumb piles. The horizontal capacity is defined by the mooring hardware, adjacent deck, pile caps, and batter piles. The inspection therefore focused on these areas, and while deterioration was observed and recorded on other parts of the structure, this report will not go into detail on any of these

In summary the piers are in the following condition:

- Pier 1 is in overall Satisfactory condition with only minor repairs suggested. No immediate repairs are needed for structural reasons.
- Pier 2 is on overall Poor condition and is in need of extensive repair.
- Pier 3 is in overall Satisfactory condition with no immediate needs for repair.

## 2. DESCRIPTION OF FACILITY

Piers 1, 2 and 3 were originally constructed in the 1940s as part of the Alameda Naval Air Station. All piers were oriented in an east-west direction, with the head of the piers at the west end. The inner 1,000 feet of Pier 2 was initially constructed around 1940. Construction of Pier 3 followed soon after in 1943. Pier 1 was constructed about 3 years after Pier 3 (in 1946). Pier 2 was extended by 210 feet in 1977. At that time the mooring dolphin at the head of Pier 2 was also constructed. In 1980, Pier 1 was substantially rebuilt. Other minor construction and utility modification projects have been done on the piers since their original construction.

The Navy berthed carriers and other vessels at the piers from 1940 through 1995. Piers 2 and 3 served as carrier piers. Pier 1 is smaller and it is assumed this pier served smaller vessels. The carrier pier designation signifies that they provide more utilities and utility capacity including steam. Also, the carrier pier designation implies that the piers were originally designed for heavy vehicle, crane and deck live load, and large mooring forces. The piers have been subjected to the marine environment for many years and as a consequence have deteriorated. In the mid-1990s as part of the Base Realignment and Closure (BRAC), the Navy ceased operations at Alameda and vacated the Naval Air Station.

### 2.1.1 Pier 1

Pier 1 is a cellular type sheet pile pier that is approximately 660 ft. long by 53 ft. wide. The rebuilding of the pier in 1980 consisted of constructing a king pile with infill concrete panel system exterior to the existing cellular panels. Concrete was placed between the new and existing structures. The south side of the pier consists of king piles nominally spaced 6 ft. 8 in. on center with profiled precast concrete panels between. The north side consists of king piles with the same 6 ft. 8 in spacing supporting flat concrete panels. The king piles on opposing side are connected with a 3 in diameter tie rod. The interior of Pier 1 is filled with sand. The deck is typically made out of 7 ½ in. thick concrete slab panels about 20 ft. wide by 20 ft. long. There is an existing pile cap with a new additional pile cap over the king piles and precast panels. A rubble mound breakwater extends west from the west end of the pier. The south side of the pier is faced with timber fender piles spaced 6 ft. 8 in. on center.

### 2.1.2 Pier 2

Pier 2 is a typical concrete pile and deck pier. The original pier was about 1000 ft. long by 80 ft. wide. The original pier consisted of an 8 in. concrete slab supported by transverse concrete bents

spaced 12 feet apart. The bents are supported by 20 in. square piles with eight (8) piles per bent. The extension is an additional 210 ft. long by 80 ft. wide with the bents being supported by 18 in. square precast, prestressed piles. The lateral support is provided by precast concrete batter piles. Through the length of the pier, there are two (2) batter piles per bent except for the end of the addition, where there are four (4) batter piles per bent. There are approximately 858 plumb piles and 216 batter piles total.

A mooring dolphin is located approximately 150 ft. west of the pier. The dolphin is supported by forty-eight (48) 24 in. square precast, prestressed concrete vertical and batter piles total.

### 2.1.3 Pier 3

Pier 3 is a typical concrete pile and deck pier. The pier is approximately 1100 ft. long by 150 ft. wide. The reinforced concrete slab is 26 in. thick at the outboard region thinning to 10 in. thick at the center. The deck is supported by 18 in. square precast concrete piles with 28 in. square jackets covering the top 13 feet. Rows of nineteen (19) and nine (9) piles alternate every six feet along the length of the pier. There are batter piles at every bent to support berthing loads with an approximate total of 3000 concrete files.

## 3. INSPECTION METHODOLOGY

The inspection of the piers at Alameda point consisted of both above water and underwater inspections of Piers 1, 2, and 3. The following was the complete scope of inspection:

Pier 1:

- Above water inspection of all king piles and concrete panels
- Topside inspection of deck, curb, and all mooring hardware
- Level I underwater inspection of all king piles and concrete panels
- Level II underwater inspection of 4 king piles and at every 100 ft of the concrete panels
- Level III underwater inspection consisting of ultrasonic thickness measurements of the king piles at 16 locations

Pier 2:

- Above water inspection of all concrete piles, deck soffit, and pile caps
- Topside inspection of deck, curb, and all mooring hardware
- Level I underwater inspection of all concrete piles
- Level II underwater inspection of approximately 20% of all concrete piles (214 piles)
- Level III underwater inspection consisting of extracting concrete cores from 11 piles, at 3 locations at each pile (3 ft below mudline, at mid-water level, and at the waterline)

Pier 3:

- Above water inspection of the piles observable from the outside of the wharf, deck soffit, and pile caps
- Topside inspection of deck, curb, and all mooring hardware
- Level III underwater inspection consisting of extracting concrete cores from 1 pile, at 3 locations (3 ft below mudline, at mid-water level, and at the waterline)

All inspection work was conducted in accordance with ASCE Standard Practice Manual No. 101, “Underwater Investigations” as well as Manual of Practice No. 130, “Waterfront Facilities Inspection and Assessment”. The above water and underwater structural inspection of the piers was conducted in the period between July and December 2016.

## 4. INSPECTION RESULTS

A summary of the inspection results for the different components of the piers is presented in the following. Details of the condition and the results can be found in the pictures in Appendix A, the figures in Appendix B and the Underwater Inspection Report in Appendix C.

### 4.1 Pier 1

#### 4.1.1 Steel King Piles

The steel king piles are in overall fair condition with minor to moderate coating loss and surface corrosion. The coating loss and surface corrosion is concentrated in a 2-3 ft wide band around the high water line (Photo 1).

#### 4.1.2 Concrete Panels

The concrete panels are generally in satisfactory condition with only minor cracking (Photo 2).

#### 4.1.3 Deck and Pile Caps

The concrete deck at Pier 1 is in overall satisfactory condition. The deck shows hairline cracks throughout most parts of the deck, but these can most probably be attributed to shrinkage (Photo 3). The pile cap connecting the king piles is in overall fair condition, with the lip overhanging the king piles and concrete infill panels being broken off in several locations (Photo 4). This damage can be considered to be mostly cosmetic.

#### 4.1.4 Mooring Hardware

The mooring hardware at Pier 1 is in fair to good condition. Most of the mooring hardware itself is in good condition with minor instances of coating loss and corrosion. The bases show minor to moderate deterioration, with the most common defect being that concrete on the land side of the cleats and bollards often is spalled off (Photo 5). This deterioration does not have much, if any, direct impact of the capacity of the mooring hardware. There are two new bollards installed at Pier 1, and these bollards are in good condition with no signs of deterioration (Photo 6). The detailed ratings of the inspection of the mooring hardware are presented in Table 1.

**Table 1 – Pier 1 Mooring Hardware Ratings**

| | | | | Rating | | |
|---|---|---|---|---|---|---|
| Station | Location | Mooring Type | In Use | Mooring Equipment | Mooring Base | Note: |
| 7+38 | N | Bollard | - | MN | MN | New |
| 7+18 | S | Bollard | - | MN | MD | |
| 7+00 | S | Cleat | - | MN | MN | |
| 6+66 | N | Cleat | - | MN | MN | |
| 6+40 | S | Bollard | Y | MN | MD | |
| 6+14 | S | Cleat | Y | MN | MD | |
| 5+88 | N | Cleat | - | MN | MN | |
| 5+61 | S | Bollard | - | MN | MD | |
| 5+40 | S | Cleat | - | MN | MN | |
| 5+10 | N | Cleat | - | MN | MD | |
| 4+84 | N | Cleat | - | MN | MN | |
| 4+87 | S | Bollard | - | MN | MD | |
| 4+56 | S | Cleat | - | MN | MN | |
| 4+38 | S | Bollard | - | MN | MD | |
| 4+32 | N | Cleat | - | MN | MD | |
| 4+06 | N | Cleat | - | MN | MN | |
| 3+79 | S | Cleat | - | MN | MN | |
| 3+53 | N | Cleat | - | MN | MN | |
| 3+28 | N | Bollard | - | MN | MD | |
| 3+28 | S | Bollard | Y | MN | MD | |
| 3+00 | S | Cleat | Y | MN | MN | |
| 2+76 | N | Cleat | - | MN | MN | |
| 2+50 | S | Bollard | - | MN | MD | |
| 2+23 | S | Cleat | - | MN | MN | |
| 2+00 | N | Cleat | - | MN | MN | |
| 1+71 | S | Bollard | Y | MN | MD | |
| 1+46 | S | Cleat | - | MN | MN | |
| 1+42 | S | Bollard | Y | MN | MD | New |

Location: N – North, S – South, Ratings: MN – Minor, MD – Moderate, MJ – Major, S - Severe

### 4.1.5 Curbs

The curbs at Pier 1 are in overall satisfactory condition with a few isolated areas of open and closed spalling (Photo 7).

### 4.1.6 Sheet Pile Wall

The sheet pile wall between the Pier and the marginal wharf is in poor condition due to extensive corrosion with multiple areas of complete section loss (Photo 8).

## 4.2 Pier 2

### 4.2.1 Piles

The condition of Pier 2 varies greatly along the length of the Pier, with the outer, newer portion from Bent 1 through 18 being in good condition, Bents 19-54 being in serious to critical condition, and Bents 54 through 102 being in Fair condition.

The piles at the original part of Pier 2 between Bents 19 and 54 are overall in serious to critical condition. Two major types of damage have been discovered during the inspection.

The most widespread type of damage was observed during the underwater inspection as well as during the parts of the above water inspection that were conducted during low tide levels. This damage seems to be due to a combination of chemical attack and alkali-silica reaction, resulting in softening of the concrete, saltwater ingress, and finally corrosion of the reinforcing steel. This damage is observed throughout the pier, but with the worst damage observed between Bents 19 and 54 of the original pier. This damage is described in more detail in the underwater inspection report and is supported by the concrete testing that was done on 11 piles at Pier 2. For this testing 3 cores were extracted from each pile. The details from the testing of the concrete are contained in the concrete testing report. In summary, the piles suffer from a combination of alkali –silica reaction, sulfate attack, and chloride ingress with following corrosion of reinforcing steel.

In addition, several piles towards the end of the original pier (Bent 19) show damage related to corrosion of reinforcing steel in the splash zone. Over time chlorides from the salt water have migrated through the concrete to the reinforcing steel, initiating corrosion. Once corrosion starts, the piles will over time develop cracks and subsequent spalls. The piles exhibit various stages of this type of damage (Photo 9 through Photo 13).

The piles of the newer extension of the pier (Bents 1 through 18) are generally in good condition with little or no signs of deterioration.

### 4.2.2 Soffit and pile caps

The soffit and pile caps at Pier 2 are in overall satisfactory condition with only a few isolated instances of corrosion related damage. It should be noted that the pile caps have been cut out at several locations adjacent to manholes that give access to the utility trench that runs the entire length of the pier, causing a discontinuity in the pile cap at these bents.

### 4.2.3 Deck

The concrete deck at Pier 2 is in overall satisfactory condition (Photo 14). The deck shows hairline cracks throughout most parts of the deck, but these can be attributed to shrinkage and the age of the pier. There are also limited areas of delamination and spalling at the deck, often located around expansion or construction joints in the deck (Photo 15).

### 4.2.4 Mooring hardware

The mooring hardware at Pier 2 ranges from fair to serious condition. Most of the cleats and bollards are in fair to good condition with minor to moderate instances of coating loss and corrosion (Photo 16). One cleat is rated Serious as it is broken (Photo 17). The bases of 10 out of 73 pieces of mooring hardware is rated Serious due to spalling and corrosion of the confining reinforcing steel of the outboard edge of the base (Photo 18). Otherwise the bases show minor to moderate deterioration.

There are three new bollards installed at Pier 2. These are all in good condition with no significant signs of deterioration or wear (Photo 19). The detailed ratings of the inspection of the mooring hardware are presented in Table 2.

**Table 2 – Pier 2 Mooring Hardware Ratings**

| | | | | Rating | | |
|---|---|---|---|---|---|---|
| Bent | Location | Mooring Type | In Use | Mooring Equipment | Mooring Base | Note: |
| 1-2 | A | Bollard | Y | MN | MN | |
| 1-2 | D-E | Bollard | - | MN | MN | |
| 1-2 | H | Bollard | - | MN | MD | |
| 3-4 | A | Cleat | - | MN | MN | |
| 3-4 | H | Cleat | Y | MN | MN | |
| 6-7 | A | Cleat | - | MN | MN | |
| 7-8 | H | Cleat | Y | MN | MD | |
| 10-11 | A | Bollard | Y | MN | MN | |

| | | | | Rating | | |
|---|---|---|---|---|---|---|
| Bent | Location | Mooring Type | In Use | Mooring Equipment | Mooring Base | Note: |
| 11-12 | H | Bollard | - | MN | MD | |
| 12-13 | A | Cleat | - | MN | MN | |
| 13-14 | H | Cleat | - | MN | MN | |
| 14-15 | A | Bollard | Y | MN | MD | |
| 16-17 | A | Cleat | - | MN | MN | |
| 17-18 | H | Cleat | - | MN | MN | |
| 20-21 | A | Bollard | Y | MN | MD | |
| 20-21 | H | Bollard | - | MN | MN | |
| 23-24 | A | Cleat | Y | MD | MN | |
| 23-24 | H | Cleat | - | MN | MN | |
| 26-27 | A | Cleat | - | MN | MN | |
| 26-27 | H | Cleat | - | MN | MN | |
| 29-30 | A | Bollard | - | MN | MN | |
| 29-30 | H | Bollard | Y | MN | MN | |
| 32-33 | A | Bollard | - | MN | MN | New |
| 32-33 | H | Cleat | - | MN | MD | |
| 35-36 | A | Bollard | Y | MN | MN | New |
| 35-36 | H | Cleat | - | MN | MN | |
| 38-39 | A | Bollard | Y | MN | S | Avoid/Repair |
| 38-39 | H | Bollard | Y | MN | S | Avoid/Repair |
| 41-42 | A | Bollard | - | MN | MN | New |
| 41-42 | H | Cleat | - | S | S | Avoid/Repair |
| 44-45 | A | Cleat | - | MN | MD | |
| 44-45 | H | Cleat | - | MN | MN | |
| 45 | H | Bollard | Y | MN | MN | New |
| 46 | H | Bollard | Y | MN | MN | New |
| 47-48 | A | Bollard | - | MN | MN | |
| 47-48 | H | Bollard | Y | MN | MN | |
| 50-51 | A | Cleat | - | MN | MN | |
| 50-51 | H | Cleat | Y | MN | MN | |
| 53-54 | A | Cleat | - | MN | MN | |
| 53-54 | H | Cleat | - | MN | MD | |
| 56-57 | A | Bollard | - | MN | MN | |
| 56-57 | H | Bollard | Y | MN | MN | |
| 59 | H | Cleat | - | MN | MN | |
| 59-60 | A | Cleat | - | MN | MN | |
| 62 | H | Cleat | - | MN | MN | |
| 62-63 | A | Cleat | - | MN | MN | |
| 65 | H | Bollard | Y | MN | MN | |
| 65-66 | A | Bollard | - | MN | MD | |

| | | | | Rating | | |
|---|---|---|---|---|---|---|
| Bent | Location | Mooring Type | In Use | Mooring Equipment | Mooring Base | Note: |
| 68 | H | Cleat | - | MN | MN | |
| 68-69 | A | Cleat | - | MN | MN | |
| 71 | H | Cleat | - | MN | MN | |
| 71-72 | A | Cleat | - | MN | S | |
| 74 | H | Bollard | - | MN | S | |
| 74-75 | A | Bollard | - | MN | MN | |
| 77 | H | Cleat | - | MN | S | |
| 77-78 | A | Cleat | - | MN | S | |
| 80-81 | A | Cleat | Y | MN | MD | |
| 80-81 | H | Cleat | Y | MN | S | Avoid/Repair |
| 83-84 | A | Bollard | Y | MN | MN | |
| 83-84 | H | Bollard | - | MN | MN | |
| 86 | H | Cleat | - | MN | MD | |
| 86-87 | A | Cleat | - | MN | MN | |
| 89 | H | Cleat | Y | MN | MN | |
| 89-90 | A | Cleat | Y | MN | MN | |
| 92-93 | A | Bollard | - | MN | S | |
| 92-93 | H | Bollard | Y | MN | MN | |
| 95 | A | Cleat | Y | MN | MD | |
| 95 | H | Cleat | Y | MN | MN | |
| 98 | A | Cleat | Y | MN | MD | |
| 98 | H | Cleat | - | MN | MN | |
| 101 | H | Bollard | Y | MN | MN | |
| 103-104 | H | Cleat | - | MN | MN | |
| 105-106 | H | Bollard | Y | MN | S | Avoid/Repair |

Location: A - Pile line A, H – Pile Line H, Ratings: MN – Minor, MD – Moderate, MJ – Major, S - Severe

### 4.2.5 Curbs

The curbs at Pier 2 are in fair to poor condition. About 20% of the length of the curb around the wharf has large cracks and open spalls, mainly due to corrosion of embedded reinforcing steel and conduit in the curbs (Photo 20). The curb deterioration has no structural significance with the exception of the cases where the spalling extends in front of mooring points.

## 4.3 Pier 3

### 4.3.1 Piles

Approximately 800 piles were inspected during the above water inspection of Pier 3. Most of these piles were observed from the outside of the pier. Due to the pile extensions present on this pier,

very few piles could be inspected to include any parts of the concrete pile that extends down to the mudline. Overall, the inspected piles are in fair to satisfactory condition. Out of the inspected piles, 29 are rated Major or Severe, mostly due to deterioration of the upper pile extensions (Photo 21 and Photo 22).

### 4.3.2 Soffit

With the exception of the edge of the deck soffit, the deck soffit at Pier 3 is on overall fair condition with little or no signs of damage apart from hairline cracks with efflorescence in the soffit under the pier (Photo 23). There is widespread cracking and spalling including exposed reinforcing steel of the lower edge of the face of the deck (Photo 24).

### 4.3.3 Deck

The concrete deck at Pier 3 is in overall satisfactory condition. The deck shows hairline cracks throughout most parts of the deck, but these can most probably be attributed to shrinkage and the age of the pier.

### 4.3.4 Mooring hardware

The mooring hardware at Pier 3 is overall in fair to poor condition. Most of the actual mooring fittings are rated Minor with minor to moderate instances of coating loss and corrosion (Photo 25). The bases of 17 out of 75 pieces of mooring hardware are rated Severe due to spalling and corrosion of the confining reinforcing steel of the outboard edge of the base (Photo 26 and Photo 27). Otherwise the bases show minor to moderate deterioration. The detailed ratings of the inspection of the mooring hardware are presented in Table 3.

**Table 3 – Pier 3 Mooring Hardware Ratings**

| | | | | Rating | | |
|---|---|---|---|---|---|---|
| Bent | Pile Line | Mooring Type | In Use | Mooring Equipment | Mooring Base | Note: |
| 1 | C | Bollard | - | MN | S | |
| 1 | H | Cleat | - | MN | MN | |
| 1 | L | Cleat | - | MN | MD | |
| 1 | Q | Bollard | - | MN | S | |
| 2-3 | A | Bollard | - | MN | MD | |
| 2-3 | S | Bollard | - | MN | MD | |
| 5-6 | A | Cleat | - | MN | Mn | |
| 5-6 | S | Cleat | - | MN | MD | |

| | | | | Rating | | |
|---|---|---|---|---|---|---|
| Bent | Pile Line | Mooring Type | In Use | Mooring Equipment | Mooring Base | Note: |
| 8-9 | A | Cleat | - | MN | MN | |
| 8-9 | S | Cleat | - | MN | S | |
| 11-12 | A | Bollard | Y | MN | MN | |
| 11-12 | S | Bollard | Y | MN | S | Avoid/Repair |
| 14-15 | A | Cleat | Y | MN | MN | |
| 14-15 | S | Cleat | Y | MN | MN | |
| 17-18 | A | Cleat | Y | MN | MN | |
| 17-18 | S | Cleat | Y | MN | MN | |
| 20-21 | A | Bollard | Y | MN | S | Avoid/Repair |
| 20-21 | S | Bollard | Y | MN | MD | |
| 23-24 | A | Cleat | Y | MN | MN | |
| 23-24 | S | Cleat | - | MN | MN | |
| 26-27 | A | Cleat | - | MN | S | |
| 26-27 | S | Cleat | - | MN | MN | |
| 29-30 | A | Bollard | Y | MN | MN | |
| 29-30 | S | Bollard | Y | MN | S | Avoid/Repair |
| 32-33 | A | Cleat | Y | MN | MN | |
| 32-33 | S | Cleat | Y | MN | S | Avoid/Repair |
| 35-36 | A | Cleat | - | MN | MN | |
| 35-36 | S | Cleat | - | MN | MN | |
| 38-39 | A | Bollard | Y | MN | S | Avoid/Repair |
| 38-39 | S | Bollard | Y | MN | S | Avoid/Repair |
| 41-42 | A | Cleat | - | MN | MD | |
| 41-42 | S | Cleat | - | MN | MN | |
| 44-45 | A | Cleat | - | MN | MN | |
| 44-45 | S | Cleat | - | MN | MN | |
| 47-48 | A | Bollard | - | MN | MD | |
| 47-48 | S | Bollard | - | MN | S | |
| 50-51 | A | Cleat | - | MN | MN | |
| 50-51 | S | Cleat | - | MN | MN | |
| 53-54 | A | Cleat | - | MN | MN | |
| 53-54 | S | Cleat | - | MN | MN | |
| 56-57 | A | Bollard | Y | MN | MN | |
| 56-57 | S | Bollard | - | MN | S | |
| 59-60 | A | Cleat | Y | MN | MN | |
| 59-60 | S | Cleat | - | MN | MD | |
| 62-63 | A | Cleat | Y | MN | MD | |
| 62-63 | S | Cleat | - | MN | MN | |
| 65-66 | A | Bollard | Y | MN | MD | |
| 65-66 | S | Bollard | Y | MN | MD | |

| | | | | Rating | | |
|---|---|---|---|---|---|---|
| Bent | Pile Line | Mooring Type | In Use | Mooring Equipment | Mooring Base | Note: |
| 68-69 | A | Cleat | - | MN | MD | |
| 68-69 | S | Cleat | Y | MN | MN | |
| 71-72 | A | Cleat | Y | MN | MN | |
| 71-72 | S | Cleat | - | MN | MD | |
| 74-75 | A | Bollard | Y | MN | MN | |
| 74-75 | S | Bollard | - | MN | S | |
| 77-78 | A | Cleat | Y | MN | MN | |
| 77-78 | S | Cleat | - | MN | MD | |
| 80-81 | A | Cleat | - | MN | MN | |
| 80-81 | S | Cleat | - | MN | MN | |
| 83-84 | A | Bollard | Y | MN | MN | |
| 83-84 | S | Bollard | Y | MN | S | Avoid/Repair |
| 86-87 | A | Cleat | - | MN | MN | |
| 86-87 | S | Cleat | - | MN | MD | |
| 89-90 | A | Cleat | - | MN | MN | |
| 89-90 | S | Cleat | - | N/A | S | |
| 93-94 | A | Bollard | - | MN | MN | |
| 93-94 | S | Bollard | - | MD | S | |
| 95-96 | A | Cleat | - | MN | MN | |
| 95-96 | S | Cleat | Y | MN | MN | |
| 98-99 | Wharf | Cleat | - | MN | MN | |
| 98-99 | S | Cleat | - | MN | MN | |
| 101-102 | S | Bollard | - | MN | MD | |
| 104-105 | S | Cleat | - | MD | MN | |
| 108-109 | S | Cleat | - | MN | MD | |
| 110-111 | S | Bollard | - | MN | S | |
| 113-114 | S | Cleat | - | MN | MD | |

Location: A - Pile line A, S – Pile Line S, Ratings: MN – Minor, MD – Moderate, MJ – Major, S - Severe

### 4.3.5 Curbs

The curbs at Pier 3 are in fair to poor condition. About 30% of the length of the curb around the wharf has large cracks and open spalls, mainly due to corrosion of embedded reinforcing steel and conduit in the curbs (Photo 28).

## 5. CONCLUSIONS AND RECOMMENDATIONS

A summary of the conclusions and recommendations are given below. More detailed recommendations for repair are given in the project report.

### 5.1 Pier 1

Pier 1 is in overall satisfactory condition, but is in need of maintenance to ensure it retains its intended capacity. The steel king piles should be cleaned and recoated. The sheet pile bulkhead towards the apron is in poor condition and should be repaired to ensure that the structural integrity of the access to the pier is not compromised.

### 5.2 Pier 2

Pier 2 is in poor to critical condition. There is widespread deterioration of the piles of the pier, especially between Bents 19 and 54. Repairs are necessary to ensure that the structural integrity of the pier is not compromised further and load restrictions of the pier should be considered until repairs have been made. Any mooring hardware rated Severe should not be used until repairs have been made.

### 5.3 Pier 3

Pier 3 is in overall satisfactory condition based on the areas that were inspected. Only a limited number of piles have been inspected, and there is some deterioration noted at this time. The deterioration is not widespread at the moment. Any mooring hardware rated Severe should not be used until repairs have been made.

# Appendix A – Photos

**Photo 1 - Typical above water condition of king piles at Pier 1**

**Photo 2 - Typical condition of concrete panels at Pier 1**

**Photo 3 - Typical condition of deck at Pier 1**

**Photo 4 – Spalled lip of pile cap at Pier 1**

**Photo 5 - Typical condition of mooring bollard and base at Pier 1**

**Photo 6 - Typical condition new mooring bollard at Pier 1**

**Photo 7 - Typical condition curb and new mooring bollard at Pier 1**

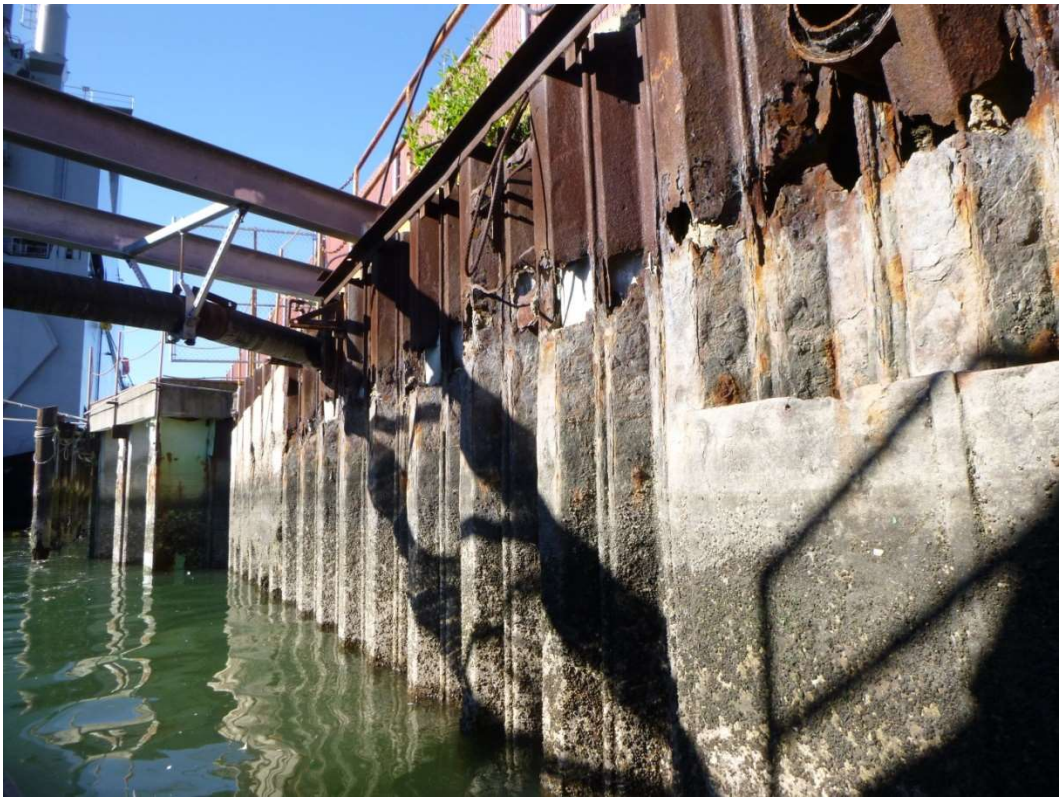


**Photo 8 – Deteriorated sheet pile wall at Pier 1**

**Photo 9 – Pile rated Major due to corrosion spalling at Pier 2**

**Photo 10 – Pile rated Severe due to corrosion spalling at Pier 2**

**Photo 11 – Pile rated Severe due to corrosion spalling at Pier 2**

**Photo 12 – Pile rated Severe due to impact damage at Pier 2**

**Photo 13 – Pile rated Major due to corrosion spalling at Pier 2**

**Photo 14 - Typical condition of deck at Pier 2**

**Photo 15 - Spalling of deck at expansion joint at Pier 2**

**Photo 16 - Typical condition of mooring bollard and base at Pier 2**

**Photo 17 – Broken cleat at Pier 2**

**Photo 18 – Spalling in front of mooring bollard base at Pier 2**

**Photo 19 – New bollards at Pier 2**

**Photo 20 – Spalling of curb at Pier 2**

**Photo 21 – Corrosion cracking of pile extension at Pier 3**

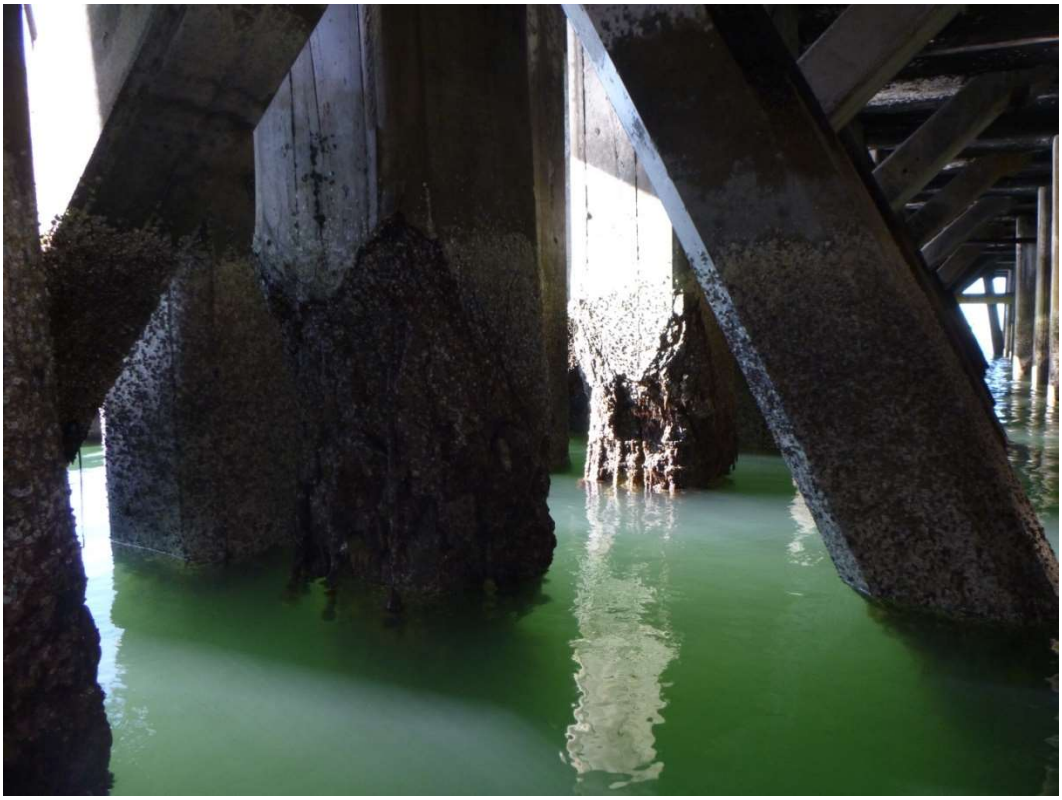


**Photo 22 – Deterioration of lower part of pile extension at Pier 3**

**Photo 23 – Efflorescence at soffit of Pier 3**

**Photo 24 – Corrosion spalling of deck edge at Pier 3**

**Photo 25 – Typical condition of mooring hardware at Pier 3**

**Photo 26 – Corrosion spalling of concrete at mooring hardware at Pier 3**

**Photo 27 – Corrosion spalling of concrete at mooring hardware at Pier 3**

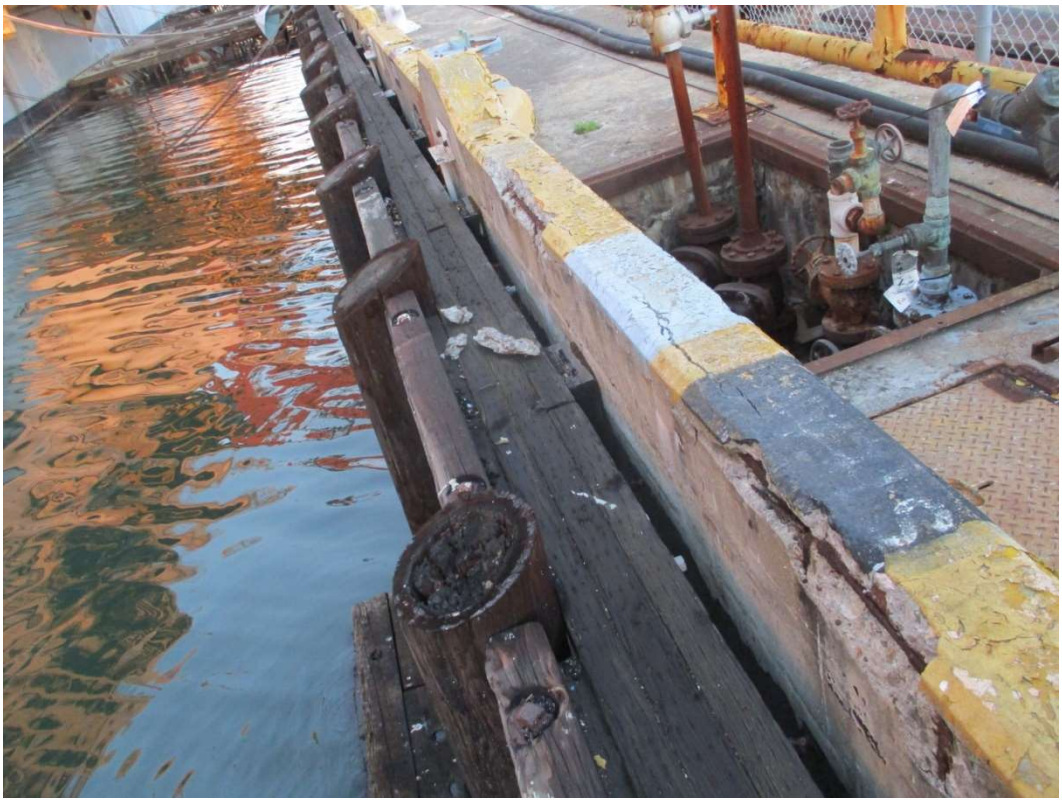


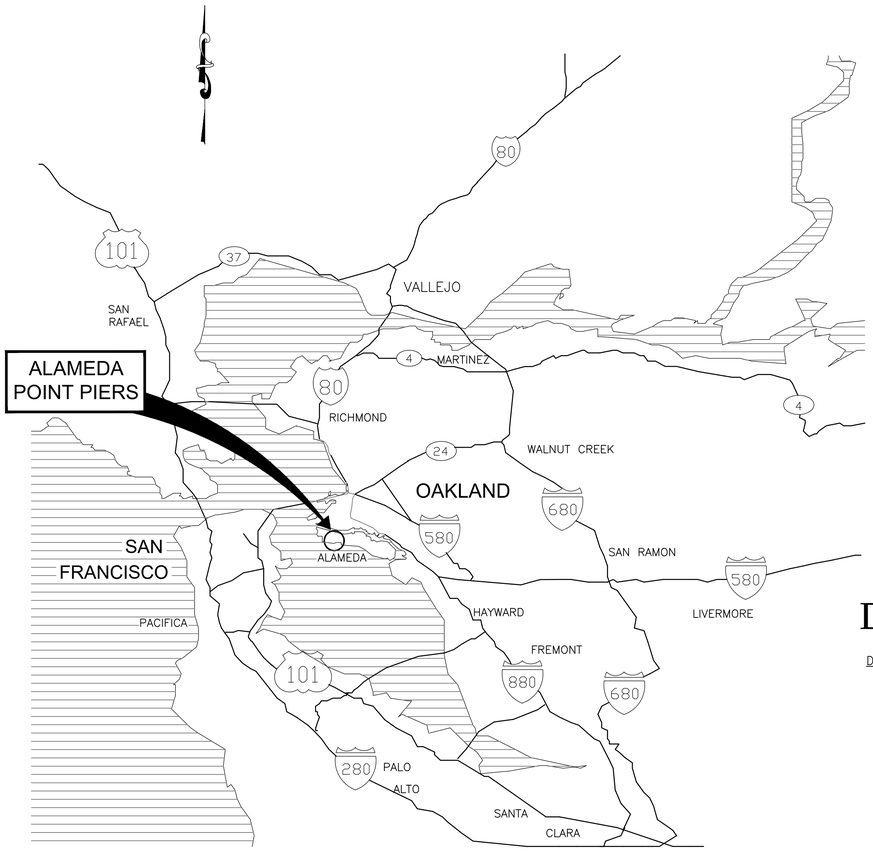
**Photo 28 – Corrosion spalling of curb at Pier 3**

# Appendix B – Figures

# ALAMEDA POINT PIERS 1, 2, & 3

# STRUCTURAL INSPECTION FINDINGS

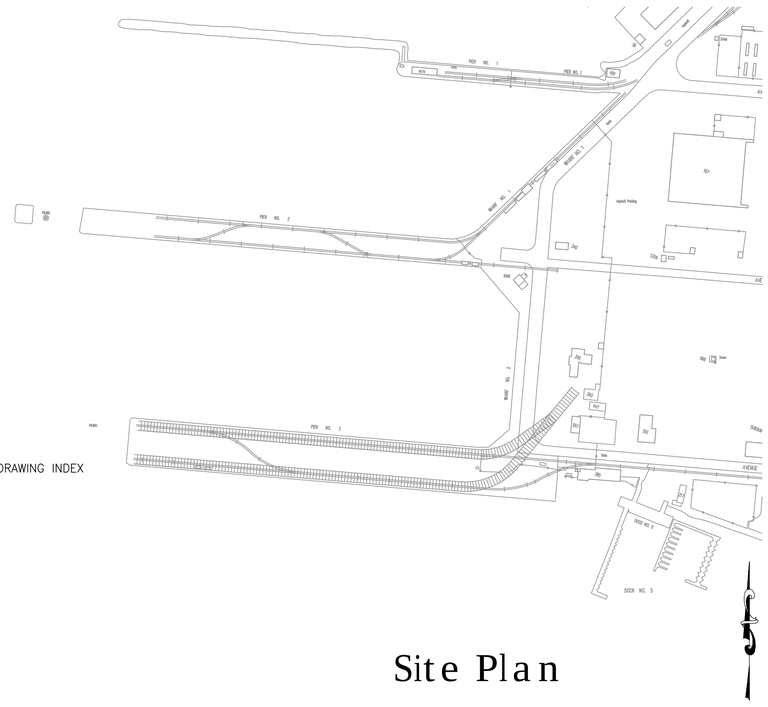
## ALAMEDA, CALIFORNIA




Vicinity Map

## Drawing Index






Site Plan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ALAMEDA POINT PIERS 1, 2, & 3 INSPECTIONS
ALAMEDA, CA

Project

TITLE SHEET, VICINITY MAP, SITE MAP & DRAWING INDEX

Drawing Title

| Project No. | Checked | Date |
|---|---|---|
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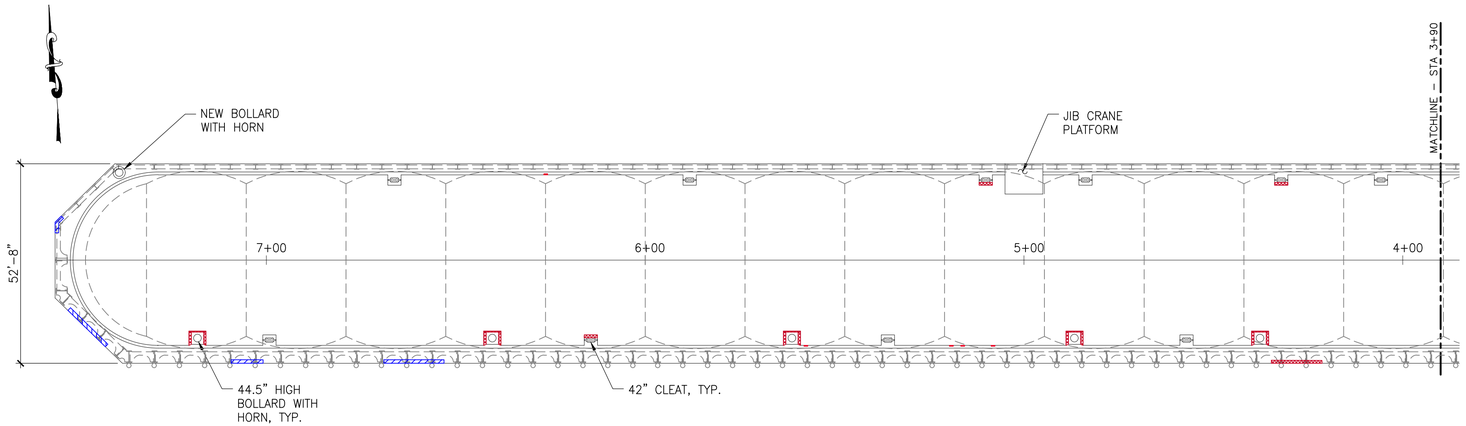
| Drawn: JRT | Approved: WMB | Scale: NONE |

Drawing No.

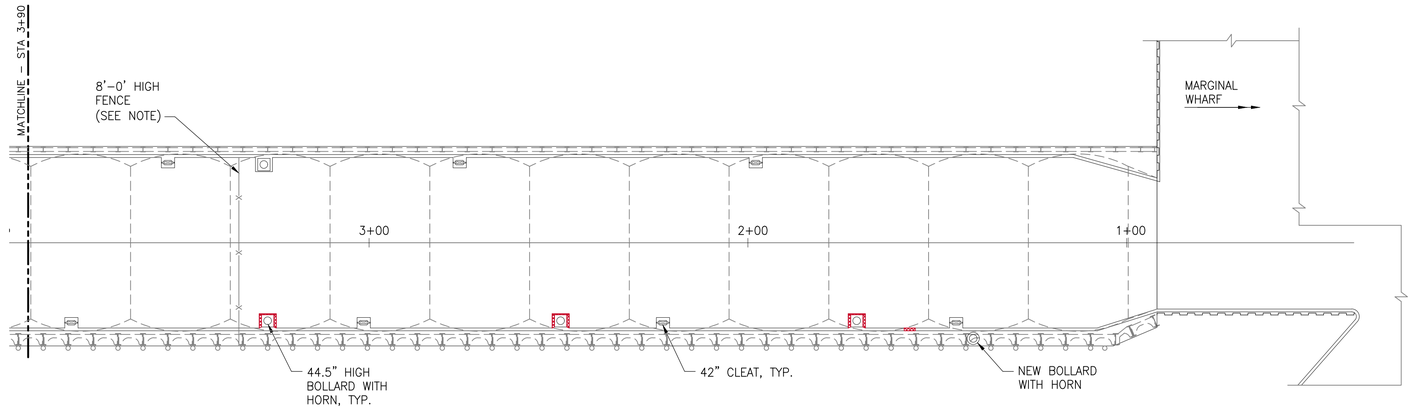
G1

Seal




LEGEND

- 44.5" HIGH BOLLARD WITH HORN
- 42" CLEAT
- OPEN SPALL
- DELAMINATION
- MOORING HARDWARE RATED SEVERE
- MOORING HARDWARE IN USE RATED SEVERE




GRAPHIC SCALE
30 0 30 60
1" = 30'

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ALAMEDA POINT
PIERS 1, 2, & 3
INSPECTIONS
ALAMEDA, CA

Project

PIER 1
DECK INSPECTION
PLAN

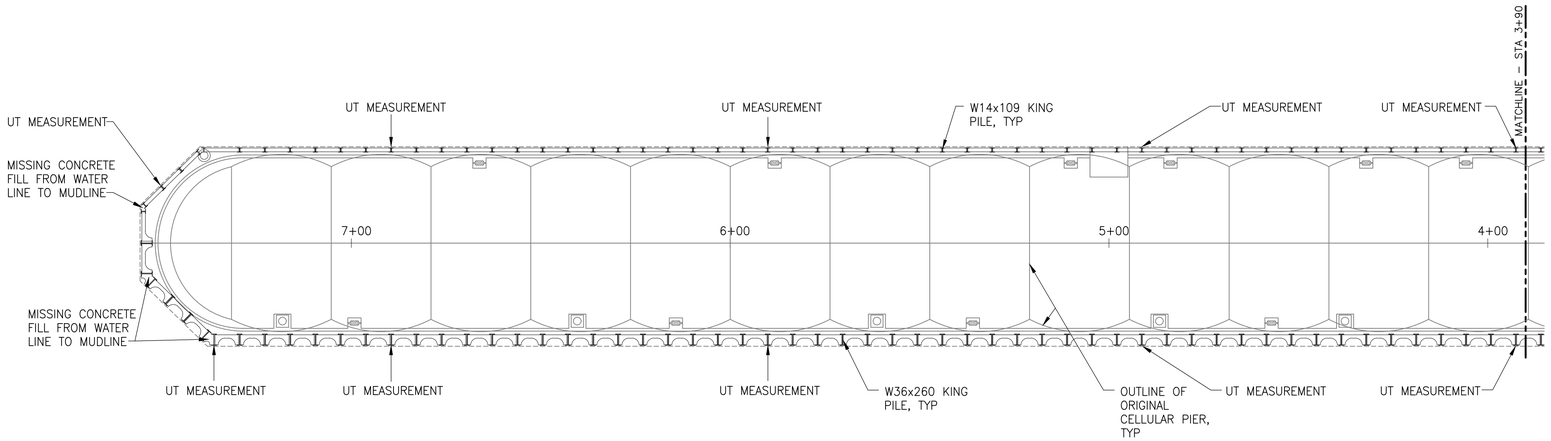
Drawing Title

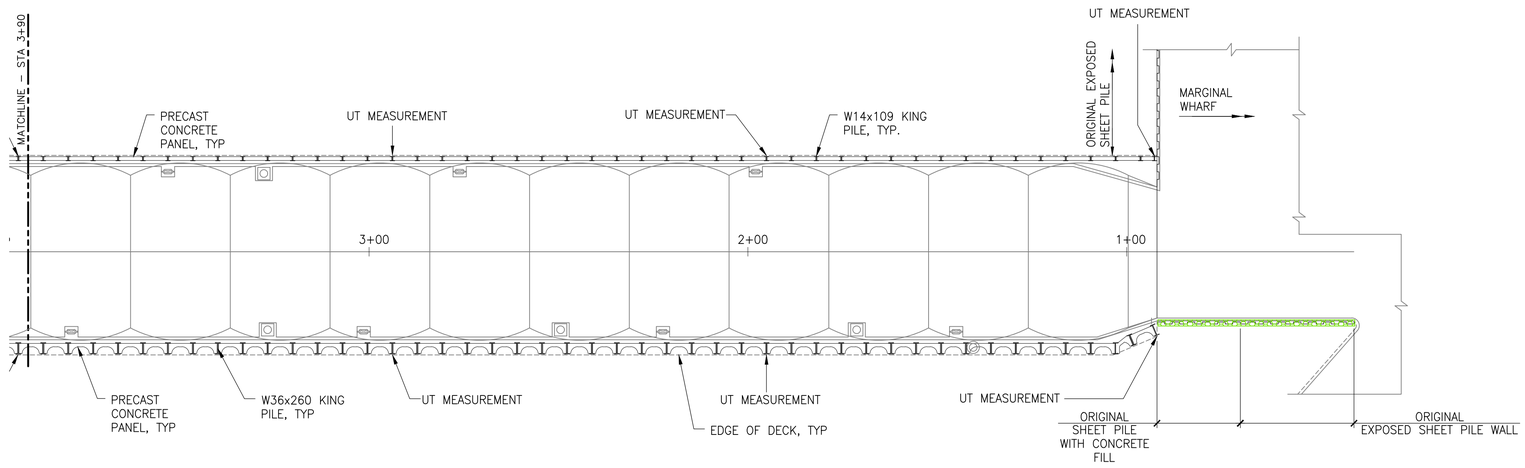
| Project No. | Checked | Date |
|---|---|---|
| 167543.00 | RI | 09/29/16 |
| Drawn | Approved | Scale |
| JRT | WMB | AS NOTED |

Seal

Drawing No.

P1-01




LEGEND

- CONCRETE PANELS
- RATED SEVERE
- STEEL PILE RATED SEVERE
- STEEL PILE RATED MAJOR
- STEEL PILE RATED MODERATE
- CORROSION OF SHEET PILE

NOTES

FENDER PILES NOT SHOWN FOR CLARITY

GRAPHIC SCALE
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1" = 30'

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PIERS 1, 2, & 3
INSPECTIONS
ALAMEDA, CA

Project

PIER 1
PILE INSPECTION
PLAN

Drawing Title

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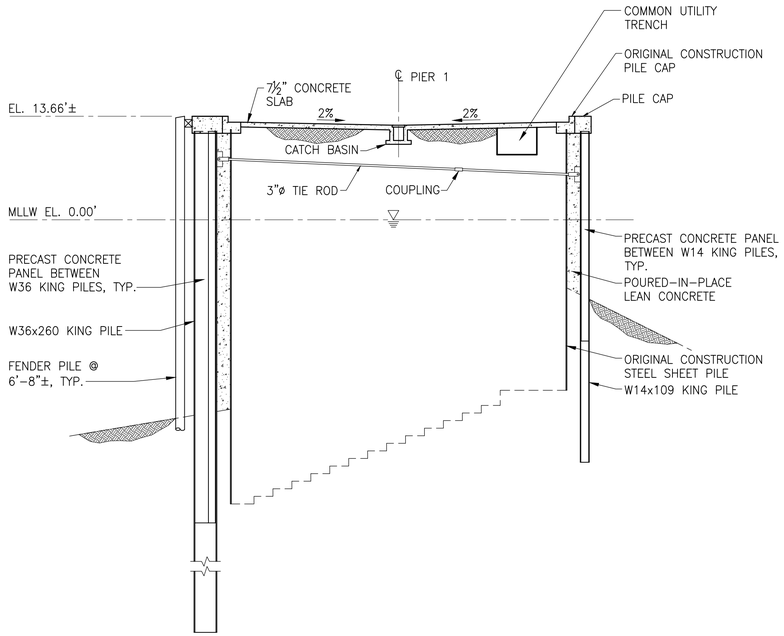
| Drawn | Approved | Scale |
| JRT | WMB | AS NOTED |

Drawing No.

P1-02

Seal




5 TYPICAL TRANSVERSE SECTION (LOOKING WEST)

SCALE: 1"=10'–0"

ALPR_P1-03.DGN TYPICAL SECTION

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PIERS 1, 2, & 3
INSPECTIONS
ALAMEDA, CA

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PIER 1
TYPICAL SECTION

Drawing Title

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|---|---|---|
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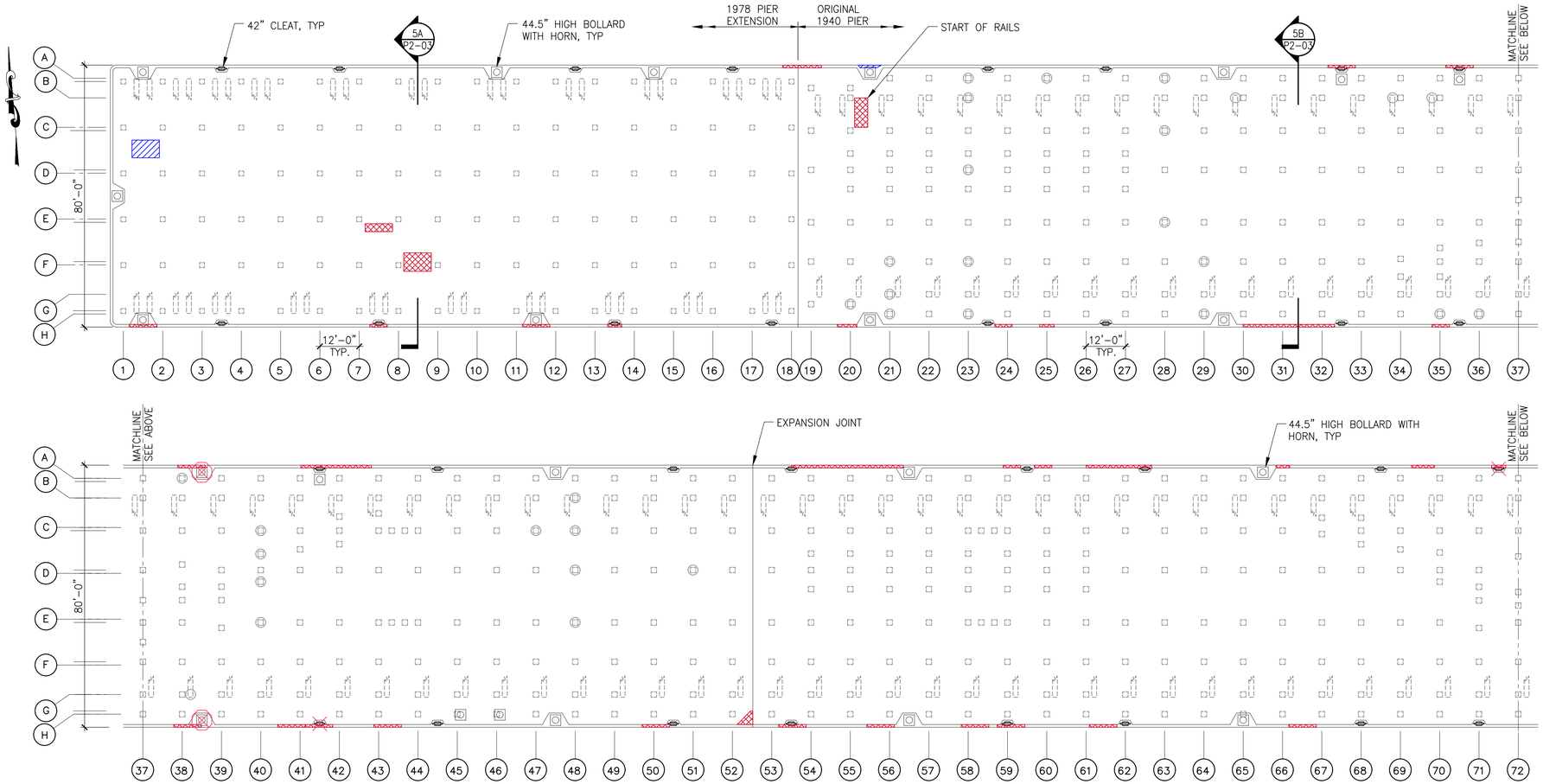
| JRT | WMB | AS NOTED |

Drawing No.

P1-03

Seal




LEGEND

- 44.5" HIGH BOLLARD WITH HORN
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ALAMEDA POINT
PIERS 1, 2, & 3
INSPECTIONS
ALAMEDA, CA

Project

PIER 2
DECK INSPECTION
PLAN

Drawing Title

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|---|---|---|
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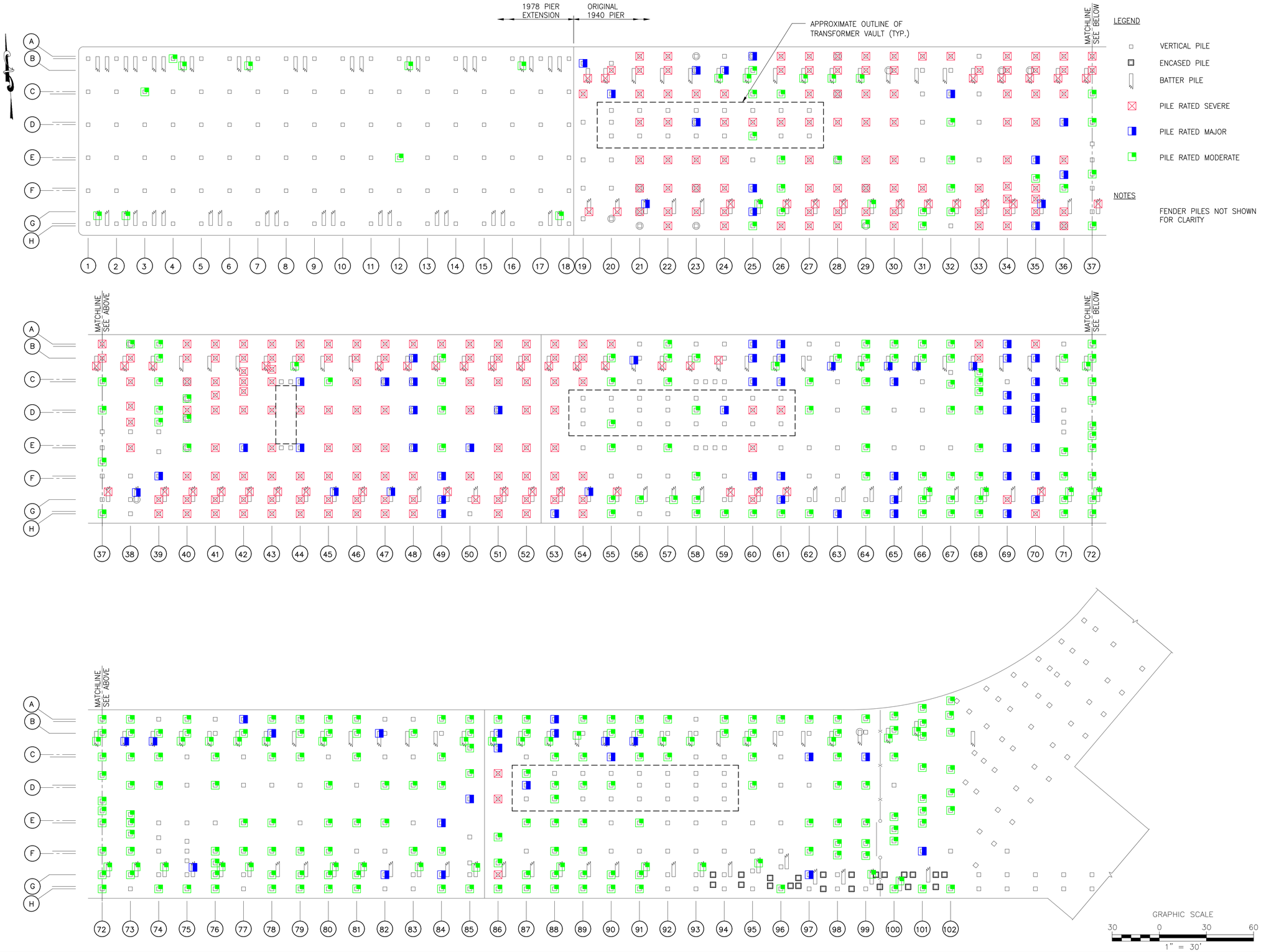
| JRT | WMB | AS NOTED |

Drawing No.

P2-01

Seal

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INSPECTIONS
ALAMEDA, CA

Project

PIER 2
PILE INSPECTION
PLAN

Drawing Title

| Project No. | Checked | Date |
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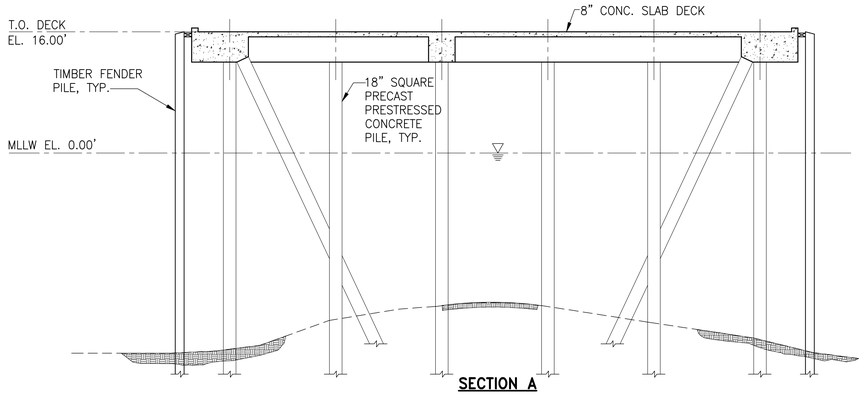
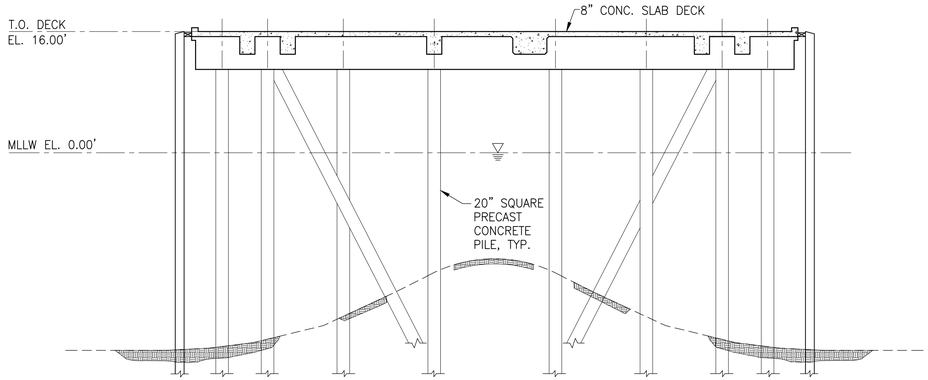
Seal

Drawing No.

P2-02




SECTION A




SECTION B

AUPR_P2-03_001 TYPICAL SECTION

5 TYPICAL SECTION

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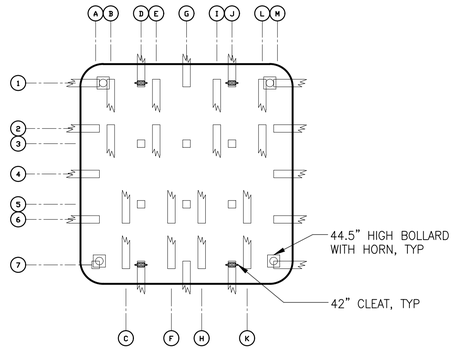
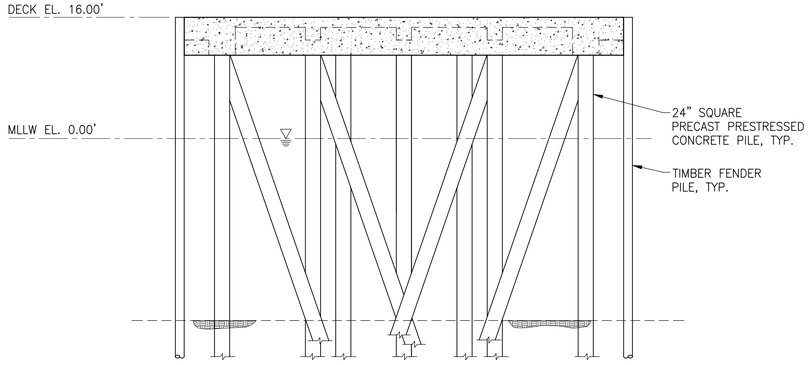



AUPR_P2-03_002 PLAN

3 PLAN

SCALE: 1"=20'-0"




AUPR_P2-03_003 TYPICAL TRANSVERSE SECTION

7 TYPICAL TRANSVERSE SECTION

SCALE: 1"=10'-0"

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PIERS 1, 2, & 3
INSPECTIONS
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Project

PIER 2
TYPICAL SECTION

Drawing Title

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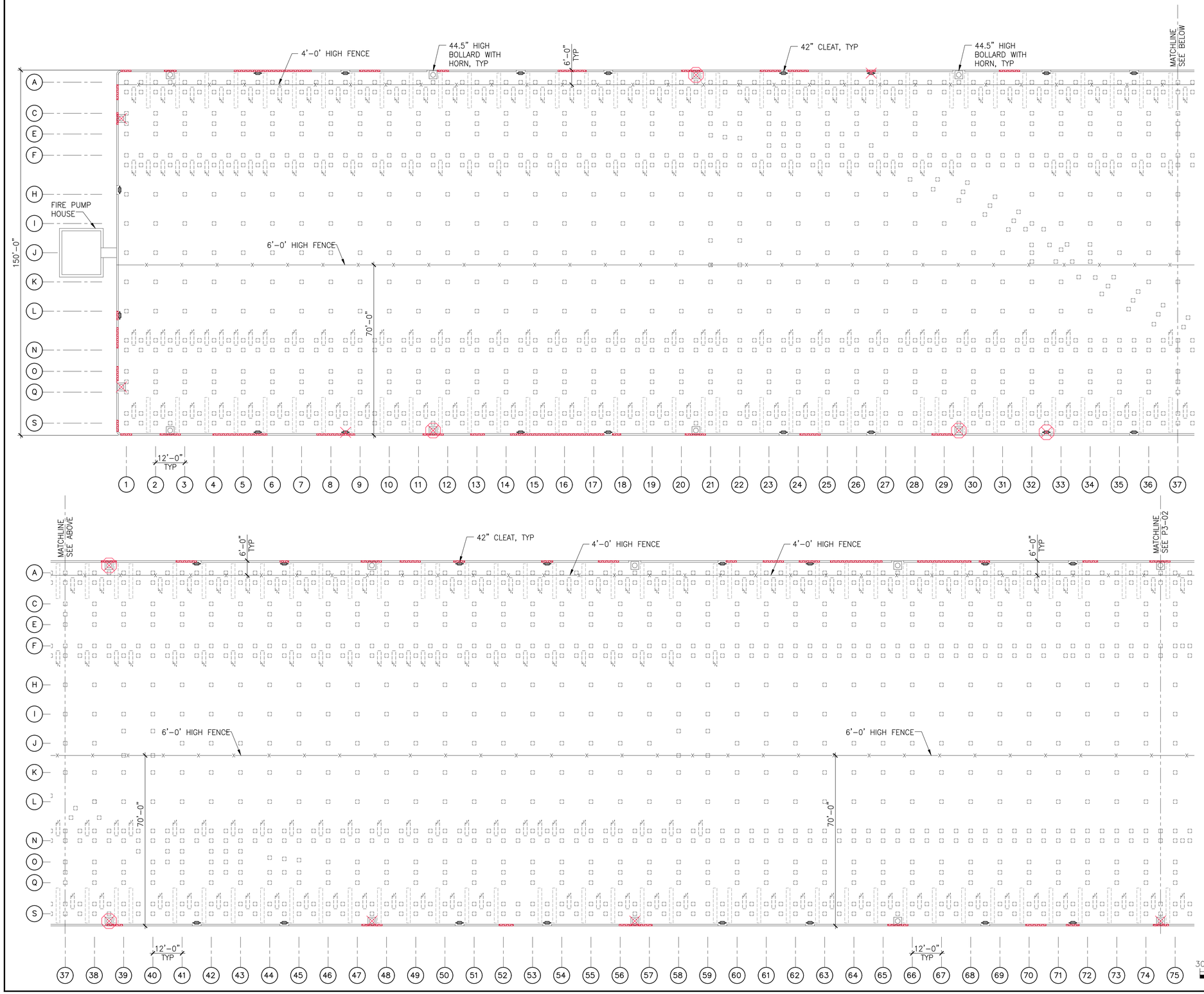
| JRT | WMB | AS NOTED |

Drawing No.

P2-03

Seal




LEGEND

- 44.5" HIGH BOLLARD WITH HORN
- 42" CLEAT
- OPEN SPALL
- MOORING HARDWARE RATED SEVERE
- MOORING HARDWARE IN USE RATED SEVERE

GRAPHIC SCALE
30 0 30 60
1" = 30'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INSPECTIONS
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PIER 3
DECK INSPECTION
PLAN

Drawing Title

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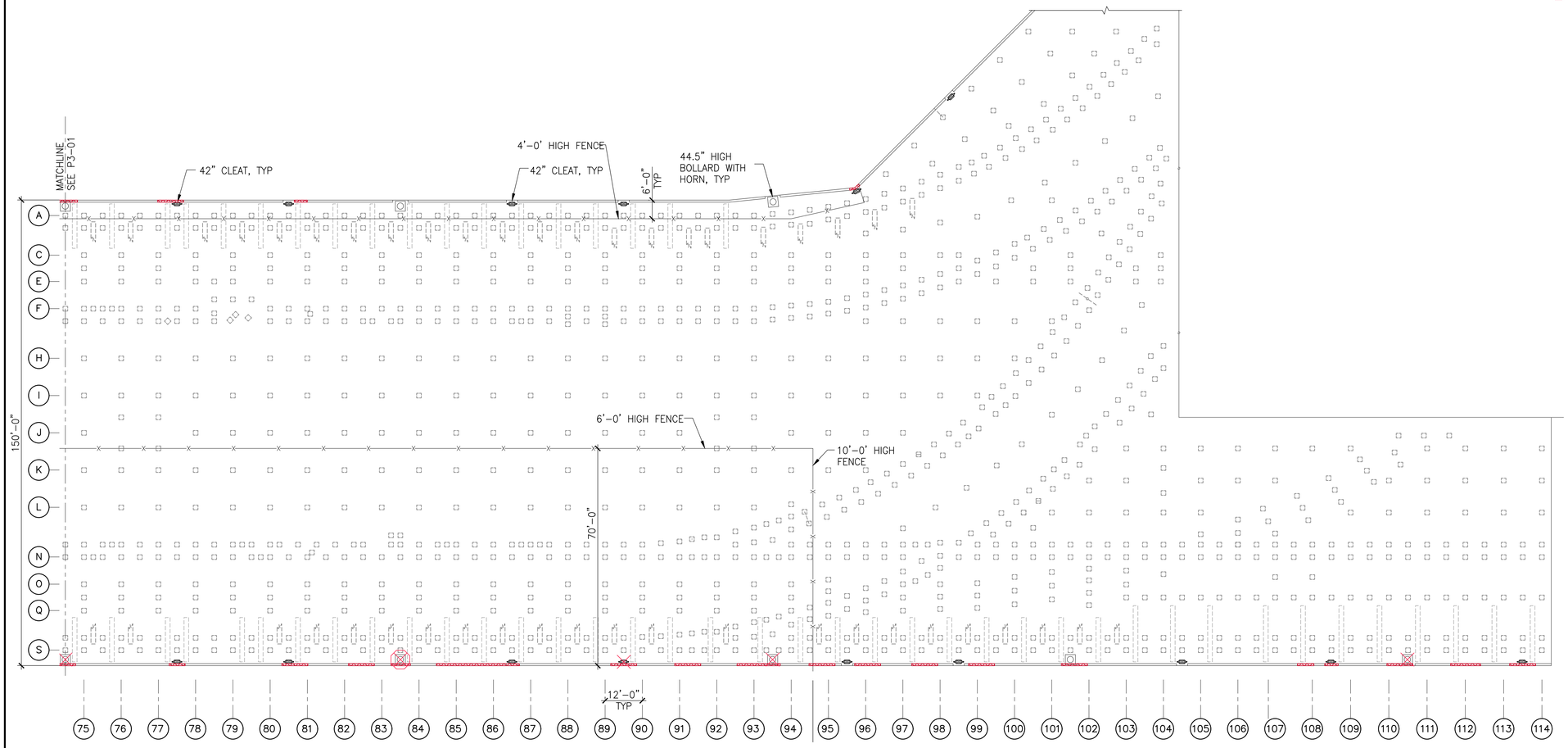
Seal

Drawing No.

P3-01




LEGEND

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- MOORING HARDWARE IN USE RATED SEVERE

GRAPHIC SCALE
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1" = 30'


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PIERS 1, 2, & 3
INSPECTIONS
ALAMEDA, CA

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PIER 3
DECK INSPECTION
PLAN

Drawing Title

| Project No. | Checked | Date |
|---|---|---|
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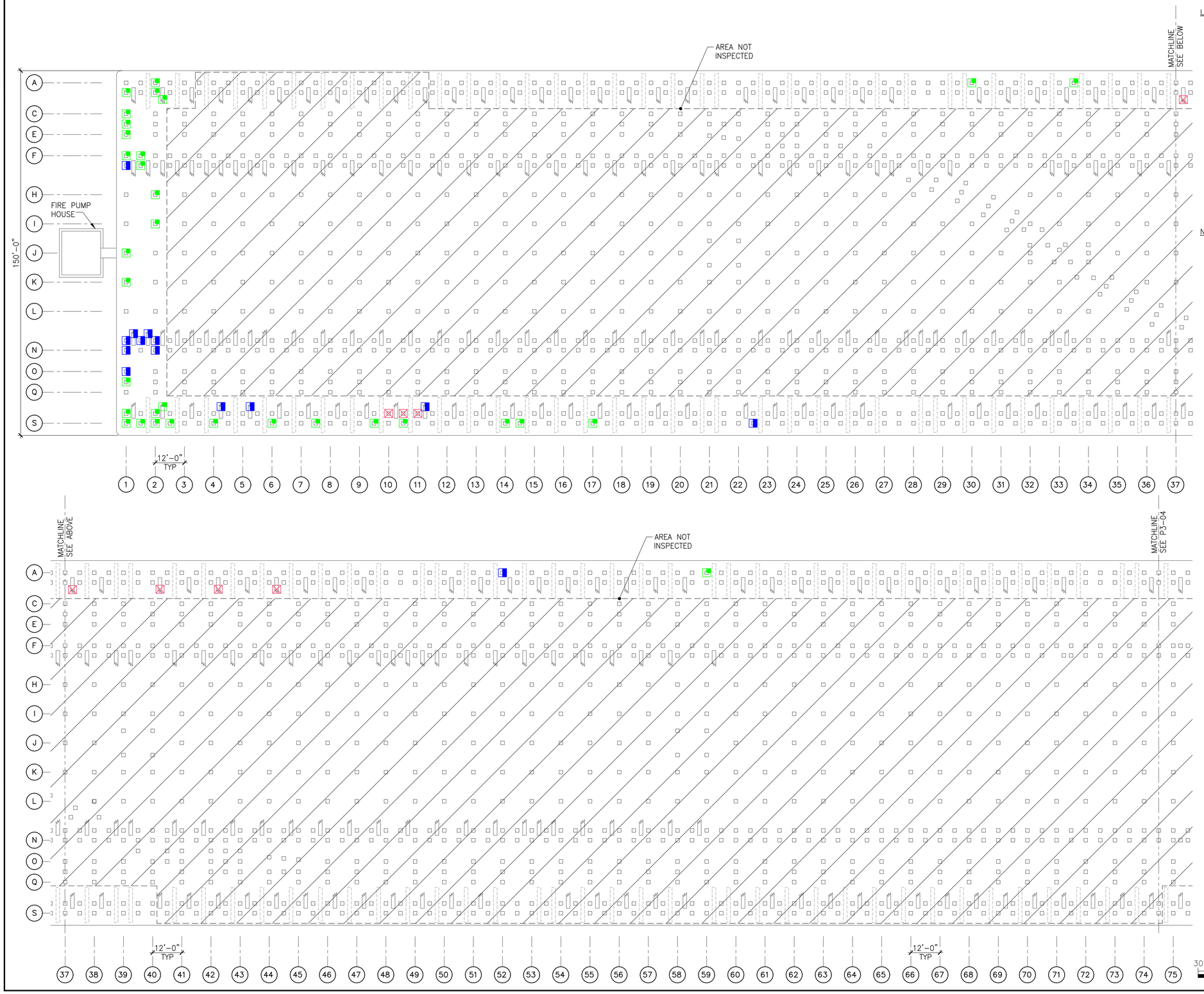
| Drawn | Approved | Scale |
| JRT | WMB | AS NOTED |

Seal

Drawing No.

P3-02

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# ALAMEDA POINT PIERS 1, 2, & 3 INSPECTIONS
ALAMEDA, CA

Project

# PIER 3 PILE INSPECTION PLAN

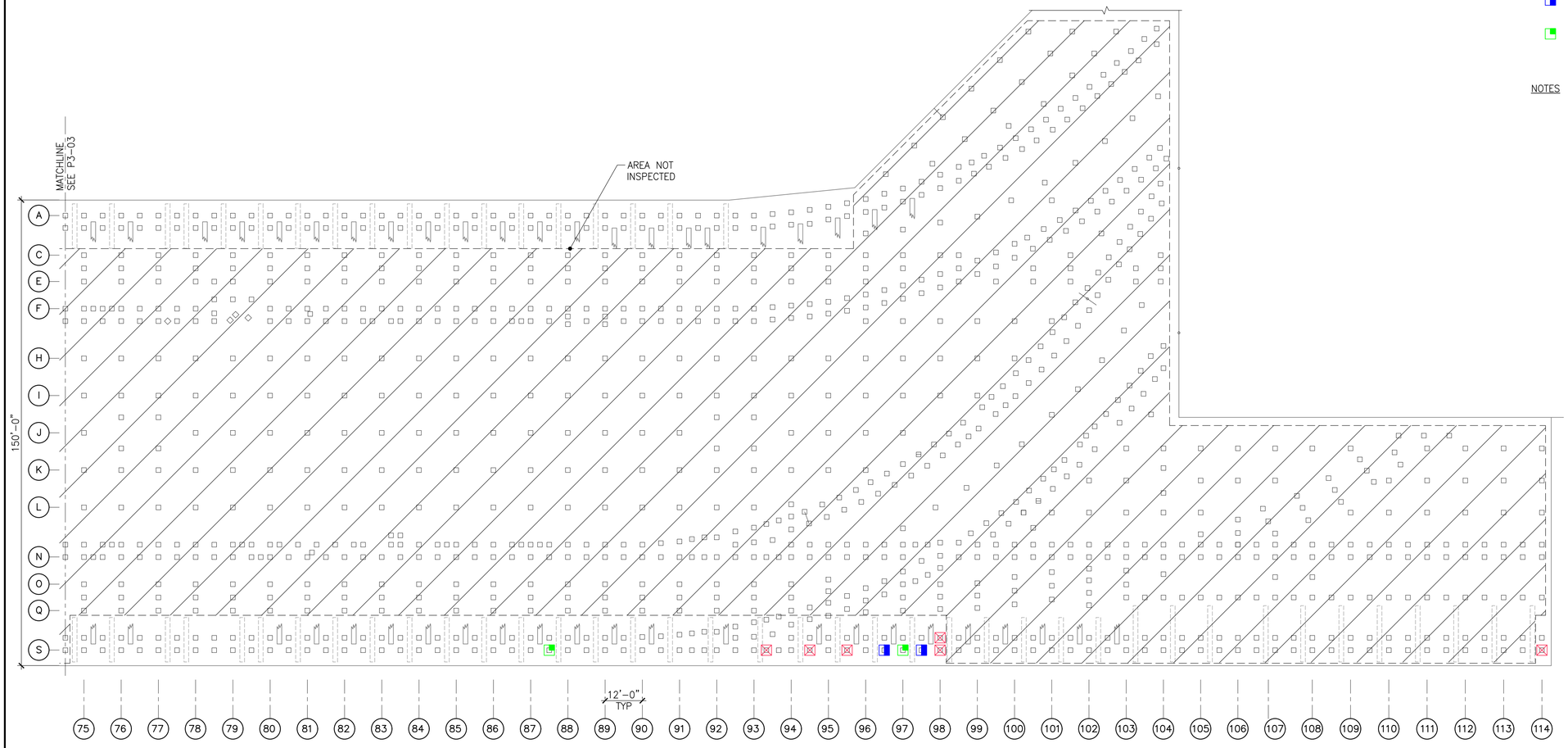
Drawing Title

| Project No. | Checked | Date |
|---|---|---|
| 167543.00 | RI | 09/29/16 |
| Drawn | Approved | Scale |
| JRT | WMB | AS NOTED |

Drawing No.

P3-03

Seal




LEGEND

- VERTICAL PILE
- BATTER PILE
- FENDER FRAME
- PILE RATED SEVERE
- PILE RATED MAJOR
- PILE RATED MODERATE

NOTES

FENDER PILES NOT SHOWN FOR CLARITY

GRAPHIC SCALE
30 0 30 60
1" = 30'

SIMPSON GUMPERTZ & HEGER
Engineering of Structures and Building Enclosures
Simpson Gumpertz & Heger Inc.
500 12th Street, Suite 270
Oakland, California 94607
main: 510.457.4600 fax: 510.457.4599
www.sgh.com
Boston
Chicago
Houston
Los Angeles
New York
San Francisco
Washington, DC

Consultant

| No. | Date | Description | By |
|---|---|---|---|
| | | | |

ALAMEDA POINT
PIERS 1, 2, & 3
INSPECTIONS
ALAMEDA, CA

Project

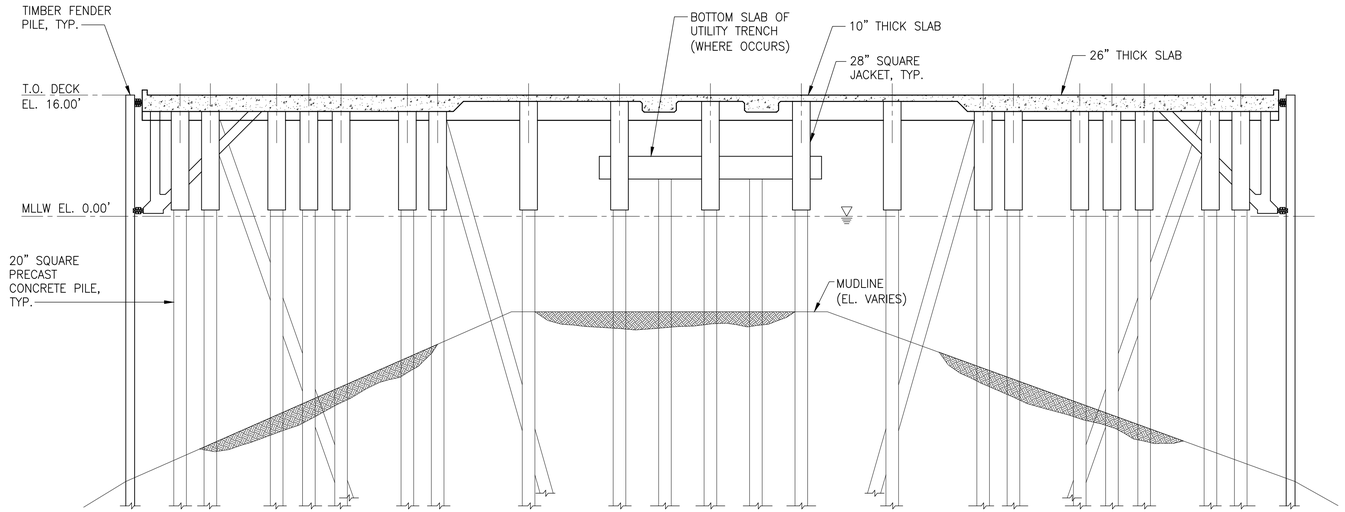
PIER 3
PILE INSPECTION
PLAN

Drawing Title

| Project No. | Checked | Date |
|---|---|---|
| 167543.00 | RI | 09/29/16 |
| Drawn | Approved | Scale |
| JRT | WMB | AS NOTED |

Drawing No.
P3-04

Seal




5 TYPICAL TRANSVERSE SECTION
(LOOKING WEST)

SCALE: 1"=10'-0"

ALMR P3-05.DGN TYPICAL SECTION

SIMPSON GUMPERTZ & HEGER
Engineering of Structures and Building Enclosures

Simpson Gumpertz & Heger Inc.
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Oakland, California 94607
main: 510.457.4600 fax: 510.457.4599
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New York
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Washington, DC

Consultant

| No. | Date | Description | By |
|---|---|---|---|
| | | | |

ALAMEDA POINT
PIERS 1, 2, & 3
INSPECTIONS
ALAMEDA, CA

Project

PIER 3
TYPICAL SECTION

Drawing Title

| Project No. | Checked | Date |
|---|---|---|
| 167543.00 | RI | 09/29/16 |
| Drawn | Approved | Scale |
| JRT | WMB | AS NOTED |

Drawing No.
P3-05

Seal

# Appendix C – Underwater Inspection

SHORELINE ENGINEERING, INC.
STRUCTURAL / CIVIL / FORENSIC / ENGINEER-DIVERS

# Alameda Point Piers
# 2016 Underwater
# Structural Condition Assessment




**For:**
**SIMPSON GUMPERTZ & HEGER, INC.**
**500 12th Street, Suite 270**
**Oakland, CA 94607**

**January 20, 2017**
**Shoreline Project #420-05**

## EXECUTIVE SUMMARY

Shoreline Engineering, Inc. (Shoreline) was retained by Simpson Gumpertz and Heger, Inc. (SGH) to perform underwater inspections of the below water structural elements of Piers 1 & 2 at Alameda Point in Alameda, California. The inspection work was conducted from August 18, 2016 through December 7, 2016. The primary goal of this work was to document the current condition of the below water structural elements of the piers. This report details the findings and recommendations of the field investigations conducted by Shoreline.

### FINDINGS

The below water structural elements of Pier 1 are generally in satisfactory condition. Minor to moderate corrosion of the steel king piles was noted in the tidal and splash zones. Below water, the pile coating is generally intact and the piles are in good condition. Only minor defects were found on the concrete infill panels. The older section of steel sheet pile between the marginal wharf and the pier on the south side is severely deteriorated with holes and visible loss of fill.

Pier 2 was originally constructed in the 1940s but was extended approximately 210 feet in the 1970s. A mooring dolphin was added to the west of the pier at that same time. The original pier is supported by conventionally reinforced concrete piles (Bents 19-102). The extension and mooring dolphin are supported by prestressed concrete piles. The original piles are in poor to serious condition due to chemical attack in the lower tidal zone and continually submerged zone. Table 1 shows the number of piles by rating for each of the different areas of the pier and mooring dolphin.

**Table 1 - Pier 2 Pile Quantities by Rating**

| Structure | No Defect | Minor | Moderate | Major | Severe | Totals |
|---|---|---|---|---|---|---|
| **Original Pier (1940s)** | 294 | 3 | 300 | 90 | 263 | 950 |
| **Extension (1970s) (Prestressed)** | 142 | 2 | 6 | 0 | 0 | 150 |
| **Dolphin** | 31 | 2 | 4 | 0 | 0 | 37 |
| **Totals** | 467 | 7 | 310 | 90 | 263 | 1137 |

### RECOMMENDATIONS

Pier 1 is in satisfactory condition. The steel king piles with corrosion and coating loss should be cleaned and recoated above water and in the tidal zone. A cathodic protection system should be considered to prolong the service life of the structure. The original steel sheet pile wall located on the south side between the pier and the marginal wharf should be considered for repair.

The original (1940s) piles at Pier 2 are in poor to critical condition. The piles rated major and severe should be repaired as soon as possible to restore the load bearing capacity of the structure. Load restrictions should be considered until repairs completed.

The last underwater inspection of Pier 3 was performed in 2007. It was a partial inspection and only included nine of 114 pile bents. The ASCE recommends concrete pile supported structures in fair condition be inspected every three years. It is recommended that a more comprehensive structural inspection of Pier 3 be performed as soon as possible.

It is unknown when the last inspection of the marginal wharf inshore of Piers 1-3 was performed. Due to the aggressive chemical attack noted at the piles on Pier 2, it is recommended that a comprehensive

structural condition inspection and assessment be performed including above and below water investigations.

This report only addresses the below water findings of the underwater inspections performed by Shoreline. Refer to SGH's structural condition assessment report for Pier 1, Pier 2, and Pier 3 for additional information.

## TABLE OF CONTENTS



Appendices:

# 1.0 INTRODUCTION

Piers 1, 2, and 3 at Alameda Point were originally constructed in the 1940s on what was formerly the Alameda Naval Air Station. The majority of the space is currently leased by the U.S. Maritime Administration (MARAD). The north side of Pier 1 is currently occupied by Power Engineering Contractors and the north side of Pier 3 is the site of the USS Hornet Museum.

The City of Alameda contracted with Simpson Gumpertz and Heger, Inc. (SGH) to provide Phase 1, "Interim Inspection, Testing, Preliminary Analyses and Reporting Services" for the Rehabilitation of Piers 1, 2, and 3. The primary goal of this work is to document the current condition of the piers, perform analyses, and determine recommendations for repair. Shoreline Engineering, Inc. (Shoreline) was retained by SGH to perform the underwater portions of the inspection work.

Shoreline conducted the underwater inspection work from August 18, 2016 through December 7, 2016. This report documents the current condition of the below water structural elements of Alameda Point Piers 1 and 2.

Figures which graphically present the inspection findings are provided in Appendix A. Representative photographs of conditions observed at the pier are provided in Appendix B. Pile inspection data is provided in Appendix C. Condition assessment rating criteria is provided in Appendix D. References used during this investigation are provided in Appendix E.

## 1.1 Facility Description

Pier 1 was originally constructed in 1946 as a cellular sheet pile structure. In the late 1980s the pier was substantially rehabilitated by installing steel king piles with concrete infill panels outside of the cellular sheet pile structure (Photo 1). The Pier is approximately 660 feet long and 53 feet wide with king piles nominally spaced at approximately 6'-8" center-to-center. The king piles at the south side of the pier are W36x260 sections and the king piles on the north side of the pier are W14x109 sections. The concrete infill panels on the south side of the structure are scalloped and on the north side they are flat (Photos 2 and 3). There is a short section of the original steel sheet pile bulkhead still visible between the start of the king pile bulkhead and the marginal wharf on the south side of the pier. The concrete deck is approximately 8 inches thick. There is a timber fender system on the south side of the pier.

Pier 2 was originally constructed in the early 1940s with conventional precast concrete piles. In the early 1970s the pier was extended approximately 210 feet. A mooring dolphin was also installed approximately 150 feet west of the extension. Both the extended portion of the pier and the mooring dolphin are supported by precast, prestressed concrete piles.

The older portion of Pier 2 is approximately 1000 feet long by 80 feet wide and is supported by pile bents typically spaced 12 feet apart consisting of eight, 20 in. square piles plumb piles and two batter piles. The newer extension is approximately 210 feet long by 80 feet wide. The extension is supported by pile bents consisting of six, 18 in. square piles per bent. A timber fender system is present on both sides of the pier.

Pier 3 was originally constructed in the 1940s and is approximately 1100 feet long by 150 feet wide. It is supported by conventionally reinforced concrete piles with cast-in-place concrete extensions from the low water line to the bottom of the deck. The concrete deck is approximately 26 inches thick at the outer sides of the pier under the crane rails and 10 inches thick at the center. A timber fender system is present on both sides of the pier.

## 1.2 Inspection Scope

For this project Shoreline performed the underwater inspection of Piers 1 and 2 and performed the deck coring at Piers 1, 2, and 3. The levels of effort for each pier are detailed in Table 1.

**Table 2 - Inspection Quantities**

| Facility | Level I | Level II | Level III |
|---|---|---|---|
| **Pier 1** | | | |
| Sheet Piles | 100% | 2 meas. per side (4 total) | 2 meas. per side (4 total) |
| King Piles | 100% | 10% | 5% |
| Concrete Infill Panels | 100% | Every 100 Linear Feet | N/A |
| Deck Coring | 0% | 0% | 2 cores |
| **Pier 2** | | | |
| 1940's Concrete Piles | 100% | 20% | 11 piles (3 cores/pile) |
| Prestressed Piles at 1970s extension and Mooring Dolphin | 100% | 10% | 0% |
| Deck Coring | 0% | 0% | 2 cores |
| **Pier 3** | | | |
| Concrete Piles | 0% | 0% | 1 pile (3 cores) |
| Deck Coring | 0% | 0% | 2 cores |

The timber fender piles were not included in the scope of the inspection; however, it was noted that the timber fender system at all three piers is generally in poor to serious condition with many broken, missing, and severely deteriorated elements. In several areas, the timber fender system is in an active state of collapse.

## 1.3 Inspection Methodology

The underwater inspection was conducted by a three-person dive team led by a California Registered Civil Engineer with experience in underwater inspections nationwide and internationally. All Shoreline divers are commercially certified in accordance with OSHA and Association of Diving Contractors International (ADCI) diving guidelines. The dive mode for this project was Surface-Supplied Air (SSA) diving using commercial diving equipment staged from a Shoreline dive trailer.

All inspection work was performed in accordance with the guidelines outlined in the American Society of Civil Engineers (ASCE) "Underwater Investigations - Standard Practice Manual". The underwater inspection work included a 100% Level I visual and tactile inspection of all below water structural elements from the mudline to +3 MLLW.

Level II inspections consisted of an in-depth examination of the selected elements including the removal of marine growth at three locations. The mechanical removal of the marine growth from the selected surfaces was performed in the tidal zone, at mid-depth, and approximately 3 ft. above the mudline. For steel elements, the Level III inspection included ultrasonic thickness measurements and electrical potential readings (CP readings) at each Level II location.

Thirty-six core samples were taken from twelve concrete piles, eleven piles were cored at Pier 2 and one pile was cored at Pier 3 to provide a comparison between the two structures. A 4.5 in. diameter diamond core bit was used to extract core samples from three locations on each pile, one in the tidal zone, one at mid-water, and one three feet below the mudline. Additionally, two core samples were extracted from the deck of each pier.

### 1.4 Previous Inspections

In 2007 partial underwater inspections of Piers 1, 2, and 3 were conducted. Pier 1 was noted to be in generally good condition. The piles supporting the older section of Pier 2 were noted to be in poor condition with chemical deterioration and loss of concrete observed on a large number of piles. The piles supporting the 1970s extension to Pier 2 were noted to be in good condition. Pier 3 was noted to be in fair condition. Chemical attack was not observed at the piles inspected on Pier 3.

## 2.0 STRUCTURAL INVESTIGATION FINDINGS

The underwater visibility during the inspection was typically less than five feet with no current. Hard and soft marine growth up to six inches thick was typically found below water (Photo 4). A commercial pressure washer was employed to remove the growth at Level II inspection locations (Photo 5).

### 2.1 Pier 1

#### *2.1.1 Sheet Piles*

The steel sheet pile wall on the south side of the pier between the marginal wharf and the pier is in poor condition with severely corroded steel, holes in the sheet piles, and loss of fill (Photos 6 and 7).

#### *2.1.2 Steel King Piles*

The steel king piles are typically in good condition below water. Pile coatings are generally intact but several isolated areas of coating loss and corrosion were noted (Photos 8 and 9). In the tidal zone and atmospheric zone there is significant coating loss and minor to moderate corrosion (Photo 10). Ultrasonic thickness (UT) measurements and electrical potential readings were recorded at all Level III locations (Photos 11 and 12). Refer to Appendix C for Level III inspection data. UT readings generally indicate little to no loss of cross section at the areas measured. There is no cathodic protection (CP) system in place at Pier 1 and the electrical potential readings confirm that the steel is unprotected.

#### *2.1.3 Concrete Infill Panels*

The concrete infill panels are generally in good condition with only minor cracking observed in a few locations. The plastic guides installed between the king piles and the infill panels are generally in place; however, in several locations they are displaced (Photo 13).

At the offshore end of the pier at corners 6+52, 6+75, and 6+92 concrete fills the void between the two king piles at each corner. This concrete extends from the deck to the lower tidal zone. Below water, the inner two flanges of the king piles are visible. At corner 6+75 there is a gap between these two flanges with minor fill loss (Photo 14).

#### *2.1.4 Deck Coring*

Core samples were extracted from two locations on the deck. One on the north side near the gangway to the floating docks and one near the offshore end of the pier. Both core samples were approximately 8 in. long and came out as one piece (Photo 15). Soil was encountered immediately below the deck with no voids noted between the fill and bottom surface of the deck.

### 2.2 Pier 2

#### *2.2.1 1940s Concrete Piles*

The original conventionally-reinforced, precast, concrete piles at Pier 2 are generally in poor to serious condition. A number of piles near the offshore end of the original pier (Bent 19) and scattered throughout the pier have deterioration due to corrosion of the reinforcing steel which presents as corrosion cracking and spalling in the splash and tidal zones. Refer to SGH's report for the above water inspection findings.

In the lower tidal zone and continually submerged zone many piles exhibit deterioration due to chemical attack. The deterioration is present throughout the pier and is considerably pronounced in the zone between Bents 19-54. In most cases the piles look good above water; however, the concrete becomes soft in the lower tidal zone, and in general, this condition continues to just above the mudline. The piles

typically appeared to be in better condition near the mudline but some piles have exposed rebar that extends below the mudline (Photo 16).

As the concrete becomes soft the corners tend to round off and no longer maintain the chamfered edge seen on intact piles (Photo 17). Based on the rating criteria, rounding up to one inch deep indicates a "Moderate" pile (Photo 18). Rounding greater than one inch deep with no exposed rebar indicates a "Major" pile (Photo 19). Once rebar becomes exposed the pile is considered to be "Severe" (Photo 20).

The compromised concrete no longer provides adequate protection for the steel reinforcing which then begins to corrode. The chemical deterioration causes internal stresses within the concrete which leads to cracking and further deterioration. As the steel reinforcing corrodes the corrosion byproducts expand within the concrete causing tremendous internal stress within the pile. As these processes continue the outer protective layer of the pile (concrete cover) cracks and eventually spalls off. This leaves the reinforcing steel open to rapid deterioration due to corrosion.

Concrete encasement repairs are present on a number of piles (Photo 21). In some cases, the encasements do not extend below the mudline and the original pile is visible below the encasement. Several of these previously repaired piles are rated major or severe due to deficiencies below the encasements (Photo 22).

#### *2.2.2 1970s Prestressed Concrete Piles*

The prestressed piles supporting the extension to Pier 2 (Bents 1-18) and the Mooring Dolphin are generally in good condition with only minor defects noted below water (Photo 23).

#### *2.2.3 Concrete Pile Coring*

Core samples were removed from 11 piles at Pier 2 (33 core samples)(Photo 24). Refer SGH's report for a discussion of the findings from the chloride intrusion analysis, petrographic analysis, and compressive strength testing.

#### *2.2.4 Deck Coring*

Core samples were extracted from two locations on the deck. One was taken from the north side of the pier close to the concrete curb between Bents 37 & 38 and the other from the south side between Bents 91 & 92. The core samples were approximately 8 in. long and came out as one piece (Photo 25). Both core samples went through the full section of the deck.

### 2.3 Pier 3

#### *2.3.1 Concrete Piles*

The concrete piles at Pier 3 were not included in the scope of the underwater inspection. SGH performed an inspection of the piles located around the perimeter of the pier that were visible by boat. The piles at Pier 3 have a larger concrete extension cast on top of the original piles (Photo 26). The extensions typically extend below the waterline making visual inspection of the original piles difficult at all but the very lowest tides. During the course of the inspection several piles were noted to be in severe condition due to chemical attack. Refer to SGH's above water inspection report for additional information.

#### *2.3.2 Concrete Pile Coring*

The original scope of work for the underwater coring was altered to facilitate a comparison of the piles supporting Piers 2 and 3. Three core samples were taken from Pile 30-A at Pier 3 to determine the severity of chemical attack.

#### *2.3.3 Deck Coring*

Core samples were extracted from two locations on the deck. Both cores were taken near the offshore end of the pier, one on the north side and one on the south side. The core samples were approximately 10 in. long and each came out as one piece (Photo 27). Due to the increased thickness of the deck at the coring locations, both core samples did not penetrate through the full section of the deck.

# 3.0 CONCLUSIONS AND RECOMMENDATIONS

## 3.1 Pier 1

### *3.1.1 Sheet Piles*

Previous repairs have been made in the area where the old sheet pile bulkhead is visible. No repair drawings were available for review and it is not clear what the extent of the repairs included. It is recommended that additional investigations be performed in this area to determine the extent of the repairs previously performed and assess whether additional repairs are warranted. Until this work is performed, this area should be monitored.

### *3.1.2 Steel King Piles*

The steel king piles should be cleaned and recoated above water and in the tidal zone to prolong the service life of the structure. Installation of a cathodic protection system should be considered to prolong the service life of these members below water.

### *3.1.3 Concrete Infill Panels*

No repairs are recommended at this time for the concrete infill panels.

### *3.1.4 Inspection Cycle*

The findings of the above water inspection performed by SGH should be combined with the underwater inspection findings and a combined rating should be established. Based on the combined rating, a global Condition Assessment Rating (CAR) should be assigned and used to determine the next underwater inspection cycle.

## 3.2 Pier 2

### *3.2.1 1940s Concrete Piles*

The piles supporting the original portion of Pier 2 are in poor to serious condition. Their load bearing capacity is reduced due to deficiencies above and below water. Significant chemical deterioration is present throughout this area of the pier. The piles rated major and severe should be repaired as soon as possible to restore the load bearing capacity of the structure. Load restrictions should be considered until repairs complete. Refer to SGH's report for additional information.

### *3.2.2 1970s Prestressed Concrete Piles*

The prestressed piles supporting the extension to Pier 2 and the Mooring Dolphin are in satisfactory condition and no repairs are recommended at this time.

### *3.2.3 Concrete Pile Coring*

Refer SGH's report for a discussion of the findings from the chloride intrusion analysis, petrographic analysis, and compressive strength testing.

### *3.2.4 Inspection Cycle*

The findings of the above water inspection performed by SGH should be combined with the underwater inspection findings and a combined rating should be established. Based on the combined rating, a global Condition Assessment Rating (CAR) should be assigned and used to determine the next underwater inspection cycle.

## 3.3 Pier 3

### *3.3.1 Concrete Piles*

The concrete piles at Pier 3 were not included in the scope of the underwater inspection. SGH performed an inspection of the piles located around the perimeter of the pier that were visible by boat. The piles at

Pier 3 have a larger concrete extension cast on top of the original piles. The extensions typically extend below the waterline making visual inspection of the original piles difficult at all but the very lowest tides. During the course of the inspection several piles were noted to be in severe condition due to chemical attack and corrosion cracking. Refer to SGH's above water inspection report for additional information.

#### *3.3.2 Concrete Pile Coring*

Refer SGH's report for a discussion of the findings from the chloride intrusion analysis, petrographic analysis, and compressive strength testing.

#### *3.3.3 Inspection Cycle*

The last underwater inspection of Pier 3 was performed in 2007 and was only a partial inspection. The recommended inspection interval, per ASCE 101 - Table 2-2, reinforced concrete located in an aggressive environment, rated Fair, is three years. Based on the observed deterioration, it is recommended that a more comprehensive inspection of the piles supporting Pier 3 be performed. Due to the large number of piles, it is recommended that the inspection include a representative sample of the total number of piles as well as piles located in areas of more concentrated loading.

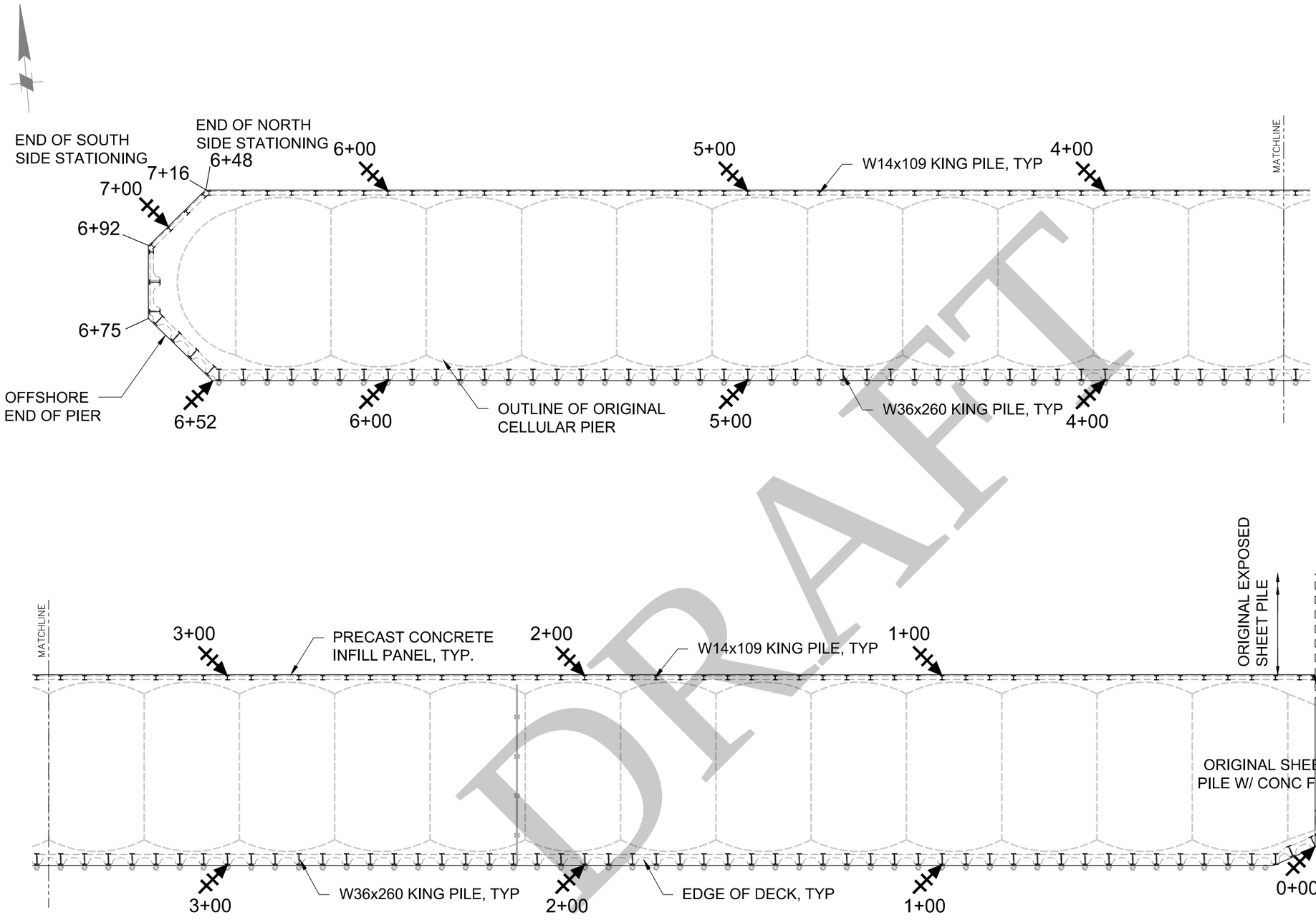
## 3.4 Limitations & General Conditions

Professional services provided by Shoreline have been provided in accordance with methods and procedures recommended by respected national and regional organizations, including the American Society of Civil Engineers and the California Building Standards Commission (California Building Code). The degree of care provided is consistent with the level of skill that is ordinarily exercised under similar circumstances by responsible engineers currently practicing in this, or similar, area/s of professional practice at the time the work on the project was performed.

The report has been prepared exclusively for SGH and is to be used solely for the purposes of providing a structural condition assessment of the structural elements from +3 MLLW to the mudline. The report has not been prepared for the use by other parties, and the report may not contain sufficient information for use by other parties or other uses not described in the report.

The recommendations contained in the structural condition assessment rely on information provided by SGH. Shoreline makes no warranty as to the accuracy and correctness of such provided information.

# Appendix A – Figures




# PIER 1 PLAN

1" = 30'-0"

SYMBOLS LEGEND:

X+XX STATION

LEVEL III INSPECTION - UT AND CP

GRAPHIC SCALE

30 0 30 60

1" = 30'

SHORELINE ENGINEERING, INC.
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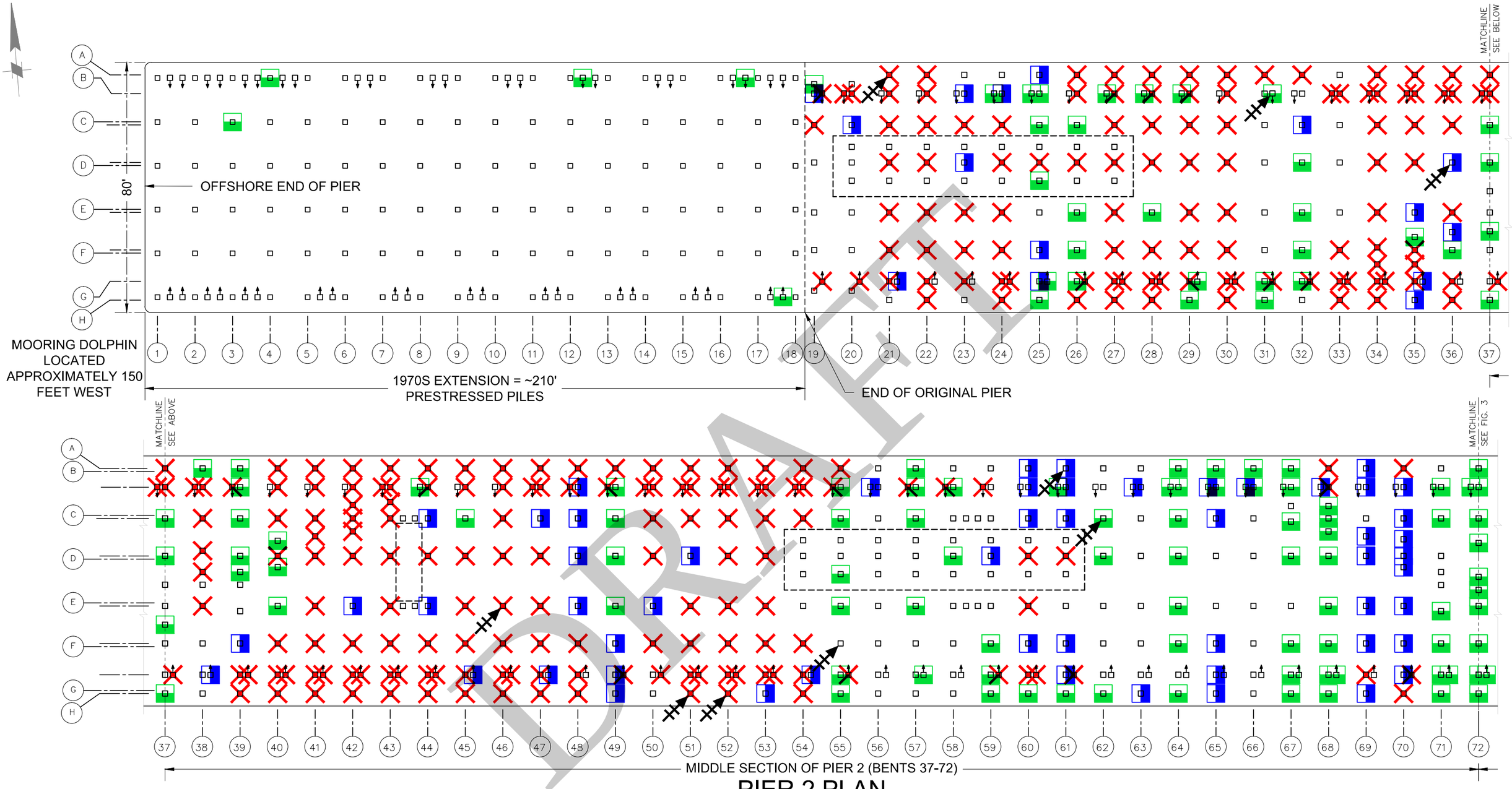
ALAMEDA POINT PIERS 1, 2 & 3 CONDITION ASSESSMENT

PIER 1

INSPECTION PLAN, SHEET 1 OF 1

FIG. 1




# PIER 2 PLAN

1" = 30'-0"

SYMBOLS LEGEND:

- PILE RATED NO DEFECT OR MINOR
- BATTER PILE RATED NO DEFECT OR MINOR
- PILE RATED MODERATE
- PILE RATED MAJOR
- PILE RATED SEVERE
- LEVEL III INSPECTION - CONCRETE CORING

GRAPHIC SCALE

30 0 30 60

1" = 30'

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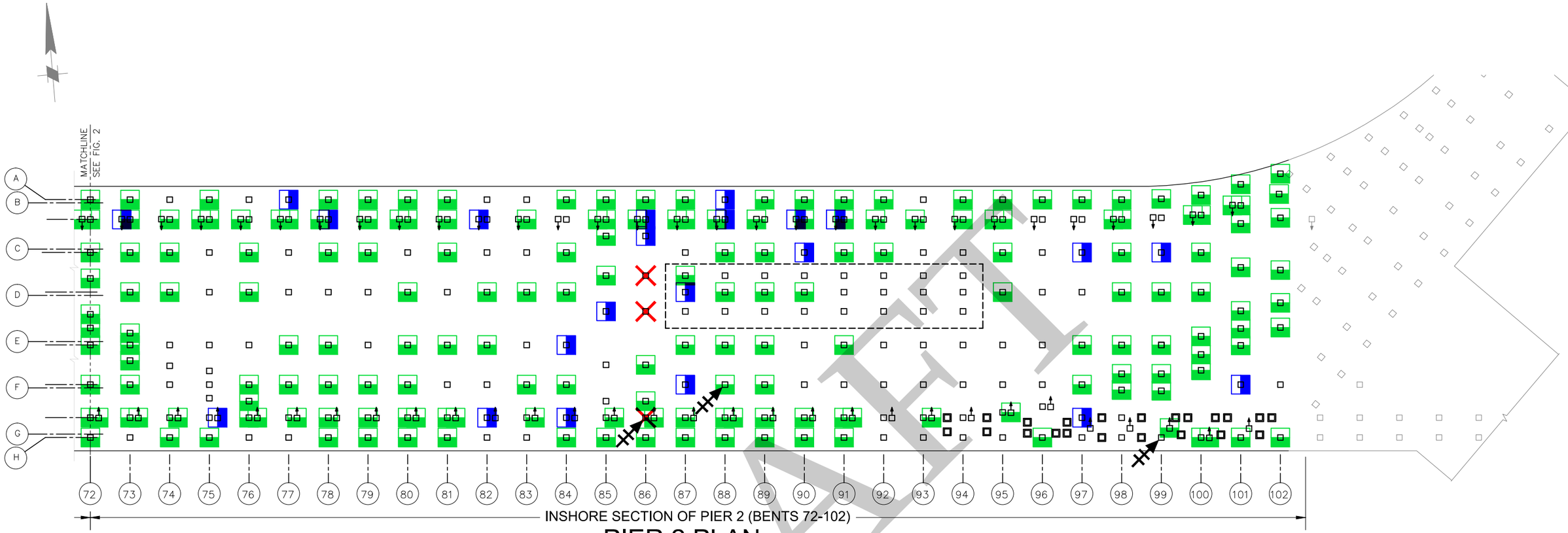
ALAMEDA POINT PIERS 1, 2 & 3 CONDITION ASSESSMENT

PIER 2

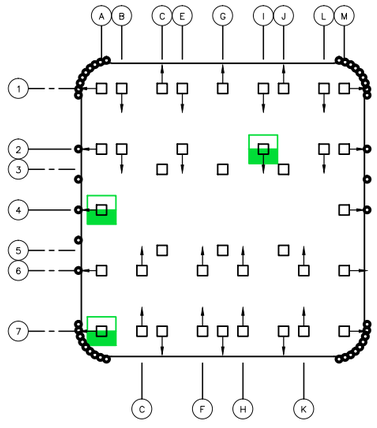
PILE INSPECTION PLAN, SHEET 1 OF 2

FIG. 2




## PIER 2 PLAN

1" = 30'-0"




## MOORING DOLPHIN PLAN

1" = 30'-0"

GRAPHIC SCALE

30 0 30 60

1" = 30'

SYMBOLS LEGEND:

- PILE RATED NO DEFECT OR MINOR
- BATTER PILE RATED NO DEFECT OR MINOR
- PILE RATED MODERATE
- PILE RATED MAJOR
- PILE RATED SEVERE
- LEVEL III INSPECTION - CONCRETE CORING

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ALAMEDA POINT PIERS 1, 2 & 3 CONDITION ASSESSMENT

PIER 2

PILE INSPECTION PLAN, SHEET 2 OF 2

FIG. 3

# Appendix B – Photographs

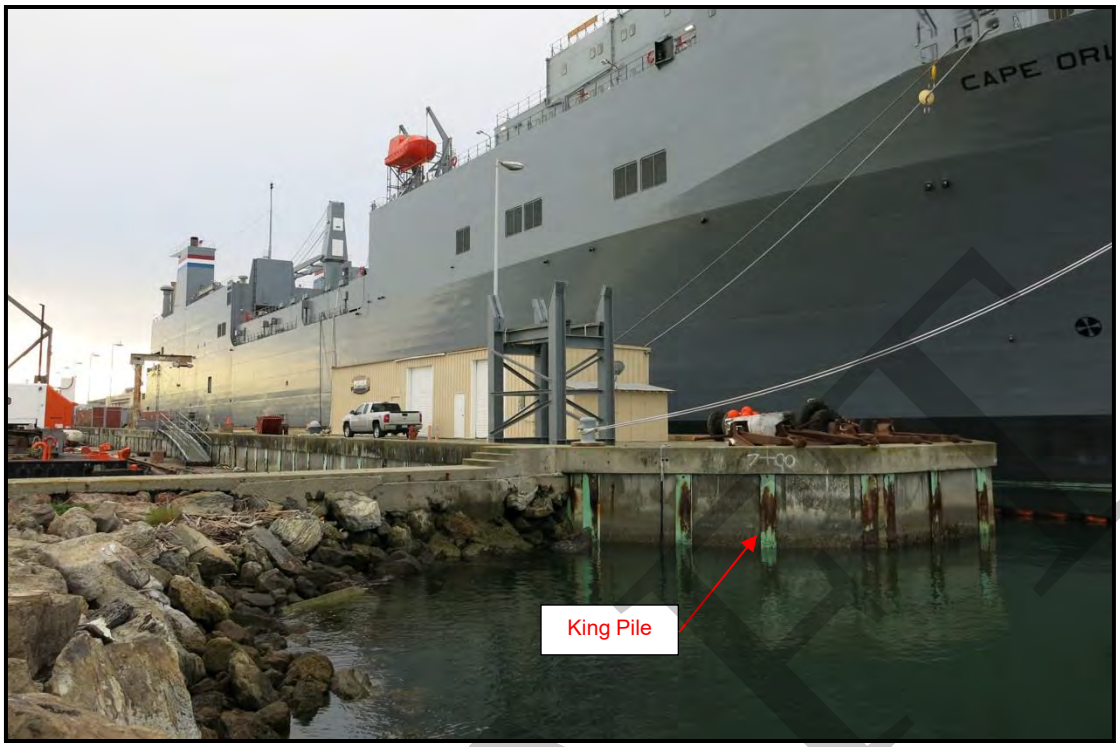



Photo 1: West end of Pier 1 looking east.


Photo 2: Scalloped concrete infill panels at south side of Pier 1.


Photo 3: Flat concrete infill panels at north side of Pier 1.

Photo 4: Typical marine growth on structural piles.

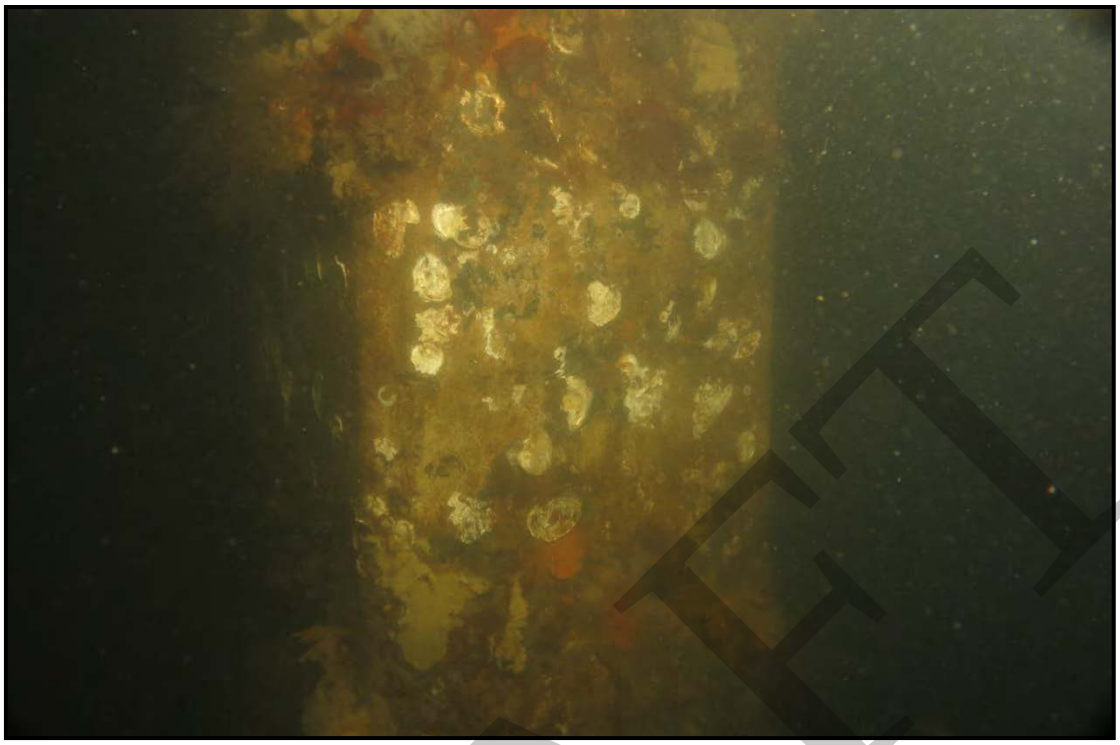


Photo 5: Typical Level II location with marine growth removed.

Photo 6: Original steel sheet pile wall at south side of Pier 1.


Photo 7: Original steel sheet pile wall at south side of Pier 1.

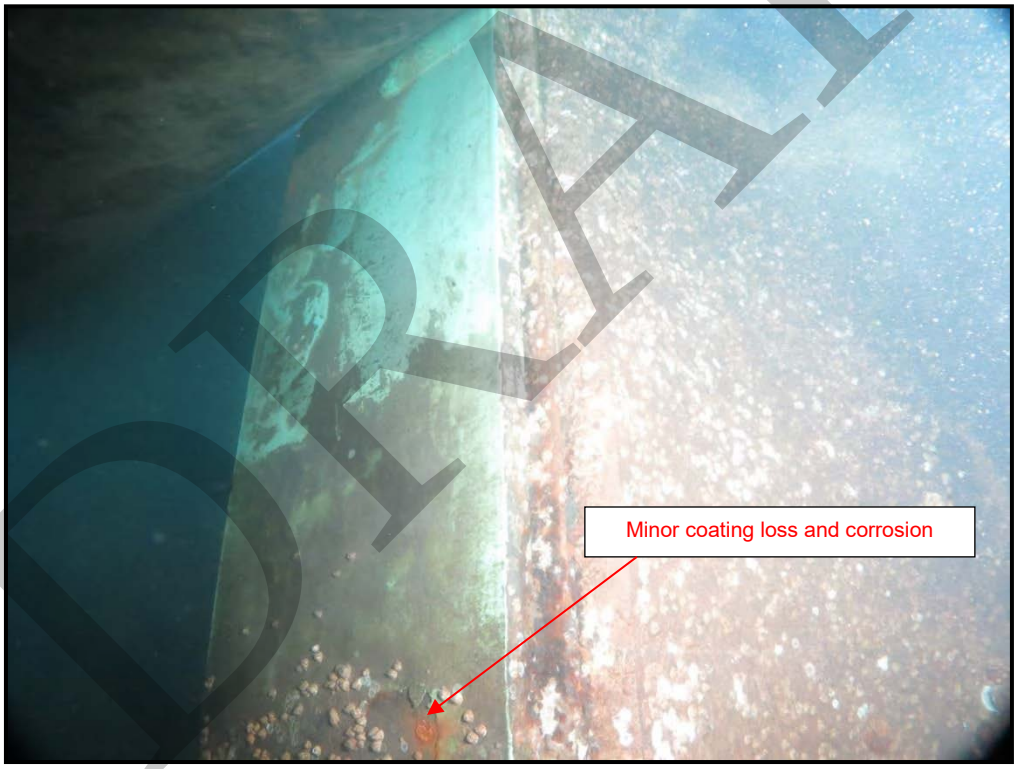



Photo 8: Steel king pile with substantially intact coating below water.

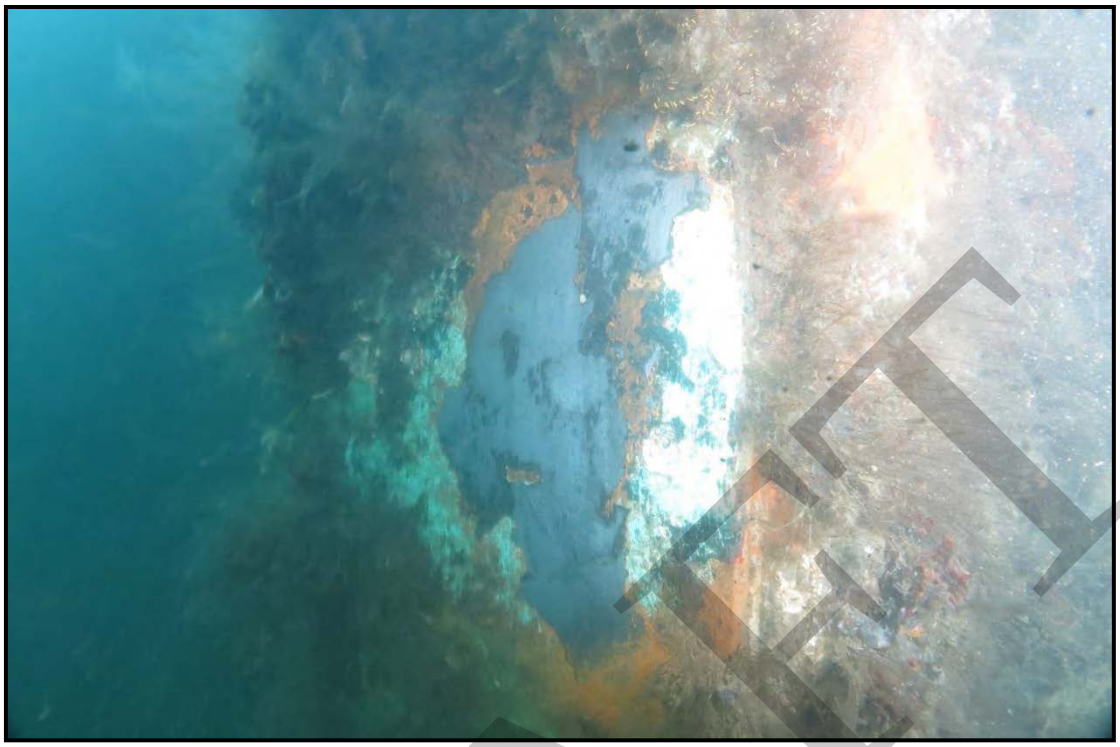


Photo 9: Coating loss and corrosion on steel king pile at Pier 1.

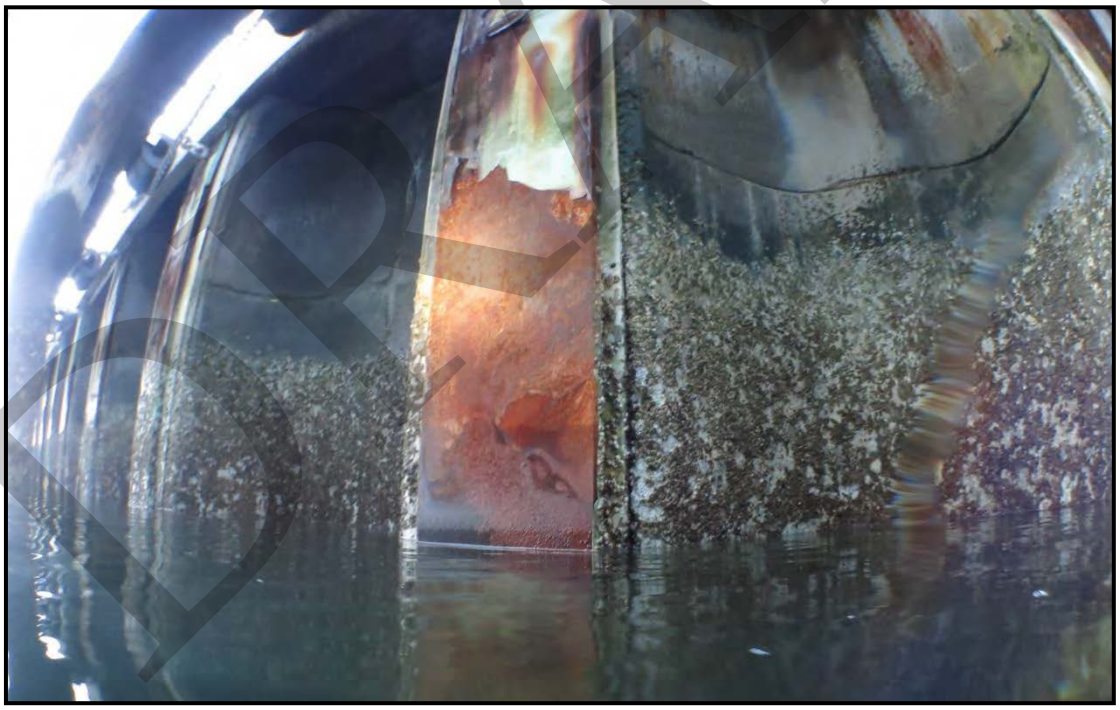


Photo 10: Coating loss and corrosion on steel king pile at Pier 1.

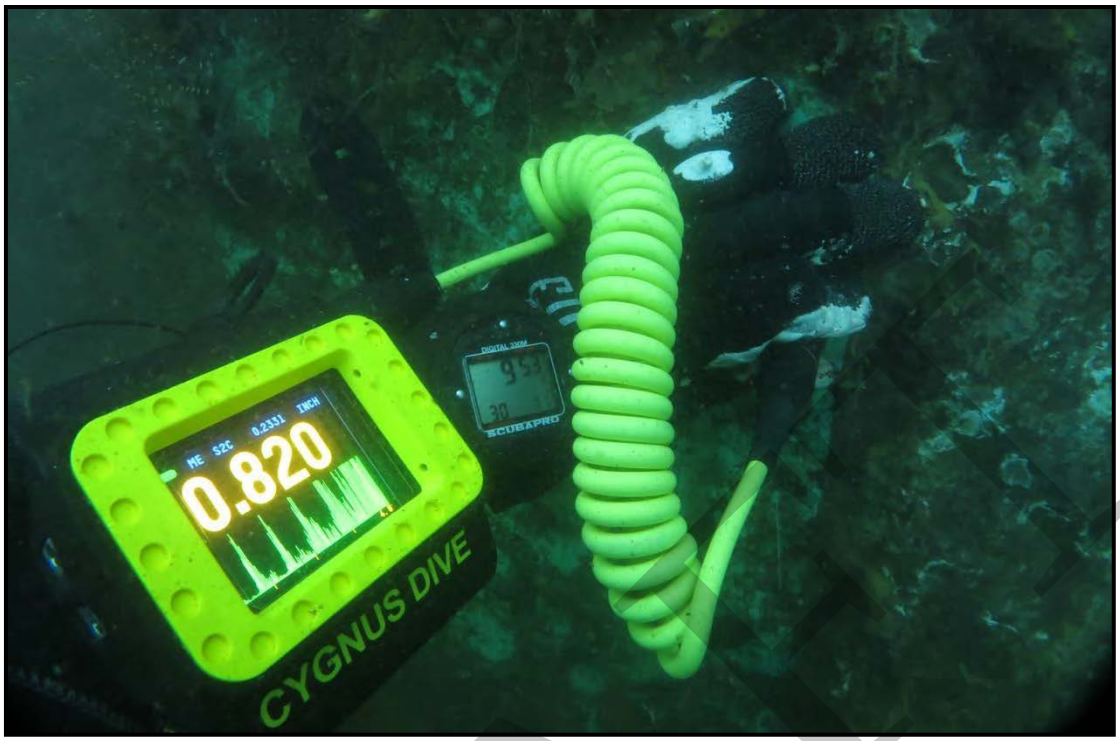



Photo 11: Ultrasonic thickness measurement at steel king pile on Pier 1.

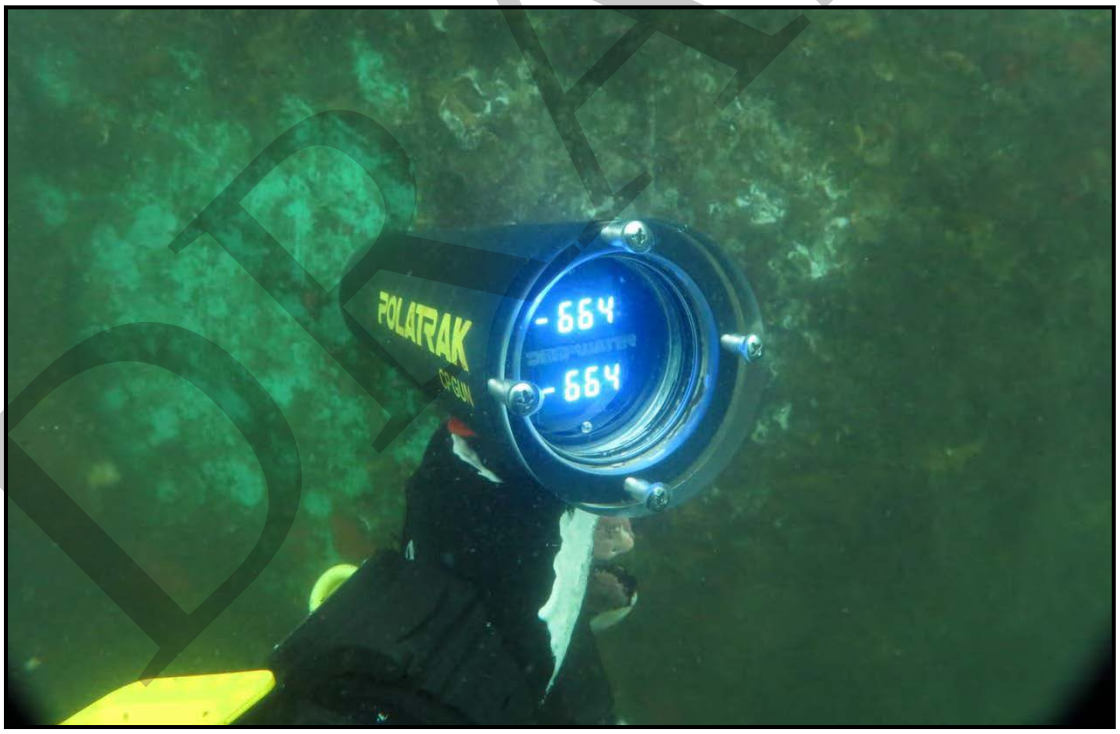



Photo 12: Electrical potential measurement at steel king pile at Pier 1.

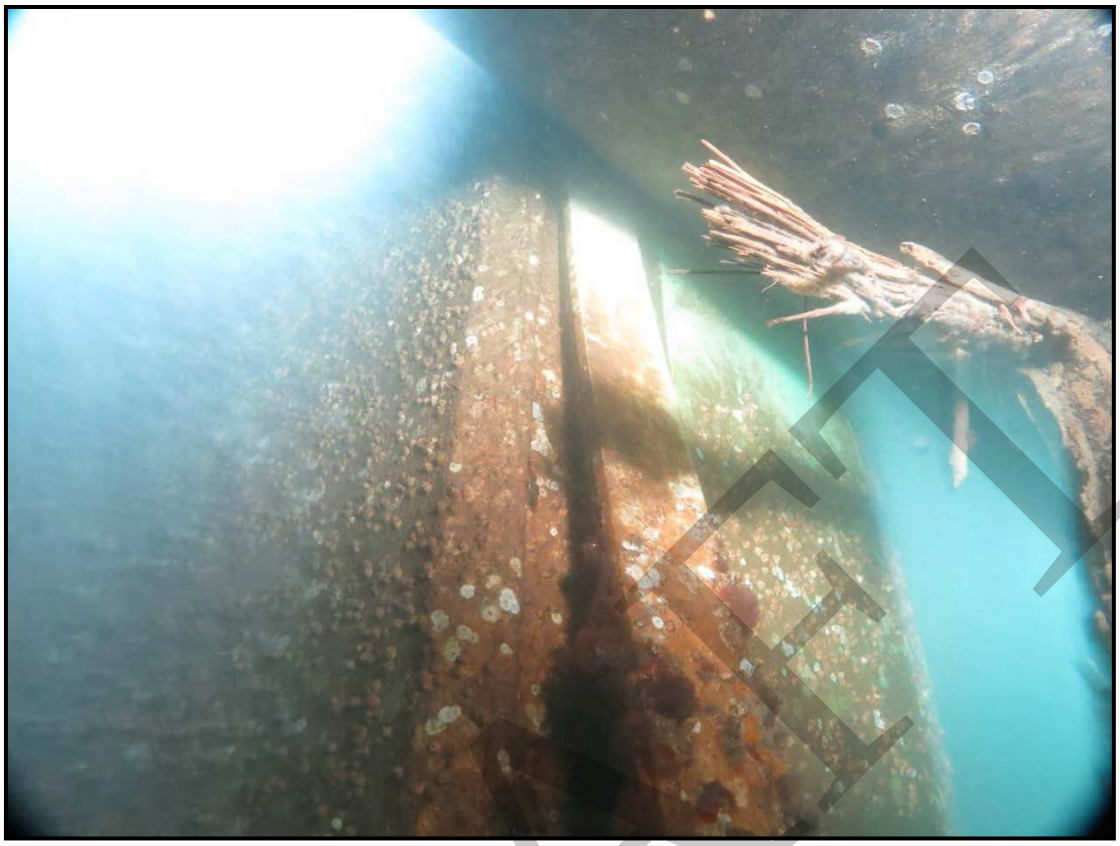


Photo 13: Displaced plastic guide between king pile and concrete infill panel.

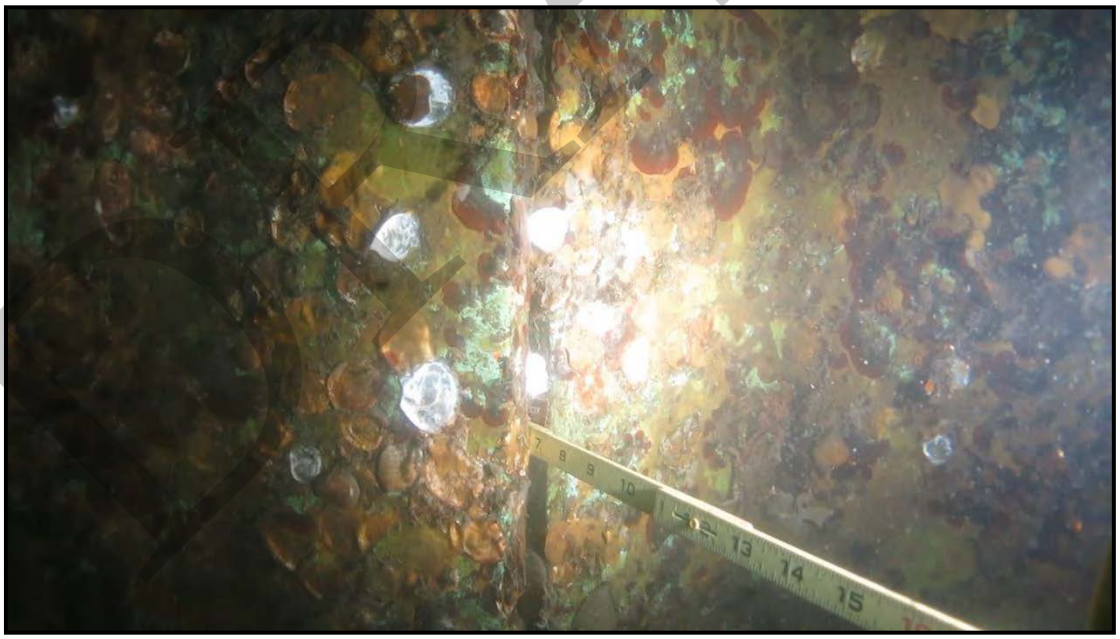


Photo 14: Gap between inner flanges of steel king piles at Corner 6+75 at the west end of Pier 1.


Photo 15: Concrete core sample taken from Pier 1 deck.

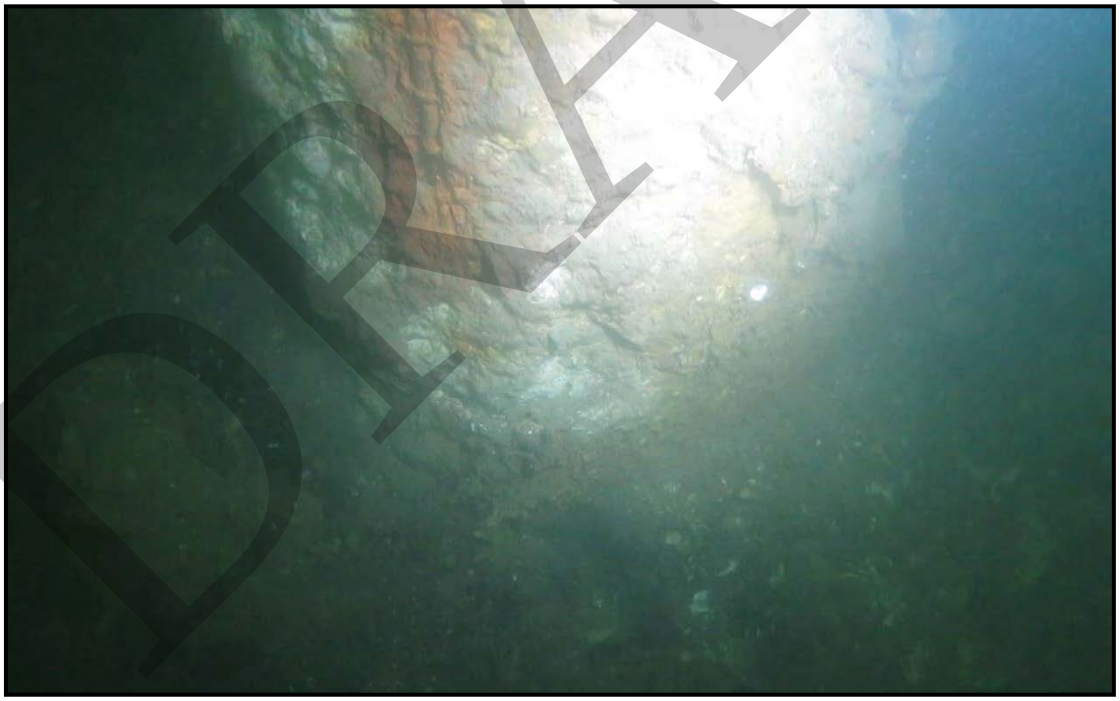


Photo 16: Pier 2, Pile 43-H - Exposed reinforcing near the mudline.

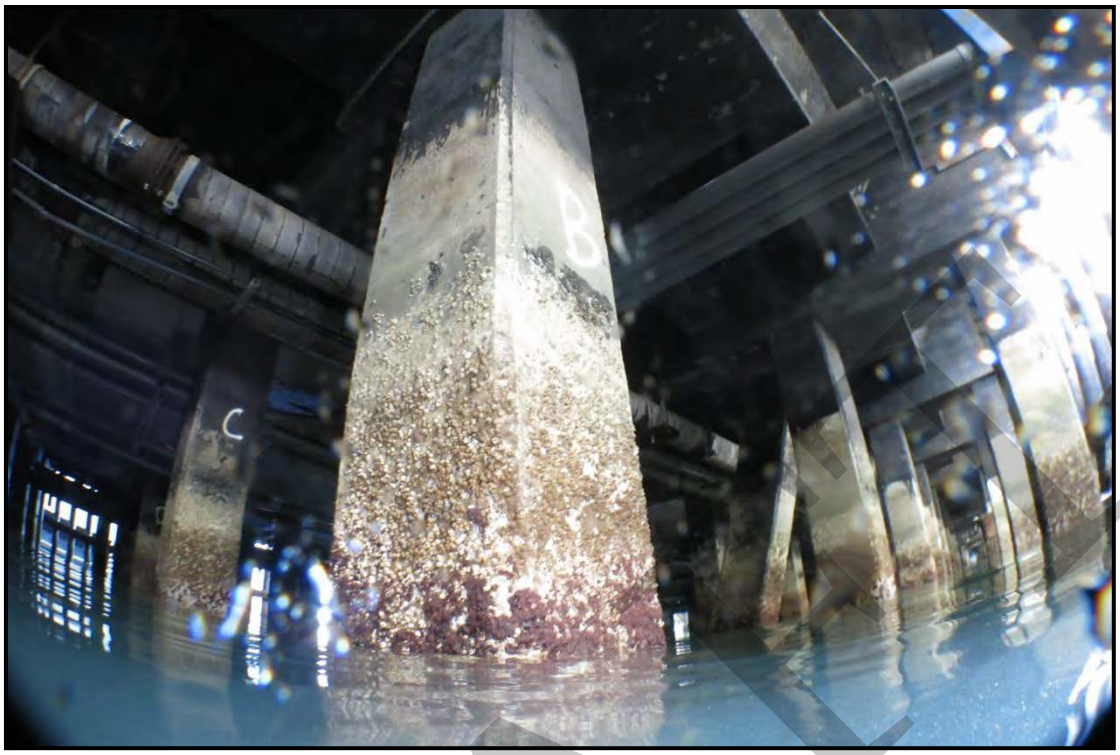



Photo 17: Typical square pile with chamfered corners.

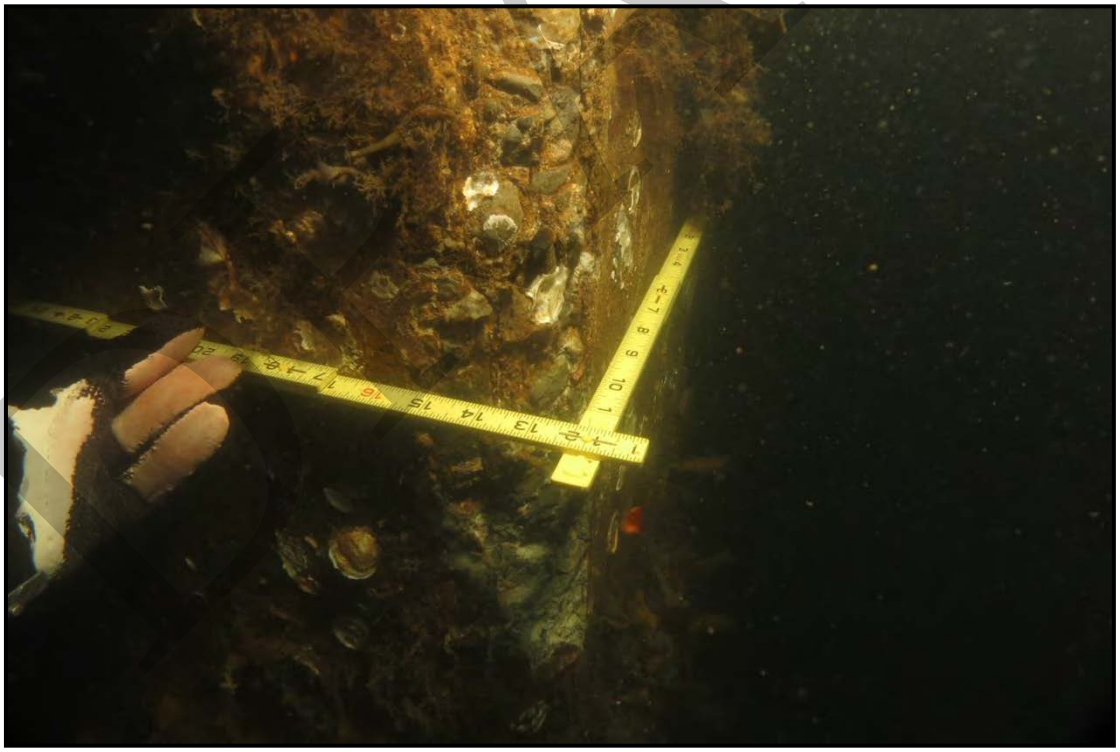


Photo 18: Minor rounding of corner due to chemical deterioration.

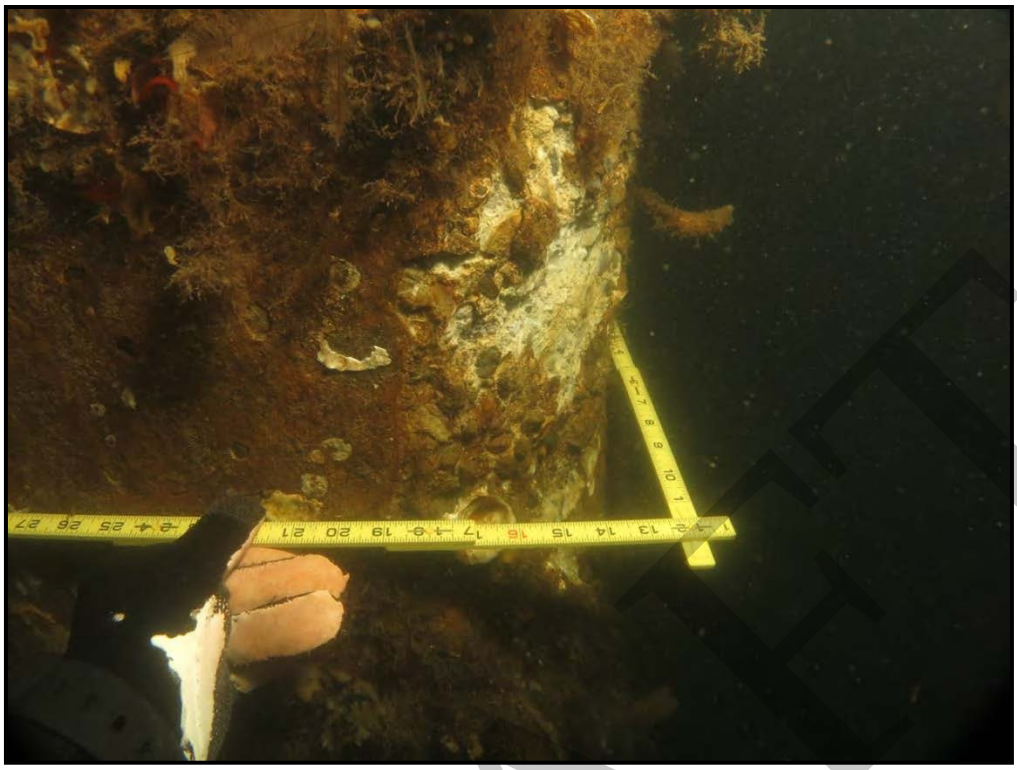


Photo 19: Major rounding of corner due to chemical deterioration.

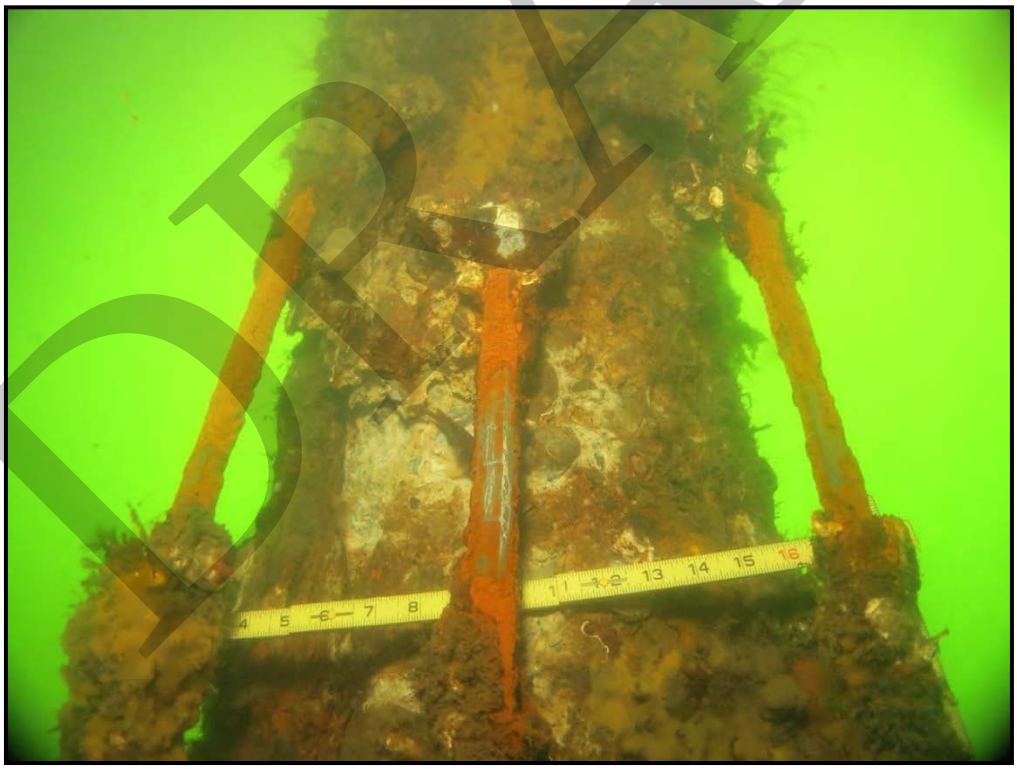


Photo 20: Severe loss of concrete section due to chemical deterioration with exposed reinforcing.

Photo 21: Typical concrete encasement installed on concrete pile at Pier 2.

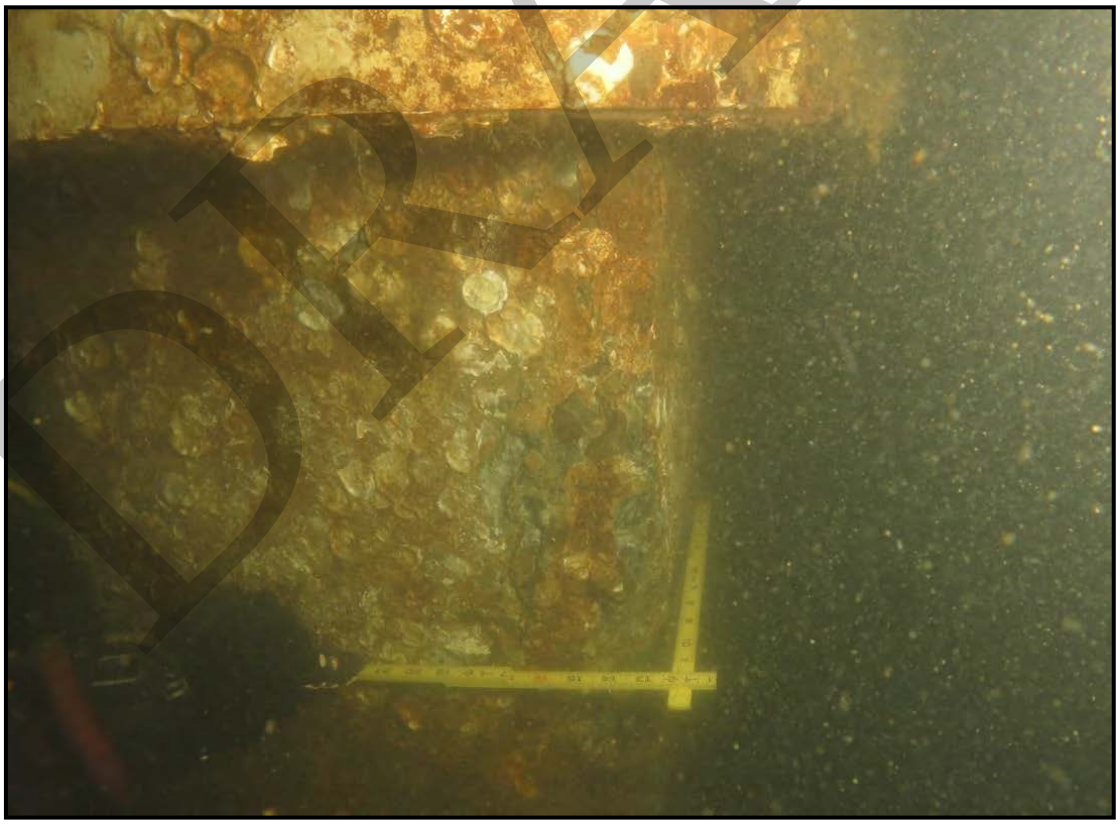


Photo 22: Deterioration of original concrete pile exposed below encasement repair.

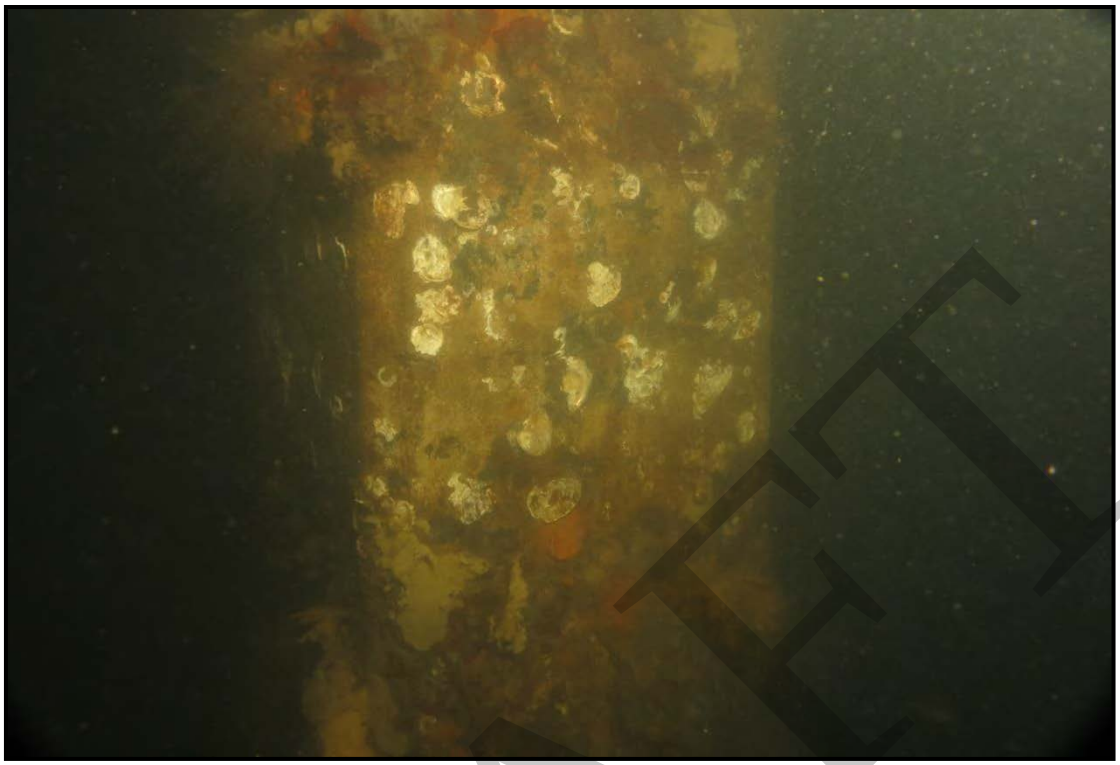


Photo 23: Typical Level II inspection location on a prestressed pile.


Photo 24: Typical concrete core sample extracted from Pier 2 (wrapped in plastic prior to packaging for delivery to the testing lab).

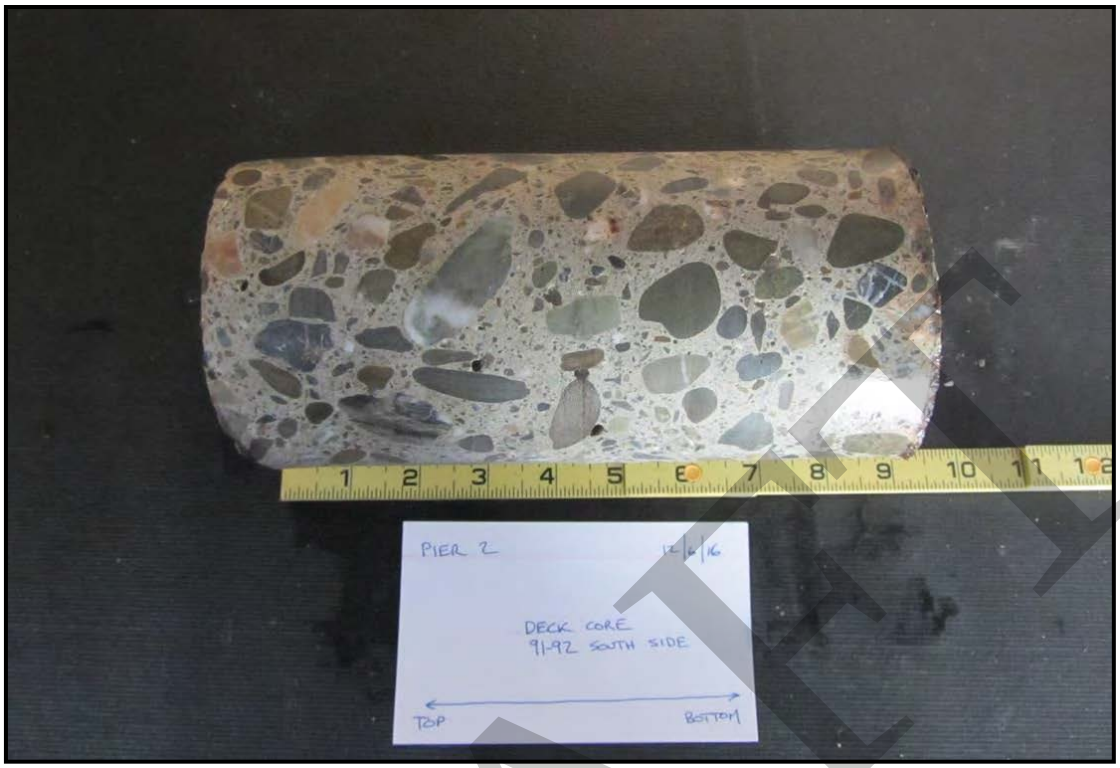



Photo 25: Core sample removed from the deck of Pier 2.

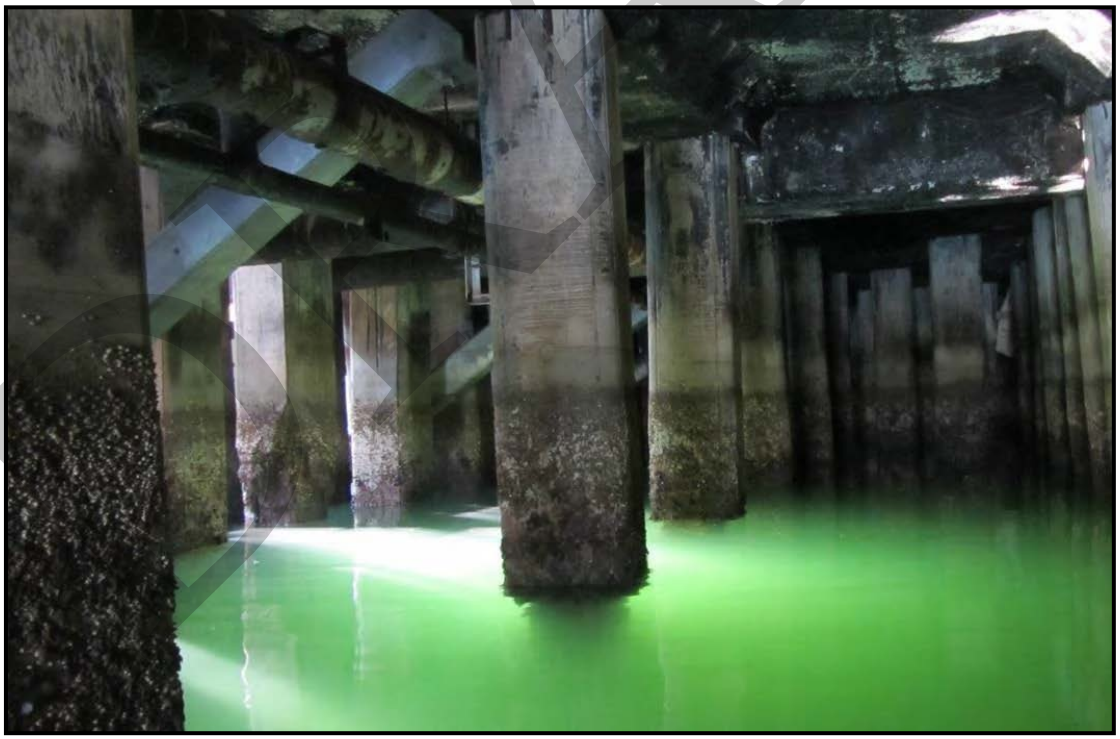


Photo 26: Pier 3 pile with larger extension cast on top of original pile (original pile visible below water).

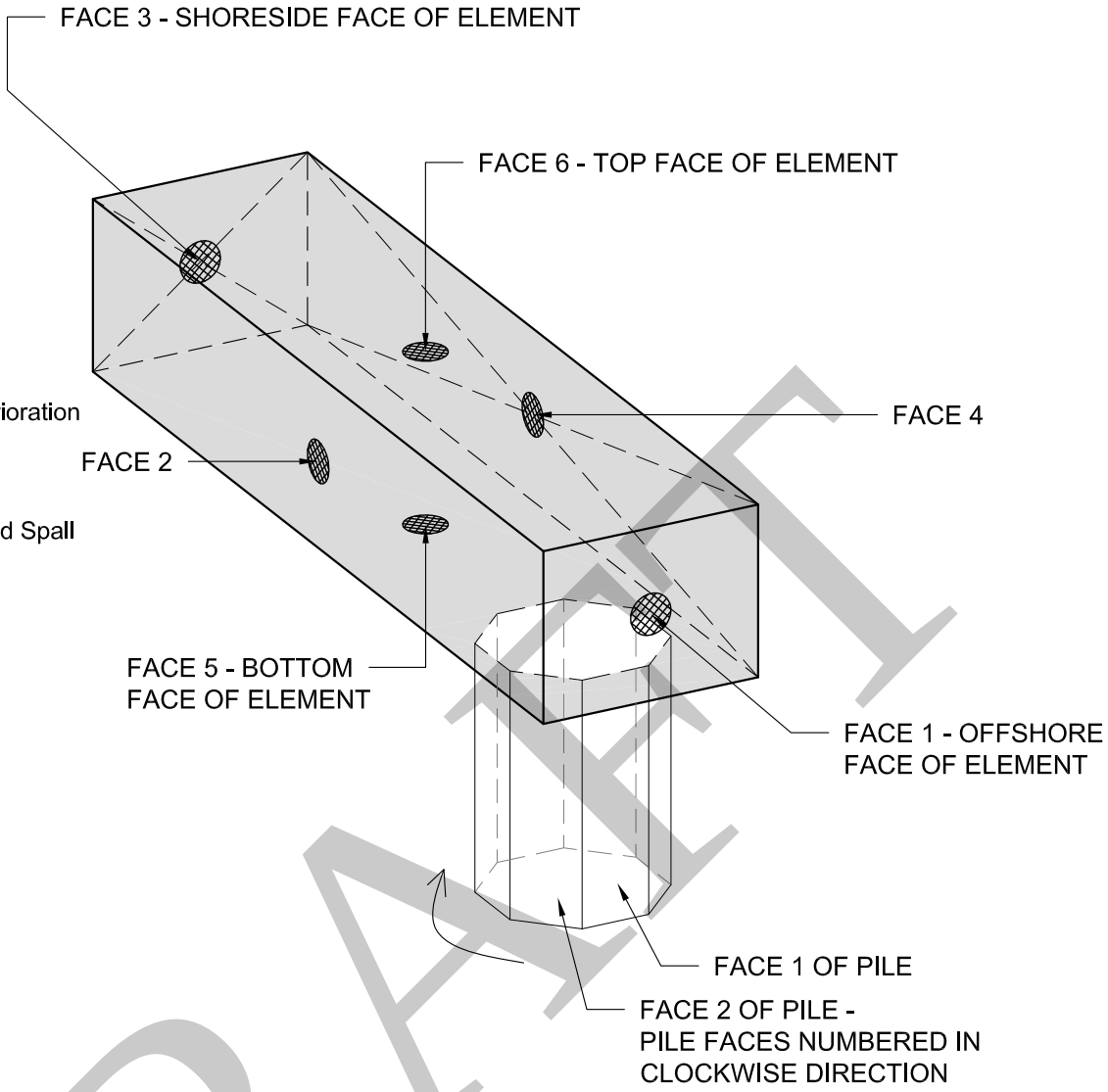

Photo 27: Core sample from deck of Pier 3.

# Appendix C – Inspection Data

Pile Ratings:
NI = Not Inspected
ND = No Defect
MN = Minor
MD = Moderate
MJ = Major
SV = Severe

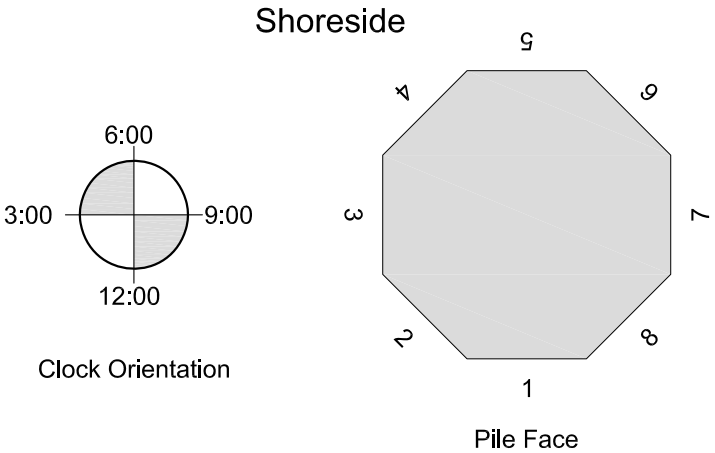
Abbreviations:
AW = Above Water
CCR = Corrosion Crack
CHEM DET = Chemical Deterioration
CL = Coating Loss
CORN = Corner
CRK = Crack
Delam = Delamination / Closed Spall
ENC = Encasement
EXP = Exposed
Full HT = Full Height
H-CRK = Horizontal Crack
HC = Horizontal Crack
HL = Hairline
MB = Marine Borers
MD = Moderate
MECH SP = Mechanical Spall
Mid = Mid-Pile
MJ = Major
MJ RND = Major Rounding
ML = Mudline
MN = Minor
MN RND = Minor Rounding
ND = No Defect
NI = Not Inspected
OCS = Open Corrosion Spall
REINF. = Reinforcing Steel
SL = Section Loss
STR CR = Structural or Horizontal Crack
SV = Severe
TZ = Tidal Zone
V-CRK = Vertical Crack
WL = Waterline

Pile Defect Locations:
Top Elev. = Approximate distance from Top of defect to top of pile
Pile Face = For octagonal piles the face(s) where the defect is found (ex. F3 = Face 3). Similar for square piles. For round piles defects are referenced to clock orientation or compass orientation.
Corners = Defects located on the corner between two pile faces are referenced by a C and the two face numbers (ex. C4/5 = corner between Face 4 and Face 5)




Element Location Key

Scale: NTS




Plan - Pile Face Orientation

Scale: NTS

Shoreline Engineering, Inc
Structural / Civil / Forensic / Engineer-Divers

505 Harbor Street
Morro Bay, CA 93442

(805) 772-6466 v
(805) 772-6467 f

e-mail: info@shoreline-engineering.net

ELEMENT AND DEFECT LOCATION KEY



PRELIMINARY DRAFT - 20 JANUARY 2017

SGH, Inc.
Alameda Point Pier Inspections
Underwater Inspection

SHORELINE ENGINEERING, INC.
STRUCTURAL / CIVIL / FORENSIC / ENGINEER-DIVERS

Underwater Inspection (LIII) | Sheet: 2 SHTS
Steel King Piles / Conc Panels | Job #: 420-05
Notes: MG | Tender: AH | Diver: JB | *Structure:* PIER 1 - South Side | Date: 10/9/2016

| Station | WL UTM READING (IN) | CP (-mV) | Notes |
|---|---|---|---|
| 0+00 | OF: 1.400/1.400/1.400 | 631 (Ag/AgCl) Seawater | ~20% coating loss |
| | Web: 0.820/0.820/0.820 | | ~40% coating loss |
| | IF: 1.420/1.420/1.415 | | no coating loss |
| **Deck-WL** | **MID UTM READING** | **CP (-mV)** | **Notes** |
| Height (ft): 8.5 | OF: | | Shallow water - readings at ML and WL only |
| Time of day: 1:19 PM | Web: | | |
| Date: 10/9/2016 | IF: | | |
| **Pneumo** | **ML UTM READING** | **CP (-mV)** | **Notes** |
| Depth (ft) **10'** | OF: 1.440/1.440/1.440 | 630 (Ag/AgCl) Seawater | no coating loss |
| Time of day: **1:28 PM** | Web: 0.825/0.820/0.825 | | no coating loss |
| Date: **10/9/2016** | IF: 1.415/1.415/1.415 | | no coating loss |
| **Station** | **WL UTM READING** | **CP (-mV)** | **Notes** |
| 1+00 | OF: 1.495/1.495/1.490 | 642 (Ag/AgCl) Seawater | no coating loss |
| | Web: Inaccessible | | |
| | IF: Inaccessible | | |
| **Deck-WL** | **MID UTM READING** | **CP (-mV)** | **Notes** |
| Height (ft): **8.5'** | OF: 1.460/1.455/1.455 | 643 (Ag/AgCl) Seawater | no coating loss |
| Time of day: **1:19 PM** | Web: Inaccessible | | |
| Date: **10/9/2016** | IF: Inaccessible | | |
| **Pneumo** | **ML UTM READING** | **CP (-mV)** | **Notes** |
| Depth (ft) **23'** | OF: 1.470/1.470/1.470 | 640 (Ag/AgCl) Seawater | no coating loss |
| Time of day: **1:31 PM** | Web: Inaccessible | | |
| Date: **10/9/2016** | IF: Inaccessible | | |
| **Station** | **WL UTM READING** | **CP (-mV)** | **Notes** |
| 2+00 | OF: 1.400/1.400/1.400 | 644 (Ag/AgCl) Seawater | no coating loss |
| | Web: Inaccessible | | |
| | IF: Inaccessible | | |
| **Deck-WL** | **MID UTM READING** | **CP (-mV)** | **Notes** |
| Height (ft): **8.1'** | OF: 1.425/1.425/1.425 | 646 (Ag/AgCl) Seawater | no coating loss |
| Time of day: **1:41 PM** | Web: Inaccessible | | |
| Date: **10/9/2016** | IF: Inaccessible | | |
| **Pneumo** | **ML UTM READING** | **CP (-mV)** | **Notes** |
| Depth (ft) **26'** | OF: 1.420/1.420/1.420 | 646 (Ag/AgCl) Seawater | no coating loss |
| Time of day: **1:41 PM** | Web: Inaccessible | | |
| Date: **10/9/2016** | IF: Inaccessible | | |
| **Station** | **WL UTM READING** | **CP (-mV)** | **Notes** |
| 3+00 | OF: 1.435/1.435/1.435 | 647 (Ag/AgCl) Seawater | Coating Intact, concrete firm |
| | Web: Inaccessible | | |
| | IF: Inaccessible | | |
| **Deck-WL** | **MID UTM READING** | **CP (-mV)** | **Notes** |
| Height (ft): **7.2'** | OF: 1.435/1.435/1.440 | 648 (Ag/AgCl) Seawater | Coating Intact, concrete firm |
| Time of day: **10:16 AM** | Web: Inaccessible | | |
| Date: **10/9/2016** | IF: Inaccessible | | |
| **Pneumo** | **ML UTM READING** | **CP (-mV)** | **Notes** |
| Depth (ft) **29'** | OF: 1.425/1.425/1.425 | 649 (Ag/AgCl) Seawater | less than 5% coating loss, concrete firm |
| Time of day: **10:16 AM** | Web: Inaccessible | | |
| Date: **10/9/2016** | IF: Inaccessible | | |

SGH, Inc.
Alameda Point Pier Inspections
Underwater Inspection

SHORELINE ENGINEERING, INC.
STRUCTURAL / CIVIL / FORENSIC / ENGINEER-DIVERS

Underwater Inspection (LIII) | Sheet: 2 SHTS
Steel King Piles / Conc Panels | Job #: 420-05
Notes: MG | Tender: AH | Diver: JB | *Structure:* PIER 1 - South Side | Date: 10/9/2016

| Station | WL UTM READING | CP (-mV) | Notes |
|---|---|---|---|
| 4+00 | OF: 1.455/1.450/1.455 | 641 (Ag/AgCl) Seawater | Coating Intact, concrete hard |
| | Web: Inaccessible | | |
| | IF: Inaccessible | | |
| **Deck-WL** | **MID UTM READING** | **CP (-mV)** | **Notes** |
| Height (ft): 7.6' | OF: 1.435/1.430/1.435 | 641 (Ag/AgCl) Seawater | Coating Intact, concrete hard |
| Time of day: 10:42 AM | Web: Inaccessible | | |
| Date: 10/9/2016 | IF: Inaccessible | | |
| **Pneumo** | **ML UTM READING** | **CP (-mV)** | **Notes** |
| Depth (ft) 30' | OF: 1.430/1.430/1.430 | 643 (Ag/AgCl) Seawater | Coating Intact, concrete hard |
| Time of day: 10:40 AM | Web: Inaccessible | | |
| Date: 10/9/2016 | IF: Inaccessible | | |
| **Station** | **WL UTM READING** | **CP (-mV)** | **Notes** |
| 5+00 | OF: 1.415/1.415/1.415 | 645 (Ag/AgCl) Seawater | Coating Intact, concrete hard |
| | Web: Inaccessible | | |
| | IF: Inaccessible | | |
| **Deck-WL** | **MID UTM READING** | **CP (-mV)** | **Notes** |
| Height (ft): 7.7' | OF: 1.400/1.400/1.400 | 647 (Ag/AgCl) Seawater | less than 5% CL, concrete firm |
| Time of day: 10:59 AM | Web: Inaccessible | | |
| Date: 10/9/2016 | IF: Inaccessible | | |
| **Pneumo** | **ML UTM READING** | **CP (-mV)** | **Notes** |
| Depth (ft) 30' | OF: 1.395/1.395/1.395 | 648 (Ag/AgCl) Seawater | Coating Intact, concrete firm |
| Time of day: 10:59 AM | Web: Inaccessible | | |
| Date: 10/9/2016 | IF: Inaccessible | | |
| **Station** | **WL UTM READING** | **CP (-mV)** | **Notes** |
| 6+00 | OF: 1.450/ 1.455/1.455 | 658 (Ag/AgCl) Seawater | Coating Intact, concrete hard |
| | Web: Inaccessible | | |
| | IF: Inaccessible | | |
| **Deck-WL** | **MID UTM READING** | **CP (-mV)** | **Notes** |
| Height (ft): 7.9' | OF: 1.455/1.455/1.450 | 657 (Ag/AgCl) Seawater | Coating Intact, concrete firm |
| Time of day: 11:30 AM | Web: Inaccessible | | |
| Date: 10/9/2016 | IF: Inaccessible | | |
| **Pneumo** | **ML UTM READING** | **CP (-mV)** | **Notes** |
| Depth (ft) 29' | OF: 1.445/1.445/1.450 | 658 (Ag/AgCl) Seawater | Coating Intact, concrete hard |
| Time of day: 11:25 AM | Web: Inaccessible | | |
| Date: 10/9/2016 | IF: Inaccessible | | |
| **Station** | **WL UTM READING** | **CP (-mV)** | **Notes** |
| 7+00 | OF: 0.815/0.815/0.815 | 659 (Ag/AgCl) Seawater | 10%-15% CL, concrete hard, MN piting |
| | Web: Inaccessible | | |
| | IF: Inaccessible | | |
| **Deck-WL** | **MID UTM READING** | **CP (-mV)** | **Notes** |
| Height (ft): 8.0' | OF: | | |
| Time of day: 11:58 AM | Web: Inaccessible | | |
| Date: 10/9/2016 | IF: Inaccessible | | |
| **Pneumo** | **ML UTM READING** | **CP (-mV)** | **Notes** |
| Depth (ft) 10' | OF: 0.830/0.830/0.825 | 664 (Ag/AgCl) Seawater | Coating Intact, concrete hard |
| Time of day: 11:59 AM | Web: Inaccessible | | |
| Date: 10/9/2016 | IF: Inaccessible | | |

Corner at 6+52, 6+75, 6+92
End at 7+16

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Underwater Inspection

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Underwater Inspection (LIII) | Sheet: 2 SHTS
Steel King Piles / Conc Panels | Job #: 420-05
Notes: MG | Tender: AH | Diver: JB | *Structure:* PIER 1 - North Side | Date: 10/8/2016

| Station | WL UTM READING (IN) | CP (-mV) | Notes |
|---|---|---|---|
| 0+00 | OF: 0.815/0.820/0.820 | 619 (Ag/AgCl) Seawater | ~10% coating loss |
| | Web: Inaccessible | | |
| | IF: Inaccessible | | |
| **Deck-WL** | **MID UTM READING** | **CP (-mV)** | **Notes** |
| Height (ft): 7.4 | OF: | | Shallow water - readings at ML and WL only |
| Time of day: 1:56 PM | Web: | | |
| Date: 10/8/2016 | IF: | | |
| **Pneumo** | **ML UTM READING** | **CP (-mV)** | **Notes** |
| Depth (ft) 5 | OF: 0.825/0.820/0.820 | 623 (Ag/AgCl) Seawater | <5% coating loss |
| Time of day: 2:05 PM | Web: Inaccessible | | |
| Date: 10/8/2016 | IF: Inaccessible | | |
| **Station** | **WL UTM READING** | **CP (-mV)** | **Notes** |
| 1+00 | OF: 0.815/0.815/0.805 | 845 (Ag/AgCl) Seawater | 70% coating loss |
| | Web: Inaccessible | | CP @ 0+95 = -663, @ 1+05 = -848, @ 1+10 = -652 |
| | IF: Inaccessible | | |
| **Deck-WL** | **MID UTM READING** | **CP (-mV)** | **Notes** |
| Height (ft): 7.4 | OF: 0.820/0.825/0.820 | 846 (Ag/AgCl) Seawater | no coating loss |
| Time of day: 1:56 PM | Web: Inaccessible | | |
| Date: 10/8/2016 | IF: Inaccessible | | |
| **Pneumo** | **ML UTM READING** | **CP (-mV)** | **Notes** |
| Depth (ft) 12 | OF: 0.820/0.820/0.825 | 846 (Ag/AgCl) Seawater | no coating loss |
| Time of day: 1:54 PM | Web: Inaccessible | | |
| Date: 10/8/2016 | IF: Inaccessible | | |
| **Station** | **WL UTM READING** | **CP (-mV)** | **Notes** |
| 2+00 | OF: 0.815/0.820/0.815 | 662 (Ag/AgCl) Seawater | 10-20% coating loss |
| | Web: Inaccessible | | |
| | IF: Inaccessible | | |
| **Deck-WL** | **MID UTM READING** | **CP (-mV)** | **Notes** |
| Height (ft): 7.6 | OF: 0.810/0.815/0.810 | 663 (Ag/AgCl) Seawater | <5% coating loss |
| Time of day: 1:37 PM | Web: Inaccessible | | |
| Date: 10/8/2016 | IF: Inaccessible | | |
| **Pneumo** | **ML UTM READING** | **CP (-mV)** | **Notes** |
| Depth (ft) 13 | OF: 0.820/0.815/0.810 | 662 (Ag/AgCl) Seawater | no coating loss |
| Time of day: 1:43 PM | Web: Inaccessible | | |
| Date: 10/8/2016 | IF: Inaccessible | | |
| **Station** | **WL UTM READING** | **CP (-mV)** | **Notes** |
| 3+00 | OF: 0.810/0.815/0.815 | 664 (Ag/AgCl) Seawater | 60% coating loss |
| | Web: Inaccessible | | |
| | IF: Inaccessible | | |
| **Deck-WL** | **MID UTM READING** | **CP (-mV)** | **Notes** |
| Height (ft): 7.6 | OF: 0.815/0.815/0.820 | 666 (Ag/AgCl) Seawater | Coating Intact |
| Time of day: 1:37 PM | Web: Inaccessible | | |
| Date: 10/8/2016 | IF: Inaccessible | | |
| **Pneumo** | **ML UTM READING** | **CP (-mV)** | **Notes** |
| Depth (ft) 15 | OF: 0.820/0.820/0.825 | 664 (Ag/AgCl) Seawater | <5% coating loss |
| Time of day: 1:37 PM | Web: Inaccessible | | |
| Date: 10/8/2016 | IF: Inaccessible | | |

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Underwater Inspection (LIII) | Sheet: 2 SHTS
Steel King Piles / Conc Panels | Job #: 420-05
Notes: MG | Tender: AH | Diver: JB | *Structure:* PIER 1 - North Side | Date: 10/8/2016

| Station | WL UTM READING | CP (-mV) | Notes |
|---|---|---|---|
| 4+00 | OF: 0.830/0.815/0.825 | 655 | <5% coating loss |
| | Web: Inaccessible | (Ag/AgCl) | |
| | IF: Inaccessible | Seawater | |
| **Deck-WL** | **MID UTM READING** | **CP (-mV)** | **Notes** |
| Height (ft): 7.8 | OF: 0.815/0.810/0.820 | 656 | Coating Intact |
| Time of day: 1:30 PM | Web: Inaccessible | (Ag/AgCl) | |
| Date: 10/8/2016 | IF: Inaccessible | Seawater | |
| **Pneumo** | **ML UTM READING** | **CP (-mV)** | **Notes** |
| Depth (ft) 16 | OF: 0.820/0.820/0.815 | 654 | Coating Intact with minor blistering |
| Time of day: 1:30 PM | Web: Inaccessible | (Ag/AgCl) | |
| Date: 10/8/2016 | IF: Inaccessible | Seawater | |
| **Station** | **WL UTM READING** | **CP (-mV)** | **Notes** |
| 5+00 | OF: 0.810/0.820/0.810 | 671 | Coating Intact |
| | Web: Inaccessible | (Ag/AgCl) | |
| | IF: Inaccessible | Seawater | |
| **Deck-WL** | **MID UTM READING** | **CP (-mV)** | **Notes** |
| Height (ft): 7.8 | OF: 0.815/0.825/0.820 | 672 | Coating Intact |
| Time of day: 1:07 PM | Web: Inaccessible | (Ag/AgCl) | |
| Date: 10/8/2016 | IF: Inaccessible | Seawater | |
| **Pneumo** | **ML UTM READING** | **CP (-mV)** | **Notes** |
| Depth (ft) 14 | OF: 0.820/0.825/0.815 | 671 | Coating Intact |
| Time of day: 1:07 PM | Web: Inaccessible | (Ag/AgCl) | |
| Date: 10/8/2016 | IF: Inaccessible | Seawater | |
| **Station** | **WL UTM READING** | **CP (-mV)** | **Notes** |
| 6+00 | OF: 0.850/0.845/0.845 | 675 | <5% coating loss with minor blistering |
| | Web: Inaccessible | (Ag/AgCl) | |
| | IF: Inaccessible | Seawater | |
| **Deck-WL** | **MID UTM READING** | **CP (-mV)** | **Notes** |
| Height (ft): 7.8 | OF: 0.825/0.830/0.840 | 673 | Coating Intact |
| Time of day: 1:17 PM | Web: Inaccessible | (Ag/AgCl) | |
| Date: 10/8/2016 | IF: Inaccessible | Seawater | |
| **Pneumo** | **ML UTM READING** | **CP (-mV)** | **Notes** |
| Depth (ft) 12 | OF: 0.850/0.830/0.825 | 673 | Coating Intact |
| Time of day: 1:17 PM | Web: Inaccessible | (Ag/AgCl) | |
| Date: 10/8/2016 | IF: Inaccessible | Seawater | |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 - PRESTRESSED | 1-A | | ND | | | | | | | 27 |
| PIER 2 - PRESTRESSED | 1-C | | ND | | | | | | | 27 |
| PIER 2 - PRESTRESSED | 1-D | | ND | | | | | | | 27 |
| PIER 2 - PRESTRESSED | 1-E | | ND | | | | | | | 27 |
| PIER 2 - PRESTRESSED | 1-F | | ND | | | | | | | 27 |
| PIER 2 - PRESTRESSED | 1-H | 2 | ND | | | | | | WL=H, MID=F, ML=H | 26 |
| PIER 2 - PRESTRESSED | 1.3-A BAT | | ND | | | | | | | 27 |
| PIER 2 - PRESTRESSED | 1.3-H BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 1.7-A BAT | | ND | | | | | | | 27 |
| PIER 2 - PRESTRESSED | 1.7-H BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 2-A | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 2-C | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 2-D | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 2-E | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 2-F | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 2-H | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 2.3-A BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 2.3-H BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 2.7-A BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 2.7-H BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 3-A | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 3-C | 2 | MD | MECH SP | | Tidal Zone | C2/3 | | 3X4X1 INCH DEEP SPALL, WL=H, MID=H, ML=F | 23 |
| PIER 2 - PRESTRESSED | 3-D | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 3-E | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 3-F | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 3-H | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 3.3-A BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 3.3-H BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 3.7-A BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 3.7-H BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 4-A | | MD | MECH SP | | Tidal Zone | C2/3 | | 3X3X1 INCH DEEP | |
| PIER 2 - PRESTRESSED | 4-C | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 4-D | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 4-E | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 4-F | 2 | ND | | | | | | WL=H, MID=F, ML=H | 24 |
| PIER 2 - PRESTRESSED | 4-H | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 4.3-A BAT | 2 | ND | | | | | | ML=H, MID=F, ML=H | 23 |
| PIER 2 - PRESTRESSED | 4.7-A BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 5-A | | ND | | | | | | | 23 |
| PIER 2 - PRESTRESSED | 5-C | | ND | | | | | | | 23 |
| PIER 2 - PRESTRESSED | 5-D | | ND | | | | | | | 21 |
| PIER 2 - PRESTRESSED | 5-E | | ND | | | | | | | 21 |
| PIER 2 - PRESTRESSED | 5-F | | ND | | | | | | | 22 |
| PIER 2 - PRESTRESSED | 5-H | | ND | | | | | | | 25 |
| PIER 2 - PRESTRESSED | 5.3-H BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 5.7-H BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 6-A | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 6-C | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 6-D | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 6-E | 2 | ND | | | | | | ML=H, MID=H, WL=F | 20 |
| PIER 2 - PRESTRESSED | 6-F | | ND | | | | | | | |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 - PRESTRESSED | 6-H | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 6.3-A BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 6.7-A BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 7-A | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 7-C | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 7-D | 2 | ND | | | | | | ML=H, MID=H, WL=H | 21 |
| PIER 2 - PRESTRESSED | 7-E | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 7-F | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 7-H | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 7.3-H BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 7.7-H BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 8-A | 2 | ND | | | | | | ML=H, MID=H, WL= H | 27 |
| PIER 2 - PRESTRESSED | 8-C | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 8-D | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 8-E | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 8-F | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 8-H | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 8.3-A BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 8.7-A BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 9-A | | ND | | | | | | | 26 |
| PIER 2 - PRESTRESSED | 9-C | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 9-D | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 9-E | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 9-F | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 9-H | 2 | ND | | | | | | ML=F, MID=H, WL=H | 23 |
| PIER 2 - PRESTRESSED | 9.3-H BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 9.7-H BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 10-A | | ND | | | | | | | 24 |
| PIER 2 - PRESTRESSED | 10-C | | ND | | | | | | | 20 |
| PIER 2 - PRESTRESSED | 10-D | | ND | | | | | | | 18 |
| PIER 2 - PRESTRESSED | 10-E | | ND | | | | | | | 19 |
| PIER 2 - PRESTRESSED | 10-F | | ND | | | | | | | 21 |
| PIER 2 - PRESTRESSED | 10-H | | ND | | | | | | | 23 |
| PIER 2 - PRESTRESSED | 10.3-A BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 10.7-A BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 11-A | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 11-C | 2 | ND | | | | | | ML=F, MID=F, WL=F | 21 |
| PIER 2 - PRESTRESSED | 11-D | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 11-E | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 11-F | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 11-H | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 11.3-H BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 11.7-H BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 12-A | | ND | | | | | | | 25 |
| PIER 2 - PRESTRESSED | 12-C | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 12-D | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 12-E | | MD | H-CRK | ≤1/32 | Mid-water | 2 | | @-7' 10:49, <1/32 PHOTO | |
| PIER 2 - PRESTRESSED | 12-F | 2 | ND | | | | | | ML=H, MID=H, WL=H | 22 |
| PIER 2 - PRESTRESSED | 12-H | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 12.3-A BAT | | MD | MECH SP | | Tidal Zone | C3/4 | | 6"X4"X1" DEEP | |
| PIER 2 - PRESTRESSED | 12.7-A BAT | | ND | | | | | | | |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 - PRESTRESSED | 13-A | | ND | | | | | | | 26 |
| PIER 2 - PRESTRESSED | 13-C | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 13-D | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 13-E | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 13-F | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 13-H | 2 | ND | | | | | | ML=H, MID=F, WL=H | 24 |
| PIER 2 - PRESTRESSED | 13.3-H BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 13.7-H BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 14-A | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 14-C | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 14-D | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 14-E | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 14-F | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 14-H | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 14.3-A BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 14.7-A BAT | 2 | MN | ABRASION | | Tidal Zone | C3/4 | | ML=F, MID=F, WL= H ABRASION 6"X6"X1" DEEP 1' BELOW WL | 24 |
| PIER 2 - PRESTRESSED | 15-A | | ND | | | | | | | 26 |
| PIER 2 - PRESTRESSED | 15-C | | ND | | | | | | | 21 |
| PIER 2 - PRESTRESSED | 15-D | | ND | | | | | | | 18 |
| PIER 2 - PRESTRESSED | 15-E | | ND | | | | | | | 18 |
| PIER 2 - PRESTRESSED | 15-F | | ND | | | | | | | 21 |
| PIER 2 - PRESTRESSED | 15-H | | ND | | | | | | | 25 |
| PIER 2 - PRESTRESSED | 15.3-H BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 15.7-H BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 16-A | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 16-C | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 16-D | 2 | ND | | | | | | ML=H, MID=F, WL= H | 18 |
| PIER 2 - PRESTRESSED | 16-E | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 16-F | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 16-H | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 16.3-A BAT | | MN | ABRASION | | | | | MN ABRASION | |
| PIER 2 - PRESTRESSED | 16.7-A BAT | | MD | ABRASION | | | | | ABRASION 5"X7"X1.5" DEEP | |
| PIER 2 - PRESTRESSED | 17-A | | ND | | | | | | | 26 |
| PIER 2 - PRESTRESSED | 17-C | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 17-D | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 17-E | 2 | ND | | | | | | ML=H, MID=F, WL=H | 16 |
| PIER 2 - PRESTRESSED | 17-F | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 17-H | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 17.3-A BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 17.3-H BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 17.7-A BAT | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 17.7-H BAT | | MD | ABRASION | | AW | C2/3 | | UP TO 1.5" DEEP ABRASION | |
| PIER 2 - PRESTRESSED | 18-A | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 18-C | 2 | ND | | | | | | ML=H, MID=H, WL=H | 21 |
| PIER 2 - PRESTRESSED | 18-D | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 18-E | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 18-F | | ND | | | | | | | |
| PIER 2 - PRESTRESSED | 18-H | | ND | | | | | | | |
| PIER 2 | 19-A.5 | | MD | MECH SP | | Mid-water | C2/3 | | 8"X6"X1"DEEP NO EXPOSED BAR @-10 SOFTER CONCRETE | |
| PIER 2 | 19-B | | MJ | OCS | Exposed Reinf. | AW | | | | |
| PIER 2 | 19-C | | SV | CHEM DET | Exposed Reinf. | Full HT | | | >50% SL PHOTO FACE 2 @-6' | |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 | 19-D | 2 | ND | | | | | | ML=MS, MID=F, WL=S | 15 |
| PIER 2 | 19-E | | ND | | | | | | | |
| PIER 2 | 19-F | | ND | | | | | | | |
| PIER 2 | 19-G.5 | | ND | | | | | | | |
| PIER 2 | 19.2-B BAT | | SV | CHEM DET | Exposed Reinf. | Mid-water | C3/4 | | | |
| PIER 2 | 19.2-G BAT | | SV | CHEM DET | Exposed Reinf. | Mid-ML | Multiple | | MULT BARS EXPOSED | 18 |
| PIER 2 | 19.8-B BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 18 |
| PIER 2 | 20-A.5 | | ND | | | | | | | |
| PIER 2 | 20-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | 50% SL AT MID-PILE, MULT BARS EXPOSED | 22 |
| PIER 2 | 20-C | 2 | MJ | CHEM DET | MJ RND | AW-TZ | Multiple | | ML=MS, MID=F W/MECH SPALL, WL=S | 18 |
| PIER 2 | 20-C.5 | | ND | | | | | | | |
| PIER 2 | 20-D | | MN | MECH SP | | | C2/3 | | SPALL AT TOP OF PILE 8"HX6"WX0.75"D | |
| PIER 2 | 20-D.5 | | ND | | | | | | | 13 |
| PIER 2 | 20-E | | ND | | | | | | | |
| PIER 2 | 20-F | | ND | | | | | | CCS AW | |
| PIER 2 | 20-G.5 | | ND | | | | | Yes | ENC 5' BC TO ML | |
| PIER 2 | 20.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | EXPOSED BARS -4' TO -16' | 18 |
| PIER 2 | 20.8-B BAT | | ND | | | | | | | |
| PIER 2 | 21-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 25 |
| PIER 2 | 21-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 23 |
| PIER 2 | 21-C | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 18 |
| PIER 2 | 21-C.5 | 2 | ND | | | | | | BOTTOM OF VAULT AT -5', ML=F, MID=F, -6'=F | 15 |
| PIER 2 | 21-D | | SV | CHEM DET | Exposed Reinf. | Full HT | Multiple | | | 14 |
| PIER 2 | 21-D.5 | | ND | | | | | | STL BEAM ABOVE PILES | |
| PIER 2 | 21-E | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 15 |
| PIER 2 | 21-F | | SV | CHEM DET | Exposed Reinf. | Mudline | Multiple | Yes | ENC 2' BC TO -16' | 19 |
| PIER 2 | 21-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 22 |
| PIER 2 | 21-H | | ND | | | | | Yes | ENC 5' BC TO ML | 23 |
| PIER 2 | 21.2-G BAT | | MJ | CHEM DET | MJ RND | Mudline | C4/1 | Yes | ENC 5' BC TO -16', SL C1/4 18"HX4"WX3/4"D | 19 |
| PIER 2 | 21.8-B BAT | | ND | | | | | | | |
| PIER 2 | 22-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 24 |
| PIER 2 | 22-B | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | ML=F, MID=S, WL=S | 21 |
| PIER 2 | 22-C | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 15 |
| PIER 2 | 22-C.5 | | ND | | | | | | | |
| PIER 2 | 22-D | | SV | CHEM DET | Exposed Reinf. | Full HT | Multiple | | | 14 |
| PIER 2 | 22-D.5 | 2 | ND | | | | | | ML=F, MID=MS, -6'=F | 12 |
| PIER 2 | 22-E | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | 20-30% SL @ MID | 17 |
| PIER 2 | 22-F | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 17 |
| PIER 2 | 22-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 22 |
| PIER 2 | 22-H | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | 20-30% SL @ MID | 23 |
| PIER 2 | 22.2-G BAT | | ND | | | | | | | |
| PIER 2 | 22.8-B BAT | | ND | | | | | | | |
| PIER 2 | 23-A | | ND | | | | | Yes | ENC 5' BC TO -28' | 26 |
| PIER 2 | 23-B | | MJ | CHEM DET | MJ RND | Mudline | C3/4 | Yes | ENC 5' BC TO -22' | 24 |
| PIER 2 | 23-C | 2 | SV | CHEM DET | Exposed Reinf. | | Multiple | | ML=S, 60% SL AT MID, WL=MS | 18 |
| PIER 2 | 23-C.5 | | ND | | | | | | | |
| PIER 2 | 23-D | | MJ | CHEM DET | MJ RND | Mudline | Multiple | Yes | ENC FROM CAP TO -14', ROUNDED CORNERS UP TO 4"D | 12 |
| PIER 2 | 23-D.5 | | ND | | | | | | | |
| PIER 2 | 23-E | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | ML=S, MID=S, WL=S | 12 |
| PIER 2 | 23-F | | SV | CHEM DET | Exposed Reinf. | Mudline | Multiple | Yes | ENC 6' BC TO -17' | 18 |
| PIER 2 | 23-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 23 |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 | 23-H | | ND | | | | | Yes | ENC 4' BC TO 6" ABOVE ML | 24 |
| PIER 2 | 23.2-G BAT | | ND | | | | | | | |
| PIER 2 | 23.8-B BAT | | MD | V-CRK | >1/8 | AW | 4 | | H-CRK F4 1/8"W @-4' @1558, V-CRK F4 3' BC 30"H X 1/8"W | |
| PIER 2 | 24-A | | ND | | | | | | MJ ABOVE WATER | 26 |
| PIER 2 | 24-B | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | H-CRK F1234 1/8"w @ -24' | 22 |
| PIER 2 | 24-C | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 17 |
| PIER 2 | 24-C.5 | | ND | | | | | | | |
| PIER 2 | 24-D | 2 | SV | CHEM DET | Exposed Reinf. | Full HT | Multiple | | ML=S, MID=S, -7'=S | 12 |
| PIER 2 | 24-D.5 | | ND | | | | | | | |
| PIER 2 | 24-E | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 14 |
| PIER 2 | 24-F | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 19 |
| PIER 2 | 24-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | 30% SL @ -7' | 21 |
| PIER 2 | 24-H | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 24 |
| PIER 2 | 24.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 18 |
| PIER 2 | 24.8-B BAT | 2 | MD | V-CRK | ≤1/16 | Mid-water | 2 | | | 19 |
| PIER 2 | 25-A | | MJ | OCS | Exposed Reinf. | AW | C1/2 | Yes | ENC 7' BELOW CAP ENDS AT -24', OCS 3'HX14"WX4" DEEP 3' BELOW CAP, | 27 |
| PIER 2 | 25-B | 2 | MD | CHEM DET | MN RND | Full HT | Multiple | | CORROSION CRK AW 1/16" | 24 |
| PIER 2 | 25-C | | MD | CHEM DET | MN RND | Mid-ML | Multiple | | | 19 |
| PIER 2 | 25-C.5 | | ND | | | | | | | 16 |
| PIER 2 | 25-D | | SV | CHEM DET | Exposed Reinf. | Full HT | Multiple | | | 12 |
| PIER 2 | 25-D.5 | 2 | MD | V-CRK | ≤1/8 | Full HT | 3 | | | 12 |
| PIER 2 | 25-E | | ND | | | | | | | 14 |
| PIER 2 | 25-F | | MJ | CHEM DET | MJ RND | Mid-water | Multiple | | HEAVY ROUNDING OF CORNERS | 19 |
| PIER 2 | 25-G | | MJ | CHEM DET | MJ RND | Mudline | Multiple | Yes | ENC 4' BELOW CAP TO -24' | 24 |
| PIER 2 | 25-H | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | 25 |
| PIER 2 | 25.2-G BAT | | MD | CHEM DET | MN RND | Mid-water | C4/1 | | | 19 |
| PIER 2 | 25.8-B BAT | | ND | | | | | | | |
| PIER 2 | 26-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 26-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 25 |
| PIER 2 | 26-C | 2 | MD | MECH SP | | Mudline | 4 | | SPALL 6"X6"X1.5" DEEP ML=MS, MID=F,WL=F | 20 |
| PIER 2 | 26-C.5 | | ND | | | | | | | |
| PIER 2 | 26-D | 2 | SV | CHEM DET | Exposed Reinf. | Full HT | Multiple | | | 14 |
| PIER 2 | 26-D.5 | | ND | | | | | | | |
| PIER 2 | 26-E | | MD | CHEM DET | MN RND | TZ-ML | C2/3 | | | |
| PIER 2 | 26-F | | MD | V-CRK | ≤1/16 | Mid-water | C1/2 | | MN ROUNDING | |
| PIER 2 | 26-G | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CRK MULTIPLE CORNERS 1/16" MID, MN ROUNDING AT ML | |
| PIER 2 | 26-H | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 26.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 26.8-B BAT | | MD | CHEM DET | MN RND | TZ-Mid | C4/1 | | | |
| PIER 2 | 27-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 27-B | | SV | CHEM DET | Exposed Reinf. | TZ-Mid | Multiple | | PHOTO, GETS BETTER NEAR ML | |
| PIER 2 | 27-C | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 27-C.5 | 2 | ND | | | | | | ML=F, MID=MS, WL=MS | 16 |
| PIER 2 | 27-D | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 27-D.5 | | ND | | | | | | | |
| PIER 2 | 27-E | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 13 |
| PIER 2 | 27-F | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | -4 |
| PIER 2 | 27-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 27-H | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 26 |
| PIER 2 | 27.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 27.8-B BAT | | MD | CHEM DET | MN RND | Mid-water | C1/2 | | | |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 | 28-A | | SV | BROKEN | Exposed Reinf. | AW | | Yes | ENCASED 6' BELOW CAP TO -29' | 27 |
| PIER 2 | 28-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 28-C | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 28-D | | SV | CHEM DET | Exposed Reinf. | Mudline | Multiple | | ENCASED 4' BELOW CAP TO 15' | 15 |
| PIER 2 | 28-E | 2 | MD | V-CRK | ≤1/8 | Mudline | Multiple | Yes | ENCASED TO 2' ABOVE ML, ML=F | 14 |
| PIER 2 | 28-F | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 17 |
| PIER 2 | 28-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 28-H | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 28.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 28.8-B BAT | | MD | CHEM DET | MN RND | Mid-water | C4/1 | | | |
| PIER 2 | 29-A | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 25 |
| PIER 2 | 29-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 29-C | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 19 |
| PIER 2 | 29-D | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 29-E | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 29-F | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | Yes | ENCASED FROM -19' TO 4' BELOW CAP | 19 |
| PIER 2 | 29-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 29-H | | MD | CHEM DET | MN RND | Mudline | C3/4 | Yes | ENCASED 6' BELOW CAP TO 1' ABOVE ML, CRACKING UP TO 1/16" C3/4 | |
| PIER 2 | 29.2-G BAT | | MD | CHEM DET | MN RND | Mid-water | Multiple | | | |
| PIER 2 | 29.8-B BAT | | ND | | | | | Yes | ENCASED 7' BELOW CAP TO -12' | |
| PIER 2 | 30-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 26 |
| PIER 2 | 30-B | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 24 |
| PIER 2 | 30-C | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 17 |
| PIER 2 | 30-D | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 15 |
| PIER 2 | 30-E | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 15 |
| PIER 2 | 30-F | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 19 |
| PIER 2 | 30-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 24 |
| PIER 2 | 30-H | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 26 |
| PIER 2 | 30.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 19 |
| PIER 2 | 31-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 31-B | | MN | | | | | | MN VOIDS FACE 1 MID PILE | |
| PIER 2 | 31-C | 2 | ND | | | | | | ML=F, MID=F, WL=F | 19 |
| PIER 2 | 31-D | | ND | | | | | | | |
| PIER 2 | 31-E | | ND | | | | | | | |
| PIER 2 | 31-F | | ND | | | | | | | |
| PIER 2 | 31-G | | MD | CHEM DET | MN RND | Mid-water | C1/2 | | | |
| PIER 2 | 31-H | | MD | V-CRK | ≤1/16 | Mid-water | C2/3 | | | |
| PIER 2 | 31.2-B BAT | 2 | MD | H-CRK | ≤1/16 | Varies | Multiple | | H-CRK MID AND ML AND WL, ML=F, MID=F, WL=F | 19 |
| PIER 2 | 31.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-Mid | Multiple | | | |
| PIER 2 | 31.8-B BAT | | ND | | | | | | | |
| PIER 2 | 32-A | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 27 |
| PIER 2 | 32-B | | ND | | | | | | | |
| PIER 2 | 32-C | | MJ | CHEM DET | ≤1/4 | Mid-water | Multiple | | V-CRK C2/3 UP TO 1/4" MID | |
| PIER 2 | 32-D | 2 | MD | CHEM DET | MN RND | Mid-water | C2/3 | | ML=F, MID=F, WL=F | 15 |
| PIER 2 | 32-E | 2 | MD | CHEM DET | MN RND | Mid-water | C2/3 | | ML=MS, MID=F, WL=F | 15 |
| PIER 2 | 32-F | | MD | V-CRK | ≤1/16 | Mid-water | C2/3 | | | |
| PIER 2 | 32-G | | MD | V-CRK | ≤1/16 | Mid-water | C2/3 | | | |
| PIER 2 | 32-H | | ND | | | | | | | |
| PIER 2 | 32.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 32.8-B BAT | | SV | CHEM DET | Exposed Reinf. | TZ-Mid | Multiple | | | |
| PIER 2 | 33-A | | ND | | | | | | | |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 | 33-B | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | PHOTO | 23 |
| PIER 2 | 33-C | 2 | ND | | | | | | ML=F, MID=F,WL=F | 18 |
| PIER 2 | 33-D | | ND | | | | | | | |
| PIER 2 | 33-E | | ND | | | | | | | |
| PIER 2 | 33-F | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 33-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 33-H | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 33.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 33.8-B BAT | | SV | CHEM DET | Exposed Reinf. | Mudline | Multiple | YES | ENC= -19' TO 6' BELOW CAP, CHEM DET. BELOW ENC. | 18 |
| PIER 2 | 34-A | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 27 |
| PIER 2 | 34-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 34-C | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 18 |
| PIER 2 | 34-D | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 34-E | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 15 |
| PIER 2 | 34-F | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 34-F.5 | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 34-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 34-H | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 34.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 34.8-B BAT | | SV | CHEM DET | Exposed Reinf. | Mudline | Multiple | YES | ENC= -19' TO 1' BELOW CAP, DEFECTS BELOW ENC. | 23 |
| PIER 2 | 35-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 26 |
| PIER 2 | 35-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 23 |
| PIER 2 | 35-C | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 16 |
| PIER 2 | 35-D | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 15 |
| PIER 2 | 35-E | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | | 15 |
| PIER 2 | 35-E.8 | | MD | CHEM DET | MN RND | Mid-water | C3/4 | | | 15 |
| PIER 2 | 35-F | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 18 |
| PIER 2 | 35-F.5 | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 21 |
| PIER 2 | 35-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 23 |
| PIER 2 | 35-H | | MJ | CHEM DET | MJ RND | Mudline | Multiple | YES | ENC= 5' BELOW CAP TO -25', DEFECTS BELOW ENC | 26 |
| PIER 2 | 35.2-G BAT | | MJ | CHEM DET | MJ RND | TZ-Mid | C3/4 | | | 17 |
| PIER 2 | 35.8-B BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 36-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 36-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 36-C | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 36-D | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | | |
| PIER 2 | 36-E | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 36-E.5 | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | | |
| PIER 2 | 36-F | 2 | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | 16 |
| PIER 2 | 36-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 36-H | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | Yes | ENC= -'25 TO 5' BELOW CAP, DEFECT BELOW ENC | 26 |
| PIER 2 | 36.2-G BAT | | ND | | | | | | | |
| PIER 2 | 36.8-B BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 37-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 37-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 37-C | | MD | V-CRK | ≤1/8 | Mid-ML | C2/3 | | | |
| PIER 2 | 37-D | | MD | V-CRK | ≤1/8 | Mid-water | C2/3 | | | |
| PIER 2 | 37-D.5 | | ND | | | | | | | |
| PIER 2 | 37-E | 2 | ND | | | | | | ML=H, MID= MS, WL=H | -4 |
| PIER 2 | 37-E.5 | | MD | V-CRK | ≤1/8 | Mid-ML | C2/3 | | | |
| PIER 2 | 37-F | | ND | | | | | | | |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 | 37-G | 2 | ND | | | | | | ML=H, MID=H, WL,H | 22 |
| PIER 2 | 37-H | 2 | MD | CHEM DET | MN RND | Mid-ML | Multiple | | ML=S, MID=S,WL=F | 23 |
| PIER 2 | 37.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 37.8-B BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 38-A | | MD | V-CRK | ≤1/16 | Mudline | Multiple | Yes | ENC= 6' BELOWCAP TO -28', MN RND BELOW ENC | 24 |
| PIER 2 | 38-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 38-C | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 38-D | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 38-D.3 | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 38-D.5 | | ND | | | | | | | |
| PIER 2 | 38-E | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 38-F | | ND | | | | | | | |
| PIER 2 | 38-G | | ND | | | | | | | |
| PIER 2 | 38-H | | ND | | | | | | | |
| PIER 2 | 38.2-G BAT | | MJ | CHEM DET | MJ RND | Mudline | Multiple | Yes | ENC= 7' BELOW CAP TO -19', DEFECTS BELOW CAP | 17 |
| PIER 2 | 38.8-B BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 39-A | | MD | V-CRK | ≤1/16 | TZ-Mid | C2/3 | | | |
| PIER 2 | 39-B | | MD | V-CRK | ≤1/8 | TZ-Mid | C4/1 | | | |
| PIER 2 | 39-C | | MD | V-CRK | ≤1/16 | Mid-ML | Multiple | | | |
| PIER 2 | 39-D | | MD | V-CRK | ≤1/8 | Mid-water | Multiple | | | |
| PIER 2 | 39-D.3 | | MD | V-CRK | ≤1/16 | Mid-water | C1/2 | | | |
| PIER 2 | 39-D.5 | | ND | | | | | | | |
| PIER 2 | 39-E.2 | 2 | ND | | | | | | ML=F, MID=F, WL=F | 13 |
| PIER 2 | 39-F | 2 | MJ | CHEM DET | MJ RND | Mid-ML | Multiple | | WL=H, MID=S, ML=S | 17 |
| PIER 2 | 39-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 39-H | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL=F, MID=S, ML=MS, CRK AT ML 1/4" WIDE 3' H | 23 |
| PIER 2 | 39.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 39.8-B BAT | | ND | | | | | | | |
| PIER 2 | 40-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | SV SL MULTIPLE EXP. BAR | |
| PIER 2 | 40-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 40-C | | SV | CHEM DET | Exposed Reinf. | Mudline | Multiple | YES | ENC=WL TO -15', DEFECT BELOW ENC. | 15 |
| PIER 2 | 40-C.7 | | MD | CHEM DET | MN RND | Mudline | Multiple | Yes | ENC= -15' TO 5' BELOW CAP, DEFECT BELOW ENC | 14 |
| PIER 2 | 40-D | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 40-D.2 | | MD | CHEM DET | MN RND | Mudline | Multiple | Yes | ENC=-14 TO 8' BELOW CAP, DEFECT BELOW CAP | 12 |
| PIER 2 | 40-E | | MD | CHEM DET | MN RND | Mudline | Multiple | Yes | ENC=-1' TO -15' | 13 |
| PIER 2 | 40-F | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | ML=S, MID=S, WL=S | 16 |
| PIER 2 | 40-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 40-H | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 40.2-G BAT | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL=S, MID=S, ML=S | 16 |
| PIER 2 | 40.8-B BAT | | ND | | | | | | | 20 |
| PIER 2 | 41-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 27 |
| PIER 2 | 41-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 21 |
| PIER 2 | 41-C | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 16 |
| PIER 2 | 41-C.5 | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 14 |
| PIER 2 | 41-D | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 13 |
| PIER 2 | 41-E | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 15 |
| PIER 2 | 41-F | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 18 |
| PIER 2 | 41-G | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL=S, H-CRK AT WL 3/16"W F4, MID=S, ML=S | 22 |
| PIER 2 | 41-H | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL=S, MID=S, ML=S, 20-30% SL AT ML | 23 |
| PIER 2 | 41.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 20 |
| PIER 2 | 41.8-B BAT | | ND | | | | | | | |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 | 42-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 42-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 42-B.5 | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | SV SL W/ MULTIPLE EXP. BAR | |
| PIER 2 | 42-C | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | SV SL W/ MULTIPLE EXP. BAR | |
| PIER 2 | 42-C.3 | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 42-D | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | SV SL W/ MULTIPLE EXP. BAR | |
| PIER 2 | 42-E | 2 | MJ | CHEM DET | ≤1/8 | TZ-ML | Multiple | | WL=F, MD=S, ML=S, 1/8" vertical crack @ ML c3/4, Chem starts 7 | 15 |
| PIER 2 | 42-F | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL=S (-5), MD=S, ML=F | 19 |
| PIER 2 | 42-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 42-H | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL=H, MD=S, ML=S | 25 |
| PIER 2 | 42.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 42.8-B BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 43-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | SV SL, MULT EXP BARS | |
| PIER 2 | 43-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | SV SL EXP STIRRUPS MULT EXP BARS @ ML | |
| PIER 2 | 43-B.5 | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 43-C | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 43-D | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL=S, MD=S, ML=S | 13 |
| PIER 2 | 43-E | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 43-F | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 43-G | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL=S, MD=S, ML=S 1/16" crack @ ML, Chem ends 5' from ML | 24 |
| PIER 2 | 43-H | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL=S, MD=S, ML=S, MULT EXP BARS, SV SL | 26 |
| PIER 2 | 43.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 43.3-C | | ND | | | | | | ONLY CONNECTED TO VAULT NEAR CAP | |
| PIER 2 | 43.3-E | | ND | | | | | | ONLY CONNECTED TO VAULT NEAR CAP | |
| PIER 2 | 43.7-C | | ND | | | | | | ONLY CONNECTED TO VAULT NEAR CAP | |
| PIER 2 | 43.7-E | | ND | | | | | | ONLY CONNECTED TO VAULT NEAR CAP | |
| PIER 2 | 43.8-B BAT | | MD | V-CRK | ≤1/8 | TZ-Mid | C4/1 | | | |
| PIER 2 | 44-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 44-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 44-C | 2 | MJ | CHEM DET | ≤1/8 | TZ-ML | Multiple | | WL=F, MD=S , ML=MS , Chem starts @ -6' and ends 3' from ML | 17 |
| PIER 2 | 44-D | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 44-E | 2 | MJ | CHEM DET | ≤1/16 | TZ-ML | Multiple | | WL=MS, MD=S , ML=S, Chem starts @ -4' and ends 3' from ML, Multi vert. cracks @ MD & ML up to 1/16" | 14 |
| PIER 2 | 44-F | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL=S, MD=S, ML=S, Chem starts @ -6' and ends 3' from ML | 18 |
| PIER 2 | 44-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 44-H | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 44.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 44.8-B BAT | | ND | | | | | | | |
| PIER 2 | 45-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 25 |
| PIER 2 | 45-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 23 |
| PIER 2 | 45-C | 2 | MD | CHEM DET | ≤1/16 | TZ-ML | Multiple | | WL=F, MD=S , ML= ,Chem starts @ -5' and ends @ -3 from ML, Rounding @ corners <1" D | 17 |
| PIER 2 | 45-D | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 14 |
| PIER 2 | 45-E | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 15 |
| PIER 2 | 45-F | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 18 |
| PIER 2 | 45-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | SV SL, 5 BARS EXP | 23 |
| PIER 2 | 45-H | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 25 |
| PIER 2 | 45.2-G BAT | 2 | MJ | CHEM DET | ≤1/8 | TZ-ML | Multiple | | WL=F, MD=S, ML=S, Chem starts @ -6' and ends -3 from ML, Mult. Cracks up to 1/8 @ MD & ML | 18 |
| PIER 2 | 45.8-B BAT | | ND | | | | | | | |
| PIER 2 | 46-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 46-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | SV SL, 8 BARS EXP | |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 | 46-C | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 46-D | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL=F, MD=S, ML=S, Chem starts @ -5' and ends -3' from ML | 15 |
| PIER 2 | 46-E | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 46-F | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 46-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 46-H | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 46.2-G BAT | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL=F, MD=S, ML=MS , Chem starts @ -6' and ends 2' from ML | 23 |
| PIER 2 | 46.8-B BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 47-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 47-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | 5 BARS EXP - SV SL | |
| PIER 2 | 47-C | 2 | MJ | CHEM DET | MJ RND | Mudline | C2/3 | Yes | Enc 8' below cap and end @ -19', -19'=S, ML=S, Chem starts below Enc and ends @ ML | 18 |
| PIER 2 | 47-D | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL=S, MD=S, ML=S, Chem Starts -4' and ends @ ML | 15 |
| PIER 2 | 47-E | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | 4 BARS EXP - SV SL | |
| PIER 2 | 47-F | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 47-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 47-H | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | 7 BARS EXP - SV SL | |
| PIER 2 | 47.2-G BAT | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | | |
| PIER 2 | 47.8-B BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 48-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | 4 BARS EXP - SV SL, BARS EXP AT ML | |
| PIER 2 | 48-B | | MJ | CHEM DET | MJ RND | Mudline | Multiple | Yes | ENC 10' BELOW CAP TO -23' | 23 |
| PIER 2 | 48-C | | MJ | CHEM DET | MJ RND | Mudline | C2/3 | Yes | ENC 10' BELOW CAP TO -19' | 18 |
| PIER 2 | 48-D | 2 | MJ | CHEM DET | MJ RND | Mudline | Multiple | Yes | Enc is 6' below cap and ends @ -17', void 8" in bottom of Enc., 1/8' cracking below Enc. to ML | 15 |
| PIER 2 | 48-E | 2 | MJ | CHEM DET | MJ RND | Mudline | C2/3 | Yes | Enc is 6' below cap and end @ -17', ML=S | 21 |
| PIER 2 | 48-F | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 48-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 48-H | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | 4 EXP BARS AT ML | |
| PIER 2 | 48.2-G BAT | | ND | | | | | | | |
| PIER 2 | 48.8-B BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 49-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | SV SL - 5 EXP BARS | |
| PIER 2 | 49-B | | MD | CHEM DET | ≤1/8 | TZ-Mid | C1/2 | | MN RND TZ-ML MULT CORN | |
| PIER 2 | 49-C | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | |
| PIER 2 | 49-D | 2 | MD | CHEM DET | ≤1/16 | Mid-ML | C2/3 | | WL=F, MD=S, ML=S, Horizontal crack face 4 <1/16", rounding of corners @ corner 2/3 | 20 |
| PIER 2 | 49-E | | MD | CHEM DET | ≤1/8 | Tidal Zone | Multiple | | MN RND TZ-ML | |
| PIER 2 | 49-F | 2 | MJ | CHEM DET | ≤1/8 | Mid-ML | Multiple | | WL=F , MD=S, ML=S , MN RND starts @ MID and ends @ ML, Rounding of corners @ MID-ML, 1/8" VCRK C2/3 AT -7' | 26 |
| PIER 2 | 49-G | | MJ | CHEM DET | MJ RND | Mid-ML | Multiple | | | |
| PIER 2 | 49-H | | MJ | CHEM DET | MJ RND | Mid-ML | Multiple | | | |
| PIER 2 | 49.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 49.8-B BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 17 |
| PIER 2 | 50-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 24 |
| PIER 2 | 50-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 22 |
| PIER 2 | 50-C | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL=F, MD=S, ML=S, Chem starts @ -6' and ends @ ML | 22 |
| PIER 2 | 50-D | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL=F, MD=S, ML=S, Chem starts @ -6' and ends 2' from ML | 21 |
| PIER 2 | 50-E | 2 | MJ | CHEM DET | MJ RND | Mid-ML | Multiple | | WL=H , MD=S , ML=S ,Chem MID-ML, MJ RND AT MID, 1/16 vertical cracking @ MD | 20 |
| PIER 2 | 50-F | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 18 |
| PIER 2 | 50-G | | ND | | | | | | | 22 |
| PIER 2 | 50-H | | ND | | | | | | | 25 |
| PIER 2 | 50.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 50.8-B BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 51-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | 2 EXP BARS MJ SECTION LOSS | |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 | 51-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | 3 EXP BARS SV SECTION LOSS | |
| PIER 2 | 51-C | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 51-D | 2 | MJ | CHEM DET | MJ RND | Mudline | C2/3 | Yes | Enc is 6' below cap and ends @ -16' , 1/16" cracking on face 4, ML=S | 19 |
| PIER 2 | 51-E | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL= H, MD=S, ML=S, Chem starts -4' and ends @ ML | 18 |
| PIER 2 | 51-F | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | 3 EXP BARS SV SECTION LOSS | |
| PIER 2 | 51-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | 4 EXP BARS | |
| PIER 2 | 51-H | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL= H, MD=S, ML=S, Chem starts -4' and ends @ ML, multiple stirrups exposed | 28 |
| PIER 2 | 51.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 51.8-B BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 52-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 52-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 52-C | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 52-D | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 52-E | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL=H, MD=S, ML=S, Chem starts @ -4' and ends @ ML | 19 |
| PIER 2 | 52-F | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 52-G | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL=H, MD=S, ML=S, Chem starts @ -4' and ends @ ML, multiple stirrup exposed | 28 |
| PIER 2 | 52-H | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL=H, MD=S, ML=S, Chem starts @ -4' and ends @ ML | 31 |
| PIER 2 | 52.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 52.8-B BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 53-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 53-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 53-C | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 53-D | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | 4 BARS EXP SV SL | |
| PIER 2 | 53-E | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 53-F | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL= H, MD=S, ML=S, Chem starts @ -4' and ends @ ML | 17 |
| PIER 2 | 53-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 53-H | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | | |
| PIER 2 | 53.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 53.8-B BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 54-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 54-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 54-C | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 54-C.5 | | ND | | | | | | | |
| PIER 2 | 54-D | | ND | | | | | | | |
| PIER 2 | 54-D.5 | | ND | | | | | | | |
| PIER 2 | 54-E | 2 | ND | | | | | | WL=F, MID=F, ML=H | 13 |
| PIER 2 | 54-F | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 54-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 54-H | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 54.2-G BAT | 2 | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | WL=H, MID=MS W/ 2" D ROUNDING & H-CRK 1/8"W F2, ML=MS W/ 1/8" V-CRK F2 | 17 |
| PIER 2 | 54.8-B BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | 6 EXP BARS SVR SL | |
| PIER 2 | 55-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 24 |
| PIER 2 | 55-B | | MD | V-CRK | ≤1/16 | Mid-water | C2/3 | | | 21 |
| PIER 2 | 55-C | 2 | MD | V-CRK | ≤1/8 | Mid-water | 4 | | ML=H ND, MID=F W/V-CRK F4 1/8"W, WL=H ND | 15 |
| PIER 2 | 55-C.5 | | ND | | | | | | | 13 |
| PIER 2 | 55-D | | ND | | | | | | | 12 |
| PIER 2 | 55-D.5 | 2 | MD | CHEM DET | MN RND | Mid-ML | Multiple | | TOP=H, MID=MS W/MN ROUNDING, ML=F | 13 |
| PIER 2 | 55-E | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | 12 |
| PIER 2 | 55-F | | ND | | | | | | | 17 |
| PIER 2 | 55-G | | MD | CHEM DET | MN RND | Mudline | Multiple | | | 22 |
| PIER 2 | 55-H | 2 | MD | H-CRK | ≤1/8 | Mid-water | 4 | | WL=H ND, MID=H W/DIAG CRK 1/8"W F4, ML=H ND | 24 |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 | 55.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 17 |
| PIER 2 | 55.8-B BAT | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | | |
| PIER 2 | 56-A | | ND | | | | | | | |
| PIER 2 | 56-B | | ND | | | | | | | |
| PIER 2 | 56-C | | ND | | | | | | | |
| PIER 2 | 56-C.5 | | ND | | | | | | | |
| PIER 2 | 56-D | | ND | | | | | | | |
| PIER 2 | 56-D.5 | | ND | | | | | | | |
| PIER 2 | 56-E | | ND | | | | | | | |
| PIER 2 | 56-F | 2 | ND | | | | | | WL=H ND, MID=F ND, ML=H ND | 17 |
| PIER 2 | 56-G | 2 | MD | V-CRK | ≤1/32 | Mid-water | Multiple | | ML=F ND, MID=F W/ V-CRK 1/32"W MULT FACES, WL=H ND | 21 |
| PIER 2 | 56-H | | ND | | | | | | | |
| PIER 2 | 56.2-G BAT | | ND | | | | | | | |
| PIER 2 | 56.8-B BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 57-A | | MD | V-CRK | ≤1/8 | TZ-Mid | C2/3 | | | |
| PIER 2 | 57-B | | MD | V-CRK | >1/8 | TZ-ML | C2/3 | | | |
| PIER 2 | 57-C | | MD | V-CRK | ≤1/16 | Mid-ML | C4/1 | | | |
| PIER 2 | 57-C.5 | | ND | | | | | | | |
| PIER 2 | 57-D | | ND | | | | | | | |
| PIER 2 | 57-D.5 | | ND | | | | | | | |
| PIER 2 | 57-E | 2 | MD | V-CRK | ≤1/4 | Mudline | C2/3 | | WL=H, MD=H, ML=H | 11 |
| PIER 2 | 57-F | | ND | | | | | | | |
| PIER 2 | 57-G | 2 | ND | | | | | | WL=H ND, MID=H ND, ML=H ND | 22 |
| PIER 2 | 57-H | | ND | | | | | | | |
| PIER 2 | 57.2-G BAT | 2 | MD | V-CRK | ≤1/8 | Mid-water | C3/4 | | ML=H ND, MID=F W/V-CRK C3/4 1/8"W, WL=F ND | 17 |
| PIER 2 | 57.8-B BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 58-A | | ND | | | | | | | |
| PIER 2 | 58-B | | MD | V-CRK | ≤1/16 | TZ-ML | C4/1 | | | |
| PIER 2 | 58-C | | ND | | | | | | | |
| PIER 2 | 58-C.5 | 2 | ND | | | | | | TOP @ -5'=F, MD=F, ML=F | 11 |
| PIER 2 | 58-D | 2 | MD | V-CRK | ≤1/8 | Mid-water | | | TOP @ -5'=F, MD=F,ML=H | 10 |
| PIER 2 | 58-D.5 | | ND | | | | | | | |
| PIER 2 | 58-E | | ND | | | | | | | |
| PIER 2 | 58-F | | ND | | | | | | | |
| PIER 2 | 58-G | | ND | | | | | | | |
| PIER 2 | 58-H | | ND | | | | | | | |
| PIER 2 | 58.2-C | | ND | | | | | | | |
| PIER 2 | 58.2-E | | ND | | | | | | | |
| PIER 2 | 58.2-G BAT | | ND | | | | | | | |
| PIER 2 | 58.8-B BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | 6 EXP BARS, EXTENDS INTO ML | |
| PIER 2 | 58.8-C | | ND | | | | | | | |
| PIER 2 | 58.8-E | | ND | | | | | | | |
| PIER 2 | 59-A | | ND | | | | | | | |
| PIER 2 | 59-B | | ND | | | | | | | |
| PIER 2 | 59-C | | ND | | | | | | | |
| PIER 2 | 59-C.5 | | ND | | | | | | | |
| PIER 2 | 59-D | | MJ | CHEM DET | MJ RND | Mid-water | C3/4 | | | |
| PIER 2 | 59-D.5 | | ND | | | | | | | |
| PIER 2 | 59-E | | ND | | | | | | | |
| PIER 2 | 59-F | 2 | MD | V-CRK | ≤1/4 | Tidal Zone | | | WL=F 3/16" vertical cracking, MD=MS, ML=F | 16 |
| PIER 2 | 59-G | 2 | MD | V-CRK | ≤1/32 | Mid-water | Multiple | | WL=F ,MD= F,ML=F, Honeycombing @ ML | 22 |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 | 59-H | 2 | MD | V-CRK | ≤1/4 | Mid-ML | C2/3 | | WL=F, MD=MS,ML=F, 1/4" vertical crack c2/3 from MD-ML | 24 |
| PIER 2 | 59.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | CHEM DET EXT INTO ML | 21 |
| PIER 2 | 59.8-B BAT | | ND | | | | | | | |
| PIER 2 | 60-A | 2 | MJ | CHEM DET | MJ RND | Mid-water | C2/3 | | WL=H, MD=F, 1/16" vertical crack c2/3, spall c2/3 10"W x 3"D (-5' to -12'), ML=F | 28 |
| PIER 2 | 60-B | | MJ | CHEM DET | MJ RND | TZ-Mid | C2/3 | | | 25 |
| PIER 2 | 60-C | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | | 19 |
| PIER 2 | 60-C.5 | | ND | | | | | | | 16 |
| PIER 2 | 60-D | | SV | CHEM DET | Exposed Reinf. | TZ-Mid | Multiple | | | 13 |
| PIER 2 | 60-D.5 | | ND | | | | | | | 13 |
| PIER 2 | 60-E | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL=H, MD=S, ML=F, Chem starts @ -7' and ends 5' from ML | 15 |
| PIER 2 | 60-F | | MJ | CHEM DET | MJ RND | TZ-Mid | Multiple | | | 17 |
| PIER 2 | 60-G | | SV | CHEM DET | Exposed Reinf. | TZ-Mid | Multiple | | | 24 |
| PIER 2 | 60-H | 2 | MD | V-CRK | ≤1/4 | Mid-ML | C1/2 | | WL=F, MD=F, M=F | 24 |
| PIER 2 | 60.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 60.8-B BAT | 2 | MD | CHEM DET | ≤1/16 | Mudline | C4/1 | | WL=F, MD=MS, ML=S, <1/16" chem. cracking | 17 |
| PIER 2 | 61-A | | MJ | CHEM DET | MJ RND | Mid-water | Multiple | | | |
| PIER 2 | 61-B | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | | |
| PIER 2 | 61-C | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | | |
| PIER 2 | 61-C.5 | | ND | | | | | | | |
| PIER 2 | 61-D | | SV | CHEM DET | Exposed Reinf. | Full HT | Multiple | | | |
| PIER 2 | 61-D.5 | 2 | ND | | | | | | top @ -7'= H, MD=MS, ML=MS | 13 |
| PIER 2 | 61-E | | ND | | | | | | | |
| PIER 2 | 61-F | | MD | V-CRK | >1/8 | Mid-ML | C2/3 | | V-CRK C2/3 3/16" ML-MID | |
| PIER 2 | 61-G | | MJ | CHEM DET | MJ RND | TZ-Mid | C2/3 | | | |
| PIER 2 | 61-H | | MD | V-CRK | ≤1/16 | Mid-water | C2/3 | | | |
| PIER 2 | 61.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 61.8-B BAT | | ND | | | | | | | |
| PIER 2 | 62-A | | ND | | | | | | | |
| PIER 2 | 62-B | | ND | | | | | | | |
| PIER 2 | 62-C | 2 | MD | V-CRK | ≤1/32 | | C2/3 | | WL=H, MD=MS, Honeycombing c3/4, ML=H | 19 |
| PIER 2 | 62-D | 2 | MD | V-CRK | ≤1/16 | Mid-water | C2/3 | | WL=H, MD=S, 1/16" vert. cracking c2/3, ML=H | 17 |
| PIER 2 | 62-E | | ND | | | | | | | |
| PIER 2 | 62-F | | ND | | | | | | | |
| PIER 2 | 62-G | | ND | | | | | | | |
| PIER 2 | 62-H | | MD | CHEM DET | MN RND | Tidal Zone | C1/2 | | | |
| PIER 2 | 62.2-G BAT | | ND | | | | | | | |
| PIER 2 | 62.8-B BAT | | MJ | CHEM DET | MJ RND | Mid-ML | Multiple | | | |
| PIER 2 | 63-A | 2 | MN | MECH SP | | Tidal Zone | 4 | | WL=F, Mech. Spall face 4 (4" dia., 3/4" D), MD=MS, ML=F | 27 |
| PIER 2 | 63-B | 2 | MD | V-CRK | ≤1/16 | Mid-ML | C1/2 | | WL=F, MD=S, Vert. cracking c1/2 <1/16", ML=H, Horizontal crack face 1 <1/16" w/ minor spalling | 25 |
| PIER 2 | 63-C | | ND | | | | | | | |
| PIER 2 | 63-D | | ND | | | | | | | |
| PIER 2 | 63-E | | ND | | | | | | | |
| PIER 2 | 63-F | | ND | | | | | | | |
| PIER 2 | 63-G | | ND | | | | | | | |
| PIER 2 | 63-H | | MJ | CHEM DET | MJ RND | Mid-water | C2/3 | | V-CRK TZ-ML 1/8" C2/3 | |
| PIER 2 | 63.2-G BAT | | ND | | | | | | LARGE TIMBER CAMEL BETWEEN BENT 63-65 | |
| PIER 2 | 63.8-B BAT | 2 | MD | V-CRK | ≤1/16 | Mid-water | C4/1 | | WL=H, MD=S vert. <1/16" vert. cracking c1/4,ML=MS | 21 |
| PIER 2 | 64-A | 2 | MD | V-CRK | ≤1/16 | | C2/3 | | WL=F, MD=MS, vert. cracking 1/16" c2/3, ML=F | 27 |
| PIER 2 | 64-B | | MD | CHEM DET | MN RND | Mid-water | C2/3 | | | |
| PIER 2 | 64-C | 2 | MD | V-CRK | ≤1/16 | | C2/3 | | WL=H, MD=S, vert. cracking 1/16" c2/3, spalling 1" deep, ML=H | 21 |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 | 64-D | | MD | CHEM DET | MN RND | TZ-Mid | Multiple | | | |
| PIER 2 | 64-E | | MD | CHEM DET | MN RND | Mid-water | Multiple | | | |
| PIER 2 | 64-F | | MD | CHEM DET | MN RND | Mid-water | Multiple | | | |
| PIER 2 | 64-G | | ND | | | | | | | |
| PIER 2 | 64-H | | MD | V-CRK | ≤1/8 | TZ-ML | C1/2 | | | |
| PIER 2 | 64.2-G BAT | | ND | | | | | | | |
| PIER 2 | 64.8-B BAT | | MJ | CHEM DET | MJ RND | TZ-Mid | Multiple | | | |
| PIER 2 | 65-A | | MD | CHEM DET | MN RND | Mudline | C4/1 | | | 27 |
| PIER 2 | 65-B | 2 | MD | V-CRK | ≤1/32 | Mid-water | C3/4 | | WL=H, MD=F, vert. cracking c3/4 <1/32", ML=F | 25 |
| PIER 2 | 65-C | 2 | MJ | CHEM DET | MJ RND | | C2/3 | | WL=H, MD=S, rounding up to 2" deep, vert. cracking 1/16", ML=F | 20 |
| PIER 2 | 65-D | | ND | | | | | | | 16 |
| PIER 2 | 65-E | | ND | | | | | | | 16 |
| PIER 2 | 65-F | | MJ | CHEM DET | MJ RND | TZ-Mid | Multiple | | | 19 |
| PIER 2 | 65-G | | MJ | CHEM DET | MJ RND | Mid-water | Multiple | | | 23 |
| PIER 2 | 65-H | | MJ | CHEM DET | MJ RND | TZ-Mid | Multiple | | | 26 |
| PIER 2 | 65.2-G BAT | | ND | | | | | | | |
| PIER 2 | 65.8-B BAT | 2 | MJ | CHEM DET | MJ RND | Mid-ML | Multiple | | WL=H, MD=S, Heavy rounding @ c1/2 and c2/3, ML=S, Chem starts @  and ends -5 from ML | 20 |
| PIER 2 | 66-A | 2 | MD | CHEM DET | MN RND | Mid-ML | C1/2 | | WL=H, MD=S, vert. cracking up to 1/8" c1/2, ML=H | 27 |
| PIER 2 | 66-B | 2 | MD | CHEM DET | MN RND | Mid-ML | Multiple | | WL=H, MD=S, vert. cracking 1/16", ML=S, vert. cracking 1/16" | 26 |
| PIER 2 | 66-C | | ND | | | | | | | |
| PIER 2 | 66-D | | ND | | | | | | | |
| PIER 2 | 66-E | | ND | | | | | | | |
| PIER 2 | 66-F | | MD | CHEM DET | MN RND | Mid-ML | Multiple | | | |
| PIER 2 | 66-G | | MD | CHEM DET | MN RND | Mid-ML | Multiple | | | |
| PIER 2 | 66-H | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | |
| PIER 2 | 66.2-G BAT | | MD | CHEM DET | MN RND | Mid-ML | C1/2 | | | |
| PIER 2 | 66.8-B BAT | | ND | | | | | | | -4 |
| PIER 2 | 67-A | 2 | MD | V-CRK | ≤1/16 | Mid-water | C1/2 | | WL=H, MD=S, vert. cracking <1/16" c1/2, ML=H | 27 |
| PIER 2 | 67-B | 2 | MD | V-CRK | ≤1/16 | Mid-water | C1/2 | | WL=H, MD=MS, vert. cracking <1/16", ML=F | 24 |
| PIER 2 | 67-B.6 | | ND | | | | | | | |
| PIER 2 | 67-C | | MD | V-CRK | ≤1/16 | Mid-water | C2/3 | | | |
| PIER 2 | 67-D | | MD | CHEM DET | MN RND | Mid-water | C2/3 | | | |
| PIER 2 | 67-E | | ND | | | | | | | |
| PIER 2 | 67-F | | MD | CHEM DET | MN RND | Mid-water | C2/3 | | | |
| PIER 2 | 67-G | | MD | CHEM DET | MN RND | Mid-water | C2/3 | | | |
| PIER 2 | 67-H | | MD | V-CRK | ≤1/8 | TZ-ML | C2/3 | | | |
| PIER 2 | 67.2-G BAT | | ND | | | | | | | |
| PIER 2 | 67.8-B BAT | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | | |
| PIER 2 | 68-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 68-B | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 68-B.6 | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | |
| PIER 2 | 68-C | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | |
| PIER 2 | 68-C.3 | | MD | CHEM DET | MN RND | Mid-water | Multiple | | | |
| PIER 2 | 68-D | 2 | MD | V-CRK | ≤1/16 | Mid-water | C1/2 | | WL= H, MD=MS, vert. cracking c1/2 up to 1/16", ML=H, Minor honeycoming @ ML | 15 |
| PIER 2 | 68-E | 2 | MD | V-CRK | ≤1/16 | Mid-water | C2/3 | | WL=H, MD=MS, vert. cracking on c2/3 up to 1/16", ML= F | 16 |
| PIER 2 | 68-F | 2 | MD | V-CRK | ≤1/16 | Mid-water | C1/2 | | WL=H, MD=F, vert. cracking @ c1/2 <1/16"  ML=H, minor honeycoming @ c3/4 | 20 |
| PIER 2 | 68-G | | MD | V-CRK | ≤1/16 | TZ-Mid | C1/2 | | | |
| PIER 2 | 68-H | | MD | V-CRK | ≤1/8 | TZ-Mid | C1/2 | | | |
| PIER 2 | 68.2-G BAT | | MD | CHEM DET | MN RND | Mid-ML | C1/2 | | | |
| PIER 2 | 68.8-B BAT | | ND | | | | | | | |
| PIER 2 | 69-A | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | | |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 | 69-B | | MJ | CHEM DET | MJ RND | Mid-water | Multiple | | | |
| PIER 2 | 69-C | | ND | | | | | | | |
| PIER 2 | 69-C.5 | 2 | MJ | CHEM DET | MJ RND | Mid-water | Multiple | | WL=H ,MD=S, vert. cracking <1/16" ,ML=MS , | 16 |
| PIER 2 | 69-D | 2 | MJ | CHEM DET | MJ RND | Mid-water | Multiple | | WL=H ,MD=S, rounding of corners ,ML=F , | 15 |
| PIER 2 | 69-E | 2 | MJ | CHEM DET | MJ RND | Mid-water | Multiple | | WL=H, MD=S w/ Heavy rounding of corners (-5' to -16'), ML=H | 16 |
| PIER 2 | 69-F | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | | |
| PIER 2 | 69-G | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 69-H | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | | |
| PIER 2 | 69.2-G BAT | | ND | | | | | | | |
| PIER 2 | 69.8-B BAT | | ND | | | | | | | |
| PIER 2 | 70-A | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 28 |
| PIER 2 | 70-B | | MJ | CHEM DET | MJ RND | TZ-Mid | C1/2 | | | 24 |
| PIER 2 | 70-C | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | | 19 |
| PIER 2 | 70-C.5 | 2 | MJ | CHEM DET | MJ RND | Mid-water | Multiple | | WL=H, minor honeycombing c3/4, MD=S, rounding @ multiple corners, ML=H | 16 |
| PIER 2 | 70-D | 2 | MJ | CHEM DET | MJ RND | Mid-water | Multiple | | WL=H, MD=S, vert. cracking up to 1/16", ML=F | 16 |
| PIER 2 | 70-D.2 | | MJ | CHEM DET | MJ RND | TZ-ML | C1/2 | | | 13 |
| PIER 2 | 70-E | | MJ | CHEM DET | MJ RND | TZ-Mid | Multiple | | | 17 |
| PIER 2 | 70-F | | MJ | CHEM DET | MJ RND | TZ-Mid | Multiple | | | 20 |
| PIER 2 | 70-G | | MJ | CHEM DET | MJ RND | TZ-Mid | Multiple | | | 25 |
| PIER 2 | 70-H | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | 27 |
| PIER 2 | 70.2-G BAT | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 70.8-B BAT | | ND | | | | | | | |
| PIER 2 | 71-A | | ND | | | | | | | |
| PIER 2 | 71-B | 2 | MD | V-CRK | ≤1/32 | Mid-water | Multiple | | WL=H, MD=MS w/ vert. cracking up to 1/32 @ multiple corners, ML=F w/ minor honeycoming @ c3/4 | 24 |
| PIER 2 | 71-C | 2 | MD | CHEM DET | MN RND | Mid-water | C2/3 | | WL=H, MD=MS, rounding @ c2/3 up to 1" D, ML=F | 20 |
| PIER 2 | 71-D | | ND | | | | | | | |
| PIER 2 | 71-D.4 | | ND | | | | | | | |
| PIER 2 | 71-D.6 | | ND | | | | | | | |
| PIER 2 | 71-E | | MD | CHEM DET | MN RND | TZ-Mid | Multiple | | | |
| PIER 2 | 71-F | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | |
| PIER 2 | 71-G | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CRK 1/8" MID-ML C1/4 | |
| PIER 2 | 71-H | | MD | CHEM DET | MN RND | Mid-ML | C1/2 | | | |
| PIER 2 | 71.2-G BAT | | MD | CHEM DET | MN RND | Mid-ML | C2/3 | | | |
| PIER 2 | 71.8-B BAT | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CRK 1/8"W MULT CORN TZ-ML | |
| PIER 2 | 72-A | 2 | MD | CHEM DET | MN RND | Mid-water | Multiple | | WL=F ND, MID=S W/ MN RND, ML=F ND | 29 |
| PIER 2 | 72-B | | MD | CHEM DET | MN RND | TZ-Mid | Multiple | | V-CRK 1/8"W MULT CORN TZ-MID | |
| PIER 2 | 72-C | | MD | V-CRK | ≤1/4 | TZ-ML | Multiple | | V-CRK UP TO 3/16"W MULT CORN TZ-ML | |
| PIER 2 | 72-C.7 | | MD | V-CRK | ≤1/8 | TZ-ML | Multiple | | V-CRK 1/8"W MULT CORN TZ-ML | |
| PIER 2 | 72-D.5 | | MD | V-CRK | ≤1/8 | Mid-ML | Multiple | | V-CRK 1/8"W MULT CORN MID-ML | |
| PIER 2 | 72-D.7 | | MD | V-CRK | ≤1/4 | TZ-ML | Multiple | | V-CRK UP TO 3/16"W MULT CORN TZ-ML | |
| PIER 2 | 72-E | 2 | MD | CHEM DET | MN RND | Mid-ML | Multiple | | WL=F, MID=S 1/8"W V-CRK C2/3 W/ 1"D RND, ML=MS 1"D RND C1/4 | 16 |
| PIER 2 | 72-F | | MD | CHEM DET | MN RND | Mid-water | Multiple | | V-CRK 1/8"W MULT CORN TZ-ML | |
| PIER 2 | 72-G | | MD | V-CRK | ≤1/16 | TZ-Mid | Multiple | | | |
| PIER 2 | 72-H | | MD | CHEM DET | MN RND | Mid-ML | Multiple | | V-CRK 1/8"W MULT CORN MID-ML | |
| PIER 2 | 72.2-G BAT | | MD | V-CRK | ≤1/8 | Mid-water | Multiple | | | |
| PIER 2 | 72.8-B BAT | 2 | MJ | V-CRK | ≤1/4 | Mid-water | Multiple | | WL=F ND, MID=S ROUNDING TO 1"D 1/4" V-CRK C1/2, ML=F ND | 20 |
| PIER 2 | 73-A | | MD | CHEM DET | MN RND | Mid-ML | Multiple | | V-CRK UP TO 3/16"W MULT CORN TZ-ML | |
| PIER 2 | 73-B | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | |
| PIER 2 | 73-C | | MD | CHEM DET | MN RND | Tidal Zone | Multiple | | | |
| PIER 2 | 73-D | | MD | CHEM DET | MN RND | Mid-ML | Multiple | | | |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 | 73-D.7 | 2 | MD | V-CRK | ≤1/8 | Mid-water | 4 | | WL=H ND, MID=F 1/8" V-CRK F4, ML=F ND | 15 |
| PIER 2 | 73-E | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | |
| PIER 2 | 73-E.3 | 2 | MD | V-CRK | ≤1/8 | Mid-water | 4 | | ML=H ND, MID=S 1/8"W V-CRK F4, WL=F ND | 15 |
| PIER 2 | 73-F | | MD | CHEM DET | MN RND | Mid-water | C1/2 | | V-CRK 1/8"W C3/4 MID | |
| PIER 2 | 73-G | | MD | V-CRK | ≤1/4 | Mid-water | C1/2 | | | |
| PIER 2 | 73-H | | ND | | | | | | LEAKY PIPE BETWEEN 72-73 | |
| PIER 2 | 73.2-G BAT | | MD | CHEM DET | MN RND | TZ-Mid | Multiple | | | |
| PIER 2 | 73.8-B BAT | | ND | | | | | | | |
| PIER 2 | 74-A | | ND | | | | | | | |
| PIER 2 | 74-B | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CRK UP TO 3/16"W TZ-ML | |
| PIER 2 | 74-C | 2 | MD | CHEM DET | MN RND | Mudline | Multiple | | WL=H ND, MID=F ND, ML=MS minor rounding @ multi. corners | 21 |
| PIER 2 | 74-D | 2 | MD | V-CRK | Hairline | Mid-water | C1/2 | | WL=H, MD=MS ,ML=F | 18 |
| PIER 2 | 74-E | | ND | | | | | | | |
| PIER 2 | 74-E.5 | | ND | | | | | | | |
| PIER 2 | 74-F | | ND | | | | | | | |
| PIER 2 | 74-G | | ND | | | | | | | |
| PIER 2 | 74-H | | MD | V-CRK | ≤1/4 | Mid-ML | C2/3 | | V-CRK UP TO 3/16"W C2/3 MID-ML | |
| PIER 2 | 74.2-G BAT | | MD | CHEM DET | MN RND | TZ-Mid | Multiple | | | |
| PIER 2 | 74.8-B BAT | | MD | CHEM DET | MN RND | TZ-Mid | Multiple | | V-CRK UP TO 1/8"W MULT CORN TZ-MID | |
| PIER 2 | 75-A | | MD | V-CRK | ≤1/8 | TZ-Mid | C2/3 | | V-CRK UP TO 1/8"W C2/3 MID | 26 |
| PIER 2 | 75-B | 2 | MD | V-CRK | ≤1/8 | Mid-water | C2/3 | | WL=F ND, MID=S 1/8" V-CRK C2/3 <1" RND, ML=H ND | 26 |
| PIER 2 | 75-C | | ND | | | | | | | 19 |
| PIER 2 | 75-D | | ND | | | | | | | 15 |
| PIER 2 | 75-E | 2 | ND | | | | | | WL=H ND, MID=F ND, ML=MS ND | 15 |
| PIER 2 | 75-E.7 | | ND | | | | | | | 15 |
| PIER 2 | 75-F | | ND | | | | | | | 18 |
| PIER 2 | 75-F.3 | | ND | | | | | | | 21 |
| PIER 2 | 75-G | | ND | | | | | | | 23 |
| PIER 2 | 75-H | | MD | V-CRK | ≤1/16 | Mid-water | C1/2 | | V-CRK 1/16"W C1/2 MID | 24 |
| PIER 2 | 75.2-G BAT | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | 2.5"D RND MULT CORN AT MID-PILE | |
| PIER 2 | 75.8-B BAT | | MD | CHEM DET | MN RND | TZ-Mid | Multiple | | | |
| PIER 2 | 76-A | 2 | ND | | | | | | WL=F ND, MID=F ND, ML=F ND | 28 |
| PIER 2 | 76-B | | ND | | | | | | | |
| PIER 2 | 76-C | | MD | V-CRK | ≤1/4 | Mid-ML | C1/2 | | V-CRK 3/16'W C1/2 MID-ML | |
| PIER 2 | 76-D | 2 | MD | V-CRK | ≤1/4 | Mid-water | C2/3 | | WL=MS MN RND MULT CORN, MID=S 3/16" V-CRK C2/3 W/ MN SPALLING, ML=MS W/ MN RND MULT CORN | 17 |
| PIER 2 | 76-E | | ND | | | | | | | |
| PIER 2 | 76-F | 2 | MD | V-CRK | Hairline | Mid-water | C1/2 | | WL=F ND, MID=S HL V-CRK C1/2 W/MN SPALLING 1/2"DX1"W, ML=F ND | 20 |
| PIER 2 | 76-F.5 | | MD | V-CRK | ≤1/8 | Mid-ML | C1/2 | | | |
| PIER 2 | 76-G | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CRK 1/8"W MULT CORN TZ-ML | |
| PIER 2 | 76-H | | ND | | | | | | | |
| PIER 2 | 76.2-G BAT | | MD | CHEM DET | MN RND | TZ-Mid | Multiple | | | |
| PIER 2 | 76.8-B BAT | | MD | CHEM DET | MN RND | Mid-water | C3/4 | | | |
| PIER 2 | 77-A | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | MJ RND (UP TO 3" D) V-CRK UP TO 3/16" TZ-ML | |
| PIER 2 | 77-B | | MD | V-CRK | ≤1/16 | Mid-water | C2/3 | | | |
| PIER 2 | 77-C | | ND | | | | | | | |
| PIER 2 | 77-D | | ND | | | | | | | |
| PIER 2 | 77-E | | MD | V-CRK | ≤1/16 | TZ-Mid | Multiple | | | |
| PIER 2 | 77-F | 2 | MD | V-CRK | ≤1/8 | Mid-water | Multiple | | WL=F  MID=MS, V-CRK <1/8" MULT. CORNERS ML=H | 21 |
| PIER 2 | 77-G | | ND | | | | | | | |
| PIER 2 | 77-H | 2 | ND | | | | | | WL=F MID=F ML=F | 27 |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 | 77.2-G BAT | | MD | CHEM DET | MN RND | TZ-Mid | Multiple | | | |
| PIER 2 | 77.8-B BAT | | MD | CHEM DET | MN RND | TZ-Mid | Multiple | | | |
| PIER 2 | 78-A | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CRK 3/16"W MULT CORN TZ-ML | |
| PIER 2 | 78-B | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | RND UP TO 3"D MID-ML | |
| PIER 2 | 78-C | | MD | CHEM DET | MN RND | Mid-ML | Multiple | | V-CRK 3/16"W MULT CORN MID-ML | |
| PIER 2 | 78-D | | ND | | | | | | | |
| PIER 2 | 78-E | 2 | MD | CHEM DET | MN RND | Mid-water | C2/3 | | WL=H MID= MS, V-CRK <1/16" ML=F | 17 |
| PIER 2 | 78-F | 2 | MD | CHEM DET | MN RND | Mid-water | Multiple | | WL=H MID= MS, V-CRK <1/16" ML=F | 18 |
| PIER 2 | 78-G | | MD | CHEM DET | MN RND | Mudline | Multiple | | V=CRK 1/8"W MULT CORN ML | |
| PIER 2 | 78-H | 2 | MD | V-CRK | >1/8 | Mid-water | C2/3 | | WL=F MID=F, V-CRK c2/3 up to 3/16" ML= H, MN RND | 26 |
| PIER 2 | 78.2-G BAT | | ND | | | | | | | |
| PIER 2 | 78.8-B BAT | | ND | | | | | | | |
| PIER 2 | 79-A | | MD | V-CRK | >1/8 | TZ-ML | Multiple | | | |
| PIER 2 | 79-B | | MD | V-CRK | ≤1/8 | TZ-Mid | C2/3 | | | |
| PIER 2 | 79-C | | MD | V-CRK | ≤1/8 | TZ-Mid | C2/3 | | | |
| PIER 2 | 79-D | | ND | | | | | | | |
| PIER 2 | 79-E | | ND | | | | | | | |
| PIER 2 | 79-F | | MD | V-CRK | ≤1/8 | TZ-Mid | C2/3 | | | |
| PIER 2 | 79-G | 2 | MD | V-CRK | Hairline | Mid-water | C2/3 | | WL=H MID=MS, V-CRK HL c2/3 ML=MS, MN HC | 24 |
| PIER 2 | 79-H | 2 | MD | V-CRK | ≤1/8 | Mid-ML | C2/3 | | WL=H MID=F, V-CRK UP TO 1/8" ML=H, vert. cracking <1/32" c2/3 | 26 |
| PIER 2 | 79.2-G BAT | | ND | | | | | | | |
| PIER 2 | 79.8-B BAT | | MD | MECH SP | | Mid-water | C3/4 | | -12' @1011 3"HX2"WX1"D | |
| PIER 2 | 80-A | | MD | CHEM DET | MN RND | Mid-ML | C2/3 | | | 25 |
| PIER 2 | 80-B | | MD | V-CRK | ≤1/8 | TZ-ML | Multiple | | V-CRK 1/8"W MULT CORN | 23 |
| PIER 2 | 80-C | | ND | | | | | | | 19 |
| PIER 2 | 80-D | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | 16 |
| PIER 2 | 80-E | 2 | MD | V-CRK | ≤1/4 | Mid-water | Multiple | | WL=H MID=S, V-CRK <3/16" (-5' TO -11') ML=H | 17 |
| PIER 2 | 80-F | 2 | MD | CHEM DET | MN RND | Mid-water | Multiple | | WL=H MID=H, V-CRK UP TO 1/16" ML=F | 19 |
| PIER 2 | 80-G | | MD | V-CRK | ≤1/8 | Mid-ML | C4/1 | | V-CRK 1/8"W C4/1 MID-ML | 25 |
| PIER 2 | 80-H | | MD | V-CRK | ≤1/4 | TZ-ML | Multiple | | V-CRK UP TO 3/16"W MULT CORN TZ-ML | 25 |
| PIER 2 | 80.2-G BAT | 2 | MD | CHEM DET | MN RND | Mid-water | Multiple | | WL=H MID=H,V-CRK <1/16" ML=H ,V-CRK HL | 19 |
| PIER 2 | 80.8-B BAT | | ND | | | | | | | |
| PIER 2 | 81-A | | MD | V-CRK | ≤1/16 | Mid-water | C2/3 | | | |
| PIER 2 | 81-B | | MD | CHEM DET | MN RND | TZ-Mid | C2/3 | | | |
| PIER 2 | 81-C | | MD | CHEM DET | MN RND | TZ-Mid | C3/4 | | | |
| PIER 2 | 81-D | | ND | | | | | | | |
| PIER 2 | 81-E | | MD | V-CRK | ≤1/4 | Mid-water | C2/3 | | V-CRK 3/16"W C2/3 MID | |
| PIER 2 | 81-F | 2 | ND | | | | | | WL=H MID=MS ML=MS | 20 |
| PIER 2 | 81-G | 2 | MD | CHEM DET | MN RND | Mid-water | Multiple | | WL=H MID=MS, V-CRK UP TO 1/16", MD ROUNDING ML=F | 22 |
| PIER 2 | 81-H | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CRK 1/8"W C2/3 MID-ML | |
| PIER 2 | 81.2-G BAT | | MD | CHEM DET | MN RND | TZ-Mid | Multiple | | V-CRK 1/8"W C2/3 TZ | |
| PIER 2 | 81.8-B BAT | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | MJ RND (UP TO 3" D) | |
| PIER 2 | 82-A | | ND | | | | | | | |
| PIER 2 | 82-B | | ND | | | | | | | |
| PIER 2 | 82-C | | ND | | | | | | | |
| PIER 2 | 82-D | 2 | MD | CHEM DET | MN RND | | C2/3 | | WL=H MID=MS, V-CRK <1/16" ML=F | 18 |
| PIER 2 | 82-E | 2 | MD | V-CRK | Hairline | Mid-water | Multiple | | WL=H MID=F, V-CRK HL MULT. CORNERS ML=F | 16 |
| PIER 2 | 82-F | | ND | | | | | | | |
| PIER 2 | 82-G | | MJ | CHEM DET | MJ RND | TZ-ML | C2/3 | | MJ RND (UP TO 3" D) | |
| PIER 2 | 82-H | | ND | | | | | | | 26 |
| PIER 2 | 82.2-G BAT | | ND | | | | | | | |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 | 82.8-B BAT | | ND | | | | | | | 20 |
| PIER 2 | 83-A | | ND | | | | | | | 27 |
| PIER 2 | 83-B | | MD | CHEM DET | MN RND | Mid-ML | Multiple | | V-CRK UP TO 3/16" | 24 |
| PIER 2 | 83-C | 2 | ND | | | | | | WL=H MID=MS ML=F | 21 |
| PIER 2 | 83-D | 2 | MD | CHEM DET | MN RND | Mid-water | Multiple | | WL=F MID=F, ML=F | 19 |
| PIER 2 | 83-E | 2 | ND | | | | | | WL=H MID=MS ML=H | 17 |
| PIER 2 | 83-F | | MD | CHEM DET | MN RND | TZ-ML | C4/1 | | | 18 |
| PIER 2 | 83-G | | ND | | | | | | | 24 |
| PIER 2 | 83-H | | ND | | | | | | | 26 |
| PIER 2 | 83.2-G BAT | | MD | V-CRK | ≤1/8 | TZ-ML | C2/3 | | | 19 |
| PIER 2 | 83.8-B BAT | | ND | | | | | | | |
| PIER 2 | 84-A | | MD | CHEM DET | MN RND | Mid-ML | C2/3 | | V-CRK UP TO 3/16" C2/3 TZ-ML | |
| PIER 2 | 84-B | | ND | | | | | | | |
| PIER 2 | 84-C | | MD | CHEM DET | MN RND | TZ-Mid | Multiple | | | |
| PIER 2 | 84-D | | MD | CHEM DET | MN RND | TZ-ML | C2/3 | | V-CRK UP TO 1/8" C2/3 | |
| PIER 2 | 84-E | 2 | MJ | CHEM DET | MJ RND | Mid-water | Multiple | | WL=F MID=MS, CHEM DET. 2" D ML=H | 17 |
| PIER 2 | 84-F | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CRK UP TO 3/16" | |
| PIER 2 | 84-G | 2 | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | WL=H, MN ROUNDING MID=MS, CHEM DET. 2" D ML=F | 25 |
| PIER 2 | 84-H | | MD | V-CRK | ≤1/8 | TZ-ML | C4/1 | | | |
| PIER 2 | 84.2-G BAT | | ND | | | | | | | |
| PIER 2 | 84.8-B BAT | | MD | CHEM DET | MN RND | Mid-ML | Multiple | | | |
| PIER 2 | 85-A | | MD | CHEM DET | MN RND | Mid-water | Multiple | | V-CRK UP TO 1/8" FROM TZ-ML | |
| PIER 2 | 85-B | | MD | CHEM DET | MN RND | Mid-ML | Multiple | | | |
| PIER 2 | 85-B.5 | | MD | CHEM DET | MN RND | Mid-ML | Multiple | | | |
| PIER 2 | 85-C.5 | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | |
| PIER 2 | 85-D.5 | 2 | MJ | CHEM DET | MJ RND | Mid-water | Multiple | | WL=H MID=MS, CHEM DET. <3" D (-5' TO -15') ML=F | 15 |
| PIER 2 | 85-E.5 | | ND | | | | | | | |
| PIER 2 | 85-F.5 | | ND | | | | | | | |
| PIER 2 | 85-G | | ND | | | | | | | |
| PIER 2 | 85-H | | MD | CHEM DET | MN RND | Mid-water | Multiple | | | |
| PIER 2 | 85.2-G BAT | 2 | MD | CHEM DET | MN RND | Mid-water | Multiple | | WL=F MID=F, V-CRK UP TO 1/16" ML=F | 19 |
| PIER 2 | 85.8-B BAT | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CRK UP TO 1/8" | |
| PIER 2 | 86-A | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CRK UP TO 1/8" | |
| PIER 2 | 86-B | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | MJ RND (3" D) @ TZ-ML | |
| PIER 2 | 86-B.5 | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | MJ RND (4" D) STARTS @ TZ AND ENDS @ -23' | 24 |
| PIER 2 | 86-C.5 | | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | | |
| PIER 2 | 86-D.5 | 2 | SV | CHEM DET | Exposed Reinf. | Mid-water | Multiple | | WL=H MID= ML=MS, CHEM DET. (-4' TO ML) ML=S | 14 |
| PIER 2 | 86-E.5 | 2 | MD | V-CRK | ≤1/8 | TZ-ML | Multiple | | WL=H MID=MS ,V-CRK UP TO 1/8" , CHEM DET. STARTS @ -5' AND ENDS @ -16' ML=F | 18 |
| PIER 2 | 86-F.5 | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CRK UP TO 1/8" | |
| PIER 2 | 86-G | 2 | SV | CHEM DET | Exposed Reinf. | TZ-ML | Multiple | | WL=S MID=S ML=MS, V-CRK HL | 26 |
| PIER 2 | 86-H | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CR UP T0 1/8" | |
| PIER 2 | 86.2-G BAT | | MD | CHEM DET | MN RND | TZ-Mid | Multiple | | V-CRK UP TO 1/8" C3/4 | |
| PIER 2 | 86.8-B BAT | | MD | V-CRK | ≤1/8 | TZ-ML | Multiple | | | |
| PIER 2 | 87-A | | MD | CHEM DET | MN RND | Mid-water | Multiple | | 1/8" V-CRK FROM TZ-ML | |
| PIER 2 | 87-B | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | 3/16" V-CRK FROM TZ-ML | |
| PIER 2 | 87-C | 2 | ND | | | | | | ML=MS ND, MID=MS ND, WL=H | 20 |
| PIER 2 | 87-C.5 | | MD | CHEM DET | MN RND | Full HT | Multiple | | | |
| PIER 2 | 87-D | | MJ | CHEM DET | MJ RND | Full HT | Multiple | | | |
| PIER 2 | 87-D.5 | | ND | | | | | | | |
| PIER 2 | 87-E | 2 | MD | CHEM DET | MN RND | Mid-ML | Multiple | | WL=H ND, MID=MS MN RND MULT CORNERS, ML=MS MN RND C2/3 | 14 |
| PIER 2 | 87-F | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | | |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 | 87-G | | MD | CHEM DET | MN RND | TZ-ML | | | | |
| PIER 2 | 87-H | 2 | MD | CHEM DET | MN RND | Mid-ML | C1/2 | | WL=H ND, MID=MS MN RND C1/2, ML=F MN RND C1/2 | 27 |
| PIER 2 | 87.2-G BAT | | ND | | | | | | | |
| PIER 2 | 87.8-B BAT | 2 | MD | CHEM DET | MN RND | Mid-water | C3/4 | | WL=H ND, MID=S V-CRK 1/18" CORNER 1/4, ML=H | 19 |
| PIER 2 | 88-A | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | V-CRK UP TO 3/16" | |
| PIER 2 | 88-B | | MJ | CHEM DET | MJ RND | TZ-ML | Multiple | | 4"D RND C1/2 & C2/3 AT ML, V-CRK UP TO 1/4"W MULT CORN AT TZ-MID | |
| PIER 2 | 88-C | | MD | CHEM DET | MN RND | TZ-Mid | Multiple | | V-CRK UP TO 3/16"W MULT CORN AT TZ-MID | |
| PIER 2 | 88-C.5 | | ND | | | | | | | |
| PIER 2 | 88-D | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | |
| PIER 2 | 88-D.5 | 2 | MD | V-CRK | ≤1/8 | TZ-Mid | Multiple | | ML=H ND, MID=H V-CRK 1/8"W F1, WL=H V-CRK 1/8"W F3 | 12 |
| PIER 2 | 88-E | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | |
| PIER 2 | 88-F | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CRK UP TO 3/16"W MULT CORN TZ-MID | |
| PIER 2 | 88-G | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CRK UP TO 3/16"W C2/3 MID-ML | 23 |
| PIER 2 | 88-H | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CRK UP TO 1/8"W MULT CORN MID-PILE | 27 |
| PIER 2 | 88.2-G BAT | | MD | CHEM DET | MN RND | Tidal Zone | Multiple | | | |
| PIER 2 | 88.8-B BAT | | MD | CHEM DET | MN RND | Mid-ML | Multiple | | | |
| PIER 2 | 89-A | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CRK UP TO 1/8"W C1/2 & C2/3 TZ-ML | 27 |
| PIER 2 | 89-B | | ND | | | | | | | 25 |
| PIER 2 | 89-C | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | 19 |
| PIER 2 | 89-C.5 | | ND | | | | | | | 17 |
| PIER 2 | 89-D | 2 | MD | CHEM DET | MN RND | TZ-Mid | Multiple | | TOP=MS @ -10' @1427 CHEM DET MULT CORN, MID=MS MN RND MULT CORN, ML=H ND | 14 |
| PIER 2 | 89-D.5 | | ND | | | | | | | 13 |
| PIER 2 | 89-E | | MD | CHEM DET | MN RND | Mid-ML | C1/2 | | | 13 |
| PIER 2 | 89-F | 2 | MD | CHEM DET | MN RND | Mid-water | Multiple | | WL=H ND, MID=MS CHEM DET MULT CORN, ML=H ND | 18 |
| PIER 2 | 89-G | 2 | MD | CHEM DET | MN RND | Mid-water | Multiple | | WL=H ND, MID=F CHEM DET MULT CORN, ML=H ND | 24 |
| PIER 2 | 89-H | | MD | V-CRK | ≤1/16 | TZ-ML | C2/3 | | | 27 |
| PIER 2 | 89.2-G BAT | | ND | | | | | | | 19 |
| PIER 2 | 89.8-B BAT | | MJ | CHEM DET | MJ RND | Mid-ML | Multiple | | 2"D RND C1/4 AND C3/4 MID-PILE | |
| PIER 2 | 90-A | | MD | CHEM DET | MN RND | Mid-ML | Multiple | | V-CRK UP TO 1/16"W MULT CORN MID-ML | |
| PIER 2 | 90-B | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | 1/8" C1/2 AND C2/3 AT MID-ML | |
| PIER 2 | 90-C | 2 | MJ | CHEM DET | MJ RND | TZ-Mid | Multiple | | ML=H ND, MID=S 2"D RND, WL=S MN RND MULT CORN | 20 |
| PIER 2 | 90-C.5 | 2 | ND | | | | | | WL=H ND, MID=H ND, ML=H ND | 17 |
| PIER 2 | 90-D | | MD | CHEM DET | MN RND | Tidal Zone | Multiple | | AT TOP OF PILE BELOW CAP | |
| PIER 2 | 90-D.5 | | ND | | | | | | | |
| PIER 2 | 90-E | | ND | | | | | | | |
| PIER 2 | 90-F | | ND | | | | | | | |
| PIER 2 | 90-G | | MD | CHEM DET | MN RND | TZ-Mid | C1/2 | | | |
| PIER 2 | 90-H | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CRK UP TO 1/16"W MULT CORN MID-ML | |
| PIER 2 | 90.2-G BAT | | ND | | | | | | | |
| PIER 2 | 90.8-B BAT | | MJ | CHEM DET | MJ RND | | Multiple | | 2.5"D RND C1/4 MID-PILE | |
| PIER 2 | 91-A | | MD | V-CRK | ≤1/16 | TZ-ML | C2/3 | | | |
| PIER 2 | 91-B | | MD | V-CRK | ≤1/16 | TZ-ML | C2/3 | | | |
| PIER 2 | 91-C | | MD | V-CRK | ≤1/16 | TZ-Mid | C2/3 | | | |
| PIER 2 | 91-C.5 | | ND | | | | | | | |
| PIER 2 | 91-D | | ND | | | | | | | |
| PIER 2 | 91-D.5 | 2 | ND | | | | | | TOP=H ND @-8' @1514, MID=H ND, ML=H ND | 15 |
| PIER 2 | 91-E | 2 | MD | V-CRK | ≤1/16 | TZ-Mid | Multiple | | ML=H ND, MID=F V-CRK 1/16"W MULT FACES, WL=H V-CRK HL F3 | 15 |
| PIER 2 | 91-F | | ND | | | | | | | |
| PIER 2 | 91-G | | MD | CHEM DET | MN RND | | Multiple | | V-CRK 3/16"W C1/4 IN TZ | |
| PIER 2 | 91-H | 2 | MD | CHEM DET | MN RND | Mid-ML | Multiple | | WL=H ND, MID=MS MN RND MULT CORN, ML=F MN RND C1/2 | 26 |
| PIER 2 | 91.2-G BAT | | MD | V-CRK | ≤1/16 | TZ-ML | Multiple | | | |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 | 91.8-B BAT | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | |
| PIER 2 | 92-A | | MD | V-CRK | ≤1/16 | TZ-ML | C2/3 | | | |
| PIER 2 | 92-B | | ND | | | | | | | |
| PIER 2 | 92-C | | MD | V-CRK | ≤1/16 | TZ-ML | C2/3 | | V-CRK 1/16"W C2/3 | 19 |
| PIER 2 | 92-C.5 | | ND | | | | | | | |
| PIER 2 | 92-D | 2 | ND | | | | | | TOP=H ND @-8 @1546, MID=H ND, ML=H ND | 15 |
| PIER 2 | 92-D.5 | | ND | | | | | | | |
| PIER 2 | 92-E | | ND | | | | | | | |
| PIER 2 | 92-F | | ND | | | | | | | |
| PIER 2 | 92-G | 2 | ND | | | | | | WL=H ND, MID=F ND, ML=H ND | 23 |
| PIER 2 | 92-H | | ND | | | | | | | |
| PIER 2 | 92.2-G BAT | | ND | | | | | | | |
| PIER 2 | 92.8-B BAT | | MD | CHEM DET | MN RND | TZ-ML | C4/1 | | | |
| PIER 2 | 93-A | | ND | | | | | | | |
| PIER 2 | 93-B | | ND | | | | | | | |
| PIER 2 | 93-C | 2 | ND | | | | | | WL=H ND, MID=MS ND, ML=H ND | 20 |
| PIER 2 | 93-C.5 | | ND | | | | | | | |
| PIER 2 | 93-D | | ND | | | | | | | |
| PIER 2 | 93-D.5 | | ND | | | | | | | |
| PIER 2 | 93-E | | ND | | | | | | | |
| PIER 2 | 93-F | 2 | ND | | | | | | WL=H ND, MID=H ND, ML=H ND | 19 |
| PIER 2 | 93-G | | ND | | | | | | | |
| PIER 2 | 93-H | | ND | | | | | | | |
| PIER 2 | 93.2-G BAT | 2 | MD | CHEM DET | MN RND | Tidal Zone | C4/1 | | ML=H ND, MID=H ND, WL=F MN RND C1/4 | 19 |
| PIER 2 | 93.5-G | | ND | | | | | | | |
| PIER 2 | 93.5-H | | ND | | | | | | | |
| PIER 2 | 93.8-B BAT | | ND | | | | | | | |
| PIER 2 | 94-A | 2 | MD | V-CRK | ≤1/8 | TZ-Mid | Multiple | | WL=S V-CRK UP TO 1/8"W MULT CORN, MID=MS V-CRK UP TO 1/8"W MULT CORN, ML=H ND | 28 |
| PIER 2 | 94-B | 2 | MD | V-CRK | ≤1/16 | TZ-Mid | Multiple | | WL=MS V-CRK 1/16"W C2/3, MID=F V-CRK 1/32"W C1/2, ML=H ND | 26 |
| PIER 2 | 94-C | | ND | | | | | | | |
| PIER 2 | 94-C.5 | 2 | ND | | | | | | 16.25 sq, TOP=H -3@0916 ND, MID=H REPAIRED MECH SPALL F2, ML=F ND | 17 |
| PIER 2 | 94-D | | ND | | | | | | | |
| PIER 2 | 94-D.5 | | ND | | | | | | 16.25" sq, TOP OF PILE AT -4' | 13 |
| PIER 2 | 94-E | | ND | | | | | | | |
| PIER 2 | 94-F | | ND | | | | | | | |
| PIER 2 | 94-G | | ND | | | | | | | |
| PIER 2 | 94-H | | ND | | | | | | | |
| PIER 2 | 94.2-G BAT | | ND | | | | | | | |
| PIER 2 | 94.5-G | | ND | | | | | | EXT TOP TO WL | |
| PIER 2 | 94.5-H | | ND | | | | | | EXT TOP TO WL | |
| PIER 2 | 94.8-B BAT | 2 | MD | V-CRK | ≤1/16 | TZ-Mid | Multiple | | ML=H ND, MID=MS V-CRK 1/16"W MULT CORN, WL=MS V-CRK UP TO 1/16"W MULT CORN | 17 |
| PIER 2 | 95-A | | MD | V-CRK | ≤1/16 | TZ-Mid | C2/3 | | V-CRK 1/16"W @WL C2/3 | 28 |
| PIER 2 | 95-B | | MD | V-CRK | Hairline | TZ-Mid | C2/3 | | | 25 |
| PIER 2 | 95-C | 2 | MD | V-CRK | ≤1/16 | TZ-Mid | Multiple | | WL=MS MN RND MULT CORN, MID=MS V-CRK UP TO 1/16"W C2/3, ML=H ND | 19 |
| PIER 2 | 95-D | | MD | V-CRK | ≤1/16 | TZ-Mid | C2/3 | | | 15 |
| PIER 2 | 95-E | | ND | | | | | | 20.5" sq | 14 |
| PIER 2 | 95-F | | ND | | | | | | 20.5" sq | 17 |
| PIER 2 | 95-G | | ND | | | | | | | 24 |
| PIER 2 | 95-H | | ND | | | | | | | 25 |
| PIER 2 | 95.2-G BAT | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 | 95.5-G | | ND | | | | | | EXT TOP TO WL @0927 (28X28) | |
| PIER 2 | 95.5-H | | ND | | | | | | EXT TOP TO WL @0927, ML TO -15' EXT SECTION AT ML W/ NO GROUT IN ANNULUS (video: 0931-0938/10min on 26349)(28X28X4) | 25 |
| PIER 2 | 95.8-B BAT | | ND | | | | | | | |
| PIER 2 | 96-A | 2 | MD | V-CRK | ≤1/16 | Mid-ML | C1/2 | | VIDEO FROM FLOAT, ML=MS V-CRK 1/32"W C1/2, MID=F V-CRK 1/16"W C1/2, WL=H ND | 28 |
| PIER 2 | 96-B | 2 | ND | | | | | | WL=MS ND, MID=F ND, ML=H ND | 24 |
| PIER 2 | 96-C | | ND | | | | | | | |
| PIER 2 | 96-D | 2 | ND | | | | | | WL=F ND, MID=F ND, ML=F ND | 16 |
| PIER 2 | 96-E | | ND | | | | | | | |
| PIER 2 | 96-F | | ND | | | | | | | |
| PIER 2 | 96-G | | ND | | | | | | | |
| PIER 2 | 96-H | | MD | V-CRK | ≤1/16 | Mudline | | | V-CRK 1/16"W C1/2 | |
| PIER 2 | 96.2-G BAT | | ND | | | | | | | |
| PIER 2 | 96.4-H | | ND | | | | | | EXT 2' ABOVE WL | |
| PIER 2 | 96.6-G | | ND | | | | | | EXT TOP TO WL | -1 |
| PIER 2 | 96.6-H | | ND | | | | | | EXT TOP TO WL | |
| PIER 2 | 96.8-B BAT | | ND | | | | | | | |
| PIER 2 | 97-A | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | 27 |
| PIER 2 | 97-B | | ND | | | | | | | |
| PIER 2 | 97-C | 2 | MJ | CHEM DET | ≤1/4 | TZ-Mid | Multiple | | WL=MS V-CRK UP TO 1/4"W MULT CORN, MID=S CHEM DET MULT CORN HEAVY RND -10' TO WL W/ 1/4" V-CRKS NO EXP REINF, ML=F ND | 19 |
| PIER 2 | 97-D | | ND | | | | | | | |
| PIER 2 | 97-E | 2 | MD | V-CRK | ≤1/8 | Mid-water | C2/3 | | WL=H ND, MID=MS V-CRK UP TO 1/8"W C2/3, ML=F ND | 14 |
| PIER 2 | 97-F | | MD | CHEM DET | MN RND | Tidal Zone | Multiple | | | |
| PIER 2 | 97-G | | MJ | CHEM DET | MJ RND | Tidal Zone | Multiple | | 2.5" D RND C1/4 | |
| PIER 2 | 97-H | | ND | | | | | | | |
| PIER 2 | 97.2-G.5 BAT | | ND | | | | | | | |
| PIER 2 | 97.5-G | | ND | | | | | | EXT TOP TO WL | |
| PIER 2 | 97.5-H | | ND | | | | | | EXT TOP TO WL | |
| PIER 2 | 97.8-B BAT | | MD | CHEM DET | MN RND | TZ-ML | C1/2 | | | |
| PIER 2 | 98-A | 2 | MD | V-CRK | ≤1/32 | Mid-water | C2/3 | | WL=F ND, MID=F V-CRK 1/32"W C2/3, ML=F ND | 28 |
| PIER 2 | 98-B | | MD | CHEM DET | MN RND | Mid-ML | Multiple | | | |
| PIER 2 | 98-C | | MD | CHEM DET | MN RND | TZ-ML | C1/2 | | | |
| PIER 2 | 98-D | 2 | MD | CHEM DET | MN RND | Mid-water | Multiple | | WL=H ND, MID=S V-CRK UP TO 1/8"W MULT CORN MN RND, ML=H ND | 16 |
| PIER 2 | 98-E | | MD | CHEM DET | MN RND | TZ-Mid | Multiple | | | |
| PIER 2 | 98-E.8 | 2 | MD | CHEM DET | MN RND | Mid-water | Multiple | | WL=F ND, MID=S V-CRK UP TO 1/8'W MULT CORN MN RND, ML=F ND | 13 |
| PIER 2 | 98-F | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | |
| PIER 2 | 98-G | | ND | | | | | | | |
| PIER 2 | 98-H | | ND | | | | | | | |
| PIER 2 | 98.2-G.5 BAT | | ND | | | | | | | |
| PIER 2 | 98.5-G | | ND | | | | | | EXT TOP TO WL | |
| PIER 2 | 98.5-H | | ND | | | | | | EXT TOP TO WL | 20 |
| PIER 2 | 98.8-B BAT | | ND | | | | | Yes | ENCASED FROM 1' BELOW CAP ABOT 5' LONG | |
| PIER 2 | 99-A | | MD | CHEM DET | MN RND | Mid-ML | C1/2 | | V-CRK C1/2 1/16" | |
| PIER 2 | 99-B | | ND | | | | | | | |
| PIER 2 | 99-C | 2 | MJ | CHEM DET | MN RND | TZ-Mid | C2/3 | | WL=H ND, MID= VOID 14"X5"X2.5" DEEP F4 , ML=H ND VIDEO @ 2:41 PM | 20 |
| PIER 2 | 99-D | | MD | V-CRK | ≤1/8 | Mid-water | Multiple | | | |
| PIER 2 | 99-E | | MD | CHEM DET | MN RND | Tidal Zone | Multiple | | | |
| PIER 2 | 99-E.8 | 2 | MD | CHEM DET | MN RND | TZ-Mid | Multiple | | WL=S V-CRK UP TO 1/8"W MULT CORN MN RND, MID=MS V-CRK UP TO 1/8"W MULT CORN MN RND, ML=F ND | 13 |
| PIER 2 | 99-F | | MD | CHEM DET | MN RND | TZ-ML | C2/3 | | | |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| PIER 2 | 99-H | | ND | | | | | | | |
| PIER 2 | 99.2-G.5 BAT | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | |
| PIER 2 | 99.5-G | | ND | | | | | | EXT TO -5 @ 2:16 PM | |
| PIER 2 | 99.5-H | | ND | | | | | | EXT TO -5 @ 2:12 PM | |
| PIER 2 | 99.7-G | | ND | | | | | | EXT TO -5 @ 2:16 PM | |
| PIER 2 | 99.8-B BAT | | MD | V-CRK | ≤1/16 | Mudline | C2/3 | | | |
| PIER 2 | 100-A | | MD | CHEM DET | MN RND | Mid-water | C2/3 | | V-CRK C2/3 1/8" | 26 |
| PIER 2 | 100-B | 2 | MD | CHEM DET | MN RND | TZ-ML | Multiple | | WL=H ND, MID=MS V-CRK UP TO 1/8"W MULT CORN MN RND, ML=H ND | 24 |
| PIER 2 | 100-C | 2 | MD | CHEM DET | MN RND | Mid-water | Multiple | | WL=H ND, MID=MS V-CRK UP TO 1/16"W, ML=F ND | 19 |
| PIER 2 | 100-D | | MD | CHEM DET | MN RND | Mid-ML | Multiple | | | 15 |
| PIER 2 | 100-D.8 | 2 | MD | CHEM DET | MN RND | Mid-water | Multiple | | WL=F ND, MID=MS V-CRK UP TO 1/8"W MULT CORN MN RND, ML=H ND | 13 |
| PIER 2 | 100-E.2 | | MD | CHEM DET | MN RND | Mid-ML | Multiple | | | 12 |
| PIER 2 | 100-E.8 | | MD | CHEM DET | MN RND | Mid-ML | Multiple | | | 14 |
| PIER 2 | 100-H | | MD | CHEM DET | MN RND | TZ-Mid | Multiple | | V-CRK 1/16" C2/3 | 24 |
| PIER 2 | 100.2-G.5 BAT | | MD | CHEM DET | MN RND | Tidal Zone | C4/1 | | | |
| PIER 2 | 100.5-G | | ND | | | | | | EXT TO -5 @2:01 PM | |
| PIER 2 | 100.5-H | | ND | | | | | | EXT TO -5 @2:03 PM | |
| PIER 2 | 100.7-G | | ND | | | | | | EXT TO -5 @ 2:01 PM | |
| PIER 2 | 100.8-B BAT | | MD | V-CRK | ≤1/8 | TZ-ML | Multiple | | | |
| PIER 2 | 101-A | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CRK C2/3 UP TO 1/16" | |
| PIER 2 | 101-B | | MD | CHEM DET | MN RND | Mudline | C2/3 | | | |
| PIER 2 | 101-B.2 | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | |
| PIER 2 | 101-C.5 | | MD | CHEM DET | MN RND | TZ-Mid | Multiple | | | |
| PIER 2 | 101-D.4 | | MD | V-CRK | ≤1/16 | Mudline | C2/3 | | | |
| PIER 2 | 101-D.7 | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | | |
| PIER 2 | 101-E | | MD | CHEM DET | MN RND | TZ-Mid | Multiple | | V-CRK MULTIPLE CORNERS UT TO 1/16" | |
| PIER 2 | 101-F | 2 | MJ | CHEM DET | MJ RND | TZ-Mid | C2/3 | | WL=H MN HC ON C3/4, MID=S, ML=F CHEM DET STOPS AT -15' | 15 |
| PIER 2 | 101-H | 2 | MD | CHEM DET | MN RND | Mid-water | C2/3 | | WL=H ND, MID=MS V-CRK 1/32" CORNER 3/4, ML=MS POCKET ON FACE 3 3"X4"X1 1/2" DEEP | 24 |
| PIER 2 | 101.2-G.5 BAT | | ND | | | | | | | |
| PIER 2 | 101.5-G | | ND | | | | | | EXT TO -4 @ 1:32 PM | |
| PIER 2 | 101.5-H | | ND | | | | | | EXT TO -5 @ 1:29 PM | |
| PIER 2 | 101.7-G | | ND | | | | | | EXT TO -4 @ 1:32 PM | |
| PIER 2 | 102-A | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CRK C/23 UP TO 1/8" | 26 |
| PIER 2 | 102-B | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CRK C2/3 UP TO 1/8" | |
| PIER 2 | 102-B.2 | | MD | CHEM DET | MN RND | TZ-ML | Multiple | | V-CRK MULTIPLE CORNERS UP TO 1/8" | |
| PIER 2 | 102-C.5 | | MD | CHEM DET | MN RND | TZ-ML | C2/3 | | V-CRK C2/3 1/8" | |
| PIER 2 | 102-D | 2 | MD | CHEM DET | MN RND | Mid-water | Multiple | | WL=H ND, MID=MS V-CRK 1/16" MULTIPLE CORNERS , ML=F ND | 13 |
| PIER 2 | 102-D.7 | 2 | MD | CHEM DET | MN RND | Mid-water | Multiple | | WL=H ND, MID=MS , ML=F ND | 13 |
| PIER 2 | 102-F | | ND | | | | | | | |
| PIER 2 | 102-H | 2 | MD | CHEM DET | MN RND | Mid-water | C2/3 | | WL=H ND, MID=MS V-CRK 1/16" C2/3, ML=F ND | 23 |
| DOLPHIN | 1-A BAT | 2 | ND | | | | | | ML=H, MID=H, WL=H | 30 |
| DOLPHIN | 1-B BAT | | ND | | | | | | | |
| DOLPHIN | 1-C BAT | | ND | | | | | | | |
| DOLPHIN | 1-E BAT | | ND | | | | | | | |
| DOLPHIN | 1-G BAT | | MD | V-CRK | ≤1/32 | Mid-ML | 3 | | @ -23' TO -27' & AT ML @ 13:18, & V-CRK @F1 @-25' | |
| DOLPHIN | 1-I BAT | | ND | | | | | | | |
| DOLPHIN | 1-J BAT | | MN | OCS | | | 3 | | corr spall above water 3" dia. X 1/4" deep | |
| DOLPHIN | 1-L BAT | | MN | MECH SP | | | 1 | | 1.5"Wx.5"Hx.5"D | 28 |
| DOLPHIN | 2-A BAT | | ND | | | | | | | |
| DOLPHIN | 2-B BAT | | ND | | | | | | | |

| STRUCTURE | PILE | INSP. LEVEL | RATING | DEFECT TYPE | DESCRIPTION | ELEV (FT) | PILE FACE | ENCASED | COMMENTS | MUDLINE DEPTH (MLLW) (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| DOLPHIN | 2-E BAT | | ND | | | | | | | |
| DOLPHIN | 2-I BAT | | MD | V-CRK | ≤1/32 | Tidal Zone | 3 | | 1' ABOVE WL X 24" H W/ CORR STAINING | |
| DOLPHIN | 2-L BAT | | ND | | | | | | | |
| DOLPHIN | 2-M BAT | | ND | | | | | | | |
| DOLPHIN | 3-D | | ND | | | | | | | |
| DOLPHIN | 3-G | | ND | | | | | | | |
| DOLPHIN | 3-J | | ND | | | | | | | |
| DOLPHIN | 4-A BAT | | MD | V-CRK | ≤1/32 | Tidal Zone | 2 | | 48"H | |
| DOLPHIN | 4-M BAT | | ND | | | | | | | |
| DOLPHIN | 5-D | 2 | ND | | | | | | ML=H, MID=H, WL=H | 29 |
| DOLPHIN | 5-G | | ND | | | | | | | |
| DOLPHIN | 5-J | | ND | | | | | | | |
| DOLPHIN | 6-A BAT | | ND | | | | | | | |
| DOLPHIN | 6-C BAT | | ND | | | | | | | |
| DOLPHIN | 6-F BAT | | ND | | | | | | | |
| DOLPHIN | 6-H BAT | | ND | | | | | | | |
| DOLPHIN | 6-K BAT | | ND | | | | | | | |
| DOLPHIN | 6-M BAT | 2 | ND | | | | | | ML=H, MID=H, WL=F | 29 |
| DOLPHIN | 7-A BAT | | MD | V-CRK | ≤1/32 | Mid-ML | 4 | | -16' TO ML | 29 |
| DOLPHIN | 7-C BAT | | ND | | | | | | | |
| DOLPHIN | 7-D BAT | 2 | ND | | | | | | ML=H, MID=H, WL=H | 29 |
| DOLPHIN | 7-F BAT | | ND | | | | | | | |
| DOLPHIN | 7-G BAT | | ND | | | | | | | |
| DOLPHIN | 7-H BAT | | ND | | | | | | | |
| DOLPHIN | 7-J BAT | | ND | | | | | | | |
| DOLPHIN | 7-K BAT | | ND | | | | | | | |
| DOLPHIN | 7-M BAT | | ND | | | | | | | |

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**Alameda Point Pier Inspections**
**Concrete Core Samples**

| Pier | Pile | Water Column Location | Location (MLLW) | Location (uncorrected) | Tidal Height | Date | Time |
|---|---|---|---|---|---|---|---|
| 2 | 21-A | Waterline | 1.5 | -3 | 4.5 | 10/15/2016 | 915 |
| 2 | 21-A | Mid-Pile | -18.5 | -23 | 4.5 | 10/15/2016 | 915 |
| 2 | 21-A | 3' ↓ Mudline | -29.5 | -34 | 4.5 | 10/15/2016 | 915 |
| 2 | 31.2-Bbat | Waterline | 2.0 | -3 | 5.0 | 12/2/2016 | 1027 |
| 2 | 31.2-Bbat | Mid-Pile | -8.0 | -13 | 5.0 | 12/2/2016 | 1028 |
| 2 | 31.2-Bbat | 3' ↓ Mudline | -20.0 | -25 | 5.0 | 12/2/2016 | 1029 |
| 2 | 36-D | Waterline | 3.9 | -2 | 5.9 | 10/12/2016 | 1017 |
| 2 | 36-D | Mid-Pile | -6.9 | -12 | 5.1 | 10/12/2016 | 1150 |
| 2 | 36-D | 3' ↓ Mudline | -19.3 | -23 | 3.7 | 10/12/2016 | 1305 |
| 2 | 46-E | Waterline | 3.1 | -2 | 5.1 | 12/3/2016 | 1127 |
| 2 | 46-E | Mid-Pile | -3.9 | -9 | 5.1 | 12/3/2016 | 1127 |
| 2 | 46-E | 3' ↓ Mudline | -16.9 | -22 | 5.1 | 12/3/2016 | 1127 |
| 2 | 51-H | Waterline | 4.2 | -1 | 5.2 | 10/15/2016 | 1401 |
| 2 | 51-H | Mid-Pile | -7.8 | -13 | 5.2 | 10/15/2016 | 1404 |
| 2 | 52-H | 3' ↓ Mudline | -27.8 | -33 | 5.2 | 10/15/2016 | 1359 |
| 2 | 55-F | Waterline | 2.9 | -3 | 5.9 | 12/3/2016 | 1436 |
| 2 | 55-F | Mid-Pile | -9.1 | -15 | 5.9 | 12/3/2016 | 1436 |
| 2 | 55-F | 3' ↓ Mudline | -19.1 | -25 | 5.9 | 12/3/2016 | 1436 |
| 2 | 61-A | Waterline | 0.6 | -3 | 3.6 | 12/4/2016 | 1022 |
| 2 | 61-A | Mid-Pile | -12.4 | -16 | 3.6 | 12/4/2016 | 1022 |
| 2 | 61-A | 3' ↓ Mudline | -28.4 | -32 | 3.6 | 12/4/2016 | 1022 |
| 2 | 62-C | Waterline | 0.8 | -5 | 5.8 | 12/4/2016 | 1443 |
| 2 | 62-C | Mid-Pile | -8.2 | -14 | 5.8 | 12/4/2016 | 1443 |
| 2 | 62-C | 3' ↓ Mudline | -21.2 | -27 | 5.8 | 12/4/2016 | 1443 |
| 2 | 86-G | Waterline | 2.1 | -3 | 5.1 | 12/5/2016 | 1356 |
| 2 | 86-G | Mid-Pile | -13.9 | -19 | 5.1 | 12/5/2016 | 1356 |
| 2 | 86-G | 3' ↓ Mudline | -25.9 | -31 | 5.1 | 12/5/2016 | 1356 |
| 2 | 88-F | Waterline | 1.8 | -3 | 4.8 | 12/7/2016 | 1700 |
| 2 | 88-F | Mid-Pile | -8.2 | -13 | 4.8 | 12/7/2016 | 1700 |
| 2 | 88-F | 3' ↓ Mudline | -20.2 | -25 | 4.8 | 12/7/2016 | 1700 |
| 2 | 99-H | Waterline | 2.7 | -2 | 4.7 | 10/16/2016 | 1457 |
| 2 | 99-H | Mid-Pile | -8.3 | -13 | 4.7 | 10/16/2016 | 1456 |
| 2 | 99-H | 3' ↓ Mudline | -24.3 | -29 | 4.7 | 10/16/2016 | 1454 |
| 3 | 30-A | Waterline | 3.5 | -2 | 5.5 | 10/10/2016 | 1436 |
| 3 | 30-A | Mid-Pile | -6.5 | -12 | 5.5 | 10/10/2016 | 1436 |
| 3 | 30-A | 3' ↓ Mudline | -22.5 | -28 | 5.5 | 10/10/2016 | 1436 |

# Appendix D

# Deficiency Rating Criteria and Definitions

**Rating Criteria**

The general condition assessment ratings for the inspected structure are based on a six point assessment scale developed by the American Society of Civil Engineers (ASCE). The six point condition ratings are:

- 6 – Good: No problems or only minor problems noted. Structural elements may show some very minor deterioration, but no overstressing observed.
- 5 – Satisfactory: Minor to moderate defects and deterioration observed, but no overstressing observed.
- 4 – Fair: All primary structural elements are sound; but minor to moderate defects and deterioration observed. Localized areas of moderate to advanced deterioration may be present but do not significantly reduce the load bearing capacity of the structure.
- 3 – Poor: Advanced deterioration or overstressing observed on widespread portions of the structure, but does not significantly reduce the load carrying capacity of the structure.
- 2 – Serious: Advanced deterioration, overstressing, or breakage may have significantly affected the load bearing capacity of primary structural elements. Local failures are possible and loading restrictions may be necessary.
- 1 – Critical: Very advanced deterioration, overstressing, or breakage has resulted in localized failure(s) of primary structural elements. More widespread failures are possible or likely to occur and load restrictions should be implemented as necessary.

Corrosion levels are defined as follows:

- Minor (or Light) – A light surface corrosion with no apparent loss of section.
- Moderate – Corrosion that is loose and flaking with some pitting. The scaling or exfoliation can be removed with some effort by use of a scraper or chipping hammer. The element exhibits measurable but not significant loss of section.
- Severe – Heavy, stratified corrosion or corrosion scales with extensive pitting. Removal requires exerted effort and may require mechanical means. Significant loss of section.

**Deficiency Rating and Definitions are based on the California State Lands Commission Marine Facilities Division's Marine Oil Terminal Engineering and Maintenance Audit Manual (May 2004).**

**TABLE D - 1**
**CONDITION ASSESSMENT RATINGS FOR STEEL ELEMENTS**

| Condition Rating | Existing Damage | Defects Indicating Higher Damage Grade(s) |
|---|---|---|
| **Not Inspected** | Not inspected, inaccessible or passed by | |
| **No Damage** | Protective coating intact<br>Light surface rust | |
| **Minor** | Less than 50 percent of perimeter or circumference affected by corrosion at any elevation or cross section<br>Loss of thickness up to 15 percent of nominal at any location | Minor damage not appropriate if:<br>Changes in straight line configuration or local buckling<br>Corrosion loss exceeding fabrication tolerances (at any location) |
| **Moderate** | Over 50 percent of perimeter or circumference affected by corrosion at any elevation or cross section<br>Loss of thickness 15 to 30 percent of nominal at any location | Moderate damage not appropriate if:<br>Changes in straight line configuration or local buckling<br>Loss of thickness exceeding 30 percent of nominal at any location |
| **Major** | Partial loss of flange edges or visible reduction of wall thickness on pipe piles<br>Loss of nominal thickness 30 to 50 percent at any location | Major damage not appropriate if:<br>Changes in straight line configuration or local buckling<br>Perforations or loss of wall thickness exceeding 50 percent of nominal |
| **Severe** | Structural bends or buckling, breakage and displacement at supports, loose or lost connections<br>Loss of wall thickness exceeding 50 percent of nominal at any location | |

**FIGURE D - 1**
**CONDITION ASSESSMENT RATINGS FOR STEEL ELEMENTS**

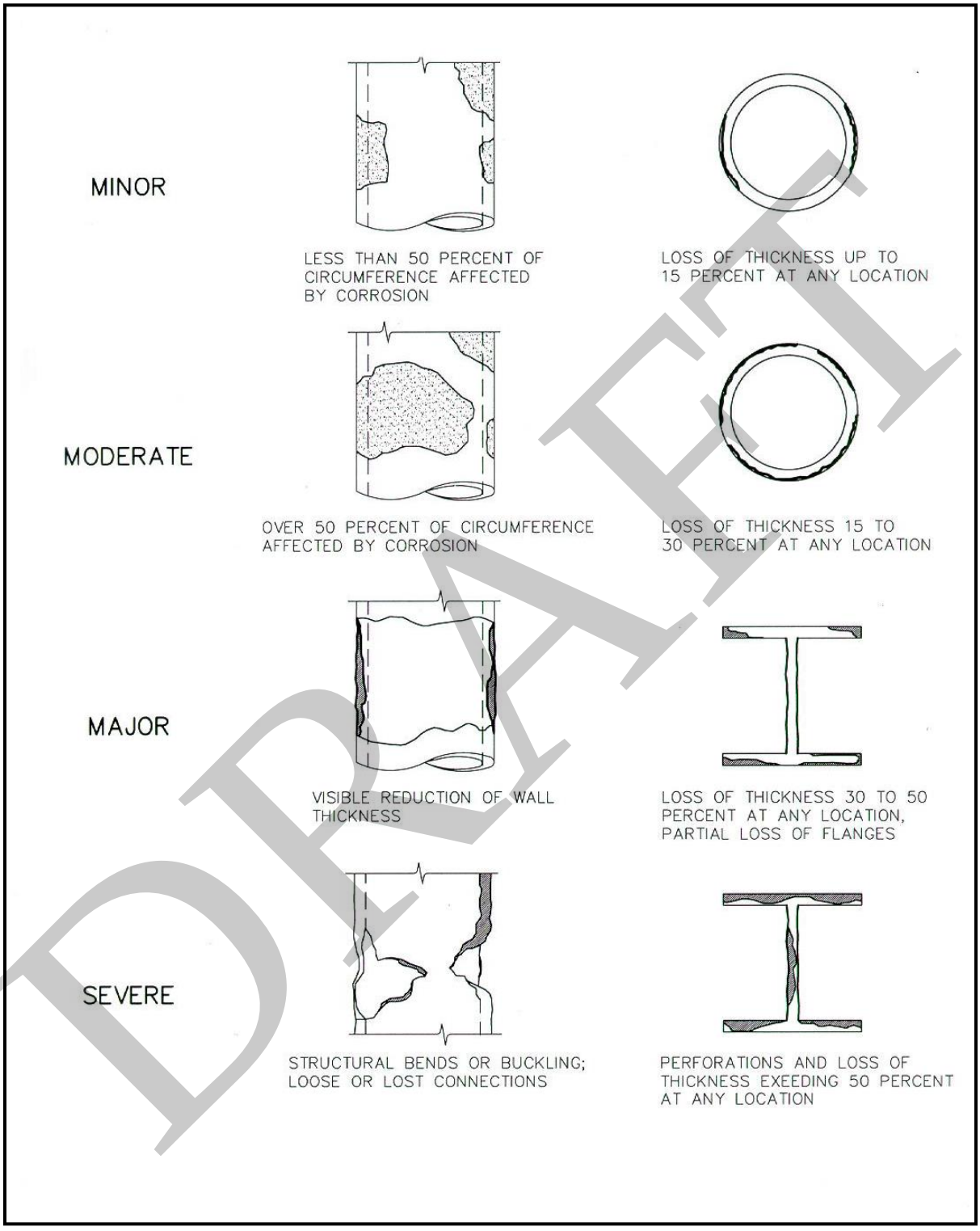

**TABLE D-2**
**CONDITION ASSESSMENT RATINGS OF TIMBER ELEMENTS**

| Condition Rating | Existing Damage | Defects Indicating Higher Damage Grade(s) |
|---|---|---|
| **Not Inspected** | Not inspected, inaccessible or passed by | |
| **No Damage** | Sound surface material | |
| **Minor** | Checks, splits and gouges less than 0.5 in. wide | Minor damage not appropriate if:<br>Loss of cross section<br>Marine borers infestation<br>Displacements, loss of bearing or connections |
| **Moderate** | Checks and splits wider than 0.5 in.<br>Remaining diameter loss up to 15 percent<br>Cross-section area loss up to 25 percent. Corroded hardware<br>Evidence of infestation by marine borers | Moderate damage not appropriate if:<br>Displacements, loss of bearing or connections |
| **Major** | Checks and splits through full depth of cross section<br>Remaining diameter loss 15 to 30 percent<br>Cross-section area loss 25 to 50 percent. Heavily corroded hardware.<br>Displacement and misalignments at connections | Major deterioration not appropriate if:<br>Partial or complete breakage |
| **Severe** | Remaining diameter reduced by more than 30 percent<br>Cross-section area loss more than 50 percent<br>Loss of connection and/or fully non-bearing condition<br>Partial or complete breakage | |

**FIGURE D-2**
**CONDITION ASSESSMENT RATINGS FOR TIMBER ELEMENTS**

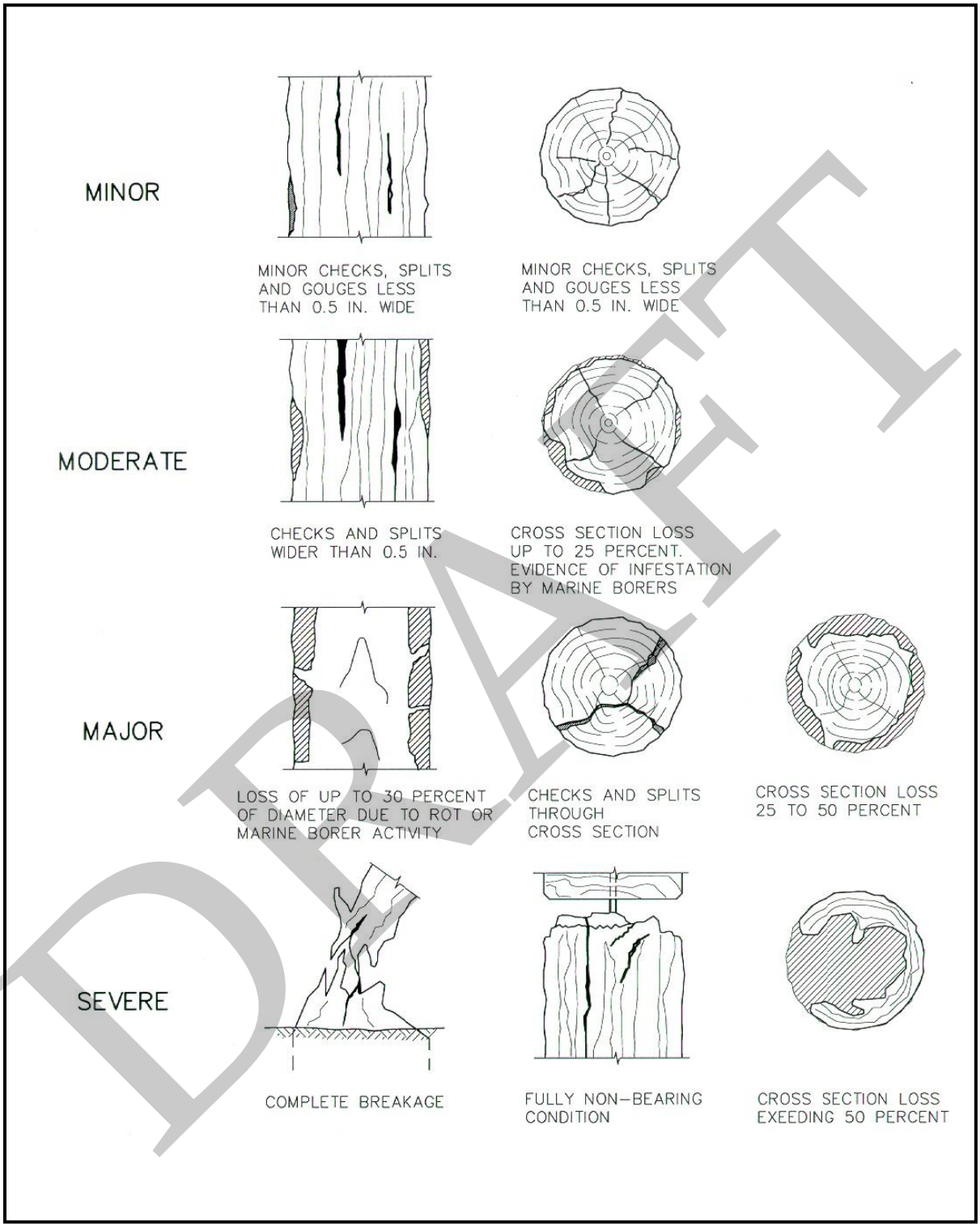

**TABLE D-3**
**CONDITION ASSESSMENT RATINGS FOR REINFORCED CONCRETE ELEMENTS**

| Condition Rating | Existing Damage | Defects Indicating Higher Damage Grade(s) |
|---|---|---|
| **Not Inspected** | Not inspected, inaccessible or passed by | |
| **No Damage** | Good original surface, hard material, sound | |
| **Minor** | Mechanical abrasion or impact dents up to 1 in. in depth<br>General cracks up to 1/16 in. in width<br>Occasional corrosion stains or small pop-out corrosion spalls | Minor damage not appropriate if:<br>Structural damage<br>Corrosion cracks<br>Chemical deterioration[1] |
| **Moderate** | Structural cracks up to 1/16 in. in width<br>Corrosion cracks up to 1/4 in. in width<br>Chemical deterioration(1): Random cracks up to 1/16 in. in width; "Soft" concrete and rounding of corners up to 1 in. deep | Moderate damage not appropriate if:<br>Structural breakage and/or spalls<br>Exposed reinforcement<br>Loss of cross section due to chemical deterioration beyond "rounding of corner edges" |
| **Major** | Structural cracks 1/16 in. to 1/4 in. in width and partial breakages (structural spalls)<br>Corrosion cracks wider than 1/4 in. and open spalls (excluding pop-outs)<br>Multiple cracking and disintegration of surface layer due to chemical deterioration | Major damage not appropriate if:<br>Loss of cross section exceeding 30 percent due to any cause |
| **Severe** | Structural cracks wider than 1/4 in. or complete breakage. Loss of bearing and displacement at connections<br>Complete loss of concrete cover due to corrosion of reinforcing steel with over 30 percent of diameter loss for any main reinforcing bar<br>Loss of concrete cover (exposed steel) due to chemical deterioration<br>Loss of over 30 percent of cross section due to any causes described above | |

1. Chemical Deterioration: Sulfate attack, alkali-silica reaction, or ettringite distress.

**FIGURE D-3**
**CONDITION ASSESSMENT RATINGS FOR REINFORCED CONCRETE ELEMENTS**

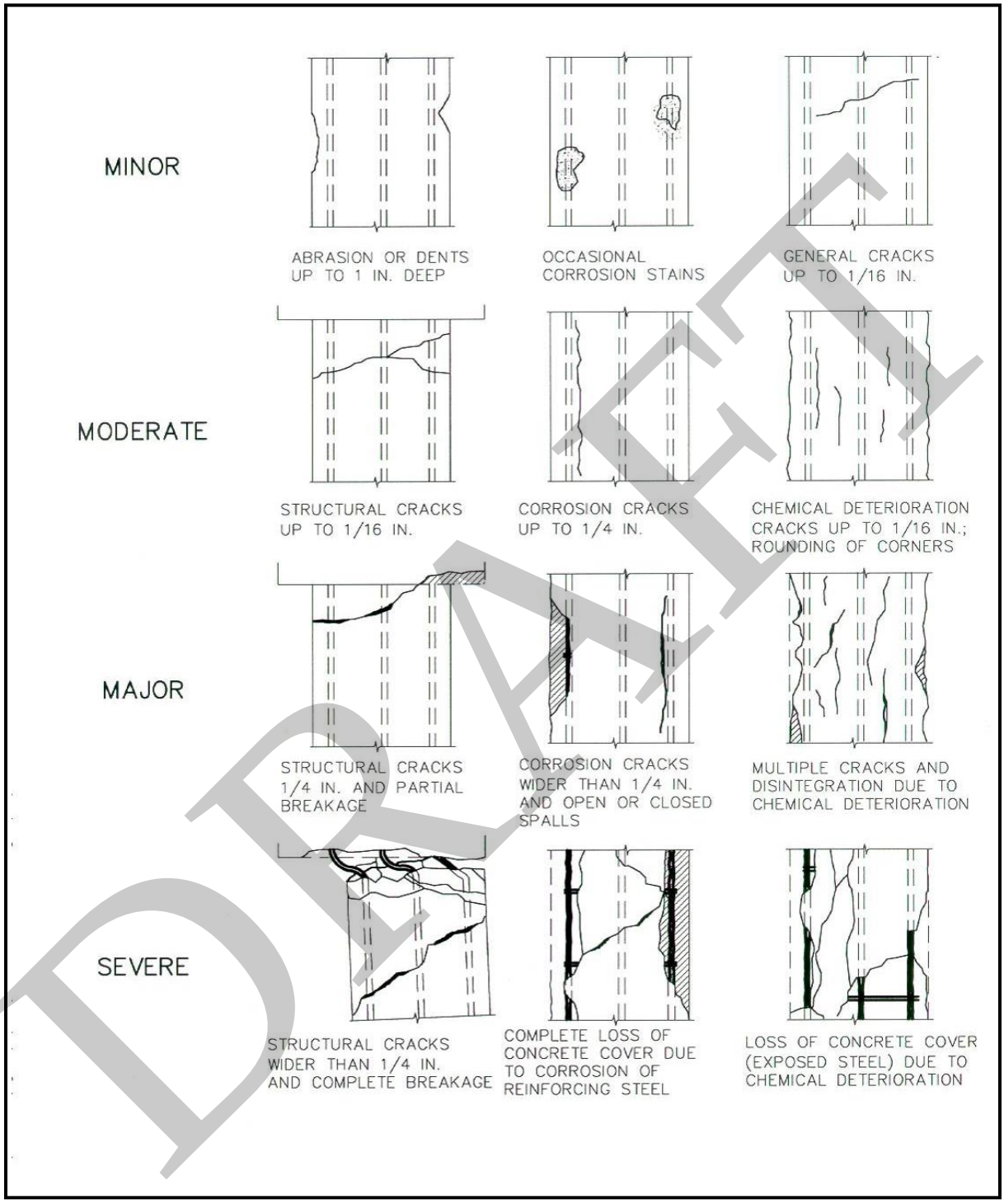

**TABLE D-4**
**CONDITION ASSESSMENT RATINGS FOR PRESTRESSED CONCRETE ELEMENTS**

| Condition Rating | Existing Damage | Defects Indicating Higher Damage Grade(s) |
|---|---|---|
| **Not Inspected** | Not inspected, inaccessible or passed by | |
| **No Damage** | Good original surface, hard material, sound | |
| **Minor** | Minor mechanical or impact spalls up to 0.5 in. deep | Minor damage not appropriate if:<br>Structural damage<br>Corrosion damage<br>Chemical deterioration[1]<br>Cracks of any type or size |
| **Moderate** | Structural cracks up to 1/32 in. in width<br>Chemical deterioration: random cracks up to 1/32 in. in width | Moderate damage not appropriate if:<br>Structural breakage and/ or spalls<br>Corrosion cracks<br>Loss of cross section in any form<br>"Softening" of concrete |
| **Major** | Structural cracks 1/32 in. to 1/8 in. in width<br>Any corrosion cracks generated by strands or cables<br>Chemical deterioration: cracks wider than 1/16 in. "Softening" or concrete up to 1 in. deep | Major deterioration not appropriate if: Exposed prestressing steel |
| **Severe** | Structural cracks wider than 1/8 in. and at least partial breakage or loss of bearing<br>Corrosion spalls over any prestressing steel<br>Partial spalling and loss of cross section due to chemical deterioration | |

1. Chemical Deterioration: Sulfate attack, alkali-silica reaction or ettringite distress.

**FIGURE D- 4**
**CONDITION ASSESSMENT RATINGS FOR PRESTRESSED CONCRETE ELEMENTS**

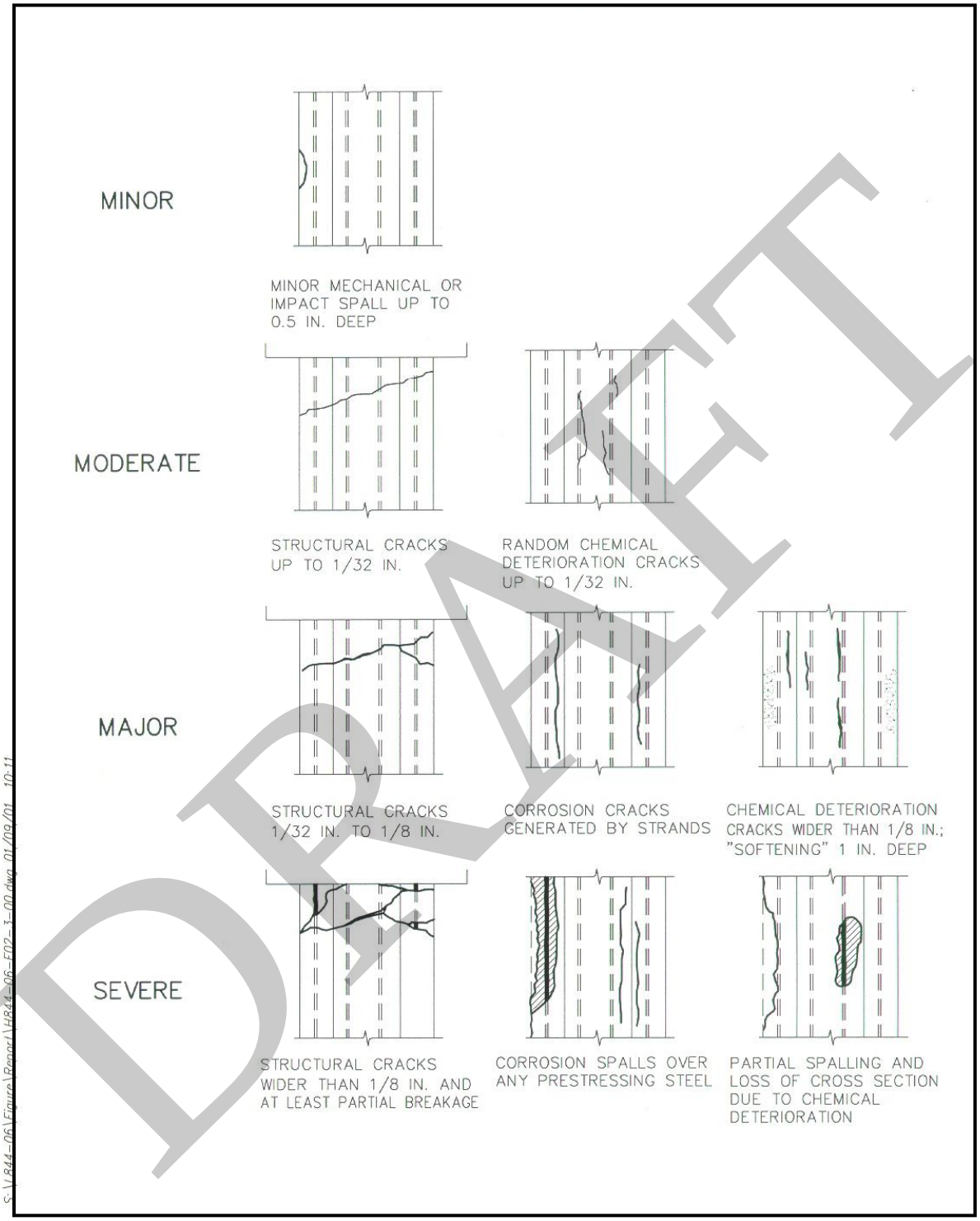


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**FIGURE D-5**
**CONDITION ASSESSMENT RATINGS FOR MOORING HARDWARE FIXTURES**

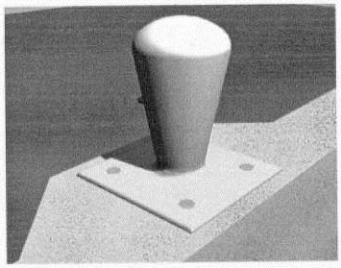
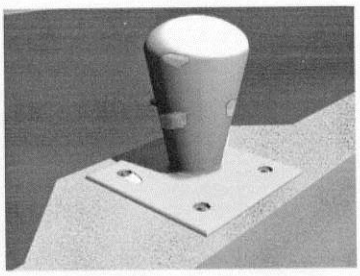
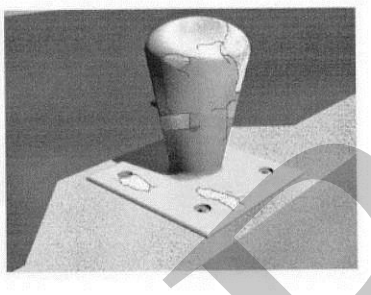
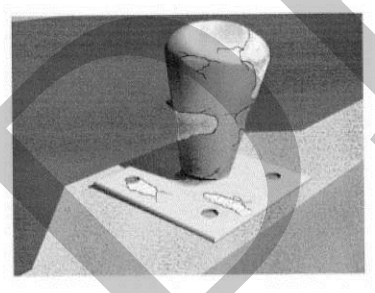
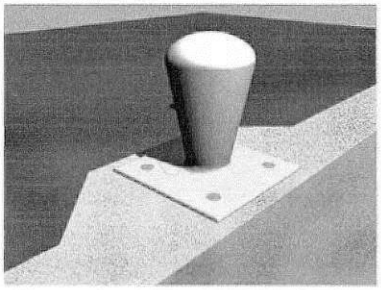
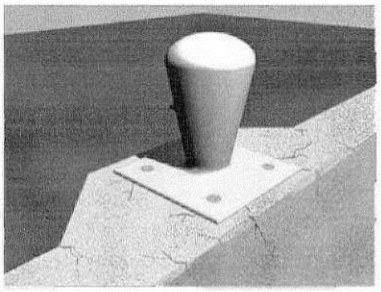
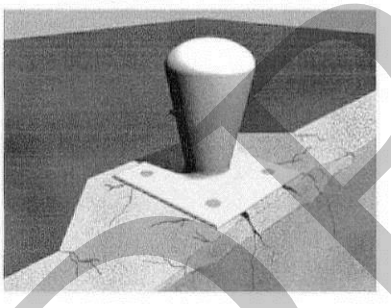
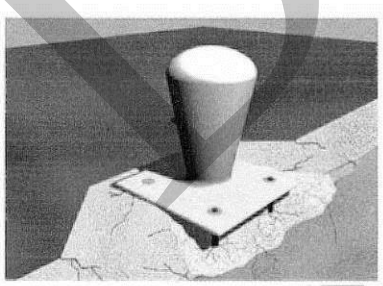
| Example of Condition | Mooring Hardware Condition Rating |
|---|---|
|  | #1 No Defects<br>• New coating (minor blemishes and corrosion on less than 10% of surface area)<br>• No wear marks<br>• No visible corrosion of fasteners<br>• Bolt countersinks sealed |
|  | #2 Minor Defects<br>• Minor surface corrosion (10% to 25% of surface area)<br>• Minor wear marks on fitting surface less than 3.125 mm (.0125 inches) deep<br>• Minor corrosion of fasteners |
|  | #3 Moderate Defects<br>• Heavy corrosion with loose scale (greater than 25%)<br>• Noticeable corrosion of fasteners<br>• Significant surface wear marks up to 7.8125 mm (0.3125 inches) deep |
|  | #4 Sever Defects<br>• Severe corrosion, heavy scale, noticeable surface pitting and 25% or greater loss of area at critical section<br>• Displaced or rotates fitting<br>• Broken or cracked fitting components<br>• Noticeable corrosion and section loss of fasteners<br>• Loose fasteners |

**FIGURE D-6**
**CONDITION ASSESSMENT RATINGS FOR**
**MOORING HARDWARE BASE STRUCTURES**

| Example of Condition | Mooring Support Structure Condition Rating |
|---|---|
|  | #1 No Defects<br>• Surface clean and smooth<br>• No cracking<br>• No noticeable deterioration |
|  | #2 minor Defects<br>• Weathering of concrete and wood<br>• Minor corrosion of steel (no significant section loss)<br>• Hairline cracking of concrete due to thermal expansion and/or age |
|  | #3 Moderate Defects<br>• Noticeable cracking of concrete due to age<br>• Corrosion of steel with section loss<br>• Timber cracked and checked, weathered, susceptible to dry rot |
|  | #4 Severe Defects<br>• Cracking or spalling as a result of overload under hardware base<br>• Dry rot on timber members<br>• Significant corrosion of steel members<br>• Displacement or yielding of any supporting members<br>• Loss of full bearing under hardware |

## TABLE D-5
## ASCE RECOMMENDED INSPECTION INTERVALS

**ASCE STANDARD PRACTICE MANUAL FOR UNDERWATER INVESTIGATIONS**
**TABLE 2-2**
**RECOMMENDED MAXIMUM INTERVAL BETWEEN UNDERWATER ROUTINE INSPECTIONS (YEARS)[1]**

| Condition Rating From Previous Inspection | CONSTRUCTION MATERIAL | | | | Channel Bottom or Mudline – Scour[4, 5] (Soundings[6] / Direct Observation) | |
|---|---|---|---|---|---|---|
| | Unwrapped Wood or Unprotected Steel (no coating or cathodic protection)[4] | | Concrete, Wrapped Wood, Protected Steel or Composite Materials (FRP, plastic, etc.)[4] | | | |
| | Benign[2] Environment | Aggressive[3] Environment | Benign[2] Environment | Aggressive[3] Environment | Benign[2] Environment | Aggressive[3] Environment |
| 6 (Good) | 6 | 4 | 6 | 5 | 6 / 6 | 2 / 5 |
| 5 (Satisfactory) | 6 | 4 | 6 | 5 | 6 / 6 | 2 / 5 |
| 4 (Fair) | 5 | 3 | 5 | 4 | 6 / 6 | 2 / 5 |
| 3 (Poor) | 4 | 3 | 5 | 4 | 6 / 6 | 2 / 5 |
| 2 (Serious) | 2 | 1 | 2 | 2 | 2 / 2 | 2 / 2 |
| 1 (Critical) | 0.5 | 0.5 | 0.5 | 0.5 | 1 / 1 | 0.5 / 1 |

1. The recommended maximum interval between Routine Inspections should be reduced as appropriate based on the extent of deterioration observed on a structure, the rate of further anticipated deterioration, the importance of the structure, or other factors. The intervals may likewise be increased as appropriate for non-typical cases such as alternative deterioration-resistance construction materials (i.e., special hardwoods), or other factors. Regulatory jurisdictions may also dictate the maximum inspection interval.
2. Benign environments include fresh water with low to moderate currents (maximum current always < .75 kts)
3. Aggressive environments include brackish or salt water, polluted water, or waters with moderate to swift currents (maximum current ≥ .75 kts)
4. The intervals indicate requirements for soundings and direct observation, respectively.
5. For most structures, two maximum intervals will be shown in this table, one for the assessment of construction material (wood, concrete, steel, etc) and one for scour (last 2 columns). The shorter interval of the two should dictate the maximum interval used.
6. Soundings may be performed at the time of the above water inspection.

# Appendix E – References

## References

1. California Code of Regulations, Title 24, Chapter 31F, "Marine Oil Terminals Engineering and Maintenance Standards", California Building Standards Commission, 2013.
2. Marine Oil Terminal Engineering and Maintenance Audit Manual, California State Lands Commission – Marine Facilities Division, May 2004
3. ASCE Manuals and Reports on Engineering Practice No. 101, Underwater Investigations-Standard Practice Manual, 2001
4. Condition Assessment Report for Pier 1, Pier 2, & Pier 3, Moffatt & Nichol, March 2008.

# APPENDIX B

# AME Concrete Test Report

APPLIED MATERIALS & ENGINEERING, INC.
980 41st Street
Oakland, CA 94608
Tel: (510) 420-8190
FAX: (510) 420-8186
e-mail: info@appmateng.com

January 26, 2017

Project Number: 1160610C

Dr. Sam X. Yao, Ph.D., P.E.
**SIMPSON GUMPERTZ & HEGER**
500 12th Street, Suite 270
Oakland, CA 94607

Email: sxyao@sgh.com

Subject: Petrographic Examination and Testing of Concrete Cores
Alameda Piers 1, 2 & 3, Alameda, California

Dear Dr. Yao:

As requested, Applied Materials & Engineering, Inc. (AME) has examined and tested concrete core samples removed by others from the above-captioned project. The objectives of the examination were to determine the physical and compositional properties of the samples, and if any deleterious reactions were present. In addition, the chloride ion contents of the pile core samples were determined at incremental depths starting from the exterior exposed surfaces.

## SAMPLE IDENTIFICATION

A total of forty-two (42) concrete cores were delivered to our laboratory in two sets. The first set, consisting of fifteen (15) cores, was delivered on October 17, 2016. The second set, consisting of 27 cores, was delivered on December 12, 2016. All samples were delivered in the wet condition, individual wrapped in plastic-wrap and protected with bubble-wrap. The sample description and sampling locations are listed in Table I (Set 1) and Table II (Set 2). Pile Cores 1 through 36 were used for petrographic examinations, compressive strength and chloride content profiles. Deck Cores 37 through 42 were tested for compressive strength only.

## TEST METHOD & RESULTS

1) ASTM C 856, "*Standard Practice for Petrographic Examination of Hardened Concrete*."

2) ASTM C 42, "*Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete*."

3) Chloride Ion Content: The chloride content tests were performed in accordance with the procedures described by the Germann Instruments Rapid Chloride Test (RCT). The precision of the RCT compares favorably with AASHTO T 260 and ASTM C 114 potentiometric titration for total acid-soluble chloride ion content of hardened concrete (Germann Instruments published product literature).

The following information was obtained:

## 1) Petrographic Examination of Pile Concrete

a) The concrete was composed of portland cement paste and normal-weight siliceous aggregate. The concrete was well proportioned and properly consolidated. No unusual placement features were observed.

b) The aggregate consisted of 1″ maximum size subangular to subround coarse aggregate composed of andesite/basalt, graywacke sandstone, chert, ultramafic volcanic rock fragments, felsite and less amounts of the granitic rock types. The fine aggregate consisted of rock fragments and minerals typical of the coarse aggregate.

c) Seawater attack caused cracking and microcracking in the out portion of the piles. The seawater attack softened the cement paste to depths typically less than 0.35″, but cracking and microcracking that was generally parallel the exterior surfaces extended to depths of 4½″ to 5″. The microcracks were typically completely filled with ettringite (calcium sulfoaluminate hydrate), carbonate minerals, and carbonated alkali-silica gel. Brucite (magnesium hydroxide) was occasionally detected, but positive identification of brucite was difficult due to the size of the crystals. It appeared that most of the areas were brucite was likely present it had converted to magnesium carbonate (the mineral magnesite) due to carbonation.

d) Observed reactions between the graywacke sandstone, and some volcanic rock types with the cement paste (reaction rims in the aggregate and calcium hydroxide depletion within the interstitial transition zone) was most likely due to alkali-silica reactivity (ASR), although ASR gel was usually absent or had carbonated. Alkali-silica reactivity was considered to be a consequence of the seawater attack, as decomposition of the cement paste reaction products (calcium silicate hydrates, abbreviated C-S-H), released silica which reacted with alkalis in the seawater. Expansion and cracking caused by ASR appeared to be minor.

e) The sulfate attack, in the form of ettringite formation in cracks and voids, was also a consequence of the seawater attack on the concrete, and appeared to be a contributing factor to cracking.

f) Deterioration was most prominent in the mid-water cores; less, but still significant, in the water-line cores; and diminished, but still present, in the mud-line cores. Figure 1 is a graph showing the DRI values for all the core samples. Note the increase in the damage rating at mid-water. Figure 2 shows the normal distribution of the DRI for the cores taken from the water-line, mid-water and mud-line locations. The DRI is typically applied to alkali-silica reactivity, but was found to be useful in rating the degree of seawater attack.

g) On average, the concrete was composed of approximately 28% cement paste and 71% aggregate, by volume. No fly ash or other supplementary cementitious materials were detected. The air content averaged approximately 1% and ranged from 0.1% to 2.5%. The concrete was not air-entrained. The average volumetric coarse-to-fine aggregate ratio (CA/FA) was approximately 1.3:1.

h) The bulk cement paste was medium gray to light gray and hard (difficult to scratch with steel probe), with a Mohs Hardness ranging from 3 to 4½. The aggregate-to-paste bond was good. In cores that had surface deterioration and paste softening, the Mohs Hardness was less than 2½.

i) The amount of unhydrated portland cement (UPC) clinker in the cement paste ranged between 3% and 7%. The paste was well hydrated and moderate to low capillary void porosity (relatively moderately dense paste).

j) The surface carbonation depth was typically less than 0.38". Carbonation along crack margins rarely exceeded 1.5".

k) The average water-cement ratio (w/c), estimated from the optical examination, was approximately 0.50 ± 0.05. Based on the estimated w/c (0.50) and the volumetric proportion of paste (28%), the calculated cement content was approximately 6 sacks/yd$^3$.

Tables III through XIV summarize the results of the petrographic examinations and damage ratings for the pile cores. Details of the individual core petrographic examinations are given in Appendix A.

## 2) Compressive Strength of Concrete Cores

The average compressive strength of the pile cores (Cores 1 through 36) was 7924 psi. The compressive strengths ranged from 2240 psi (Core 4) to 11350 psi (Core 24). It should be noted that the L/D ratio for Core 4 was less than 1.00, which makes the low compressive strength of the test sample questionable. All other core samples had compressive strengths greater than 5990 psi.

The average compressive strength of the deck cores (Cores 37 through 42) was 4992 psi. The compressive strengths ranged from 3870 psi (Core 41) to 6260 psi (Core 39).

Results of the compressive strength tests are given in Table XV (Set 1, Pile Cores 1 through 16), Table XVI (Set 2, Pile Cores 16 through 30), Table XVII (Set 2, Pile Cores 31 through 36) and Table XVIII (Set 2, Deck Cores 37 through 42). The individual test results are also included in the petrographic examination summary tables.

## 3) Chloride Ion Contents of Pile Concrete Cores

The chloride ion contents of the concrete were determined at incremental depths of 1" starting at ½" from the outer exposed surface. The results of the chloride ion profile testing are given in Tables XIX through XXI. The chloride ion contents are shown graphically in Figures 3 through 7. The individual test results are also included in the petrographic examination summary tables.

According to American Concrete Institute's ACI 222R-13, Manual of Concrete Practice, the theoretical maximum acid-soluble chloride content for reinforced concrete (to minimize chloride-induced corrosion) is 0.20% by weight of cement. Using the average cement content of 564 lb/yd$^3$,

and an estimated concrete mixture weighing 4000 lb/yd$^3$, the maximum acid-soluble chloride content (theoretical threshold level) would be 0.028%, by weight of concrete, or the equivalent of 1.2 lb of chlorides per cubic yard of concrete.

According to Caltrans Guidelines for Chloride Concrete in Reinforced Concrete, 0.0 to 1.2 lb/yd$^3$ of chloride ions in concrete is considered passive (non-corroding), 1.2 to 3.0 lb/yd$^3$ indicate corrosion initiation, and greater than 3.0 lb/yd$^3$ indicates there is active corrosion.

All locations tested, except one, had chloride ion contents that exceeded the theoretical threshold level for chloride induced corrosion of reinforcing steel in concrete. The general trend was higher chloride contents at the surface and decreasing at depth. Sample 4-5, which was taken at approximately 8″ depth, was the only sample where the chloride ion content was less than 0.05%.

## CONCLUSIONS

1) The pile concrete represented by Cores 1 through 36 was composed of portland cement paste and subangular to subround siliceous aggregate. The concrete was well consolidated. The aggregate distributions were good. No unusual placement features were observed.

2) Deterioration due to sea-water attack was significant in all pile cores. The depth of deterioration was observed to depths of 4.5" to 5". The damage caused by the sea-water attack consisted primarily of cracks and microcracks filled with ettringite, carbonate minerals and carbonated alkali-silica gel. Brucite was occasionally observable. Alkali-silica reactivity was a consequence of the sea-water attack, but not a major contributing factor to the formation of cracking. Sulfate attack appeared to be a secondary contributing factor to the microcracking.

3) The average pile concrete compressive strength was 7924 psi. The average deck concrete compressive strength was 4992 psi.

4) The chloride ion contents to 4.5″ depth, as measured from the exposed surface, were higher than the theoretical threshold value for chloride-induced corrosion of steel reinforcement embedded in concrete.

Please call if any questions arise.

Sincerely,

**APPLIED MATERIALS & ENGINEERING, INC.**

Jon Asselanis
Materials Scientist/Senior Petrographer

Reviewed by:

Armen Tajirian, Ph.D., PE
Principal

**Samples will be held for 30 days after submittal of final report and then discarded unless notified in writing. Storage of held samples will be billed monthly. There is a $100 per month storage fee. Return shipment charges are the responsibility of the client.**

# TABLE I

## CONCRETE CORES SAMPLE IDENTIFICATIONS AND SAMPLING LOCATIONS

## Alameda Piers 1, 2 & 3, Alameda, California

## AME Project No. 1160610C

| Set 1 – Received October 17, 2016 | | | | | | |
|---|---|---|---|---|---|---|
| Count | Date Received | Date Cored | Pier | Pile | Face | Location |
| 1 | 10/17/16 | 10/14/16 | 2 | 21-A | 2 | Water-line |
| 2 | 10/17/16 | 10/14/16 | 2 | 21-A | 2 | Mid-water |
| 3 | 10/17/16 | 10/15/16 | 2 | 21-A | 2 | Mud-line |
| 4 | 10/17/16 | 10/12/16 | 2 | 36-D | 2 | Water-line |
| 5 | 10/17/16 | 10/12/16 | 2 | 36-D | 2 | Mid-water |
| 6 | 10/17/16 | 10/12/16 | 2 | 36-D | 2 | Mud-line |
| 7 | 10/17/16 | 10/15/16 | 2 | 51-H | 4 | Water-line |
| 8 | 10/17/16 | 10/15/16 | 2 | 51-H | 1 | Mid-water |
| 9 | 10/17/16 | 10/13/16 | 2 | 52-H | 4 | Mud-line |
| 10 | 10/17/16 | 10/16/16 | 2 | 99-H | 4 | Water-line |
| 11 | 10/17/16 | 10/16/16 | 2 | 99-H | 4 | Mid-water |
| 12 | 10/17/16 | 10/16/16 | 2 | 99-H | 4 | Mud-line |
| 13 | 10/17/16 | 10/11/16 | 3 | 30-A | 2 | Water-line |
| 14 | 10/17/16 | 10/10/16 | 3 | 30-A | 2 | Mid-water |
| 15 | 10/17/16 | 10/11/16 | 3 | 30-A | 2 | Mud-line |

**TABLE II**

**CONCRETE CORES SAMPLE IDENTIFICATIONS AND SAMPLING LOCATIONS**

**Alameda Piers 1, 2 & 3, Alameda, California**

**AME Project No. 1160610C**

| Set 2 – Received December 7, 2016 | | | | | | |
|---|---|---|---|---|---|---|
| Count | Date Received | Date Cored | Pier | Pile | Face | Location |
| 16 | 12/7/16 | 12/2/16 | 2 | 31.2-B | 3 | Water-line |
| 17 | 12/7/16 | 12/2/16 | 2 | 31.2-B | 3 | Mid-water |
| 18 | 12/7/16 | 12/2/16 | 2 | 31.2-B | 3 | Mud-line |
| 19 | 12/7/16 | 12/3/16 | 2 | 46-E | 4 | Water-line |
| 20 | 12/7/16 | 12/3/16 | 2 | 46-E | 4 | Mid-water |
| 21 | 12/7/16 | 12/3/16 | 2 | 46-E | 4 | Mud-line |
| 22 | 12/7/16 | 12/3/16 | 2 | 55-F | 4 | Water-line |
| 23 | 12/7/16 | 12/3/16 | 2 | 55-F | 4 | Mid-water |
| 24 | 12/7/16 | 12/3/16 | 2 | 55-F | 4 | Mud-line |
| 25 | 12/7/16 | 12/4/16 | 2 | 61-A | 2 | Water-line |
| 26 | 12/7/16 | 12/4/16 | 2 | 61-A | 2 | Mid-water |
| 27 | 12/7/16 | 12/4/16 | 2 | 61-A | 2 | Mud-line |
| 28 | 12/7/16 | 12/4/16 | 2 | 62-C | 2 | Water-line |
| 29 | 12/7/16 | 12/4/16 | 2 | 62-C | 2 | Mid-water |
| 30 | 12/7/16 | 12/4/16 | 2 | 62-C | 2 | Mud-line |
| 31 | 12/7/16 | 12/5/16 | 2 | 86-G | 4 | Water-line |
| 32 | 12/7/16 | 12/5/16 | 2 | 86-G | 4 | Mid-water |
| 33 | 12/8/16 | 12/7/16 | 2 | 86-G | 4 | Mud-line |
| 34 | 12/8/16 | 12/7/16 | 2 | 88-F | 1 | Water-line |
| 35 | 12/8/16 | 12/7/16 | 2 | 88-F | 4 | Mid-water |
| 36 | 12/8/16 | 12/7/16 | 2 | 88-F | 4 | Mud-line |
| 37 | 12/7/16 | 12/6/16 | 1 | --- | --- | Deck - West End |
| 38 | 12/7/16 | 12/6/16 | 1 | --- | --- | Deck - East End |
| 39 | 12/7/16 | 12/6/16 | 2 | 37-38 | --- | North Side |
| 40 | 12/7/16 | 12/6/16 | 2 | 91-92 | --- | South Side |
| 41 | 12/7/16 | 12/6/16 | 3 | --- | --- | 1 |
| 42 | 12/7/16 | 12/6/16 | 3 | --- | --- | South Side |

**TABLE III**

**SUMMARY OF THE PETROGRAPHIC EXAMINATIONS AND DAMAGE RATING INDEX OF PILE CONCRETE CORES**

**Alameda Piers 1, 2 & 3, Alameda, California**

**AME Project No. 1160610C**

| **Pier 2, Pile 21-A** | | | | |
|---|---|---|---|---|
| Core Location (within Pile) and Number | Water-line (Core 1) | Mid-water (Core 2) | Mud-line (Core 3) | Average |
| Concrete Characteristics: | | | | |
| Paste Content, % | 30.5 | 27.9 | 26.9 | 28.4 |
| Coarse Aggregate Content, % | 39.6 | 47.3 | 42.6 | 43.2 |
| Fine Aggregate Content, % | 29.5 | 24.1 | 29.4 | 27.7 |
| Coarse-to-fine aggregate ratio (CA/FA) | 1.3:1 | 2.0:1 | 1.4:1 | 1.6:1 |
| Total Air Content, % | 0.4 | 0.7 | 1.1 | 0.7 |
| Total Aggregate Content, % | 69.0 | 71.4 | 72.0 | 70.8 |
| Cement Content, sacks/yd$^3$ | 6.6 | 6.1 | 6.1 | 6.3 |
| Estimated water-to-cement ratio (w/c) | 0.48 | 0.48 | 0.48 | 0.48 |
| Damage Index Rating (DRI) | 1057 | 5017 | 3934 | 3336.1 |
| Compressive Strength, psi | 6320 | 5990 | 6740 | 6350 |
| Chloride Ion Content, % by wt. of concrete: | | | | |
| 0.5 from exterior surface, in. | 0.236 | 0.948 | 0.714 | 0.633 |
| 1.5 from exterior surface, in. | 0.195 | 0.952 | 0.575 | 0.574 |
| 2.5 from exterior surface, in. | 0.174 | 0.967 | 0.444 | 0.529 |
| 3.5 from exterior surface, in. | 0.115 | 0.650 | 0.324 | 0.363 |
| 4.5 from exterior surface, in. | 0.066 | 0.611 | 0.137 | 0.271 |

**TABLE IV**

**SUMMARY OF THE PETROGRAPHIC EXAMINATIONS AND DAMAGE RATING INDEX OF PILE CONCRETE CORES**

**Alameda Piers 1, 2 & 3, Alameda, California**

**AME Project No. 1160610C**

| **Pier 2, Pile 36-D** | | | | |
|---|---|---|---|---|
| Core Location (within Pile) and Number | Water-line (Core 4) | Mid-water (Core 5) | Mud-line (Core 6) | Average |
| Concrete Characteristics: | | | | |
| Paste Content, % | 27.1 | 24.6 | 28.2 | 26.6 |
| Coarse Aggregate Content, % | 31.8 | 36.3 | 30.6 | 32.9 |
| Fine Aggregate Content, % | 40.8 | 37.7 | 40.2 | 39.6 |
| Coarse-to-fine aggregate ratio (CA/FA) | 0.8:1 | 1.0:1 | 0.8:1 | 0.8:1 |
| Total Air Content, % | 0.3 | 1.4 | 1.0 | 0.9 |
| Total Aggregate Content, % | 72.6 | 73.9 | 70.8 | 72.5 |
| Cement Content, sacks/yd$^3$ | 6.0 | 5.6 | 6.2 | 5.9 |
| Estimated water-to-cement ratio (w/c) | 0.48 | 0.48 | 0.48 | 0.48 |
| Damage Index Rating (DRI) | 912 | 5208 | 1697 | 2606 |
| Compressive Strength, psi | 2240 | 7590 | 8190 | 6010 |
| Chloride Ion Content, % by wt. of concrete: | | | | |
| 0.5 from exterior surface, in. | 0.127 | 0.917 | 0.572 | 0.539 |
| 1.5 from exterior surface, in. | 0.173 | 0.650 | 0.195 | 0.339 |
| 2.5 from exterior surface, in. | 0.067 | 0.700 | 0.200 | 0.322 |
| 3.5 from exterior surface, in. | 0.072 | 0.545 | 0.090 | 0.236 |
| 4.5 from exterior surface, in. | 0.009 | 0.311 | 0.416 | 0.245 |

**TABLE V**

**SUMMARY OF THE PETROGRAPHIC EXAMINATIONS AND DAMAGE RATING INDEX OF PILE CONCRETE CORES**

**Alameda Piers 1, 2 & 3, Alameda, California**

**AME Project No. 1160610C**

| **Pier 2, Pile 51-H and 52-H** | | | | |
|---|---|---|---|---|
| Core Location (within Pile) and Number | Water-line (Core 7) | Mid-water (Core 8) | Mud-line (Core 9) | Average |
| Concrete Characteristics: | | | | |
| Paste Content, % | 25.7 | 31.9 | 27.2 | 28.3 |
| Coarse Aggregate Content, % | 35.6 | 33.6 | 38.2 | 35.8 |
| Fine Aggregate Content, % | 38.2 | 34.3 | 34.3 | 35.6 |
| Coarse-to-fine aggregate ratio (CA/FA) | 0.9:1 | 1.0:1 | 1.1:1 | 1.0:1 |
| Total Air Content, % | 0.5 | 0.1 | 0.3 | 0.3 |
| Total Aggregate Content, % | 73.8 | 67.9 | 72.5 | 71.4 |
| Cement Content, sacks/$yd^3$ | 5.6 | 6.9 | 5.9 | 6.1 |
| Estimated water-to-cement ratio (w/c) | 0.50 | 0.48 | 0.50 | 0.49 |
| Damage Index Rating (DRI) | 2591 | 5019 | 1446 | 3019 |
| Compressive Strength, psi | 7200 | 6040 | 7540 | 6930 |
| Chloride Ion Content, % by wt. of concrete: | | | | |
| 0.5 from exterior surface, in. | 0.859 | 1.037 | 0.814 | 0.904 |
| 1.5 from exterior surface, in. | 0.708 | 0.500 | 0.694 | 0.634 |
| 2.5 from exterior surface, in. | 0.262 | 0.910 | 0.575 | 0.582 |
| 3.5 from exterior surface, in. | 0.257 | 0.538 | 0.932 | 0.576 |
| 4.5 from exterior surface, in. | 0.234 | 0.717 | 0.750 | 0.567 |

**TABLE VI**

**SUMMARY OF THE PETROGRAPHIC EXAMINATIONS AND DAMAGE RATING INDEX OF PILE CONCRETE CORES**

**Alameda Piers 1, 2 & 3, Alameda, California**

**AME Project No. 1160610C**

| **Pier 2, Pile 99-H** | | | | |
|---|---|---|---|---|
| Core Location (within Pile) and Number | Water-line (Core 10) | Mid-water (Core 11) | Mud-line (Core 12) | Average |
| Concrete Characteristics: | | | | |
| Paste Content, % | 28.6 | 20.7 | 30.2 | 26.5 |
| Coarse Aggregate Content, % | 37.5 | 53.0 | 39.4 | 43.3 |
| Fine Aggregate Content, % | 33.3 | 25.4 | 29.8 | 29.5 |
| Coarse-to-fine aggregate ratio (CA/FA) | 1.1:1 | 2.1:1 | 1.3:1 | 1.5:1 |
| Total Air Content, % | 0.5 | 1.0 | 0.6 | 0.7 |
| Total Aggregate Content, % | 70.8 | 78.3 | 69.2 | 72.8 |
| Cement Content, sacks/yd$^3$ | 6.2 | 4.7 | 6.5 | 5.8 |
| Estimated water-to-cement ratio (w/c) | 0.50 | 0.50 | 0.50 | 0.50 |
| Damage Index Rating (DRI) | 1474 | 3285 | 392 | 1717 |
| Compressive Strength, psi | 8810 | 7860 | 7730 | 8130 |
| Chloride Ion Content, % by wt. of concrete: | | | | |
| 0.5 from exterior surface, in. | 0.449 | 0.385 | 0.772 | 0.535 |
| 1.5 from exterior surface, in. | 0.541 | 0.680 | 0.621 | 0.614 |
| 2.5 from exterior surface, in. | 0.449 | 0.451 | 0.559 | 0.486 |
| 3.5 from exterior surface, in. | 0.421 | 0.431 | 0.218 | 0.357 |
| 4.5 from exterior surface, in. | 0.248 | 0.245 | 0.226 | 0.240 |

**TABLE VII**

**SUMMARY OF THE PETROGRAPHIC EXAMINATIONS AND DAMAGE RATING INDEX OF PILE CONCRETE CORES**

**Alameda Piers 1, 2 & 3, Alameda, California**

**AME Project No. 1160610C**

| **Pier 3, Pile 30-A** | | | | |
|---|---|---|---|---|
| Core Location (within Pile) and Number | Water-line (Core 13) | Mid-water (Core 14) | Mud-line (Core 15) | Average |
| Concrete Characteristics: | | | | |
| Paste Content, % | 28.0 | 30.2 | 29.1 | 29.1 |
| Coarse Aggregate Content, % | 42.3 | 34.6 | 37.1 | 38.0 |
| Fine Aggregate Content, % | 28.8 | 33.7 | 32.1 | 31.5 |
| Coarse-to-fine aggregate ratio (CA/FA) | 1.5:1 | 1.0:1 | 1.2:1 | 1.2:1 |
| Total Air Content, % | 1.0 | 1.5 | 1.7 | 1.4 |
| Total Aggregate Content, % | 71.1 | 68.3 | 69.2 | 69.5 |
| Cement Content, sacks/yd$^3$ | 6.3 | 6.7 | 6.5 | 6.5 |
| Estimated water-to-cement ratio (w/c) | 0.45 | 0.45 | 0.45 | 0.45 |
| Damage Index Rating (DRI) | 1194 | 684 | 1545 | 1141 |
| Compressive Strength, psi | 10480 | 8530 | 8480 | 9160 |
| Chloride Ion Content, % by wt. of concrete: | | | | |
| 0.5 from exterior surface, in. | 1.140 | 0.979 | 0.711 | 0.944 |
| 1.5 from exterior surface, in. | 0.512 | 0.804 | 0.653 | 0.657 |
| 2.5 from exterior surface, in. | 0.547 | 0.532 | 0.523 | 0.534 |
| 3.5 from exterior surface, in. | 0.391 | 0.677 | 0.372 | 0.480 |
| 4.5 from exterior surface, in. | 0.391 | 0.446 | 0.339 | 0.392 |

**TABLE VIII**

**SUMMARY OF THE PETROGRAPHIC EXAMINATIONS AND DAMAGE RATING INDEX OF PILE CONCRETE CORES**

**Alameda Piers 1, 2 & 3, Alameda, California**

**AME Project No. 1160610C**

| **Pier 2, Pile 31.2-B** | | | | |
|---|---|---|---|---|
| Core Location (within Pile) and Number | Water-line (Core 16) | Mid-water (Core 17) | Mud-line (Core 18) | Average |
| Concrete Characteristics: | | | | |
| Paste Content, % | 29.9 | 29.9 | 27.5 | 29.1 |
| Coarse Aggregate Content, % | 32.1 | 38.6 | 41.0 | 37.3 |
| Fine Aggregate Content, % | 37.2 | 30.7 | 30.7 | 32.9 |
| Coarse-to-fine aggregate ratio (CA/FA) | 0.9:1 | 1.3:1 | 1.3:1 | 1.2:1 |
| Total Air Content, % | 0.8 | 0.8 | 0.7 | 0.8 |
| Total Aggregate Content, % | 69.3 | 69.3 | 71.8 | 70.1 |
| Cement Content, sacks/yd$^3$ | 6.2 | 6.4 | 5.7 | 6.1 |
| Estimated water-to-cement ratio (w/c) | 0.53 | 0.50 | 0.55 | 0.53 |
| Damage Index Rating (DRI) | 1124 | 2401 | 2283 | 1936 |
| Compressive Strength, psi | 9620 | 8980 | 8750 | 9120 |
| Chloride Ion Content, % by wt. of concrete: | | | | |
| 0.5 from exterior surface, in. | 0.494 | 0.671 | 0.302 | 0.489 |
| 1.5 from exterior surface, in. | 0.712 | 0.619 | 0.357 | 0.563 |
| 2.5 from exterior surface, in. | 0.706 | 0.649 | 0.323 | 0.559 |
| 3.5 from exterior surface, in. | 0.572 | 0.421 | 0.315 | 0.436 |
| 4.5 from exterior surface, in. | 0.521 | 0.100 | 0.298 | 0.307 |

**TABLE IX**

**SUMMARY OF THE PETROGRAPHIC EXAMINATIONS AND DAMAGE RATING INDEX OF PILE CONCRETE CORES**

**Alameda Piers 1, 2 & 3, Alameda, California**

**AME Project No. 1160610C**

| **Pier 2, Pile 46-E** | | | | |
|---|---|---|---|---|
| Core Location (within Pile) and Number | Water-line (Core 19) | Mid-water (Core 20) | Mud-line (Core 21) | Average |
| Concrete Characteristics: | | | | |
| Paste Content, % | 27.0 | 31.0 | 28.6 | 28.9 |
| Coarse Aggregate Content, % | 50.5 | 38.6 | 46.4 | 45.2 |
| Fine Aggregate Content, % | 21.9 | 30.0 | 24.7 | 25.5 |
| Coarse-to-fine aggregate ratio (CA/FA) | 2.3:1 | 1.3:1 | 1.9:1 | 1.8:1 |
| Total Air Content, % | 0.6 | 0.4 | 0.4 | 0.4 |
| Total Aggregate Content, % | 72.4 | 68.6 | 71.0 | 70.7 |
| Cement Content, sacks/yd$^3$ | 5.9 | 6.6 | 5.9 | 6.1 |
| Estimated water-to-cement ratio (w/c) | 0.50 | 0.50 | 0.55 | 0.52 |
| Damage Index Rating (DRI) | 4541 | 5425 | 3585 | 4517 |
| Compressive Strength, psi | 7350 | 6390 | 7580 | 7110 |
| Chloride Ion Content, % by wt. of concrete: | | | | |
| 0.5 from exterior surface, in. | 0.641 | 0.496 | 0.824 | 0.654 |
| 1.5 from exterior surface, in. | 0.654 | 0.943 | 0.807 | 0.801 |
| 2.5 from exterior surface, in. | 0.688 | 0.871 | 0.724 | 0.761 |
| 3.5 from exterior surface, in. | 0.565 | 0.897 | 1.423 | 0.961 |
| 4.5 from exterior surface, in. | 0.528 | 0.975 | 0.405 | 0.636 |

**TABLE X**

**SUMMARY OF THE PETROGRAPHIC EXAMINATIONS AND DAMAGE RATING INDEX OF PILE CONCRETE CORES**

**Alameda Piers 1, 2 & 3, Alameda, California**

**AME Project No. 1160610C**

| **Pier 2, Pile 55-F** | | | | |
|---|---|---|---|---|
| Core Location (within Pile) and Number | Water-line (Core 22) | Mid-water (Core 23) | Mud-line (Core 24) | Average |
| Concrete Characteristics: | | | | |
| Paste Content, % | 27.0 | 27.2 | 30.4 | 28.2 |
| Coarse Aggregate Content, % | 46.9 | 47.2 | 44.2 | 46.1 |
| Fine Aggregate Content, % | 25.1 | 25.0 | 24.5 | 24.9 |
| Coarse-to-fine aggregate ratio (CA/FA) | 1.9:1 | 1.9:1 | 1.8:1 | 1.9:1 |
| Total Air Content, % | 1.0 | 0.6 | 0.9 | 0.8 |
| Total Aggregate Content, % | 72.0 | 72.2 | 68.7 | 71.0 |
| Cement Content, sacks/yd$^3$ | 5.6 | 5.7 | 6.3 | 5.9 |
| Estimated water-to-cement ratio (w/c) | 0.55 | 0.53 | 0.53 | 0.54 |
| Damage Index Rating (DRI) | 1121 | 1342 | 453 | 972 |
| Compressive Strength, psi | 8550 | 8450 | 11350 | 9450 |
| Chloride Ion Content, % by wt. of concrete: | | | | |
| 0.5 from exterior surface, in. | 0.761 | 0.715 | 0.423 | 0.633 |
| 1.5 from exterior surface, in. | 0.660 | 0.893 | 0.272 | 0.608 |
| 2.5 from exterior surface, in. | 0.471 | 0.777 | 0.195 | 0.481 |
| 3.5 from exterior surface, in. | 0.482 | 0.260 | 0.112 | 0.284 |
| 4.5 from exterior surface, in. | 0.460 | 0.379 | 0.052 | 0.297 |

**TABLE XI**

**SUMMARY OF THE PETROGRAPHIC EXAMINATIONS AND DAMAGE RATING INDEX OF PILE CONCRETE CORES**

**Alameda Piers 1, 2 & 3, Alameda, California**

**AME Project No. 1160610C**

| **Pier 2, Pile 61-A** | | | | |
|---|---|---|---|---|
| Core Location (within Pile) and Number | Water-line (Core 25) | Mid-water (Core 26) | Mud-line (Core 27) | Average |
| Concrete Characteristics: | | | | |
| Paste Content, % | 29.6 | 33.6 | 30.2 | 31.1 |
| Coarse Aggregate Content, % | 37.9 | 29.0 | 41.1 | 36.0 |
| Fine Aggregate Content, % | 32.0 | 37.2 | 27.9 | 32.4 |
| Coarse-to-fine aggregate ratio (CA/FA) | 1.2:1 | 0.8:1 | 1.5:1 | 1.1:1 |
| Total Air Content, % | 0.4 | 0.2 | 0.8 | 0.5 |
| Total Aggregate Content, % | 69.9 | 66.2 | 69.0 | 68.4 |
| Cement Content, sacks/yd$^3$ | 6.4 | 7.1 | 6.6 | 6.7 |
| Estimated water-to-cement ratio (w/c) | 0.50 | 0.50 | 0.48 | 0.49 |
| Damage Index Rating (DRI) | 4918 | 7444 | 1350 | 4571 |
| Compressive Strength, psi | 8910 | 8430 | 7160 | 8170 |
| Chloride Ion Content, % by wt. of concrete: | | | | |
| 0.5 from exterior surface, in. | 0.764 | 0.912 | 0.562 | 0.746 |
| 1.5 from exterior surface, in. | 0.694 | 0.758 | 0.475 | 0.642 |
| 2.5 from exterior surface, in. | 0.641 | 0.767 | 0.204 | 0.538 |
| 3.5 from exterior surface, in. | 0.334 | 0.745 | 0.115 | 0.398 |
| 4.5 from exterior surface, in. | 0.273 | 0.665 | 0.058 | 0.332 |

**TABLE XII**

**SUMMARY OF THE PETROGRAPHIC EXAMINATIONS AND DAMAGE RATING INDEX OF PILE CONCRETE CORES**

**Alameda Piers 1, 2 & 3, Alameda, California**

**AME Project No. 1160610C**

| **Pier 2, Pile 62-C** | | | | |
|---|---|---|---|---|
| Core Location (within Pile) and Number | Water-line (Core 28) | Mid-water (Core 29) | Mud-line (Core 30) | Average |
| Concrete Characteristics: | | | | |
| Paste Content, % | 31.4 | 28.7 | 29.5 | 29.9 |
| Coarse Aggregate Content, % | 37.0 | 39.6 | 33.2 | 36.6 |
| Fine Aggregate Content, % | 29.1 | 30.9 | 35.0 | 31.6 |
| Coarse-to-fine aggregate ratio (CA/FA) | 1.3:1 | 1.3:1 | 0.9:1 | 1.2:1 |
| Total Air Content, % | 2.5 | 0.8 | 2.4 | 1.9 |
| Total Aggregate Content, % | 66.1 | 70.5 | 68.1 | 68.2 |
| Cement Content, sacks/yd$^3$ | 6.4 | 5.9 | 6.2 | 6.2 |
| Estimated water-to-cement ratio (w/c) | 0.55 | 0.55 | 0.53 | 0.54 |
| Damage Index Rating (DRI) | 2482 | 3646 | 629 | 2252 |
| Compressive Strength, psi | 9070 | 7590 | 6350 | 7670 |
| Chloride Ion Content, % by wt. of concrete: | | | | |
| 0.5 from exterior surface, in. | 1.153 | 0.824 | 0.517 | 0.832 |
| 1.5 from exterior surface, in. | 0.761 | 1.008 | 0.311 | 0.694 |
| 2.5 from exterior surface, in. | 0.421 | 0.794 | 0.151 | 0.455 |
| 3.5 from exterior surface, in. | 0.515 | 0.724 | 0.145 | 0.461 |
| 4.5 from exterior surface, in. | 0.421 | 0.638 | 0.065 | 0.375 |

**TABLE XIII**

**SUMMARY OF THE PETROGRAPHIC EXAMINATIONS AND DAMAGE RATING INDEX OF PILE CONCRETE CORES**

**Alameda Piers 1, 2 & 3, Alameda, California**

**AME Project No. 1160610C**

| **Pier 2, Pile 86-G** | | | | |
|---|---|---|---|---|
| Core Location (within Pile) and Number | Water-line (Core 31) | Mid-water (Core 32) | Mud-line (Core 33) | Average |
| Concrete Characteristics: | | | | |
| Paste Content, % | 27.3 | 25.4 | 27.0 | 26.6 |
| Coarse Aggregate Content, % | 43.1 | 43.8 | 40.0 | 42.3 |
| Fine Aggregate Content, % | 28.1 | 30.1 | 32.0 | 30.1 |
| Coarse-to-fine aggregate ratio (CA/FA) | 1.5:1 | 1.5:1 | 1.2:1 | 1.4:1 |
| Total Air Content, % | 1.5 | 0.7 | 1.1 | 1.1 |
| Total Aggregate Content, % | 71.2 | 73.9 | 72.0 | 72.4 |
| Cement Content, sacks/yd$^3$ | 5.7 | 5.1 | 5.6 | 5.4 |
| Estimated water-to-cement ratio (w/c) | 0.55 | 0.58 | 0.55 | 0.56 |
| Damage Index Rating (DRI) | 5537 | 3482 | 1516 | 3512 |
| Compressive Strength, psi | 8590 | 7870 | 8460 | 8310 |
| Chloride Ion Content, % by wt. of concrete: | | | | |
| 0.5 from exterior surface, in. | 0.530 | 0.597 | 0.838 | 0.655 |
| 1.5 from exterior surface, in. | 0.983 | 0.777 | 0.528 | 0.763 |
| 2.5 from exterior surface, in. | 0.671 | 0.811 | 0.439 | 0.640 |
| 3.5 from exterior surface, in. | 0.625 | 0.267 | 0.243 | 0.378 |
| 4.5 from exterior surface, in. | 0.479 | 0.582 | 0.137 | 0.399 |

## TABLE XIV

## SUMMARY OF THE PETROGRAPHIC EXAMINATIONS AND DAMAGE RATING INDEX OF PILE CONCRETE CORES

## Alameda Piers 1, 2 & 3, Alameda, California

## AME Project No. 1160610C

| Pier 2, Pile 88-F | | | | |
|---|---|---|---|---|
| Core Location (within Pile) and Number | Water-line (Core 34) | Mid-water (Core 35) | Mud-line (Core 36) | Average |
| Concrete Characteristics: | | | | |
| Paste Content, % | 27.3 | 30.4 | 27.3 | 28.4 |
| Coarse Aggregate Content, % | 43.6 | 40.3 | 40.6 | 41.5 |
| Fine Aggregate Content, % | 27.8 | 28.5 | 31.0 | 29.1 |
| Coarse-to-fine aggregate ratio (CA/FA) | 1.6:1 | 1.4:1 | 1.3:1 | 1.4:1 |
| Total Air Content, % | 1.3 | 0.7 | 1.0 | 1.0 |
| Total Aggregate Content, % | 71.4 | 68.8 | 71.6 | 70.6 |
| Cement Content, sacks/yd$^3$ | 6.0 | 6.6 | 6.0 | 6.2 |
| Estimated water-to-cement ratio (w/c) | 0.48 | 0.48 | 0.48 | 0.48 |
| Damage Index Rating (DRI) | 1275 | 3936 | 998 | 2070 |
| Compressive Strength, psi | 8330 | 9550 | 8210 | 8700 |
| Chloride Ion Content, % by wt. of concrete: | | | | |
| 0.5 from exterior surface, in. | 0.614 | 0.646 | 0.253 | 0.505 |
| 1.5 from exterior surface, in. | 0.612 | 0.607 | 0.238 | 0.485 |
| 2.5 from exterior surface, in. | 0.665 | 0.544 | 0.177 | 0.462 |
| 3.5 from exterior surface, in. | 1.106 | 0.542 | 0.114 | 0.587 |
| 4.5 from exterior surface, in. | 0.196 | 0.475 | 0.075 | 0.249 |

**TABLE XV**

**COMPRESSIVE STRENGTH OF CONCRETE CORES**

**Alameda Piers 1, 2 & 3, Alameda, California**

**AME Project No. 1160610C**

| Set 1 – Pile Cores 1 through 15 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sample ID | As Received Height (in.) | Trimmed Height (in.) | Diameter (in.) | Capped Height (in.) | Area ($in.^2$) | L/D Ratio | Correction Factor | Ultimate Load (lb) | Ultimate Strength (psi) |
| 1 | 11.08 | 4.50 | 4.21 | 4.31 | 13.91 | 1.02 | 0.875 | 100,490 | 6320 |
| 2 | 11.41 | 4.67 | 4.21 | 4.94 | 13.91 | 1.17 | 0.911 | 91,410 | 5990 |
| 3 | 8.49 | 5.24 | 4.21 | 5.48 | 13.91 | 1.30 | 0.936 | 100,230 | 6740 |
| 4 | 9.44 | 3.76 | 4.21 | 4.19* | 13.91 | 0.99 | 0.870* | 35,860 | 2240* |
| 5 | 10.35 | 4.92 | 4.21 | 5.12 | 13.91 | 1.22 | 0.923 | 114,480 | 7590 |
| 6 | 10.47 | 4.43 | 4.21 | 4.72 | 13.91 | 1.12 | 0.899 | 126,720 | 8190 |
| 7 | 9.68 | 4.27 | 4.21 | 4.47 | 13.91 | 1.06 | 0.884 | 113,360 | 7200 |
| 8 | 15.81 | 4.09 | 4.21 | 4.30 | 13.91 | 1.02 | 0.875 | 96,010 | 6040 |
| 9 | 10.90 | 4.58 | 4.21 | 4.71 | 13.91 | 1.12 | 0.899 | 116,620 | 7540 |
| 10 | 11.97 | 5.16 | 4.21 | 5.43 | 13.91 | 1.29 | 0.934 | 131,250 | 8810 |
| 11 | 11.54 | 5.41 | 4.21 | 5.58 | 13.91 | 1.33 | 0.939 | 116,480 | 7860 |
| 12 | 11.39 | 4.78 | 4.21 | 4.97 | 13.91 | 1.18 | 0.913 | 117,730 | 7730 |
| 13 | 10.98 | 4.98 | 4.21 | 5.13 | 13.91 | 1.22 | 0.923 | 158,030 | 10480 |
| 14 | 10.57 | 4.86 | 4.21 | 5.04 | 13.91 | 1.20 | 0.918 | 129,260 | 8530 |
| 15 | 10.59 | 4.74 | 4.21 | 4.98 | 13.91 | 1.18 | 0.913 | 129,160 | 8480 |
| | | | | | | | | Average (Set 1) | 7316 |
| | | | | | | | | Standard Deviation (Set 1) | 1769 |
| | | | | | | | | Coefficient of Variation (Set 1) | 24.2% |
| *Test data is questionable due to L/D ratio less than 1:1 (trimmed height was less than diameter). 0.870 correction factor used for calculation | | | | | | | | | |

**TABLE XVI**

**COMPRESSIVE STRENGTH OF CONCRETE CORES**

**Alameda Piers 1, 2 & 3, Alameda, California**

**AME Project No. 1160610C**

| Set 2 – Pile Cores 16 through 30 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sample ID | As Received Height (in.) | Trimmed Height (in.) | Diameter (in.) | Capped Height (in.) | Area ($in.^2$) | L/D Ratio | Correction Factor | Ultimate Load (lb) | Ultimate Strength (psi) |
| 16 | | 5.51 | 4.18 | 5.70 | 13.72 | 1.36 | 0.943 | 139,910 | 9620 |
| 17 | | .. | 4.18 | 4.30 | 13.72 | 1.03 | 0.877 | 140,420 | 8980 |
| 18 | | .. | 4.18 | 4.31 | 13.72 | 1.03 | 0.877 | 136,830 | 8750 |
| 19 | | .. | 4.18 | 3.98* | 13.72 | 0.95 | 0.870* | 115,810 | 7346 |
| 20 | | 4.64 | 4.18 | 4.80 | 13.72 | 1.15 | 0.905 | 96,780 | 6390 |
| 21 | | 5.49 | 4.18 | 5.73 | 13.72 | 1.37 | 0.944 | 110,190 | 7580 |
| 22 | | 5.09 | 4.18 | 4.02* | 13.72 | 0.96 | 0.870* | 134,840 | 8553 |
| 23 | | 4.69 | 4.18 | 5.06 | 13.72 | 1.21 | 0.920 | 125,970 | 8450 |
| 24 | | 5.06 | 4.18 | 5.32 | 13.72 | 1.27 | 0.932 | 167,070 | 11350 |
| 25 | | 4.65 | 4.18 | 4.97 | 13.72 | 1.19 | 0.916 | 133,400 | 8910 |
| 26 | | 5.02 | 4.18 | 5.26 | 13.72 | 1.26 | 0.931 | 124,130 | 8430 |
| 27 | | 4.18 | 4.18 | 4.43 | 13.72 | 1.06 | 0.884 | 111,140 | 7160 |
| 28 | | 4.69 | 4.18 | 4.98 | 13.72 | 1.19 | 0.916 | 135,850 | 9070 |
| 29 | | 4.00 | 4.18 | 4.24 | 13.72 | 1.01 | 0.872 | 119,410 | 7590 |
| 30 | | 5.07 | 4.18 | 5.34 | 13.72 | 1.28 | 0.933 | 93,410 | 6350 |
| *Test data is questionable due to L/D ratio less than 1:1 (trimmed height was less than diameter). 0.870 correction factor used for calculation | | | | | | | | | |

**TABLE XVII**

**COMPRESSIVE STRENGTH OF CONCRETE CORES**

**Alameda Piers 1, 2 & 3, Alameda, California**

**AME Project No. 1160610C**

| Set 2 – Pile Cores 31 through 36 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sample ID | As Received Height (in.) | Trimmed Height (in.) | Diameter (in.) | Capped Height (in.) | Area ($in.^2$) | L/D Ratio | Correction Factor | Ultimate Load (lb) | Ultimate Strength (psi) |
| 31 | | 5.28 | 4.18 | 5.51 | 13.72 | 1.32 | 0.938 | 125,650 | 8590 |
| 32 | | 5.25 | 4.18 | 5.51 | 13.72 | 1.32 | 0.938 | 115,050 | 7870 |
| 33 | | 4.49 | 4.18 | 4.73 | 13.72 | 1.13 | 0.901 | 128,830 | 8460 |
| 34 | | 5.67 | 4.18 | 5.90 | 13.72 | 1.41 | 0.949 | 120,430 | 8330 |
| 35 | | 4.83 | 4.18 | 5.06 | 13.72 | 1.21 | 0.920 | 142,400 | 9550 |
| 36 | | 5.04 | 4.18 | 5.28 | 13.72 | 1.26 | 0.931 | 120,980 | 8210 |
| | | | | | | | | Average (Set 2) | 8359 |
| | | | | | | | | Standard Deviation (Set 2) | 1097 |
| | | | | | | | | Coefficient of Variation (Set 2) | 13.1% |
| | | | | | | | | Average (All Pile Cores) | 7924 |
| | | | | | | | | Standard Deviation (All Pile Cores) | 1506 |
| | | | | | | | | Coefficient of Variation (All Pile Cores) | 19.0% |

**TABLE XVIII**

**COMPRESSIVE STRENGTH OF CONCRETE CORES**

**Alameda Piers 1, 2 & 3, Alameda, California**

**AME Project No. 1160610C**

| Set 2 – Deck Cores 37 through 42 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sample ID | As Received Height (in.) | Trimmed Height (in.) | Diameter (in.) | Capped Height (in.) | Area ($in.^2$) | L/D Ratio | Correction Factor | Ultimate Load (lb) | Ultimate Strength (psi) |
| 37 | 8.61 | 8.24 | 4.18 | 8.52 | 13.72 | 2.04 | 1.000 | 65,990 | 4810 |
| 38 | 8.72 | 8.02 | 4.18 | 8.38 | 13.72 | 2.00 | 1.000 | 75,290 | 5490 |
| 39 | 8.15 | .. | 4.18 | 8.33 | 13.72 | 1.99 | 1.000 | 85,850 | 6260 |
| 40 | 8.73 | 8.12 | 4.18 | 8.31 | 13.72 | 1.99 | 1.000 | 66,950 | 4880 |
| 41 | 10.83 | 8.43 | 4.18 | 8.61 | 13.72 | 2.06 | 1.000 | 53,140 | 3870 |
| 42 | 10.48 | 8.36 | 4.18 | 8.63 | 13.72 | 2.06 | 1.000 | 63,680 | 4640 |
| | | | | | | | | Average | 4992 |
| | | | | | | | | Standard Deviation | 740 |
| | | | | | | | | Coefficient of Variation | 14.8% |

# TABLE XIX

## CHLORIDE ION CONTENTS OF CONCRETE CORES

## Alameda Piers 1, 2 & 3, Alameda, California

## AME Project No. 1160610C

| Sample ID | Depth from Exposed Surface (in.) | Meter Reading (mV) | Chlorides by Weight of Concrete (%) | Chlorides by Weight of Concrete ($lb/yd^3$)[1] | Above Threshold Level |
|---|---|---|---|---|---|
| 1-1 | 0.5 | 11.4 | 0.236 | 9.44 | Yes |
| 1-2 | 1.5 | 16.1 | 0.195 | 7.79 | Yes |
| 1-3 | 2.5 | 18.8 | 0.174 | 6.97 | Yes |
| 1-4 | 3.5 | 28.9 | 0.115 | 4.61 | Yes |
| 1-5 | 4.5 | 42.6 | 0.066 | 2.63 | Yes |
| 2-1 | 0.5 | -22.5 | 0.948 | 37.91 | Yes |
| 2-2 | 1.5 | -22.6 | 0.952 | 38.07 | Yes |
| 2-3 | 2.5 | -23 | 0.967 | 38.70 | Yes |
| 2-4 | 3.5 | -13.3 | 0.650 | 26.00 | Yes |
| 2-5 | 4.5 | -11.8 | 0.611 | 24.45 | Yes |
| 3-1 | 0.5 | -15.6 | 0.714 | 28.57 | Yes |
| 3-2 | 1.5 | -10.3 | 0.575 | 22.99 | Yes |
| 3-3 | 2.5 | -4.0 | 0.444 | 17.76 | Yes |
| 3-4 | 3.5 | 3.7 | 0.324 | 12.95 | Yes |
| 3-5 | 4.5 | 24.6 | 0.137 | 5.50 | Yes |
| 4-1 | 0.5 | 26.5 | 0.127 | 5.09 | Yes |
| 4-2 | 1.5 | 19.0 | 0.173 | 6.92 | Yes |
| 4-3 | 2.5 | 42.2 | 0.067 | 2.67 | Yes |
| 4-4 | 3.5 | 40.2 | 0.072 | 2.90 | Yes |
| 4-5 | ~8 | 90.9 | 0.009 | 0.36 | No |
| 5-1 | 0.5 | -21.7 | 0.917 | 36.69 | Yes |
| 5-2 | 1.5 | -13.3 | 0.650 | 26.00 | Yes |
| 5-3 | 2.5 | -15.1 | 0.700 | 27.99 | Yes |
| 5-4 | 3.5 | -9.0 | 0.545 | 21.80 | Yes |
| 5-5 | 4.5 | 4.7 | 0.311 | 12.43 | Yes |
| 6-1 | 0.5 | -10.2 | 0.572 | 22.90 | Yes |
| 6-2 | 1.5 | 16.1 | 0.195 | 7.79 | Yes |
| 6-3 | 2.5 | 15.5 | 0.200 | 7.98 | Yes |
| 6-4 | 3.5 | 34.9 | 0.090 | 3.60 | Yes |
| 6-5 | 4.5 | -2.4 | 0.416 | 16.63 | Yes |
| 7-1 | 0.5 | -20.1 | 0.859 | 34.36 | Yes |
| 7-2 | 1.5 | -15.4 | 0.708 | 28.34 | Yes |
| 7-3 | 2.5 | 8.9 | 0.262 | 10.46 | Yes |
| 7-4 | 3.5 | 9.3 | 0.257 | 10.29 | Yes |
| 7-5 | 4.5 | 11.6 | 0.234 | 9.37 | Yes |
| 8-1 | 0.5 | -24.7 | 1.037 | 41.49 | Yes |
| 8-2 | 1.5 | -6.9 | 0.500 | 20.00 | Yes |
| 8-3 | 2.5 | -21.5 | 0.910 | 36.39 | Yes |
| 8-4 | 3.5 | -8.7 | 0.538 | 21.53 | Yes |
| 8-5 | 4.5 | -15.7 | 0.717 | 28.69 | Yes |

[1] Cement content based on average derived from the petrographic examination data, concrete unit weight assumed to be 4000 $lb/yd^3$

# TABLE XX

## CHLORIDE ION CONTENTS OF CONCRETE CORES

## Alameda Piers 1, 2 & 3, Alameda, California

## AME Project No. 1160610C

| Sample ID | Depth from Exposed Surface (in.) | Meter Reading (mV) | Chlorides by Weight of Concrete (%) | Chlorides by Weight of Concrete ($lb/yd^3$)[1] | Above Threshold Level |
|---|---|---|---|---|---|
| 9-1 | 0.5 | -18.8 | 0.814 | 32.58 | Yes |
| 9-2 | 1.5 | -14.9 | 0.694 | 27.76 | Yes |
| 9-3 | 2.5 | -10.3 | 0.575 | 22.99 | Yes |
| 9-4 | 3.5 | -22.1 | 0.932 | 37.30 | Yes |
| 9-5 | 4.5 | -16.8 | 0.750 | 30.01 | Yes |
| 10-1 | 0.5 | -4.3 | 0.449 | 17.98 | Yes |
| 10-2 | 1.5 | -8.8 | 0.541 | 21.62 | Yes |
| 10-3 | 2.5 | -4.3 | 0.449 | 17.98 | Yes |
| 10-4 | 3.5 | -2.7 | 0.421 | 16.84 | Yes |
| 10-5 | 4.5 | 10.2 | 0.248 | 9.92 | Yes |
| 11-1 | 0.5 | -0.5 | 0.385 | 15.38 | Yes |
| 11-2 | 1.5 | -14.4 | 0.680 | 27.20 | Yes |
| 11-3 | 2.5 | -4.4 | 0.451 | 18.05 | Yes |
| 11-4 | 3.5 | -3.3 | 0.431 | 17.26 | Yes |
| 11-5 | 4.5 | 10.5 | 0.245 | 9.80 | Yes |
| 12-1 | 0.5 | -17.5 | 0.772 | 30.89 | Yes |
| 12-2 | 1.5 | -12.2 | 0.621 | 24.85 | Yes |
| 12-3 | 2.5 | -9.6 | 0.559 | 22.34 | Yes |
| 12-4 | 3.5 | 13.4 | 0.218 | 8.70 | Yes |
| 12-5 | 4.5 | 12.5 | 0.226 | 9.03 | Yes |
| 13-1 | 0.5 | -27 | 1.140 | 45.60 | Yes |
| 13-2 | 1.5 | -7.5 | 0.512 | 20.50 | Yes |
| 13-3 | 2.5 | -9.1 | 0.547 | 21.89 | Yes |
| 13-4 | 3.5 | -0.9 | 0.391 | 15.64 | Yes |
| 13-5 | 4.5 | -0.9 | 0.391 | 15.64 | Yes |
| 14-1 | 0.5 | -23.3 | 0.979 | 39.18 | Yes |
| 14-2 | 1.5 | -18.5 | 0.804 | 32.18 | Yes |
| 14-3 | 2.5 | -8.4 | 0.532 | 21.27 | Yes |
| 14-4 | 3.5 | -14.3 | 0.677 | 27.09 | Yes |
| 14-5 | 4.5 | -4.1 | 0.446 | 17.83 | Yes |
| 15-1 | 0.5 | -15.5 | 0.711 | 28.46 | Yes |
| 15-2 | 1.5 | -13.4 | 0.653 | 26.11 | Yes |
| 15-3 | 2.5 | -8 | 0.523 | 20.92 | Yes |
| 15-4 | 3.5 | 0.3 | 0.372 | 14.89 | Yes |
| 15-5 | 4.5 | 2.6 | 0.339 | 13.55 | Yes |

[1] Cement content based on average derived from the petrographic examination data, concrete unit weight assumed to be 4000 $lb/yd^3$

# TABLE XXI

## CHLORIDE ION CONTENTS OF CONCRETE CORES

## Alameda Piers 1, 2 & 3, Alameda, California

## AME Project No. 1160610C

| Sample ID | Depth from Exposed Surface (in.) | Meter Reading (mV) | Chlorides by Weight of Concrete (%) | Chlorides by Weight of Concrete ($lb/yd^3$)[1] | Above Threshold Level |
|---|---|---|---|---|---|
| 1-1 | 0.5 | 11.4 | 0.236 | 9.44 | Yes |
| 1-2 | 1.5 | 16.1 | 0.195 | 7.79 | Yes |
| 1-3 | 2.5 | 18.8 | 0.174 | 6.97 | Yes |
| 1-4 | 3.5 | 28.9 | 0.115 | 4.61 | Yes |
| 1-5 | 4.5 | 42.6 | 0.066 | 2.63 | Yes |
| 2-1 | 0.5 | -22.5 | 0.948 | 37.91 | Yes |
| 2-2 | 1.5 | -22.6 | 0.952 | 38.07 | Yes |
| 2-3 | 2.5 | -23 | 0.967 | 38.70 | Yes |
| 2-4 | 3.5 | -13.3 | 0.650 | 26.00 | Yes |
| 2-5 | 4.5 | -11.8 | 0.611 | 24.45 | Yes |
| 3-1 | 0.5 | -15.6 | 0.714 | 28.57 | Yes |
| 3-2 | 1.5 | -10.3 | 0.575 | 22.99 | Yes |
| 3-3 | 2.5 | -4.0 | 0.444 | 17.76 | Yes |
| 3-4 | 3.5 | 3.7 | 0.324 | 12.95 | Yes |
| 3-5 | 4.5 | 24.6 | 0.137 | 5.50 | Yes |
| 4-1 | 0.5 | 26.5 | 0.127 | 5.09 | Yes |
| 4-2 | 1.5 | 19.0 | 0.173 | 6.92 | Yes |
| 4-3 | 2.5 | 42.2 | 0.067 | 2.67 | Yes |
| 4-4 | 3.5 | 40.2 | 0.072 | 2.90 | Yes |
| 4-5 | ~8 | 90.9 | 0.009 | 0.36 | No |
| 5-1 | 0.5 | -21.7 | 0.917 | 36.69 | Yes |
| 5-2 | 1.5 | -13.3 | 0.650 | 26.00 | Yes |
| 5-3 | 2.5 | -15.1 | 0.700 | 27.99 | Yes |
| 5-4 | 3.5 | -9.0 | 0.545 | 21.80 | Yes |
| 5-5 | 4.5 | 4.7 | 0.311 | 12.43 | Yes |
| 6-1 | 0.5 | -10.2 | 0.572 | 22.90 | Yes |
| 6-2 | 1.5 | 16.1 | 0.195 | 7.79 | Yes |
| 6-3 | 2.5 | 15.5 | 0.200 | 7.98 | Yes |
| 6-4 | 3.5 | 34.9 | 0.090 | 3.60 | Yes |
| 6-5 | 4.5 | -2.4 | 0.416 | 16.63 | Yes |
| 7-1 | 0.5 | -20.1 | 0.859 | 34.36 | Yes |
| 7-2 | 1.5 | -15.4 | 0.708 | 28.34 | Yes |
| 7-3 | 2.5 | 8.9 | 0.262 | 10.46 | Yes |
| 7-4 | 3.5 | 9.3 | 0.257 | 10.29 | Yes |
| 7-5 | 4.5 | 11.6 | 0.234 | 9.37 | Yes |
| 8-1 | 0.5 | -24.7 | 1.037 | 41.49 | Yes |
| 8-2 | 1.5 | -6.9 | 0.500 | 20.00 | Yes |
| 8-3 | 2.5 | -21.5 | 0.910 | 36.39 | Yes |
| 8-4 | 3.5 | -8.7 | 0.538 | 21.53 | Yes |
| 8-5 | 4.5 | -15.7 | 0.717 | 28.69 | Yes |

[1] Cement content based on average derived from the petrographic examination data, concrete unit weight assumed to be 4000 $lb/yd^3$

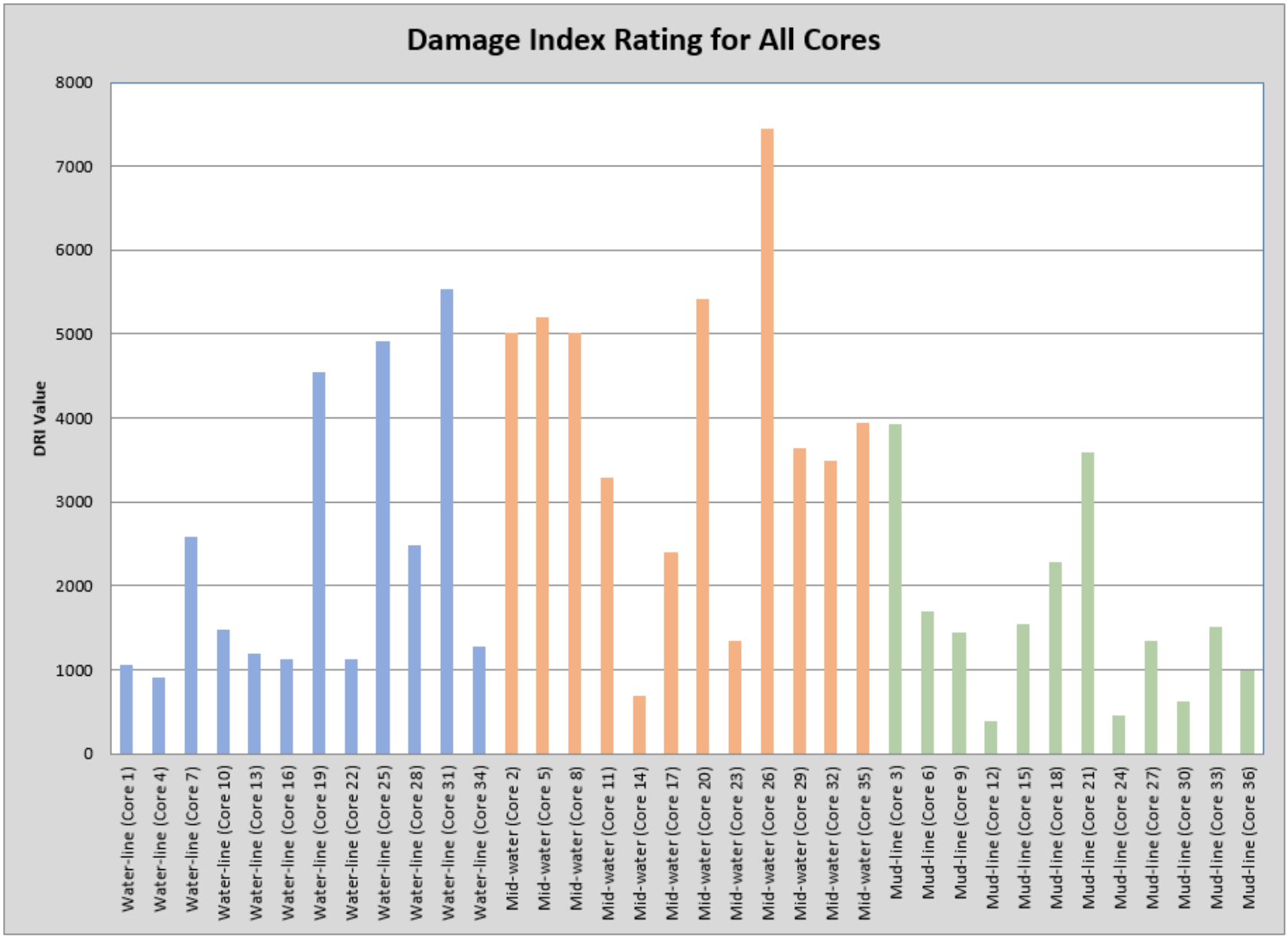



**Figure 1. Damage Rating Index (DRI) for all the pile cores**

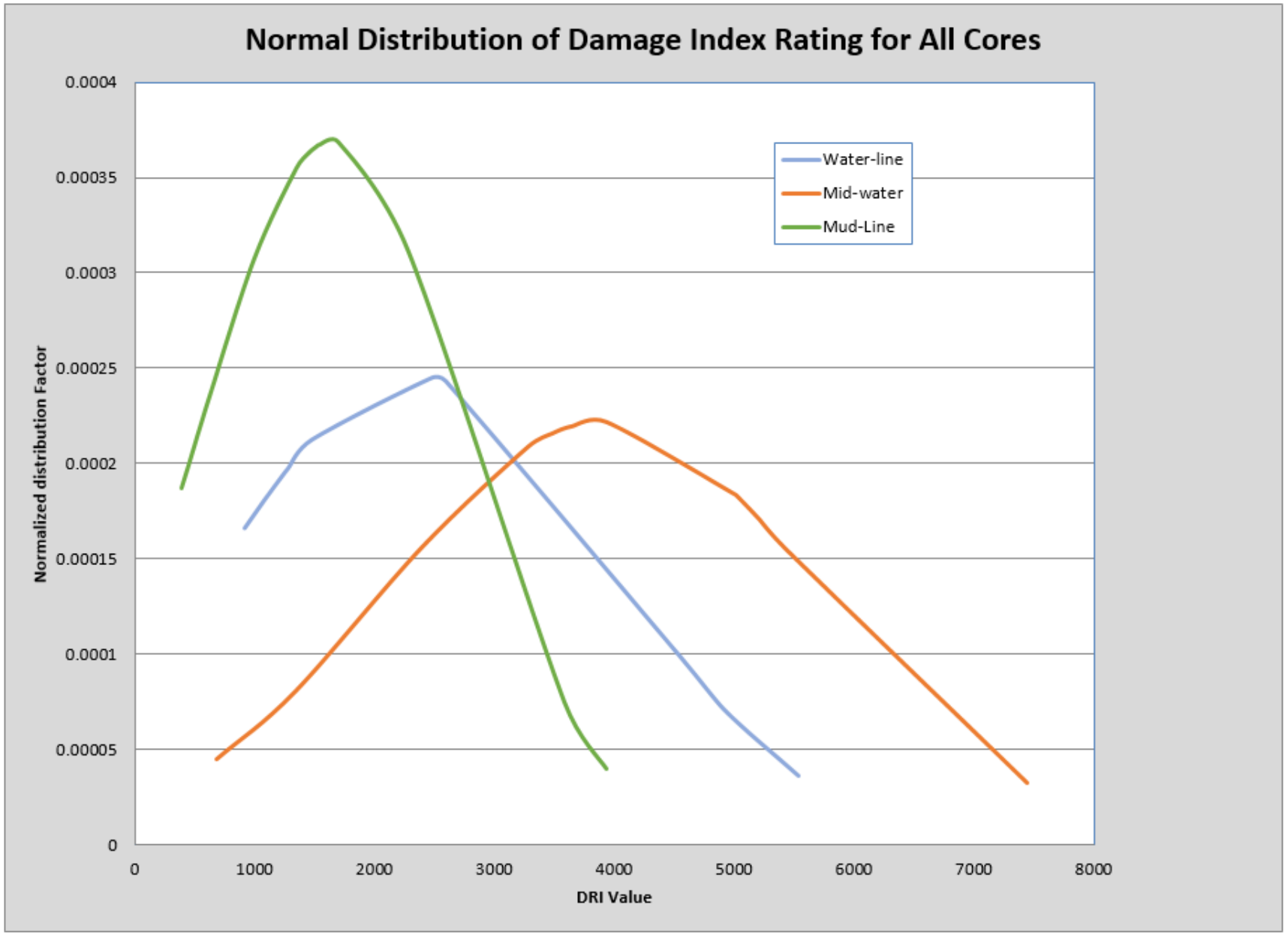



**Figure 2. Normal distribution of Damage Rating Index values for the pile core samples. The frequency of DRI occurred with the mid-water core samples.**

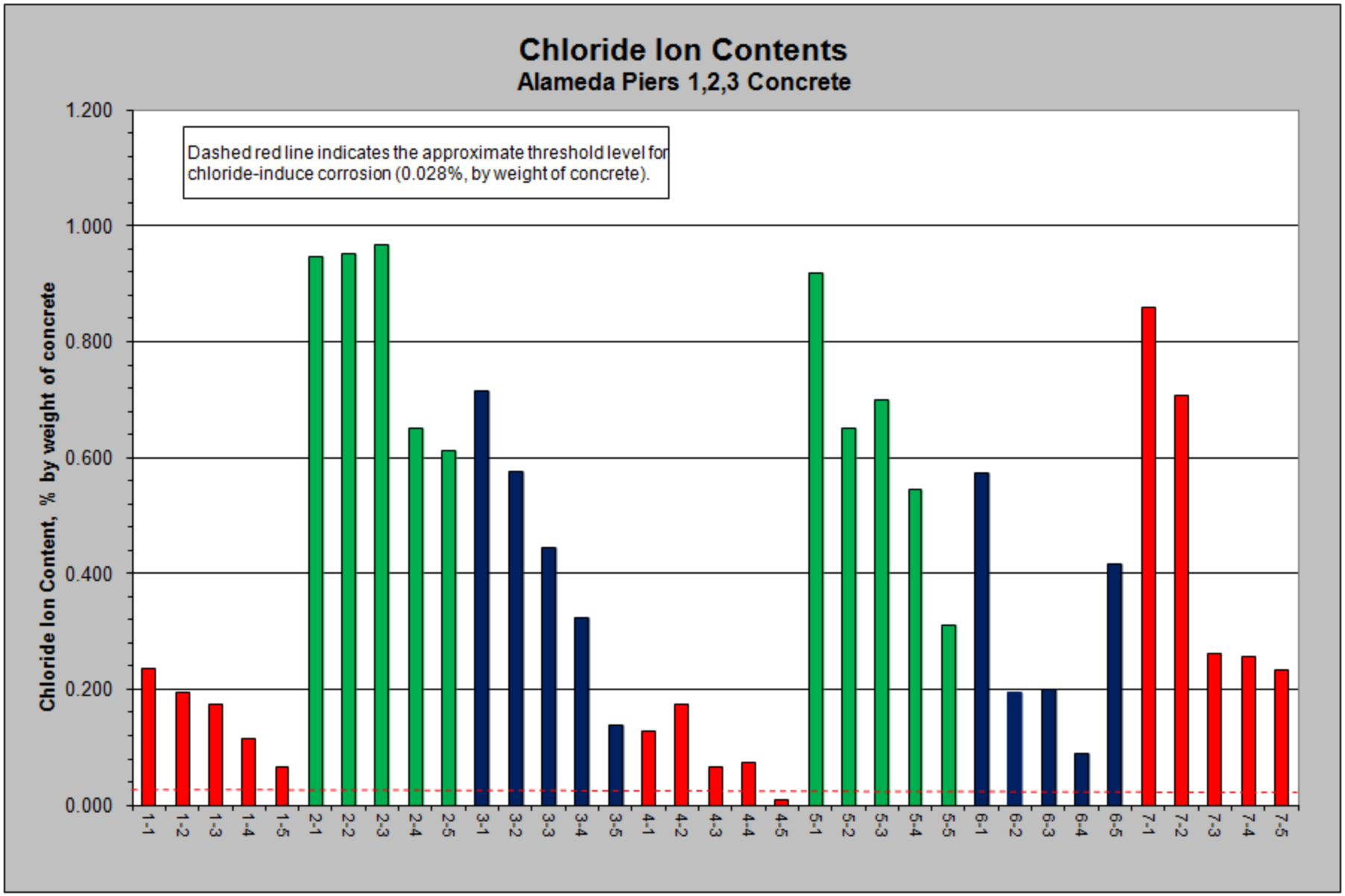



**Figure 3. Chloride Contents for Set 1, Cores 1 through 7**

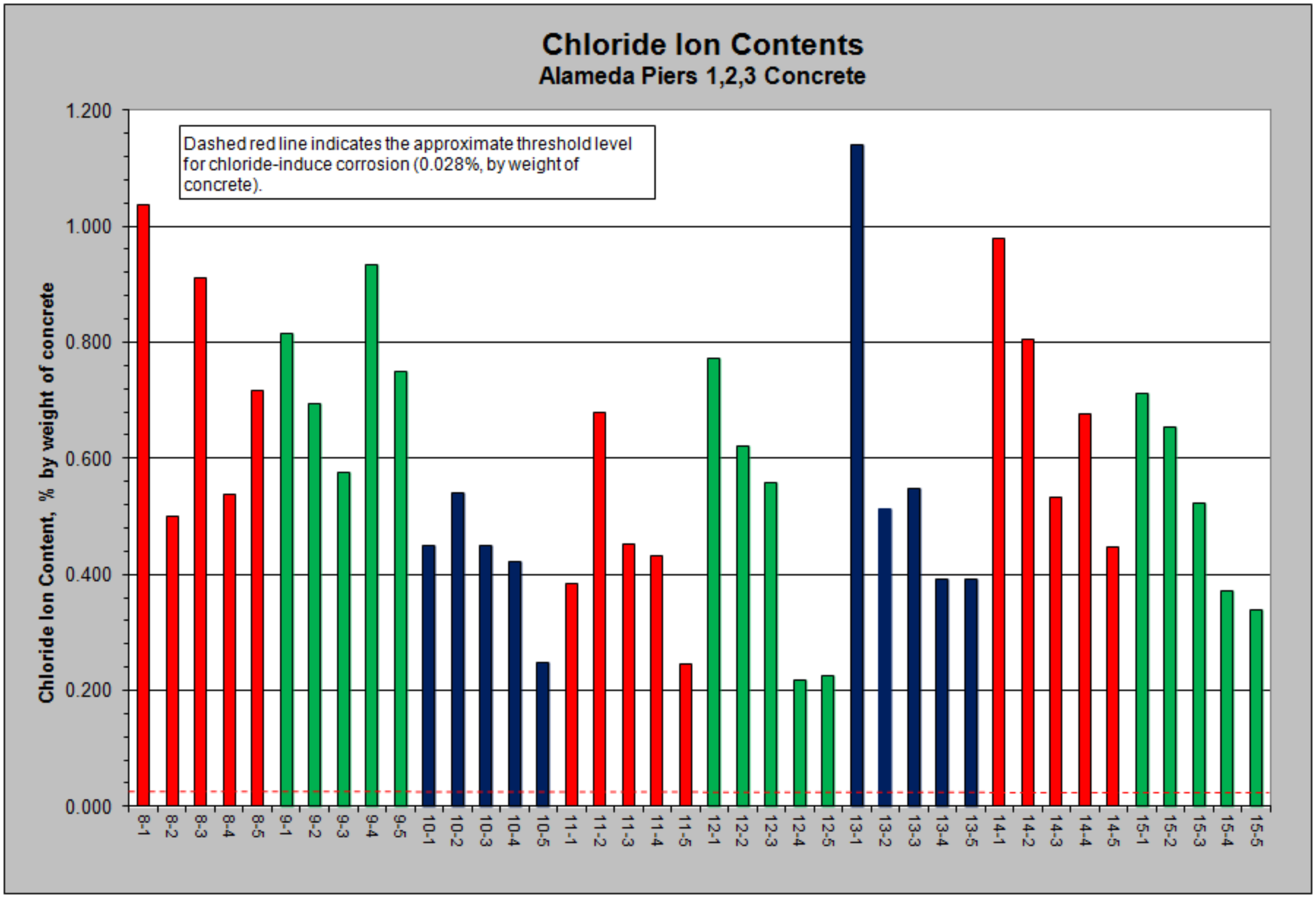



**Figure 4. Chloride Contents for Set 1, Cores 8 through 15**

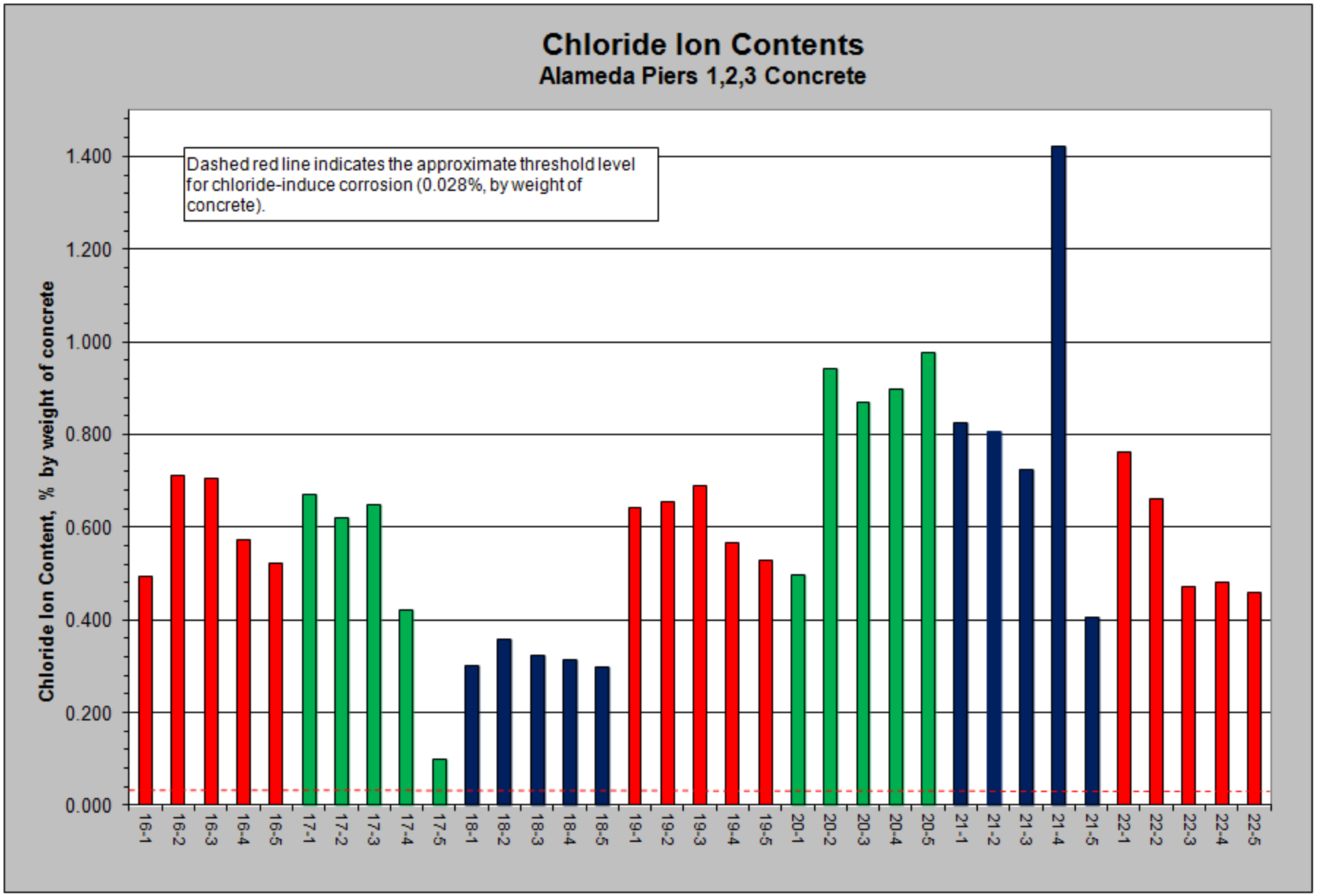



**Figure 5. Chloride Contents for Set 2, Cores 16 through 22**

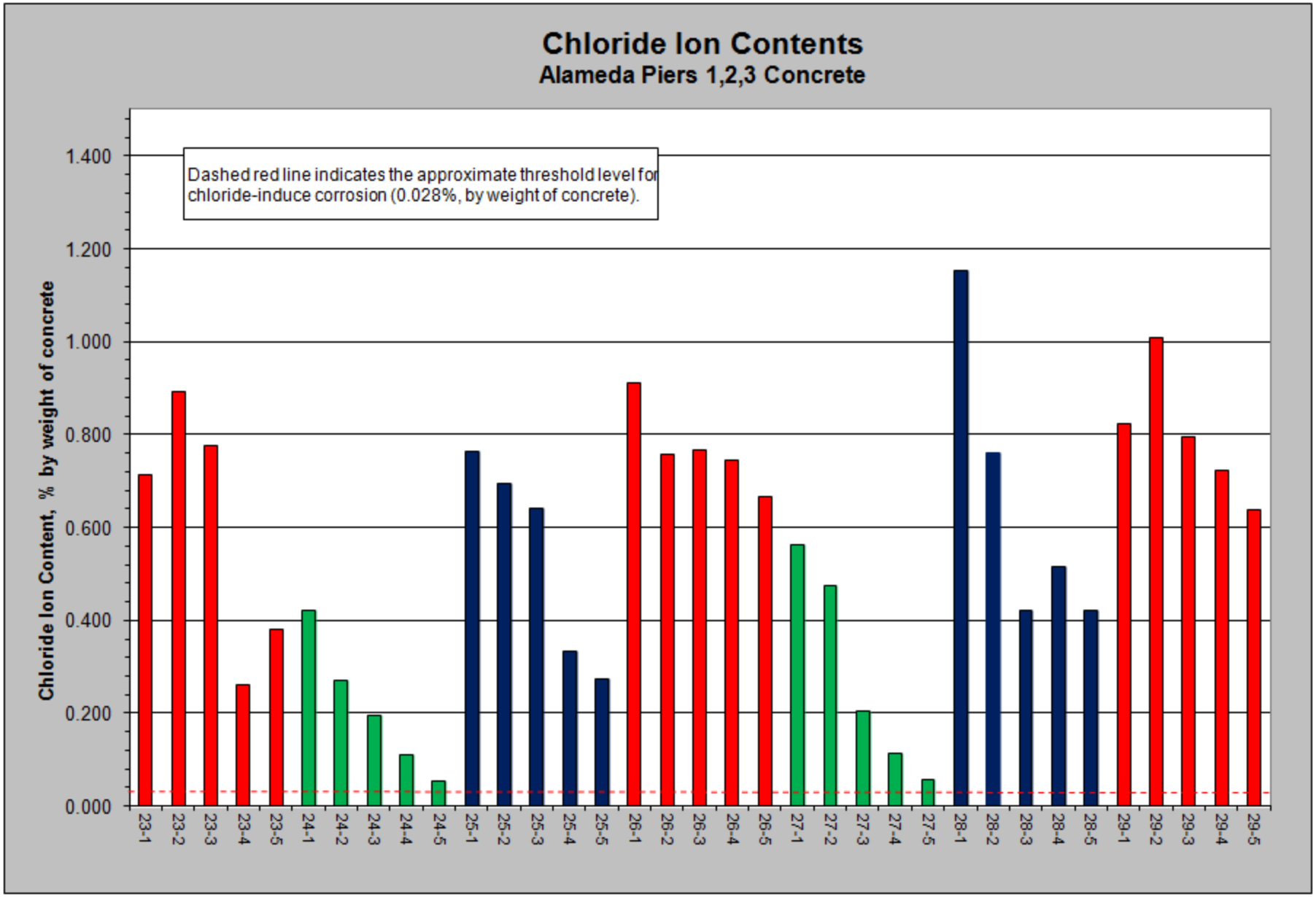



**Figure 6. Chloride Contents for Set 2, Cores 23 through 29**

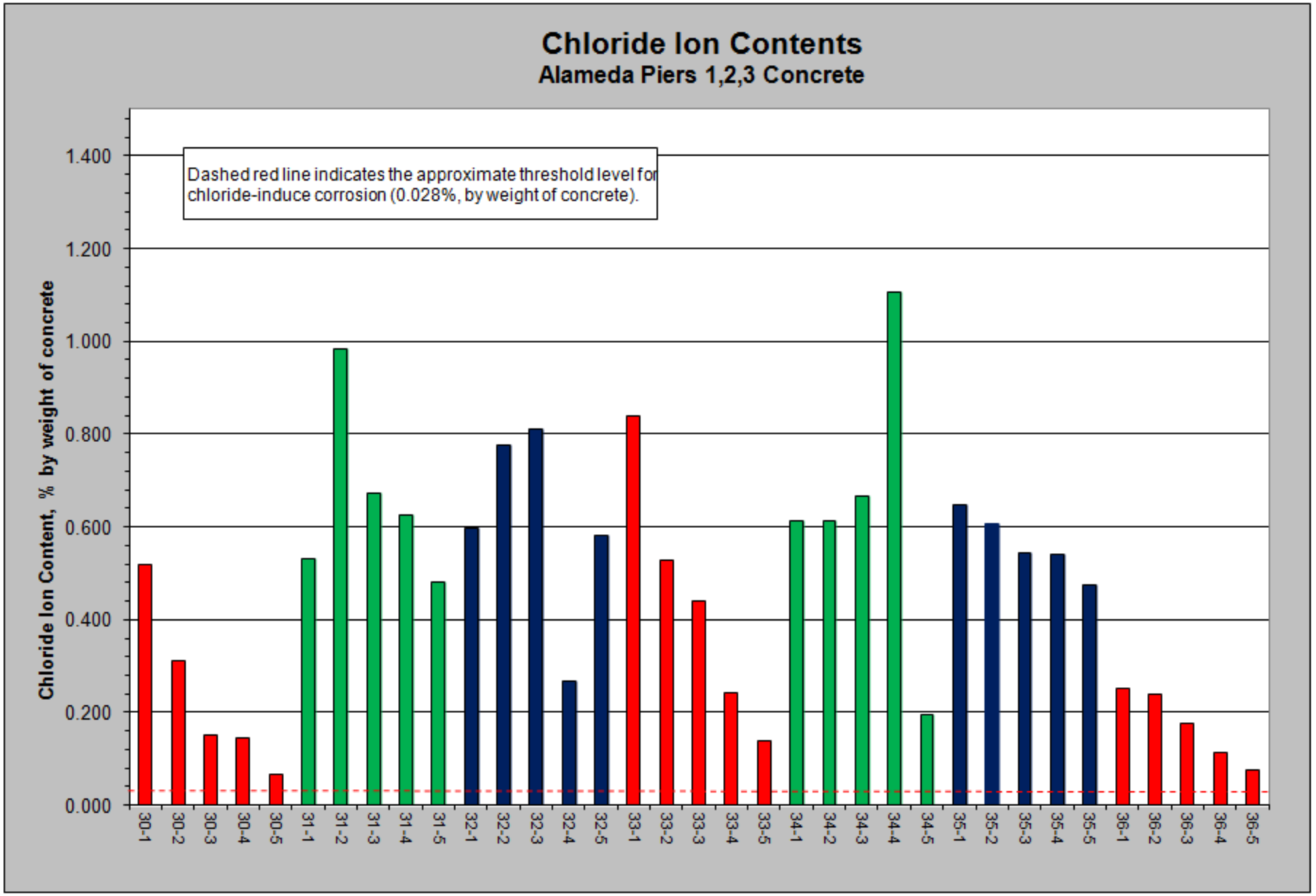



**Figure 7. Chloride Contents for Set 2, Cores 30 through 36**

# APPENDIX A

## PETROGRAPHIC EXAMINATION DATA SHEETS

# Petrographic Examination
## Macroscopic Analysis

| | |
|---|---|
| Client: | SGH |
| Project: | Alameda Piers 1, 2 & 3 |
| AME Project Number: | 1160610C |
| Date: | 11/7/2016 |

Sample ID: Pier 2, Pile 21-A

| | Water-line (Core 1) | | Mid-water (Core 2) | | Mud-line (Core 3) | |
|---|---|---|---|---|---|---|
| **POINT COUNT:** | | | | | | |
| **Volumetric Proportions (% by volume)** | | | | | | |
| | Count (0.10" increments) | % | Count (0.10" increments) | % | Count (0.10" increments) | % |
| Paste Content | 570 | 30.5 | 478 | 27.9 | 432 | 26.9 |
| Coarse Aggregate (CA) Content | 739 | 39.6 | 812 | 47.3 | 683 | 42.6 |
| Fine Aggregate (FA) Content | 550 | 29.5 | 414 | 24.1 | 472 | 29.4 |
| Entrained Air (spherical voids with diameters < 1 mm) | 5 | 0.3 | 4 | 0.2 | 3 | 0.2 |
| Entrapped Air (irregular shaped voids or diameters > 1 mm) | 3 | 0.2 | 8 | 0.5 | 14 | 0.9 |
| Total | 1867 | 100.0 | 1716 | 100.0 | 1604 | 100.0 |
| Coarse-to-fine aggregate ratio (CA/FA) | | 1.34 | | 1.96 | | 1.45 |
| Total Air Content | | 0.4 | | 0.7 | | 1.1 |
| Total Aggregate Content | | 69.0 | | 71.4 | | 72.0 |
| Estimated cementitious materials content (sacks/yd³): | 6.6 | | 6.1 | | 6.1 | |
| **GENERAL AGGREGATE PROPERTIES:** | | | | | | |
| Maximum Size Aggregate (MSA), in.: | ¾ | | 1 | | 1 | |
| Volumetric Proportions (% Aggregate): | 69 | | 71 | | 72 | |
| Distribution: | Good | | Good | | Good | |
| Segregation: | None | | None | | None | |
| Consolidation: | Good | | Good | | Good | |
| Flat & Elongated Particles: | Low | | Low | | Low | |
| CA/FA: | 1.34:1 | | 1.96:1 | | 1.45:1 | |
| Gap Graded: | Slightly gapped at #4 | | Slightly gapped at #4 | | Slightly gapped at #4 | |
| One Size: | No | | No | | No | |
| **Coarse Aggregate Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke sandstone, chert, mafic volcanic | | Graywacke sandstone, chert, mafic volcanic | | Graywacke sandstone, chert, mafic volcanic | |
| Minor: | Granitic rock types, fine-grain gabbro | | Granitic rock types, fine-grain gabbro | | Granitic rock types, fine-grain gabbro | |
| Trace: | Vein quartz, serpentinite | | Vein quartz, serpentinite | | Vein quartz, serpentinite | |
| Shape and Texture: | Subangular | | Subangular | | Subangular | |
| **Fine Aggregate Mineral Species and Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | |
| Minor: | Mafic volcanic rock fragments | | Mafic volcanic rock fragments | | Mafic volcanic rock fragments | |
| Trace: | Pyroxene, chlorite, opaques | | Pyroxene, chlorite, opaques | | Pyroxene, chlorite, opaques | |
| Shape and Texture: | Angular to subangular | | Angular to subangular | | Angular to subangular | |
| **Reinforcement:** | #8 rebar at 4.81", ⅜" diameter smooth bar at 3.84" depth | | #8 rebar at 3.45", corroded | | #8 rebar at 3.45", corroded, ⅜" dimeter wire at same depth | |
| **Cement Paste:** | | | | | | |
| Color: | Light gray to tan | | Light gray to tan | | Light gray to tan | |
| Scratch Hardness (Mohs Hardness): | 4½ | | 3 to 3½ | | 4½ | |
| Surface Carbonation Depth, in. (Determined by pH): | Nil | | Nil | | Nil | |
| Cracking and Other Features: | Reaction rims, secondary mineralization in cracks and voids, fractured aggregate | | Secondary mineralization in TZ common. Reaction rims, secondary mineralization in cracks and voids, fractured aggregate | | Secondary mineralization in cracks, voids and TZ common. Reaction rims, fractured aggregate | |
| Diameter (in.) | 4.3 | | 4.2 | | 4.2 | |
| Nominal Length (in.) | 11.1 | | 11.4 | | 8.5 | |
| **MISCELLANEOUS SAMPLE INFORMATION:** | Marine growth on surface (barnacles) | | Marine growth on surface (mullusca) | | Marine growth on surface (mullusca) | |

# Petrographic Examination
## Macroscopic Analysis

Client: SGH
Project: Alameda Piers 1, 2 & 3
AME Project Number: 1160610C
Date: 11/7/2016

Sample ID: Pier 2, Pile 21-A

| | Water-line (Core 1) | Mid-water (Core 2) | Mud-line (Core 3) |
|---|---|---|---|
| **Thin-section (TS) Number(s):** | 3826 | 3827 | 3828 |
| **CEMENT PASTE PROPERTIES:** | | | |
| **Carbonation:** Determined by thin-section: | | | |
| Carbonation Intensity | Light to medium at surface | Light at surface | Typically light, medium along crack margins |
| **Calcium Hydroxide Content (CH)*:** | 15 to 18% | 20% | 15% |
| Size: | Small to medium | Small to medium | Very small to small |
| Distribution: | Fairly even | Even | Even (depletion common) |
| **Transition Zone ( TZ) Development:** | Nil | Thin | Nil |
| **Capillary Void Porosity (CVP):** | Moderately low | Moderately low | Moderately low |
| **Unhydrated Portland Cement Particles (UPC's), %*:** | 5 to 6% | 5 to 6% | 6 to 7% |
| Shape: | Subround to subangular | Subround to subangular | Subround to subangular |
| Type: | Belite clusters, belite | Belite clusters, belite | Belite clusters, belite |
| Size: | Clusters up to 150 μm across | Clusters up to 120 μm across common | Clusters up to 145 μm across |
| Grain Relief: | Low | Low | Low |
| **Pozzolans*, Additives and Pigments:** *percent of cement paste volume | None | None | None |
| **Estimated water-binder ratio (w/b), ±0.05:** (Binder = cement + pozzolan) | 0.48 | 0.48 | 0.45 |
| **Secondary Deposits:** | ASR reaction product (carbonated gel) in cracks and lining to filling voids, ettringite lining and filling voids and cracks | ASR reaction product (carbonated gel) in cracks and lining to filling voids, ettringite lining and filling voids and cracks | ASR reaction product (carbonated gel) in cracks and lining to filling voids, ettringite lining and filling voids and cracks, possible brucite lining some large cracks |
| **Deleterious Reactions:** | Sea water attack: CH depletion, ASR and minor sulfate attack | Sea water attack: CH depletion, ASR and minor sulfate attack, numerous parallel cracking at approximately 2" depth | Sea water attack: CH depletion, ASR and minor sulfate attack, numerous parallel cracking at approximately 2" depth |
| **Fiber Reinforcement** (type and amount**): **percent of sample volume | None | None | None |
| **Microcracking:** | | | |
| Radial: | Moderate | High | High |
| Transverse: | Moderate | High | High |
| **MISCELLANEOUS CEMENT PASTE INFORMATION:** | Minor paste alteration, still hard and strong | Minor paste alteration, still hard and strong | Minor paste alteration, still hard and strong |

# Petrographic Examination
## Macroscopic Analysis

| | |
|---|---|
| Client: | SGH |
| Project: | Alameda Piers 1, 2 & 3 |
| AME Project Number: | 1160610C |
| Date: | 11/7/2016 |

Sample ID: Pier 2, Pile 36-D

| | Water-line (Core 4) | | Mid-water (Core 5) | | Mud-line (Core 6) | |
|---|---|---|---|---|---|---|
| **POINT COUNT:** | | | | | | |
| **Volumetric Proportions (% by volume)** | | | | | | |
| | Count (0.10" increments) | % | Count (0.10" increments) | % | Count (0.10" increments) | % |
| Paste Content | 408 | 27.1 | 377 | 24.6 | 429 | 28.2 |
| Coarse Aggregate (CA) Content | 479 | 31.8 | 555 | 36.3 | 466 | 30.6 |
| Fine Aggregate (FA) Content | 615 | 40.8 | 577 | 37.7 | 612 | 40.2 |
| Entrained Air (spherical voids with diameters < 1 mm) | 3 | 0.2 | 9 | 0.6 | 13 | 0.9 |
| Entrapped Air (irregular shaped voids or diameters > 1 mm) | 1 | 0.1 | 13 | 0.8 | 2 | 0.1 |
| Total | 1506 | 100.0 | 1531 | 100.0 | 1522 | 100.0 |
| Coarse-to-fine aggregate ratio (CA/FA) | | 0.78 | | 0.96 | | 0.76 |
| Total Air Content | | 0.3 | | 1.4 | | 1.0 |
| Total Aggregate Content | | 72.6 | | 73.9 | | 70.8 |
| Estimated cementitious materials content (sacks/yd³): | 6.0 | | 5.6 | | 6.2 | |
| **GENERAL AGGREGATE PROPERTIES:** | | | | | | |
| Maximum Size Aggregate (MSA), in.: | ¾ | | 1 | | ¾ | |
| Volumetric Proportions (% Aggregate): | 73 | | 74 | | 71 | |
| Distribution: | Good | | Good | | Good | |
| Segregation: | None | | None | | None | |
| Consolidation: | Good | | Good | | Good | |
| Flat & Elongated Particles: | Low | | Low | | Low | |
| CA/FA: | 0.78:1 | | 0.96:1 | | 0.76:1 | |
| Gap Graded: | Gapped at #4 | | Gapped at #4 | | Gapped at #4 | |
| One Size: | No | | No | | No | |
| **Coarse Aggregate Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke sandstone, chert, mafic volcanic | | Graywacke sandstone, chert, mafic volcanic | | Graywacke sandstone, chert, mafic volcanic | |
| Minor: | Granitic rock types, fine-grain gabbro | | Granitic rock types, fine-grain gabbro | | Granitic rock types, fine-grain gabbro | |
| Trace: | Vein quartz, serpentinite | | Vein quartz, serpentinite | | Vein quartz, serpentinite | |
| Shape and Texture: | Subangular | | Subangular | | Subangular | |
| **Fine Aggregate Mineral Species and Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | |
| Minor: | Mafic volcanic rock fragments | | Mafic volcanic rock fragments | | Mafic volcanic rock fragments | |
| Trace: | Pyroxene, chlorite, opaques, opal | | Pyroxene, chlorite, opaques | | Pyroxene, chlorite, opaques | |
| Shape and Texture: | Angular to subangular | | Angular to subangular | | Angular to subangular | |
| **Reinforcement:** | #8 rebar at 4.21", ⅜" diameter smooth bar cast at 3.44" depth | | Smooth bar at 3.34" depth (very corroded), small rebar cast at 4.13" depth | | #8 rebar at 6.43", corroded, ⅛" diameter wire at 3.44 depth | |
| **Cement Paste:** | | | | | | |
| Color: | Light gray to tan | | Light gray to tan | | Light gray to tan | |
| Scratch Hardness (Mohs Hardness): | 3½ | | 4½ | | 3½ | |
| Surface Carbonation Depth, in. (Determined by pH): | Nil | | Nil | | Nil | |
| Cracking and Other Features: | Reaction rims, traces of secondary mineralization in cracks and voids | | Some secondary mineralization in TZ common. Reaction rims, secondary mineralization in cracks and voids, fractured aggregate | | Extensive subparallel cracking in outer 1" | |
| Diameter (in.) | 4.2 | | 4.2 | | 4.2 | |
| Nominal Length (in.) | 9.4 | | 10.4 | | 10.5 | |
| **MISCELLANEOUS SAMPLE INFORMATION:** | Marine growth on surface (barnacles) | | Fractured exterior surface, appears deteriorated | | Marine growth on surface | |

# Petrographic Examination
## Macroscopic Analysis

Client: SGH
Project: Alameda Piers 1, 2 & 3
AME Project Number: 1160610C
Date: 11/7/2016

Sample ID: Pier 2, Pile 36-D

| | Water-line (Core 4) | Mid-water (Core 5) | Mud-line (Core 6) |
|---|---|---|---|
| **Thin-section (TS) Number(s):** | 3829 | 3830 | 3831 |
| **CEMENT PASTE PROPERTIES:** | | | |
| **Carbonation:** Determined by thin-section: | | | |
| Carbonation Intensity | Light to medium at surface | Light at surface | Light to medium |
| **Calcium Hydroxide Content (CH)*:** | 20% | 20% | 15% |
| Size: | Small to medium | Small to medium | Very small to small |
| Distribution: | Fairly even | Fairly uneven | Fairly even (depletion fairly common) |
| **Transition Zone ( TZ) Development:** | Nil | Thin | Nil |
| **Capillary Void Porosity (CVP):** | Moderately low | Moderately low | Moderately low |
| **Unhydrated Portland Cement Particles (UPC's), %*:** | 5% | 5 to 6% | 6 to 7% |
| Shape: | Subround to subangular | Subround to subangular | Subround to subangular |
| Type: | Belite clusters, belite | Belite clusters, belite | Belite clusters, belite |
| Size: | Clusters to 130 μm across common, up to 170 μm | Clusters up to 150 μm across common | Clusters up to 145 μm across |
| Grain Relief: | Low | Low | Low |
| **Pozzolans*, Additives and Pigments:** *percent of cement paste volume | None | None | None |
| **Estimated water-binder ratio (w/b), ±0.05:** (Binder = cement + pozzolan) | 0.48 | 0.48 | 0.48 |
| **Secondary Deposits:** | Secondary CH and calcite in small voids | ASR reaction product (carbonated gel) in cracks and lining to filling voids, ettringite lining and filling voids and cracks | Ettringite lining and filling voids and cracks |
| **Deleterious Reactions:** | Minor sea water attack: minor amount of CH depletion | Sea water attack: CH depletion, ASR and minor sulfate attack, numerous cracks in TZ | Sea water attack: CH depletion, minor ASR and minor sulfate attack |
| **Fiber Reinforcement** (type and amount**): **percent of sample volume | None | None | None |
| **Microcracking:** | | | |
| Radial: | Moderately low | High | Moderately low |
| Transverse: | Low | High | Moderate |
| **MISCELLANEOUS CEMENT PASTE INFORMATION:** | Minor paste alteration | Minor paste alteration, paste still hard | Minor paste alteration, still hard and strong |

# Petrographic Examination
## Macroscopic Analysis

| | |
|---|---|
| Client: | SGH |
| Project: | Alameda Piers 1, 2 & 3 |
| AME Project Number: | 1160610C |
| Date: | 11/8/2016 |

Sample ID: Pier 2, Pile 51-H and 52-H

| | Water-line (Core 7) | | Mid-water (Core 8) | | Mud-line (Core 9) | |
|---|---|---|---|---|---|---|
| **POINT COUNT:** | | | | | | |
| **Volumetric Proportions (% by volume)** | | | | | | |
| | Count (0.10" increments) | % | Count (0.10" increments) | % | Count (0.10" increments) | % |
| Paste Content | 397 | 25.7 | 523 | 31.9 | 418 | 27.2 |
| Coarse Aggregate (CA) Content | 550 | 35.6 | 551 | 33.6 | 586 | 38.2 |
| Fine Aggregate (FA) Content | 590 | 38.2 | 562 | 34.3 | 527 | 34.3 |
| Entrained Air (spherical voids with diameters < 1 mm) | 8 | 0.5 | 2 | 0.1 | 2 | 0.1 |
| Entrapped Air (irregular shaped voids or diameters > 1 mm) | 0 | 0.0 | 0 | 0.0 | 3 | 0.2 |
| Total | 1545 | 100.0 | 1638 | 100.0 | 1536 | 100.0 |
| Coarse-to-fine aggregate ratio (CA/FA) | | 0.93 | | 0.98 | | 1.11 |
| Total Air Content | | 0.5 | | 0.1 | | 0.3 |
| Total Aggregate Content | | 73.8 | | 67.9 | | 72.5 |
| Estimated cementitious materials content (sacks/yd³): | 5.6 | | 6.9 | | 5.9 | |
| **GENERAL AGGREGATE PROPERTIES:** | | | | | | |
| Maximum Size Aggregate (MSA), in.: | 1 | | 1 | | ¾ | |
| Volumetric Proportions (% Aggregate): | 74 | | 68 | | 72 | |
| Distribution: | Good | | Poor | | Good | |
| Segregation: | None | | Slight | | None | |
| Consolidation: | Good | | Good | | Good | |
| Flat & Elongated Particles: | Low | | Low | | Low | |
| CA/FA: | 0.93:1 | | 0.98:1 | | 1.11:1 | |
| Gap Graded: | None | | Not gapped, but poor distribution | | None | |
| One Size: | No | | No | | No | |
| **Coarse Aggregate Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke sandstone, chert, mafic volcanic | | Graywacke sandstone, chert, mafic volcanic | | Graywacke sandstone, chert, mafic volcanic | |
| Minor: | Granitic rock types, felsites, fine-grain gabbro | | Granitic rock types, felsites, fine-grain gabbro | | Granitic rock types, felsites, fine-grain gabbro | |
| Trace: | Vein quartz, serpentinite | | Vein quartz, serpentinite | | Vein quartz, serpentinite | |
| Shape and Texture: | Subangular | | Subangular | | Subangular | |
| **Fine Aggregate Mineral Species and Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | |
| Minor: | Mafic volcanic rock fragments | | Mafic volcanic rock fragments | | Mafic volcanic rock fragments | |
| Trace: | Pyroxene, chlorite, opaques, opal | | Pyroxene, chlorite, opaques, opal | | Pyroxene, chlorite, opaques | |
| Shape and Texture: | Angular to subangular | | Angular to subangular | | Angular to subangular | |
| **Reinforcement:** | None | | None | | smooth ⅜" diameter bar at 3.57" depth | |
| **Cement Paste:** | | | | | | |
| Color: | Light gray | | Light gray | | Light gray | |
| Scratch Hardness (Mohs Hardness): | 4½ | | 4 | | 4½ | |
| Surface Carbonation Depth, in. (Determined by pH): | Nil | | 0.06 | | Nil | |
| Cracking and Other Features: | One crack normal to surface to depth of approximately 1", parallel cracking at 1" depth | | Numerous subparallel cracks to 2" depth and random cracking at depth | | Extensive subparallel cracking to 4" depth | |
| Diameter (in.) | 4.2 | | 4.2 | | 4.2 | |
| Nominal Length (in.) | 9.7 | | 15.2 | | 10.9 | |
| **MISCELLANEOUS SAMPLE INFORMATION:** | Marine growth on surface | | Marine growth on surface | | Minor marine growth on surface | |

# Petrographic Examination
## Macroscopic Analysis

| | |
|---|---|
| Client: | SGH |
| Project: | Alameda Piers 1, 2 & 3 |
| AME Project Number: | 1160610C |
| Date: | 11/8/2016 |

Sample ID: Pier 2, Pile 51-H and 52-H

| | Water-line (Core 7) | Mid-water (Core 8) | Mud-line (Core 9) |
|---|---|---|---|
| **Thin-section (TS) Number(s):** | 3832 | 3833 | 3834 |
| **CEMENT PASTE PROPERTIES:** | | | |
| **Carbonation:** Determined by thin-section: | | | |
| Carbonation Intensity | None is TS | Light to medium at surface | Very light at surface |
| **Calcium Hydroxide Content (CH)*:** | 20% | 20% | 15 to 20% |
| Size: | Small to occasionally medium | Small | Small |
| Distribution: | Even | Even | Even |
| **Transition Zone ( TZ) Development:** | Nil | Thin | Nil |
| **Capillary Void Porosity (CVP):** | Moderately low | Moderately low | Moderately low |
| **Unhydrated Portland Cement Particles (UPC's), %*:** | 4% | 4-5% | 4-5% |
| Shape: | Subround to subangular | Subround to subangular | Subround to subangular |
| Type: | Belite clusters, belite | Belite clusters, belite | Belite clusters, belite |
| Size: | Clusters to 160 μm across | Clusters up to 125 μm across common | Clusters to 165 μm across |
| Grain Relief: | Low | Low | Low |
| **Pozzolans*, Additives and Pigments:** *percent of cement paste volume | None | None | None |
| **Estimated water-binder ratio (w/b), ±0.05:** (Binder = cement + pozzolan) | 0.50 | 0.48 | 0.50 |
| **Secondary Deposits:** | Ettringite in voids and cracks | ASR reaction product (carbonated gel) in cracks and lining to filling voids, ettringite lining and filling voids and cracks | Ettringite in voids and cracks |
| **Deleterious Reactions:** | Sea water attack: CH depletion, ASR and sulfate attack, numerous parallel cracking at approximately 2" depth | Sea water attack: CH depletion, ASR and sulfate attack, numerous parallel cracking at approximately 5" depth | Sea water attack: CH depletion, ASR and sulfate attack, numerous parallel cracking at approximately 3½" depth |
| **Fiber Reinforcement** (type and amount**): **percent of sample volume | None | None | None |
| **Microcracking:** | | | |
| Radial: | High | High | Moderately high |
| Transverse: | Moderately high | High | Moderately high |
| **MISCELLANEOUS CEMENT PASTE INFORMATION:** | Minor paste alteration | Minor paste alteration, still hard and strong | Minor paste alteration |

# Petrographic Examination
## Macroscopic Analysis

| | |
|---|---|
| Client: | SGH |
| Project: | Alameda Piers 1, 2 & 3 |
| AME Project Number: | 1160610C |
| Date: | 11/8/2016 |

Sample ID: Pier 2, Pile 99-H

| | Water-line (Core 10) | | Mid-water (Core 11) | | Mud-line (Core 12) | |
|---|---|---|---|---|---|---|
| **POINT COUNT:** | | | | | | |
| **Volumetric Proportions (% by volume)** | | | | | | |
| | Count (0.10" increments) | % | Count (0.10" increments) | % | Count (0.10" increments) | % |
| Paste Content | 489 | 28.6 | 353 | 20.7 | 559 | 30.2 |
| Coarse Aggregate (CA) Content | 640 | 37.5 | 905 | 53.0 | 730 | 39.4 |
| Fine Aggregate (FA) Content | 569 | 33.3 | 434 | 25.4 | 551 | 29.8 |
| Entrained Air (spherical voids with diameters < 1 mm) | 6 | 0.4 | 7 | 0.4 | 7 | 0.4 |
| Entrapped Air (irregular shaped voids or diameters > 1 mm) | 3 | 0.2 | 10 | 0.6 | 4 | 0.2 |
| Total | 1707 | 100.0 | 1709 | 100.0 | 1851 | 100.0 |
| Coarse-to-fine aggregate ratio (CA/FA) | | 1.12 | | 2.09 | | 1.32 |
| Total Air Content | | 0.5 | | 1.0 | | 0.6 |
| Total Aggregate Content | | 70.8 | | 78.3 | | 69.2 |
| Estimated cementitious materials content (sacks/yd³): | 6.2 | | 4.7 | | 6.5 | |
| **GENERAL AGGREGATE PROPERTIES:** | | | | | | |
| Maximum Size Aggregate (MSA), in.: | 1 | | 1 | | 1 | |
| Volumetric Proportions (% Aggregate): | 71 | | 78 | | 69 | |
| Distribution: | Moderately poor | | Good | | Poor | |
| Segregation: | None | | None | | Slight | |
| Consolidation: | Good | | Good | | Good | |
| Flat & Elongated Particles: | Low | | Low | | Low | |
| CA/FA: | 1.12:1 | | 2.09:1 | | 1.32:1 | |
| Gap Graded: | None | | None | | Appears gapped at #4 | |
| One Size: | No | | No | | No | |
| **Coarse Aggregate Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke sandstone, chert, mafic volcanic | | Graywacke sandstone, chert, mafic volcanic | | Graywacke sandstone, chert, mafic volcanic | |
| Minor: | Granitic rock types, felsites, fine-grain gabbro | | Granitic rock types, felsites, fine-grain gabbro | | Granitic rock types, felsites, fine-grain gabbro | |
| Trace: | Vein quartz, serpentinite | | Vein quartz, serpentinite | | Vein quartz, serpentinite | |
| Shape and Texture: | Subangular | | Subangular | | Subangular | |
| **Fine Aggregate Mineral Species and Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | |
| Minor: | Mafic volcanic rock fragments | | Mafic volcanic rock fragments | | Mafic volcanic rock fragments | |
| Trace: | Pyroxene, chlorite, opaques, opal | | Pyroxene, chlorite, opaques, opal | | Pyroxene, chlorite, opaques | |
| Shape and Texture: | Angular to subangular | | Angular to subangular | | Angular to subangular | |
| **Reinforcement:** | None | | smooth ⅜" diameter bar at 2.11" depth | | #8 rebar at 2.66", corroded | |
| **Cement Paste:** | | | | | | |
| Color: | Light gray | | Light gray | | Light gray | |
| Scratch Hardness (Mohs Hardness): | 4½ | | 3½ | | 4 to 4½ | |
| Surface Carbonation Depth, in. (Determined by pH): | Nil | | Nil | | Nil | |
| Cracking and Other Features: | Minor brown discoloration near surface | | Secondary mineralization in TZ common | | Mortar rich, secondary mineralization in TZ fairly common | |
| Diameter (in.) | 4.2 | | 4.2 | | 4.2 | |
| Nominal Length (in.) | 11.0 | | 11.5 | | 11.4 | |
| **MISCELLANEOUS SAMPLE INFORMATION:** | Marine growth on surface | | Brown staining on surface | | Brown staining on surface | |

# Petrographic Examination
## Macroscopic Analysis

Client: SGH
Project: Alameda Piers 1, 2 & 3
AME Project Number: 1160610C
Date: 11/8/2016

Sample ID: Pier 2, Pile 99-H

| | Water-line (Core 10) | Mid-water (Core 11) | Mud-line (Core 12) |
|---|---|---|---|
| **Thin-section (TS) Number(s):** | 3835 | 3836 | 3837 |
| **CEMENT PASTE PROPERTIES:** | | | |
| **Carbonation:** Determined by thin-section: | | | |
| Carbonation Intensity | Very light | Light, typical. Medium along crack margins | Light to medium |
| **Calcium Hydroxide Content (CH)*:** | 15 to 20% | 20% | >20% |
| Size: | Small | Small | Small |
| Distribution: | Even | Even | Even |
| **Transition Zone ( TZ) Development:** | Thin to nil | Thin | Thin to nil |
| **Capillary Void Porosity (CVP):** | Moderately low | Moderately low | Moderately low |
| **Unhydrated Portland Cement Particles (UPC's), %*:** | 4-5% | 4% | 4% |
| Shape: | Subround to subangular | Subround to subangular | Subround to subangular |
| Type: | Belite clusters, belite | Belite clusters, belite | Belite clusters, belite |
| Size: | Clusters to 115 μm across common | Clusters up to 140 μm across common | Clusters to 100 μm across typical. Up to 190 μm |
| Grain Relief: | Low | Low | Low |
| **Pozzolans*, Additives and Pigments:** *percent of cement paste volume | None | None | None |
| **Estimated water-binder ratio (w/b), ±0.05:** (Binder = cement + pozzolan) | 0.50 | 0.50 | 0.50 |
| **Secondary Deposits:** | Minor amounts of Ettringite in voids and cracks | ASR reaction product (carbonated gel) in cracks and lining to filling voids, ettringite lining and filling voids and cracks, possible brucite lining some large cracks | Ettringite in voids and some cracks, seconary CH throughout |
| **Deleterious Reactions:** | Sea water attack: CH depletion, minor ettringite formation | Sea water attack: CH depletion, ASR and sulfate attack, heavy microcracking | Sea water attack: minor amount of CH depletion, ettringite formation in voids |
| **Fiber Reinforcement** (type and amount**): **percent of sample volume | None | None | None |
| **Microcracking:** | | | |
| Radial: | Moderately low | High | Low |
| Transverse: | Moderately low | High | Moderately low |
| **MISCELLANEOUS CEMENT PASTE INFORMATION:** | Minor paste alteration | Paste alteration, but still hard and strong | Minor paste alteration |

# Petrographic Examination
## Macroscopic Analysis

| | |
|---|---|
| Client: | SGH |
| Project: | Alameda Piers 1, 2 & 3 |
| AME Project Number: | 1160610C |
| Date: | 11/9/2016 |

Sample ID: Pier 3, Pile 30-A

| | Water-line (Core 13) | | Mid-water (Core 14) | | Mud-line (Core 15) | |
|---|---|---|---|---|---|---|
| **POINT COUNT:** | | | | | | |
| **Volumetric Proportions (% by volume)** | | | | | | |
| | Count (0.10" increments) | % | Count (0.10" increments) | % | Count (0.10" increments) | % |
| Paste Content | 497 | 28.0 | 534 | 30.2 | 441 | 29.1 |
| Coarse Aggregate (CA) Content | 751 | 42.3 | 613 | 34.6 | 562 | 37.1 |
| Fine Aggregate (FA) Content | 512 | 28.8 | 596 | 33.7 | 487 | 32.1 |
| Entrained Air (spherical voids with diameters < 1 mm) | 9 | 0.5 | 16 | 0.9 | 20 | 1.3 |
| Entrapped Air (irregular shaped voids or diameters > 1 mm) | 8 | 0.5 | 11 | 0.6 | 5 | 0.3 |
| Total | 1777 | 100.0 | 1770 | 100.0 | 1515 | 100.0 |
| Coarse-to-fine aggregate ratio (CA/FA) | | 1.47 | | 1.03 | | 1.15 |
| Total Air Content | | 1.0 | | 1.5 | | 1.7 |
| Total Aggregate Content | | 71.1 | | 68.3 | | 69.2 |
| Estimated cementitious materials content (sacks/yd³): | 6.3 | | 6.7 | | 6.5 | |
| **GENERAL AGGREGATE PROPERTIES:** | | | | | | |
| Maximum Size Aggregate (MSA), in.: | ¾ | | ¾ | | 1 | |
| Volumetric Proportions (% Aggregate): | 71 | | 68 | | 69 | |
| Distribution: | Good | | Good | | Good | |
| Segregation: | None | | None | | None | |
| Consolidation: | Good | | Good | | Good | |
| Flat & Elongated Particles: | Low | | Low | | Low | |
| CA/FA: | 1.47:1 | | 1.03:1 | | 1.15:1 | |
| Gap Graded: | None | | None | | Slightly gapped at #4 | |
| One Size: | No | | No | | No | |
| **Coarse Aggregate Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke and arkose sandstone, chert, mafic volcanic | | Graywacke and arkose sandstone, chert, mafic volcanic | | Graywacke and arkose sandstone, chert, mafic volcanic | |
| Minor: | Felsites, gabbro | | Felsites, gabbro | | Felsites, gabbro | |
| Trace: | Vein quartz | | Vein quartz | | Vein quartz | |
| Shape and Texture: | Subround to subangular | | Subround to subangular | | Subround to subangular | |
| **Fine Aggregate Mineral Species and Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | |
| Minor: | Mafic volcanic rock fragments | | Mafic volcanic rock fragments | | Mafic volcanic rock fragments | |
| Trace: | Granitic rock fragments, chlorite. Serpentine, opaques | | Granitic rock fragments, chlorite. Serpentine, opaques | | Granitic rock fragments, chlorite. Serpentine, opaques | |
| Shape and Texture: | Angular to subangular | | Angular to subangular | | Angular to subangular | |
| **Reinforcement:** | ⅜" diameter smooth bar at 2.21" depth, 0.63" diameter wire at 3.46" depth | | None | | ⅜" diameter smooth bar at 1.96" depth, #8 rebar at 2.81" depth | |
| **Cement Paste:** | | | | | | |
| Color: | Medium dark gray | | Medium dark gray | | Medium dark gray | |
| Scratch Hardness (Mohs Hardness): | 4½ in bulk, 3 in carbonated layer | | 4½ in bulk, 3 to 3½ in carbonated paste | | 3½ to 4 | |
| Surface Carbonation Depth, in. (Determined by pH): | 0.18 | | 0.16 | | 0.05 | |
| Cracking and Other Features: | Heavy microcracking at surface | | Heavy microcracking at surface | | Surface eroded except where there is marine growth | |
| Diameter (in.) | 4.2 | | 4.2 | | 4.2 | |
| Nominal Length (in.) | 11.0 | | 10.6 | | 10.6 | |
| **MISCELLANEOUS SAMPLE INFORMATION:** | Marine growth on surface | | Brown staining and marine growth on surface | | Marine growth on surface, eroded | |

# Petrographic Examination
## Macroscopic Analysis

Client: SGH
Project: Alameda Piers 1, 2 & 3
AME Project Number: 1160610C
Date: 11/9/2016

Sample ID: Pier 3, Pile 30-A

| | Water-line (Core 13) | Mid-water (Core 14) | Mud-line (Core 15) |
|---|---|---|---|
| **Thin-section (TS) Number(s):** | 3838 | 3839 | 3840 |
| **CEMENT PASTE PROPERTIES:** | | | |
| **Carbonation:** Determined by thin-section: | | | |
| Carbonation Intensity | Spoardic medium to light | Spoardic medium to light | Light to medium |
| **Calcium Hydroxide Content (CH)*:** | < 15% | < 15% | 15 to 18% |
| Size: | Small | Small | Small |
| Distribution: | Uneven | Uneven | Uneven |
| **Transition Zone ( TZ) Development:** | Thin to nil | Thin to nil | Thin to nil |
| **Capillary Void Porosity (CVP):** | Low | Low | Low |
| **Unhydrated Portland Cement Particles (UPC's), %*:** | 6 to 7% | 6 to 7% | 6 to 7% |
| Shape: | Subround to subangular | Subround to subangular | Subround to subangular |
| Type: | Belite clusters, belite, alite | Belite clusters, belite, some alite | Belite clusters, belite, alite |
| Size: | Clusters typically < 80 μm | Clusters typically < 115 μm | Clusters to 80 μm across typical. Up to 180 μm |
| Grain Relief: | Low | Low | Low |
| **Pozzolans*, Additives and Pigments:** *percent of cement paste volume | None | None | None |
| **Estimated water-binder ratio (w/b), ±0.05:** (Binder = cement + pozzolan) | 0.45 | 0.45 | 0.45 |
| **Secondary Deposits:** | Ettringite filling voids and cracks | Ettringite filling voids and cracks | Some ettringite in voids and some cracks |
| **Deleterious Reactions:** | Sea water attack: CH depletion, ettringite formation, heavy microcarcking | Sea water attack: CH depletion, ASR and sulfate attack, heavy microcracking | Sea water attack: minor amount of CH depletion, ettringite formation in voids |
| **Fiber Reinforcement** (type and amount**): **percent of sample volume | None | None | None |
| **Microcracking:** | | | |
| Radial: | High | High | High |
| Transverse: | High | High | Moderately high |
| **MISCELLANEOUS CEMENT PASTE INFORMATION:** | Minor paste alteration | Paste alteration, but still hard and strong | Paste alteration |

# Petrographic Examination
## Macroscopic Analysis

| | |
|---|---|
| Client: | SGH |
| Project: | Alameda Piers 1, 2 & 3 |
| AME Project Number: | 1160610C |
| Date: | 1/18/2017 |
| Sample ID: | Pier 2, Pile 31.2-B |

| | Water-line (Core 16) | | Mid-water (Core 17) | | Mud-line (Core 18) | |
|---|---|---|---|---|---|---|
| **POINT COUNT:** | | | | | | |
| **Volumetric Proportions (% by volume)** | | | | | | |
| | Count (0.10" increments) | % | Count (0.10" increments) | % | Count (0.10" increments) | % |
| Paste Content | 519 | 29.9 | 615 | 29.9 | 553 | 27.5 |
| Coarse Aggregate (CA) Content | 558 | 32.1 | 793 | 38.6 | 825 | 41.0 |
| Fine Aggregate (FA) Content | 645 | 37.2 | 631 | 30.7 | 618 | 30.7 |
| Entrained Air (spherical voids with diameters < 1 mm) | 9 | 0.5 | 10 | 0.5 | 6 | 0.3 |
| Entrapped Air (irregular shaped voids or diameters > 1 mm) | 5 | 0.3 | 6 | 0.3 | 8 | 0.4 |
| Total | 1736 | 100.0 | 2055 | 100.0 | 2010 | 100.0 |
| Coarse-to-fine aggregate ratio (CA/FA) | | 0.87 | | 1.26 | | 1.33 |
| Total Air Content | | 0.8 | | 0.8 | | 0.7 |
| Total Aggregate Content | | 69.3 | | 69.3 | | 71.8 |
| Estimated cementitious materials content (sacks/yd³): | 6.2 | | 6.4 | | 5.7 | |
| **GENERAL AGGREGATE PROPERTIES:** | | | | | | |
| Maximum Size Aggregate (MSA), in.: | ¾ | | ¾ | | 1 | |
| Volumetric Proportions (% Aggregate): | 69 | | 69 | | 72 | |
| Distribution: | Good | | Good | | Good | |
| Segregation: | None | | None | | None | |
| Consolidation: | Good | | Good | | Good | |
| Flat & Elongated Particles: | Low | | Low | | Low | |
| CA/FA: | 0.87:1 | | 1.26:1 | | 1.33:1 | |
| Gap Graded: | None | | Slightly gapped at #4 | | Gapped at #4 | |
| One Size: | No | | No | | No | |
| **Coarse Aggregate Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Mafic volcanic. graywacke sandstone, chert | | Graywacke sandstone, chert, mafic volcanic | | Graywacke sandstone, chert, mafic volcanic | |
| Minor: | Vein quartz, fine-grain gabbro | | Granitic rock types, fine-grain gabbro | | Granitic rock types, fine-grain gabbro | |
| Trace: | Ultramafic | | Vein quartz, serpentinite | | Vein quartz, serpentinite | |
| Shape and Texture: | Subangular to subround | | Subangular | | Subangular | |
| **Fine Aggregate Mineral Species and Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | |
| Minor: | Mafic volcanic rock fragments | | Mafic volcanic rock fragments, serpentine | | Mafic volcanic rock fragments | |
| Trace: | Pyroxene, chlorite, opaques | | Pyroxene, chlorite, opaques | | Pyroxene, chlorite, opaques | |
| Shape and Texture: | Angular to subangular | | Angular to subangular | | Angular to subangular | |
| **Reinforcement:** | None | | #8 rebar cast at 3.58", ⅜" dimeter wire at same depth | | 0.07" diameter wire at 3.32" and 4.53" | |
| **Cement Paste:** | | | | | | |
| Color: | Light gray to tan | | Light gray to tan | | Light gray to tan | |
| Scratch Hardness (Mohs Hardness): | 3½ | | 3 to 3½ | | 4 | |
| Surface Carbonation Depth, in. (Determined by pH): | Unevenly to a depth of 0.21 | | Unevenly to a depth of 0.16 | | Unevenly to a depth of 0.15 | |
| Cracking and Other Features: | Reaction rims, secondary mineralization in cracks and voids | | Reaction rims, secondary mineralization in cracks and voids | | Secondary mineralization in cracks, voids and TZ common. Reaction rims, fractured aggregate | |
| Diameter (in.) | 4.2 | | 4.2 | | 4.2 | |
| Nominal Length (in.) | 11.9 | | 11.8 | | 10.7 | |
| **MISCELLANEOUS SAMPLE INFORMATION:** | Marine growth on surface (barnacles) | | Marine growth on surface (Mollusca) | | Marine growth on surface (Mollusca) | |

# Petrographic Examination
## Macroscopic Analysis

Client: SGH
Project: Alameda Piers 1, 2 & 3
AME Project Number: 1160610C
Date: 1/18/2017

Sample ID: Pier 2, Pile 31.2-B

| | Water-line (Core 16) | Mid-water (Core 17) | Mud-line (Core 18) |
|---|---|---|---|
| **Thin-section (TS) Number(s):** | 3869 | 3870 | 3871 |
| **CEMENT PASTE PROPERTIES:** | | | |
| **Carbonation:** Determined by thin-section: | | | |
| Carbonation Intensity | Light to medium at surface | Medium to slightly heavy at surface | Typically light, medium along crack margins |
| **Calcium Hydroxide Content (CH)*:** | 20 to 25% | 20% | 15 to 20% |
| Size: | Small to medium | Small to medium | Very small to small |
| Distribution: | Fairly even | Even | Common in TZ |
| **Transition Zone ( TZ) Development:** | Thin | Very thin | Thin |
| **Capillary Void Porosity (CVP):** | Moderate | Moderately low | Moderate |
| **Unhydrated Portland Cement Particles (UPC's), %*:** | 3 to 5% | 4 to 6% | 4 to 5% |
| Shape: | Subround to subangular | Subround to subangular | Subround to subangular |
| Type: | Belite clusters, belite, trace alite | Belite clusters, belite | Belite clusters, belite |
| Size: | Clusters up to 150 μm across | Clusters up to 175 μm across | Clusters up to 200 μm across, typ. < 150 μm |
| Grain Relief: | Low | Low | Low |
| **Pozzolans*, Additives and Pigments:** *percent of cement paste volume | None | None | None |
| **Estimated water-binder ratio (w/b), ±0.05:** (Binder = cement + pozzolan) | 0.53 | 0.50 | 0.55 |
| **Secondary Deposits:** | Ettringite lining and filling voids and cracks | Ettringite lining and filling voids and cracks | Ettringite lining and filling voids and cracks |
| **Deleterious Reactions:** | Sea water attack: CH depletion, minor ASR and minor sulfate attack | Sea water attack: CH depletion, minor ASR and minor sulfate attack | Sea water attack: CH depletion, ASR and minor sulfate attack |
| **Fiber Reinforcement** (type and amount**): **percent of sample volume | None | None | None |
| **Microcracking:** | | | |
| Radial: | High | Moderate | Low |
| Transverse: | Moderate to high | Moderate | Low |
| **MISCELLANEOUS CEMENT PASTE INFORMATION:** | Minor paste alteration, still hard and strong | Minor paste alteration, still hard and strong | Minor paste alteration, still hard and strong |

# Petrographic Examination
## Macroscopic Analysis

| | |
|---|---|
| Client: | SGH |
| Project: | Alameda Piers 1, 2 & 3 |
| AME Project Number: | 1160610C |
| Date: | 1/18/2017 |

Sample ID: Pier 2, Pile 46-E

| | Water-line (Core 19) | | Mid-water (Core 20) | | Mud-line (Core 21) | |
|---|---|---|---|---|---|---|
| **POINT COUNT:** | | | | | | |
| **Volumetric Proportions (% by volume)** | | | | | | |
| | Count (0.10" increments) | % | Count (0.10" increments) | % | Count (0.10" increments) | % |
| Paste Content | 478 | 27.0 | 524 | 31.0 | 503 | 28.6 |
| Coarse Aggregate (CA) Content | 894 | 50.5 | 653 | 38.6 | 816 | 46.4 |
| Fine Aggregate (FA) Content | 388 | 21.9 | 507 | 30.0 | 434 | 24.7 |
| Entrained Air (spherical voids with diameters < 1 mm) | 4 | 0.2 | 3 | 0.2 | 7 | 0.4 |
| Entrapped Air (irregular shaped voids or diameters > 1 mm) | 6 | 0.3 | 3 | 0.2 | 0 | 0.0 |
| Total | 1770 | 100.0 | 1690 | 100.0 | 1760 | 100.0 |
| Coarse-to-fine aggregate ratio (CA/FA) | | 2.30 | | 1.29 | | 1.88 |
| Total Air Content | | 0.6 | | 0.4 | | 0.4 |
| Total Aggregate Content | | 72.4 | | 68.6 | | 71.0 |
| Estimated cementitious materials content (sacks/yd³): | 5.9 | | 6.6 | | 5.9 | |
| **GENERAL AGGREGATE PROPERTIES:** | | | | | | |
| Maximum Size Aggregate (MSA), in.: | 1 | | 1 | | ¾ to 1 | |
| Volumetric Proportions (% Aggregate): | 72 | | 69 | | 71 | |
| Distribution: | Good | | Good | | Good | |
| Segregation: | None | | None | | None | |
| Consolidation: | Good | | Good | | Good | |
| Flat & Elongated Particles: | Low | | Low | | Low | |
| CA/FA: | 2.3:1 | | 1.29:1 | | 1.88:1 | |
| Gap Graded: | Slightly gapped at #4 | | Slightly gapped at #4 | | Slight gap at #4 | |
| One Size: | No | | No | | No | |
| **Coarse Aggregate Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | mafic volcanic, graywacke sandstone, chert | | Graywacke sandstone, chert, mafic volcanic | | Graywacke sandstone, chert, mafic volcanic | |
| Minor: | Vein quartz, fine-grain gabbro | | Granitic rock types, fine-grain gabbro | | Vein quartz, serpentinite | |
| Trace: | ---- | | Vein quartz, serpentinite | | Granitic rock types | |
| Shape and Texture: | Subangular | | Subangular | | Subround to subangular | |
| **Fine Aggregate Mineral Species and Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke rock fragments, chert, quartz, feldspar | | Quartz, chert, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | |
| Minor: | Mafic volcanic rock fragments | | Mafic volcanic rock fragments, graywacke rock fragments | | Mafic volcanic rock fragments | |
| Trace: | Pyroxene, lizardite, chlorite, opaques | | Pyroxene, chlorite, opal, opaques | | Pyroxene, chlorite, opaques | |
| Shape and Texture: | Angular to subangular | | Angular to subangular | | Angular to subangular | |
| **Reinforcement:** | #8 rebar at 3" and 9.68" depth, 0.3" diameter smooth bar 2.28" and 3.89" depth, plus tie-wire | | Rebar cast at base | | #8 rebar at 3.64", corroded, 0.3" diameter smooth bar at 2.81 depth | |
| **Cement Paste:** | | | | | | |
| Color: | Light gray | | Light gray | | Light gray to tan | |
| Scratch Hardness (Mohs Hardness): | 3½ | | 3 to 3½ | | 4 | |
| Surface Carbonation Depth, in. (Determined by pH): | Less than 0.02" | | to 1.20" following cracks | | Nil | |
| Cracking and Other Features: | Reaction rims, secondary mineralization in TZ, cracks and voids, Extensive subparallel cracking in outer 2" | | Secondary mineralization in TZ fairly common. Reaction rims, secondary mineralization in cracks and voids, fractured aggregate. Extensive cracking in outer 2" | | Secondary mineralization in TZ common. Reaction rims, secondary mineralization in cracks and voids, fractured aggregate. Extensive cracking in outer 2½" | |
| Diameter (in.) | 4.2 | | 4.2 | | 4.2 | |
| Nominal Length (in.) | 11.5 | | 9.4 | | 13.1 | |
| **MISCELLANEOUS SAMPLE INFORMATION:** | Marine growth on surface (barnacles) | | Fractured exterior surface | | Marine growth on surface | |

# Petrographic Examination
## Macroscopic Analysis

| | |
|---|---|
| Client: | SGH |
| Project: | Alameda Piers 1, 2 & 3 |
| AME Project Number: | 1160610C |
| Date: | 1/18/2017 |

Sample ID: Pier 2, Pile 46-E

| | Water-line (Core 19) | Mid-water (Core 20) | Mud-line (Core 21) |
|---|---|---|---|
| **Thin-section (TS) Number(s):** | 3872 | 3873 | 3874 |
| **CEMENT PASTE PROPERTIES:** | | | |
| **Carbonation:** Determined by thin-section: | | | |
| Carbonation Intensity | None in TS | Heavy at surface | Light |
| **Calcium Hydroxide Content (CH)*:** | 18 to 22% | Obscured by carbonation | 20% |
| Size: | Small | ---- | Very small to small |
| Distribution: | Fairly even | ---- | Even |
| **Transition Zone ( TZ) Development:** | Nil | Thin | Thin |
| **Capillary Void Porosity (CVP):** | Moderately low | Moderately low | Moderate |
| **Unhydrated Portland Cement Particles (UPC's), %*:** | 5% | 4 to 6% | 4% |
| Shape: | Subround to subangular | Subround to subangular | Subround to subangular |
| Type: | Belite clusters, belite | Belite clusters, belite | Belite clusters, belite |
| Size: | Clusters as large as 360 μm across | Clusters up to 130 μm across | Clusters up to 110 μm across |
| Grain Relief: | Low | Very low | Low |
| **Pozzolans*, Additives and Pigments:** *percent of cement paste volume | None | None | None |
| **Estimated water-binder ratio (w/b), ±0.05:** (Binder = cement + pozzolan) | 0.50 | 0.50 | 0.55 |
| **Secondary Deposits:** | Ettringite and possible carbonated ASR gel filling voids and cracks | Ettringite and possible brucite lining and filling voids and cracks | Ettringite and possible carbonated ASR gel filling voids and cracks |
| **Deleterious Reactions:** | Minor sea water attack: minor ASR, minor amount of CH depletion, ettringite in TZ | Sea water attack: CH depletion, minor ASR and minor sulfate attack, numerous cracks in TZ | Sea water attack: CH depletion, minor ASR and minor sulfate attack |
| **Fiber Reinforcement** (type and amount**): **percent of sample volume | None | None | None |
| **Microcracking:** | | | |
| Radial: | Moderate | High | Moderately high |
| Transverse: | Moderately low | High | Moderate |
| **MISCELLANEOUS CEMENT PASTE INFORMATION:** | Minor paste alteration | Minor paste alteration, paste still hard | Minor paste alteration, still hard and strong |

# Petrographic Examination
## Macroscopic Analysis

| | |
|---|---|
| Client: | SGH |
| Project: | Alameda Piers 1, 2 & 3 |
| AME Project Number: | 1160610C |
| Date: | 1/19/2017 |

Sample ID: Pier 2, Pile 55-F

| | Water-line (Core 22) | | Mid-water (Core 23) | | Mud-line (Core 24) | |
|---|---|---|---|---|---|---|
| **POINT COUNT:** | | | | | | |
| **Volumetric Proportions (% by volume)** | | | | | | |
| | Count (0.10" increments) | % | Count (0.10" increments) | % | Count (0.10" increments) | % |
| Paste Content | 502 | 27.0 | 503 | 27.2 | 588 | 30.4 |
| Coarse Aggregate (CA) Content | 872 | 46.9 | 873 | 47.2 | 853 | 44.2 |
| Fine Aggregate (FA) Content | 467 | 25.1 | 463 | 25.0 | 474 | 24.5 |
| Entrained Air (spherical voids with diameters < 1 mm) | 5 | 0.3 | 7 | 0.4 | 12 | 0.6 |
| Entrapped Air (irregular shaped voids or diameters > 1 mm) | 14 | 0.8 | 4 | 0.2 | 5 | 0.3 |
| Total | 1860 | 100.0 | 1850 | 100.0 | 1932 | 100.0 |
| Coarse-to-fine aggregate ratio (CA/FA) | | 1.87 | | 1.89 | | 1.80 |
| Total Air Content | | 1.0 | | 0.6 | | 0.9 |
| Total Aggregate Content | | 72.0 | | 72.2 | | 68.7 |
| Estimated cementitious materials content (sacks/yd³): | 5.6 | | 5.7 | | 6.3 | |
| **GENERAL AGGREGATE PROPERTIES:** | | | | | | |
| Maximum Size Aggregate (MSA), in.: | ¾ | | ¾ | | 1 | |
| Volumetric Proportions (% Aggregate): | 72 | | 72 | | 69 | |
| Distribution: | Good | | Good | | Good | |
| Segregation: | None | | None | | None | |
| Consolidation: | Good | | Good | | Good | |
| Flat & Elongated Particles: | Low | | Low | | Low | |
| CA/FA: | 1.87:1 | | 1.89:1 | | 1.8:1 | |
| Gap Graded: | No | | No | | None | |
| One Size: | No | | No | | No | |
| **Coarse Aggregate Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke sandstone, chert, mafic volcanic | | Graywacke sandstone, chert, mafic volcanic | | Graywacke sandstone, chert, mafic volcanic | |
| Minor: | Granitic rock types, felsites, fine-grain gabbro | | Granitic rock types, felsites, fine-grain gabbro | | Granitic rock types, felsites, fine-grain gabbro | |
| Trace: | Vein quartz, serpentinite | | Vein quartz, serpentinite | | Vein quartz, serpentinite | |
| Shape and Texture: | Subround to subangular | | Subround to subangular | | Subangular | |
| **Fine Aggregate Mineral Species and Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | |
| Minor: | Mafic volcanic rock fragments | | Mafic volcanic rock fragments | | Mafic volcanic rock fragments | |
| Trace: | Pyroxene, chlorite, opaques, opal | | Pyroxene, chlorite, opaques, serpentine | | Pyroxene, chlorite, opaques | |
| Shape and Texture: | Angular to subangular | | Angular to subangular | | Angular to subangular | |
| **Reinforcement:** | None | | None | | Smooth 0.3" diameter bar on top of #8 rebar at 2.85" depth with tie wire | |
| **Cement Paste:** | | | | | | |
| Color: | Medium gray | | Medium gray | | Medium gray | |
| Scratch Hardness (Mohs Hardness): | 4½ | | 3-3½ | | 4 | |
| Surface Carbonation Depth, in. (Determined by pH): | Nil | | 0.17" maximum | | Nil | |
| Cracking and Other Features: | Reaction rims on coarse aggregate particles, white mineralization lining voids | | Reaction rims on coarse aggregate particles, white mineralization lining voids | | Reaction rims on coarse aggregate particles, minor white mineralization lining voids | |
| Diameter (in.) | 4.2 | | 4.2 | | 4.2 | |
| Nominal Length (in.) | 10.8 | | 11.0 | | 11.1 | |
| **MISCELLANEOUS SAMPLE INFORMATION:** | Marine growth and mud on surface | | Marine growth and mud on surface | | Minor marine growth on surface | |

# Petrographic Examination
## Macroscopic Analysis

| | |
|---|---|
| Client: | SGH |
| Project: | Alameda Piers 1, 2 & 3 |
| AME Project Number: | 1160610C |
| Date: | 1/19/2017 |

Sample ID: Pier 2, Pile 55-F

| | Water-line (Core 22) | Mid-water (Core 23) | Mud-line (Core 24) |
|---|---|---|---|
| **Thin-section (TS) Number(s):** | 3875 | 3876 | 3877 |
| **CEMENT PASTE PROPERTIES:** | | | |
| **Carbonation:** Determined by thin-section: | | | |
| Carbonation Intensity | Medium to occasionally heavy around voids | Medium to heavy | Light |
| **Calcium Hydroxide Content (CH)*:** | 20% | 20% | 15 to 20% |
| Size: | Small and medium to occasionally large in TZ | Small to medium | Small to medium |
| Distribution: | Uneven | Uneven | Uneven |
| **Transition Zone ( TZ) Development:** | Moderate | Thin to moderate | Thin to moderate |
| **Capillary Void Porosity (CVP):** | Moderately low | Moderately low | Moderately low |
| **Unhydrated Portland Cement Particles (UPC's), %*:** | 4% | 4-5% | 4-5% |
| Shape: | Subround to subangular | Subround to subangular | Subround to subangular |
| Type: | Belite clusters, belite | Belite clusters, belite | Belite clusters, belite |
| Size: | Clusters typically < 110 μm | Clusters up to 175 μm across, typ. < 100 μm | Clusters to 145 μm across, typ. Less |
| Grain Relief: | Low | Low | Low |
| **Pozzolans*, Additives and Pigments:** *percent of cement paste volume | None | None | None |
| **Estimated water-binder ratio (w/b), ±0.05:** (Binder = cement + pozzolan) | 0.55 | 0.53 | 0.53 |
| **Secondary Deposits:** | Ettringite lining and partially filling voids | Possible brucite in TZ cracks, ettringite filling fine cracks | Minor amounts of carbonated ettringite lining voids |
| **Deleterious Reactions:** | Minor sea water attack: minor CH depletion | Sea water attack: CH depletion in fine crack zones, possible ASR and sulfate attack, numerous parallel cracking at approximately ½" depth | Minor sea water attack: minor CH depletion |
| **Fiber Reinforcement** (type and amount**): **percent of sample volume | None | None | None |
| **Microcracking:** | | | |
| Radial: | Low | High | Low |
| Transverse: | Low | High | Very low |
| **MISCELLANEOUS CEMENT PASTE INFORMATION:** | Very minor paste alteration | Paste alteration, still hard and strong | Very minor paste alteration |

# Petrographic Examination
## Macroscopic Analysis

| | |
|---|---|
| Client: | SGH |
| Project: | Alameda Piers 1, 2 & 3 |
| AME Project Number: | 1160610C |
| Date: | 1/19/2017 |

Sample ID: Pier 2, Pile 61-A

| | Water-line (Core 25) | | Mid-water (Core 26) | | Mud-line (Core 27) | |
|---|---|---|---|---|---|---|
| **POINT COUNT:** | | | | | | |
| **Volumetric Proportions (% by volume)** | | | | | | |
| | Count (0.10" increments) | % | Count (0.10" increments) | % | Count (0.10" increments) | % |
| Paste Content | 543 | 29.6 | 636 | 33.6 | 540 | 30.2 |
| Coarse Aggregate (CA) Content | 695 | 37.9 | 549 | 29.0 | 735 | 41.1 |
| Fine Aggregate (FA) Content | 587 | 32.0 | 704 | 37.2 | 498 | 27.9 |
| Entrained Air (spherical voids with diameters < 1 mm) | 6 | 0.3 | 2 | 0.1 | 7 | 0.4 |
| Entrapped Air (irregular shaped voids or diameters > 1 mm) | 2 | 0.1 | 2 | 0.1 | 7 | 0.4 |
| Total | 1833 | 100.0 | 1893 | 100.0 | 1787 | 100.0 |
| Coarse-to-fine aggregate ratio (CA/FA) | | 1.18 | | 0.78 | | 1.48 |
| Total Air Content | | 0.4 | | 0.2 | | 0.8 |
| Total Aggregate Content | | 69.9 | | 66.2 | | 69.0 |
| Estimated cementitious materials content (sacks/yd³): | 6.4 | | 7.1 (high content due to low CA content) | | 6.6 | |
| **GENERAL AGGREGATE PROPERTIES:** | | | | | | |
| Maximum Size Aggregate (MSA), in.: | 1 | | 1 | | ¾ | |
| Volumetric Proportions (% Aggregate): | 70 | | 66 | | 69 | |
| Distribution: | Moderately good | | Poor | | Moderately good | |
| Segregation: | None | | Moderate | | Slight | |
| Consolidation: | Good | | Good | | Good | |
| Flat & Elongated Particles: | Low | | Low | | Low | |
| CA/FA: | 1.18:1 | | 0.78:1 | | 1.48:1 | |
| Gap Graded: | Slight gap at #4 | | Gapped at sizes > than ½" | | No | |
| One Size: | No | | No | | No | |
| **Coarse Aggregate Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke sandstone, chert, mafic volcanic | | Graywacke sandstone, chert, mafic volcanic | | Graywacke sandstone, chert, mafic volcanic | |
| Minor: | Vein quartz, fine-grain gabbro | | Vein quartz, fine-grain gabbro | | Granitic rock types, felsites, fine-grain gabbro | |
| Trace: | Felsites | | Felsites | | Vein quartz, serpentinite | |
| Shape and Texture: | Subround to subangular | | Subround to subangular | | Subangular | |
| **Fine Aggregate Mineral Species and Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | |
| Minor: | Mafic volcanic rock fragments | | Mafic volcanic rock fragments | | Mafic volcanic rock fragments | |
| Trace: | Pyroxene, chlorite, opaques | | Pyroxene, chlorite, opaques, lizardite | | Pyroxene, chlorite, opaques | |
| Shape and Texture: | Angular to subangular | | Angular to subangular | | Angular to subangular | |
| **Reinforcement:** | 0.3" diameter smooth bar at 3.54" depth, #8 rebar at 3.68" depth, with tie wire | | Smooth 0.29" diameter bar at 3.4" depth, #8 rebar at 4.09" depth | | Smooth 0.29" diameter bar at 3.27" depth, #8 rebar at 4.12" depth | |
| **Cement Paste:** | | | | | | |
| Color: | Medium light gray | | Light gray | | Light gray | |
| Scratch Hardness (Mohs Hardness): | 4 | | 3-3½ | | 3½ | |
| Surface Carbonation Depth, in. (Determined by pH): | Nil, carbonation in voids and crack margins common | | 0.22" with carbonation in voids and crack margins common | | < 0.03" | |
| Cracking and Other Features: | Subparallel cracks to surface with secondary white mineralization to approximately 1" depth | | Crack normal to exterior face to approximately 3.4". Subparallel cracks to surface with secondary white mineralization to approximately 5.2" depth | | Some reaction rims on CA | |
| Diameter (in.) | 4.2 | | 4.2 | | 4.2 | |
| Nominal Length (in.) | 10.0 | | 11.0 | | 10.3 | |
| **MISCELLANEOUS SAMPLE INFORMATION:** | Marine growth on surface | | Marine growth on surface | | Marine growth and mud on surface | |

# Petrographic Examination
## Macroscopic Analysis

Client: SGH
Project: Alameda Piers 1, 2 & 3
AME Project Number: 1160610C
Date: 1/19/2017

Sample ID: Pier 2, Pile 61-A

| | Water-line (Core 25) | Mid-water (Core 26) | Mud-line (Core 27) |
|---|---|---|---|
| **Thin-section (TS) Number(s):** | 3878 | 3879 | 3880 |
| **CEMENT PASTE PROPERTIES:** | | | |
| **Carbonation:** Determined by thin-section: | | | |
| Carbonation Intensity | medium to heavy in and around voids | Light, typical. Medium to heavy in around voids and crack margins | Light, occasionally medium around voids |
| **Calcium Hydroxide Content (CH)*:** | 15 to 20% | 20% | >20% |
| Size: | Small | Small | Small |
| Distribution: | Fairly | Even | Even |
| **Transition Zone ( TZ) Development:** | Appears thin | Appears thin to nil | Thin to nil |
| **Capillary Void Porosity (CVP):** | Moderately low | Moderately low | Moderately low |
| **Unhydrated Portland Cement Particles (UPC's), %*:** | 4-5% | 4-6% | 5-6% |
| Shape: | Subround to subangular | Subround to subangular | Subround to subangular |
| Type: | Belite clusters, belite | Belite clusters, belite | Belite clusters, belite |
| Size: | Clusters to 185 μm across, typ. < 90 μm | Clusters up to 130 μm across | Clusters to 110 μm across common |
| Grain Relief: | Low | Low | Low |
| **Pozzolans*, Additives and Pigments:** *percent of cement paste volume | None | None | None |
| **Estimated water-binder ratio (w/b), ±0.05:** (Binder = cement + pozzolan) | 0.50 | 0.50 | 0.48 |
| **Secondary Deposits:** | Possible brucite filling crack ins in CA TZ. Ettringite in voids and cracks, cracks with carbonated ASR in CA and paste | ASR reaction product (carbonated gel) in cracks and lining to filling voids, ettringite lining and filling voids and cracks, possible brucite lining some large cracks | Ettringite lining and filling small voids, minor CH depletion |
| **Deleterious Reactions:** | Sea water attack: CH depletion, ASR and sulfate attack, heavy microcracking | Sea water attack: CH depletion, ASR and sulfate attack, heavy microcracking | Sea water attack: minor amount of CH depletion, ettringite formation in voids |
| **Fiber Reinforcement** (type and amount**): **percent of sample volume | None | None | None |
| **Microcracking:** | | | |
| Radial: | High | High | Low |
| Transverse: | High | High | Very low |
| **MISCELLANEOUS CEMENT PASTE INFORMATION:** | Moderate paste alteration | Paste alteration, but still fairly hard | Minor paste alteration |

# Petrographic Examination
## Macroscopic Analysis

| | |
|---|---|
| Client: | SGH |
| Project: | Alameda Piers 1, 2 & 3 |
| AME Project Number: | 1160610C |
| Date: | 1/23/2017 |

Sample ID: Pier 2, Pile 62-C

| | Water-line (Core 28) | | Mid-water (Core 29) | | Mud-line (Core 30) | |
|---|---|---|---|---|---|---|
| **POINT COUNT:** | | | | | | |
| **Volumetric Proportions (% by volume)** | | | | | | |
| | Count (0.10" increments) | % | Count (0.10" increments) | % | Count (0.10" increments) | % |
| Paste Content | 539 | 31.4 | 485 | 28.7 | 492 | 29.5 |
| Coarse Aggregate (CA) Content | 635 | 37.0 | 668 | 39.6 | 553 | 33.2 |
| Fine Aggregate (FA) Content | 498 | 29.1 | 521 | 30.9 | 583 | 35.0 |
| Entrained Air (spherical voids with diameters < 1 mm) | 14 | 0.8 | 6 | 0.4 | 15 | 0.9 |
| Entrapped Air (irregular shaped voids or diameters > 1 mm) | 28 | 1.6 | 7 | 0.4 | 25 | 1.5 |
| Total | 1714 | 100.0 | 1687 | 100.0 | 1668 | 100.0 |
| Coarse-to-fine aggregate ratio (CA/FA) | | 1.28 | | 1.28 | | 0.95 |
| Total Air Content | | 2.5 | | 0.8 | | 2.4 |
| Total Aggregate Content | | 66.1 | | 70.5 | | 68.1 |
| Estimated cementitious materials content (sacks/yd³): | 6.4 | | 5.9 | | 6.2 | |
| **GENERAL AGGREGATE PROPERTIES:** | | | | | | |
| Maximum Size Aggregate (MSA), in.: | ¾ to 1 | | ¾ | | ¾ to 1 | |
| Volumetric Proportions (% Aggregate): | 66 | | 70 | | 68 | |
| Distribution: | Good | | Good | | Good | |
| Segregation: | None | | None | | None | |
| Consolidation: | Good | | Good | | Good | |
| Flat & Elongated Particles: | Low | | Low | | Low | |
| CA/FA: | 1.28:1 | | 1.28:1 | | 0.95:1 | |
| Gap Graded: | No | | No | | No | |
| One Size: | No | | No | | No | |
| **Coarse Aggregate Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke and arkose sandstone, chert, mafic volcanic | | Graywacke and arkose sandstone, chert, mafic volcanic | | Graywacke and arkose sandstone, chert, mafic volcanic | |
| Minor: | Vein Quartz | | Vein Quartz | | Vein Quartz | |
| Trace: | Felsite, granitic rock types | | Felsite, granitic rock types | | Felsite, granitic rock types | |
| Shape and Texture: | Subround to subangular | | Subround to subangular | | Subround to subangular | |
| **Fine Aggregate Mineral Species and Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | |
| Minor: | Mafic volcanic rock fragments | | Mafic volcanic rock fragments | | Mafic volcanic rock fragments | |
| Trace: | Granitic rock fragments, chlorite. Serpentine, opaques | | Granitic rock fragments, chlorite. Serpentine, opaques | | Granitic rock fragments, chlorite. Serpentine, opaques | |
| Shape and Texture: | Angular to subangular | | Angular to subangular | | Angular to subangular | |
| **Reinforcement:** | #8 rebar at 4.47" depth | | #8 rebar at 4.04" depth | | 0.29" diameter smooth bar at 3.28" depth, #8 rebar at 4.07" depth | |
| **Cement Paste:** | | | | | | |
| Color: | Medium light gray | | Medium light gray | | Medium light gray | |
| Scratch Hardness (Mohs Hardness): | 3 | | 4½ in bulk, < 2 in carbonated paste | | 3½ to 4 | |
| Surface Carbonation Depth, in. (Determined by pH): | < 0.04" | | 0.30 | | 0.16 | |
| Cracking and Other Features: | Minor amount of CA with reaction rims | | Heavy microcracking at surface to 3" depth, outer 0.30" weak and decomposed | | Minor amount of CA with reaction rims, white secondary mineral deposits in crack at bottom (purposely fractured for core extraction) | |
| Diameter (in.) | 4.2 | | 4.2 | | 4.2 | |
| Nominal Length (in.) | 10.3 | | 9.7 | | 10.3 | |
| **MISCELLANEOUS SAMPLE INFORMATION:** | Marine growth on surface | | Marine growth on surface | | Marine growth on surface | |

# Petrographic Examination
## Macroscopic Analysis

Client: SGH
Project: Alameda Piers 1, 2 & 3
AME Project Number: 1160610C
Date: 1/23/2017

Sample ID: Pier 2, Pile 62-C

| | Water-line (Core 28) | Mid-water (Core 29) | Mud-line (Core 30) |
|---|---|---|---|
| **Thin-section (TS) Number(s):** | 3890 | 3891 | 3892 |
| **CEMENT PASTE PROPERTIES:** | | | |
| **Carbonation:** Determined by thin-section: | | | |
| Carbonation Intensity | Medium to heavy (heavy along crack margins) | Medium to heavy (heavy along crack margins) | Medium to heavy (heavy along crack margins) |
| **Calcium Hydroxide Content (CH)*:** | 20% | < 15% | 20% |
| Size: | Small | Small | Small |
| Distribution: | Even | Uneven (due to depletion) | Fairly uneven |
| **Transition Zone ( TZ) Development:** | Thin | Thin | Thin to nil |
| **Capillary Void Porosity (CVP):** | Moderately low | Moderately low | Low |
| **Unhydrated Portland Cement Particles (UPC's), %*:** | 3 to 5% | 4% | 4 to 6% |
| Shape: | Subround to subangular | Subround to subangular | Subround to subangular |
| Type: | Belite clusters, belite | Belite clusters, belite | Belite clusters, belite |
| Size: | Clusters typically < 150 μm | Clusters typically < 140 μm | Clusters to 145 μm across . Typ. < 80 μm |
| Grain Relief: | Low | Low | Low |
| **Pozzolans*, Additives and Pigments:** *percent of cement paste volume | None | None | None |
| **Estimated water-binder ratio (w/b), ±0.05:** (Binder = cement + pozzolan) | 0.55 | 0.55 | 0.53 |
| **Secondary Deposits:** | Ettringite filling voids and cracks, possible brucite in some cracks | Ettringite filling voids and cracks | Ettringite in most cracks |
| **Deleterious Reactions:** | Sea water attack: CH depletion, possible ASR | Sea water attack: CH depletion, ASR and sulfate attack, heavy microcracking | Sea water attack: CH depletion, probable ASR and sulfate attack |
| **Fiber Reinforcement** (type and amount**): **percent of sample volume | None | None | None |
| **Microcracking:** | | | |
| Radial: | Moderate | High | Moderate |
| Transverse: | Moderately high | High | Moderately high |
| **MISCELLANEOUS CEMENT PASTE INFORMATION:** | Minor to moderate paste alteration | Paste alteration, but still hard and strong | Paste alteration common |

# Petrographic Examination
## Macroscopic Analysis

Client: SGH
Project: Alameda Piers 1, 2 & 3
AME Project Number: 1160610C
Date: 1/24/2017

Sample ID: Pier 2, Pile 86-G

| | Water-line (Core 31) | | Mid-water (Core 32) | | Mud-line (Core 33) | |
|---|---|---|---|---|---|---|
| **POINT COUNT:** | | | | | | |
| **Volumetric Proportions (% by volume)** | | | | | | |
| | Count (0.10" increments) | % | Count (0.10" increments) | % | Count (0.10" increments) | % |
| Paste Content | 507 | 27.3 | 461 | 25.4 | 462 | 27.0 |
| Coarse Aggregate (CA) Content | 800 | 43.1 | 794 | 43.8 | 684 | 40.0 |
| Fine Aggregate (FA) Content | 522 | 28.1 | 546 | 30.1 | 548 | 32.0 |
| Entrained Air (spherical voids with diameters < 1 mm) | 15 | 0.8 | 12 | 0.7 | 13 | 0.8 |
| Entrapped Air (irregular shaped voids or diameters > 1 mm) | 12 | 0.6 | 0 | 0.0 | 5 | 0.3 |
| Total | 1856 | 100.0 | 1813 | 100.0 | 1712 | 100.0 |
| Coarse-to-fine aggregate ratio (CA/FA) | | 1.53 | | 1.45 | | 1.25 |
| Total Air Content | | 1.5 | | 0.7 | | 1.1 |
| Total Aggregate Content | | 71.2 | | 73.9 | | 72.0 |
| Estimated cementitious materials content (sacks/yd³): | 5.7 | | 5.1 | | 5.6 | |
| **GENERAL AGGREGATE PROPERTIES:** | | | | | | |
| Maximum Size Aggregate (MSA), in.: | 1 | | ¾ | | ¾ | |
| Volumetric Proportions (% Aggregate): | 71 | | 74 | | 72 | |
| Distribution: | Good | | Good | | Good | |
| Segregation: | None | | None | | None | |
| Consolidation: | Good | | Good | | Good | |
| Flat & Elongated Particles: | Low | | Low | | Low | |
| CA/FA: | 1.53:1 | | 1.45:1 | | 1.25:1 | |
| Gap Graded: | No | | No | | No | |
| One Size: | No | | No | | No | |
| **Coarse Aggregate Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke and arkose sandstone, chert, mafic volcanic | | Graywacke and arkose sandstone, chert, mafic volcanic | | Graywacke and arkose sandstone, chert, mafic volcanic | |
| Minor: | Felsites, gabbro | | Vein quartz | | Felsites, gabbro | |
| Trace: | Vein quartz | | Felsites, gabbro | | Vein quartz | |
| Shape and Texture: | Subangular | | Subangular | | Subround to subangular | |
| **Fine Aggregate Mineral Species and Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | |
| Minor: | Mafic volcanic rock fragments | | Mafic volcanic rock fragments | | Mafic volcanic rock fragments | |
| Trace: | Granitic rock fragments, chlorite. Serpentine, opaques | | Granitic rock fragments, chlorite. Serpentine, opaques | | Granitic rock fragments, chlorite. Serpentine, opaques | |
| Shape and Texture: | Angular to subangular | | Angular to subangular | | Angular to subangular | |
| **Reinforcement:** | None | | None | | None | |
| **Cement Paste:** | | | | | | |
| Color: | Medium gray | | Medium gray | | Medium gray | |
| Scratch Hardness (Mohs Hardness): | 3½ in bulk, 2½ in carbonated layer | | 3½ in bulk, 2½ in carbonated paste | | 3 to 3½ | |
| Surface Carbonation Depth, in. (Determined by pH): | 0.38" nominal, to 1.86" along cracks from surface | | 0.33" (max) | | < 0.05" | |
| Cracking and Other Features: | Hairline cracks to 3.41" depth, partially filled with white secondary minerals, Minor amount of reaction rims on CA | | Microcracks to 1.75", Reaction rims on CA common | | Minor amount of reaction rims on CA | |
| Diameter (in.) | 4.2 | | 4.2 | | 4.2 | |
| Nominal Length (in.) | 11.2 | | 11.2 | | 9.9 | |
| **MISCELLANEOUS SAMPLE INFORMATION:** | Marine growth on surface | | Marine growth on surface | | Marine growth on surface | |

# Petrographic Examination
## Macroscopic Analysis

Client: SGH
Project: Alameda Piers 1, 2 & 3
AME Project Number: 1160610C
Date: 1/24/2017

Sample ID: Pier 2, Pile 86-G

| | Water-line (Core 31) | Mid-water (Core 32) | Mud-line (Core 33) |
|---|---|---|---|
| **Thin-section (TS) Number(s):** | 3893 | 3894 | 3895 |
| **CEMENT PASTE PROPERTIES:** | | | |
| **Carbonation:** Determined by thin-section: | | | |
| Carbonation Intensity | Medium to heavy, mainly along cracks and voids | Medium to heavy | Medium, occasionally heavy |
| **Calcium Hydroxide Content (CH)*:** | 15 to 20% | 20 to 22% | 20% |
| Size: | Small | Small | Small |
| Distribution: | Even | Even | Uneven |
| **Transition Zone ( TZ) Development:** | Thin to nil | Thin to nil | Thin to nil |
| **Capillary Void Porosity (CVP):** | Moderate | Moderate | Moderate to moderate low |
| **Unhydrated Portland Cement Particles (UPC's), %*:** | 3 to 5% | 3 to 4% | 4 to 5% |
| Shape: | Subround to subangular | Subround to subangular | Subround to subangular |
| Type: | Belite clusters, belite | Belite clusters, belite | Belite clusters, belite |
| Size: | Clusters to to 200 μm, typically < 80 μm | Clusters to to 180 μm, typically < 100 μm | Clusters to 150 μm across common. Up to 205 μm |
| Grain Relief: | Very low | Very low | Low |
| **Pozzolans*, Additives and Pigments:** *percent of cement paste volume | None | None | None |
| **Estimated water-binder ratio (w/b), ±0.05:** (Binder = cement + pozzolan) | 0.55 | 0.58 | 0.55 |
| **Secondary Deposits:** | Ettringite filling voids and cracks, possible carbonated ASR gel and brucite | Ettringite lining/filling voids and filling cracks | Carbonation at depth, possible brucite |
| **Deleterious Reactions:** | Sea water attack: CH depletion, ettringite formation, ASR | Sea water attack: CH depletion, Sulfate attack, possible ASR | Sea water attack: CH depletion, carbonation of paste matrix |
| **Fiber Reinforcement** (type and amount**): **percent of sample volume | None | None | None |
| **Microcracking:** | | | |
| Radial: | High | Moderate | Low |
| Transverse: | High | High (mainly in outer 1") | Low |
| **MISCELLANEOUS CEMENT PASTE INFORMATION:** | Paste alteration | Paste alteration | High degree of paste alteration, but little cracking |

# Petrographic Examination
## Macroscopic Analysis

| | |
|---|---|
| Client: | SGH |
| Project: | Alameda Piers 1, 2 & 3 |
| AME Project Number: | 1160610C |
| Date: | 1/19/2017 |

Sample ID: Pier 2, Pile 88-F

| | Water-line (Core 34) | | Mid-water (Core 35) | | Mud-line (Core 36) | |
|---|---|---|---|---|---|---|
| **POINT COUNT:** | | | | | | |
| **Volumetric Proportions (% by volume)** | | | | | | |
| | Count (0.10" increments) | % | Count (0.10" increments) | % | Count (0.10" increments) | % |
| Paste Content | 496 | 27.3 | 499 | 30.4 | 475 | 27.3 |
| Coarse Aggregate (CA) Content | 793 | 43.6 | 661 | 40.3 | 706 | 40.6 |
| Fine Aggregate (FA) Content | 505 | 27.8 | 468 | 28.5 | 538 | 31.0 |
| Entrained Air (spherical voids with diameters < 1 mm) | 5 | 0.3 | 11 | 0.7 | 13 | 0.7 |
| Entrapped Air (irregular shaped voids or diameters > 1 mm) | 18 | 1.0 | 1 | 0.1 | 5 | 0.3 |
| Total | 1817 | 100.0 | 1640 | 100.0 | 1737 | 100.0 |
| Coarse-to-fine aggregate ratio (CA/FA) | | 1.57 | | 1.41 | | 1.31 |
| Total Air Content | | 1.3 | | 0.7 | | 1.0 |
| Total Aggregate Content | | 71.4 | | 68.8 | | 71.6 |
| Estimated cementitious materials content (sacks/yd³): | 6.0 | | 6.6 | | 6.0 | |
| **GENERAL AGGREGATE PROPERTIES:** | | | | | | |
| Maximum Size Aggregate (MSA), in.: | 1 | | ¾ | | ¾ | |
| Volumetric Proportions (% Aggregate): | 71 | | 69 | | 72 | |
| Distribution: | Good | | Moderately good | | Good | |
| Segregation: | None | | Moderate | | None | |
| Consolidation: | Good | | Good | | Good | |
| Flat & Elongated Particles: | Low | | Low | | Low | |
| CA/FA: | 1.57:1 | | 1.41:1 | | 1.31:1 | |
| Gap Graded: | No | | Gapped at #4 | | No | |
| One Size: | No | | No | | No | |
| **Coarse Aggregate Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke and arkose sandstone, chert, mafic volcanic | | Graywacke and arkose sandstone, chert, mafic volcanic | | Graywacke and arkose sandstone, chert, mafic volcanic | |
| Minor: | Felsites, gabbro/diabase | | Felsites, gabbro | | Felsites, gabbro | |
| Trace: | Vein quartz | | Vein quartz | | Vein quartz | |
| Shape and Texture: | Subround to subangular | | Subround to subangular | | Subround to subangular | |
| **Fine Aggregate Mineral Species and Rock Types:** | Normal Weight | | Normal Weight | | Normal Weight | |
| Major: | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | | Graywacke rock fragments, chert, quartz, feldspar | |
| Minor: | Mafic volcanic rock fragments | | Mafic volcanic rock fragments | | Mafic volcanic rock fragments | |
| Trace: | Granitic rock fragments, opaques | | Granitic rock fragments, chlorite, pyroxene, opaques | | Granitic/gabbroic rock fragments, opaques | |
| Shape and Texture: | Angular to subangular | | Angular to subangular | | Angular to subangular | |
| **Reinforcement:** | 0.28" diameter smooth bar at 3.00" depth, #8 rebar 3.73" depth | | None | | #8 rebar at 3.33" depth | |
| **Cement Paste:** | | | | | | |
| Color: | Medium gray | | Medium gray | | Medium gray | |
| Scratch Hardness (Mohs Hardness): | 4 to 4½ in bulk, 2 in carbonated layer | | 3 to 3½ in bulk, 2 to 2½ in carbonated paste | | 3½ to 4 | |
| Surface Carbonation Depth, in. (Determined by pH): | 0.31 | | 0.23" max | | Nil | |
| Cracking and Other Features: | Reaction rims on CA common | | Minor amount of reaction rims on CA | | Reaction rims on CA common | |
| Diameter (in.) | 4.2 | | 4.2 | | 4.2 | |
| Nominal Length (in.) | 11.8 | | 9.9 | | 10.3 | |
| **MISCELLANEOUS SAMPLE INFORMATION:** | Marine growth on surface | | Marine growth on surface | | Marine growth on surface | |

# Petrographic Examination
## Macroscopic Analysis

Client: SGH
Project: Alameda Piers 1, 2 & 3
AME Project Number: 1160610C
Date: 1/19/2017

Sample ID: Pier 2, Pile 88-F

| | Water-line (Core 34) | Mid-water (Core 35) | Mud-line (Core 36) |
|---|---|---|---|
| **Thin-section (TS) Number(s):** | 3904 | 3905 | 3906 |
| **CEMENT PASTE PROPERTIES:** | | | |
| **Carbonation:** Determined by thin-section: | | | |
| Carbonation Intensity | Medium to heavy, mainly along cracks and voids | Medium to heavy, mainly along cracks and voids | Medium to heavy, mainly along cracks and voids |
| **Calcium Hydroxide Content (CH)*:** | 15 to 18% | 15 to 18% | 15% |
| Size: | Small | Small | Small |
| Distribution: | Uneven | Uneven | Fairly even |
| **Transition Zone ( TZ) Development:** | Thin to nil | Thin to nil | Thin to nil |
| **Capillary Void Porosity (CVP):** | Low | Low | Low |
| **Unhydrated Portland Cement Particles (UPC's), %*:** | 6% | 5 to 6% | 5 to 6% |
| Shape: | Subround to subangular | Subround to subangular | Subround to subangular |
| Type: | Belite clusters, belite, trace alite | Belite clusters, belite | Belite clusters, belite |
| Size: | Clusters typically < 130 μm | Clusters typically < 135 μm | Clusters up to 170 μm |
| Grain Relief: | Low | Low | Low |
| **Pozzolans*, Additives and Pigments:** *percent of cement paste volume | None | None | None |
| **Estimated water-binder ratio (w/b), ±0.05:** (Binder = cement + pozzolan) | 0.48 | 0.48 | 0.48 |
| **Secondary Deposits:** | Ettringite filling voids and cracks | Ettringite filling cracks | Carbonation at depth |
| **Deleterious Reactions:** | Sea water attack: CH depletion, sulfate attack | Sea water attack: CH depletion, sulfate attack | Sea water attack: CH depletion, carbonation of paste matrix |
| **Fiber Reinforcement** (type and amount**): **percent of sample volume | None | None | None |
| **Microcracking:** | | | |
| Radial: | High | High | Low |
| Transverse: | High | High | Low |
| **MISCELLANEOUS CEMENT PASTE INFORMATION:** | Paste alteration | Paste alteration, still hard and strong | Paste alteration |

# APPENDIX B

## DAMAGE RATING INDEX (DRI) DATA SHEETS

APPLIED MATERIALS & ENGINEERING, INC.
980 41st Street
Oakland, CA 94608
Tel: (510) 420-8190
FAX: (510) 420-8186
e-mail: info@appmateng.com

# Criteria for Damage Rating Index (DRI) for Determining the Alkali-Silica Reactivity (ASR) in Concrete Cores

The following criteria are used for the *Damage Rating Index* (DRI) determination of potential Alkali-Silica Reactivity (ASR) for core samples removed from concrete structures:

Each core sample is sawn-cut with a continuous-rim, water-cooled diamond-bonded saw blade in the longitudinal direction. The longitudinal cross-section is lapped on diamond bond metal discs until all saw-cut marks are removed and a smooth nearly-polished surface is obtained. The cross-sections are then examined by naked-eye and a variable zoom stereomicroscope with magnifications up to 56x. The *Damage Rating Index* (DRI) is determined by counting petrographic features that indicate the presence or potential presence of ASR. The DRI is described by Grattan-Bellew (1992) and Dunbar and Grattan-Bellew (1995), among others. The petrographic features used to determine the DRI are given in Table I. Each feature is given a weighing factor based on their relative significance in the overall deterioration process. The DRI in this study focused on coarse aggregate particles, or aggregate greater than the No. 4 U.S. standard sieve size.

As noted by others, there is currently no rating system for the DRI values that correspond to the severity of concrete affected by ASR. However, based on our experience, we have adopted the following general guideline for the degree of ASR, based on the visual examination determination of the DRI:

1) If the DRI is 0 then no ASR is present,
2) If the DRI is between 0 and 500 then ASR is very unlikely,
3) If the DRI is between 500 and 1000 then ASR is unlikely,
4) If the DRI is between 1000 and 2000 then ASR is possible, and
5) If the DRI is greater than 2000 than ASR is probable.

Based on these DRI values, a cut-off at 1500 was used in this study for selection of concrete core samples to evaluate further by microscopic thin-section analysis and other petrographic techniques.

The DRI value of approximately 1500 equates to one (1) of each petrographic feature on a 3" by 4" cross-sectional slice, or 12 $in.^2$ of concrete.

**SELECTED REFERENCES**

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3) FHWA-RD-01-164. Van Dam, T.J., Sutter, L.L., Smith, K.D., Wade, M.J., Peterson, K.R., Guidelines for Detection, Analysis, and Treatment of Materials-Related Distress in Concrete Pavements – Volume 2: Appendix B: Laboratory Methods, Federal Highway Administration (FHWA), August 2002.

4) Dunbar. P.A. and Grattan-Bellew, P.E. 1995. Results of damage rating evaluation of condition of concrete from a number of structures affected by AAR. *In* Proceedings of CANMET/ACI International Workshop on AAR in Concrete, Dartmouth, Nova Scotia, CANMET, Department of Natural Resources Canada, pp. 257-265.

5) Grattan-Bellew, P.E. 1992. Comparison of laboratory and field evaluation of alkali-silica reaction in large dams. *In* Proceedings of the First International Conference on Concrete Alkali-Aggregate Reactions in Hydroelectric Plants and Dams, September-October 1992, Fredericton, NB, Canada, 23p.

6) Grattan-Bellew, P.E. and Mitchell, L.D. 2006. Quantitative petrographic analysis of concrete–the damage rating index (DRI) method, a review. Proceedings of *Marc-André Bérubé Symposium on Alkali-Aggregate Reaction (AAR) in Concrete*, Montréal (Canada), May 2006, edited by B. Fournier, CANMET-MTL, 45-70.

## TABLE I

## PETROGRPAHIC FEATURES AND WEIGHING FACTORS FOR THE DAMAGE RATING INDEX TO DETERMINE POTENTIAL ALKALI-SILICA REACTIVITY IN CONCRETE

| Petrographic Feature | Weighing Factor |
|---|---|
| Cementitious Paste with Cracks and Gel | x 4.00 |
| De-bonded Coarse Aggregate | x 3.00 |
| Coarse Aggregate with Cracks and Gel | x 2.00 |
| Cementitious Paste with Cracks | x 2.00 |
| Air Voids Lined or Filled with Gel | x 0.50 |
| Reaction Rims around Aggregate | x 0.50 |
| Coarse Aggregate with Cracks | x 0.25 |

# TABLE II

## DAMAGE RATING INDEX RESULTS

## Alameda Piers 1, 2, and 3

## AME Project 1160610C

| Sample Identification | | Pier 2 Pile 21-A Face 2 | | | | | |
|---|---|---|---|---|---|---|---|
| | | Water-line | | Mid-Water | | Mud-Line | |
| | | Sample 1 | | Sample 2 | | Sample 3 | |
| **Petrographic Feature** | Weighing Factor | Feature | Weighed | Feature | Weighed | Feature | Weighed |
| Coarse aggregate with cracks | 0.25 | 0 | 0 | 0 | 0 | 1 | 0.25 |
| Coarse aggregate with cracks and gel | 2.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Coarse aggregate debonded | 3.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reaction rims around aggregate | 0.50 | 5 | 2.5 | 0 | 0 | 8 | 4 |
| Cement paste with cracks | 2.00 | 0 | 0 | 4 | 8 | 3 | 6 |
| Cement paste with cracks and gel | 4.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Air voids lined or filled with gel | 0.50 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | |
| Sum | | 5 | 2.5 | 4 | 8 | 12 | 10.25 |
| | | | | | | | |
| Area ($cm^2$) | | 139.5 | | 120.6 | | 123.3 | |
| Normalized Area ($cm^2$) | | 1.40 | | 1.21 | | 1.23 | |
| **Damage Rating Index (DRI)** | | **179** | | **663** | | **831** | |

| **Area Calculations** | | | |
|---|---|---|---|
| Length (in.) | 5.15 | 4.45 | 4.55 |
| Width (in.) | 4.2 | 4.2 | 4.2 |
| Area ($in.^2$) | 21.63 | 18.69 | 19.11 |
| Area ($cm^2$) | 139.5 | 120.6 | 123.3 |

## TABLE II.1 (Cont.)

## DAMAGE RATING INDEX RESULTS

## Alameda Piers 1, 2, and 3

## AME Project 1160610C

| Sample Identification | | Pier 2 Pile 36-D Face 2 | | | | | |
|---|---|---|---|---|---|---|---|
| | | Water-line | | Mid-Water | | Mud-Line | |
| | | Sample 4 | | Sample 5 | | Sample 6 | |
| **Petrographic Feature** | Weighing Factor | Feature | Weighed | Feature | Weighed | Feature | Weighed |
| Coarse aggregate with cracks | 0.25 | 0 | 0 | 0 | 0 | 1 | 0.25 |
| Coarse aggregate with cracks and gel | 2.00 | 0 | 0 | 1 | 2 | 0 | 0 |
| Coarse aggregate debonded | 3.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reaction rims around aggregate | 0.50 | 2 | 1 | 2 | 1 | 5 | 2.5 |
| Cement paste with cracks | 2.00 | 0 | 0 | 3 | 6 | 2 | 4 |
| Cement paste with cracks and gel | 4.00 | 0 | 0 | 1 | 4 | 0 | 0 |
| Air voids lined or filled with gel | 0.50 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | |
| Sum | | 2 | 1 | 7 | 13 | 8 | 6.75 |
| | | | | | | | |
| Area (cm²) | | 98.6 | | 117.6 | | 107.6 | |
| Normalized Area (cm²) | | 0.99 | | 1.18 | | 1.08 | |
| **Damage Rating Index (DRI)** | | **101** | | **1105** | | **627** | |

| **Area Calculations** | | | |
|---|---|---|---|
| Length (in.) | 3.64 | 4.34 | 3.97 |
| Width (in.) | 4.2 | 4.2 | 4.2 |
| Area (in.²) | 15.288 | 18.228 | 16.674 |
| Area (cm²) | 98.6 | 117.6 | 107.6 |

**TABLE II.2 (Cont.)**

**DAMAGE RATING INDEX RESULTS**

**Alameda Piers 1, 2, and 3**

**AME Project 1160610C**

| Sample Identification | | Pier 2 Pile 51-H Face 4 | | Pier 2 Pile 51-H Face 1 | | Pier 2 Pile 52-H Face 4 | |
|---|---|---|---|---|---|---|---|
| | | Water-line | | Mid-Water | | Mud-Line | |
| | | Sample 7 | | Sample 8 | | Sample 9 | |
| **Petrographic Feature** | Weighing Factor | Feature | Weighed | Feature | Weighed | Feature | Weighed |
| Coarse aggregate with cracks | 0.25 | 1 | 0.25 | 11 | 2.75 | 2 | 0.5 |
| Coarse aggregate with cracks and gel | 2.00 | 0 | 0 | 0 | 0 | 2 | 4 |
| Coarse aggregate debonded | 3.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reaction rims around aggregate | 0.50 | 3 | 1.5 | 5 | 2.5 | 5 | 2.5 |
| Cement paste with cracks | 2.00 | 5 | 10 | 7 | 14 | 4 | 8 |
| Cement paste with cracks and gel | 4.00 | 0 | 0 | 0 | 0 | 2 | 8 |
| Air voids lined or filled with gel | 0.50 | 1 | 0.5 | 1 | 0.5 | 0 | 0 |
| | | | | | | | |
| Sum | | 10 | 12.25 | 24 | 19.75 | 15 | 23 |
| | | | | | | | |
| Area (cm²) | | 103.2 | | 190.8 | | 108.9 | |
| Normalized Area (cm²) | | 1.03 | | 1.91 | | 1.09 | |
| **Damage Rating Index (DRI)** | | **1187** | | **1035** | | **2111** | |

| **Area Calculations** | | | |
|---|---|---|---|
| Length (in.) | 3.81 | 7.04 | 4.02 |
| Width (in.) | 4.2 | 4.2 | 4.2 |
| Area (in.²) | 16.002 | 29.568 | 16.884 |
| Area (cm²) | 103.2 | 190.8 | 108.9 |

**TABLE II.3 (Cont.)**

**DAMAGE RATING INDEX RESULTS**

**Alameda Piers 1, 2, and 3**

**AME Project 1160610C**

| | | Pier 2 Pile 99-H Face 4 | | | | | |
|---|---|---|---|---|---|---|---|
| | | Water-line | | Mid-Water | | Mud-Line | |
| **Sample Identification** | | Sample 10 | | Sample 11 | | Sample 12 | |
| **Petrographic Feature** | Weighing Factor | Feature | Weighed | Feature | Weighed | Feature | Weighed |
| Coarse aggregate with cracks | 0.25 | 0 | 0 | 2 | 0.5 | 0 | 0 |
| Coarse aggregate with cracks and gel | 2.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Coarse aggregate debonded | 3.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reaction rims around aggregate | 0.50 | 0 | 0 | 1 | 0.5 | 3 | 1.5 |
| Cement paste with cracks | 2.00 | 2 | 4 | 2 | 4 | 0 | 0 |
| Cement paste with cracks and gel | 4.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Air voids lined or filled with gel | 0.50 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | |
| Sum | | 2 | 4 | 5 | 5 | 3 | 1.5 |
| | | | | | | | |
| Area (cm²) | | 130.6 | | 143.1 | | 133.9 | |
| Normalized Area (cm²) | | 1.31 | | 1.43 | | 1.34 | |
| **Damage Rating Index (DRI)** | | **306** | | **349** | | **112** | |

| **Area Calculations** | | | |
|---|---|---|---|
| Length (in.) | 4.82 | 5.28 | 4.94 |
| Width (in.) | 4.2 | 4.2 | 4.2 |
| Area (in.²) | 20.244 | 22.176 | 20.748 |
| Area (cm²) | 130.6 | 143.1 | 133.9 |

## TABLE II.4 (Cont.)

## DAMAGE RATING INDEX RESULTS

## Alameda Piers 1, 2, and 3

## AME Project 1160610C

| | | Pier 3 Pile 30-A Face 2 | | | | | |
|---|---|---|---|---|---|---|---|
| | | Water-line | | Mid-Water | | Mud-Line | |
| **Sample Identification** | | Sample 13 | | Sample 14 | | Sample 15 | |
| **Petrographic Feature** | Weighing Factor | Feature | Weighed | Feature | Weighed | Feature | Weighed |
| Coarse aggregate with cracks | 0.25 | 0 | 0 | 0 | 0 | 1 | 0.25 |
| Coarse aggregate with cracks and gel | 2.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Coarse aggregate debonded | 3.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reaction rims around aggregate | 0.50 | 2 | 1 | 1 | 0.5 | 2 | 1 |
| Cement paste with cracks | 2.00 | 2 | 4 | 0 | 0 | 3 | 6 |
| Cement paste with cracks and gel | 4.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Air voids lined or filled with gel | 0.50 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | |
| Sum | | 4 | 5 | 1 | 0.5 | 6 | 7.25 |
| | | | | | | | |
| Area (cm²) | | 144.4 | | 127.9 | | 118.1 | |
| Normalized Area (cm²) | | 1.44 | | 1.28 | | 1.18 | |
| **Damage Rating Index (DRI)** | | **346** | | **39** | | **614** | |

| **Area Calculations** | | | |
|---|---|---|---|
| Length (in.) | 5.33 | 4.72 | 4.36 |
| Width (in.) | 4.2 | 4.2 | 4.2 |
| Area (in.²) | 22.386 | 19.824 | 18.312 |
| Area (cm²) | 144.4 | 127.9 | 118.1 |

**TABLE II.5 (Cont.)**

**DAMAGE RATING INDEX RESULTS**

**Alameda Piers 1, 2, and 3**

**AME Project 1160610C**

| Sample Identification | | Pier 2 Pile 31.2-B Face 3 | | | | | |
|---|---|---|---|---|---|---|---|
| | | Water-line | | Mid-Water | | Mud-Line | |
| | | Sample 16 | | Sample 17 | | Sample 18 | |
| **Petrographic Feature** | Weighing Factor | Feature | Weighed | Feature | Weighed | Feature | Weighed |
| Coarse aggregate with cracks | 0.25 | 0 | 0 | 0 | 0 | 1 | 0.25 |
| Coarse aggregate with cracks and gel | 2.00 | 0 | 0 | 0 | 0 | 3 | 6 |
| Coarse aggregate debonded | 3.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reaction rims around aggregate | 0.50 | 3 | 1.5 | 4 | 2 | 5 | 2.5 |
| Cement paste with cracks | 2.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cement paste with cracks and gel | 4.00 | 2 | 8 | 7 | 28 | 4 | 16 |
| Air voids lined or filled with gel | 0.50 | 10 | 5 | 13 | 6.5 | 16 | 8 |
| | | | | | | | |
| Sum | | 15 | 14.5 | 24 | 36.5 | 29 | 32.75 |
| | | | | | | | |
| Area (cm²) | | 129.0 | | 152.0 | | 143.5 | |
| Normalized Area (cm²) | | 1.29 | | 1.52 | | 1.43 | |
| **Damage Rating Index (DRI)** | | **1124** | | **2401** | | **2283** | |

| **Area Calculations** | | | |
|---|---|---|---|
| Length (in.) | 4.76 | 5.61 | 5.32 |
| Width (in.) | 4.20 | 4.20 | 4.18 |
| Area (in.²) | 19.99 | 23.56 | 22.24 |
| Area (cm²) | 129.0 | 152.0 | 143.5 |

**TABLE II.6 (Cont.)**

**DAMAGE RATING INDEX RESULTS**

**Alameda Piers 1, 2, and 3**

**AME Project 1160610C**

| Sample Identification | | Pier 2 Pile 46-E Face 4 | | | | | |
|---|---|---|---|---|---|---|---|
| | | Water-line | | Mid-Water | | Mud-Line | |
| | | Sample 19 | | Sample 20 | | Sample 21 | |
| **Petrographic Feature** | Weighing Factor | Feature | Weighed | Feature | Weighed | Feature | Weighed |
| Coarse aggregate with cracks | 0.25 | 2 | 0.5 | 7 | 1.75 | 0 | 0 |
| Coarse aggregate with cracks and gel | 2.00 | 2 | 4 | 6 | 12 | 3 | 6 |
| Coarse aggregate debonded | 3.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reaction rims around aggregate | 0.50 | 2 | 1 | 3 | 1.5 | 12 | 6 |
| Cement paste with cracks | 2.00 | 0 | 0 | 3 | 6 | 0 | 0 |
| Cement paste with cracks and gel | 4.00 | 11 | 44 | 9 | 36 | 11 | 44 |
| Air voids lined or filled with gel | 0.50 | 8 | 4 | 11 | 5.5 | 12 | 6 |
| | | | | | | | |
| Sum | | 25 | 53.5 | 39 | 62.75 | 38 | 62 |
| | | | | | | | |
| Area (cm²) | | 117.8 | | 115.7 | | 173.0 | |
| Normalized Area (cm²) | | 1.18 | | 1.16 | | 1.73 | |
| **Damage Rating Index (DRI)** | | **4541** | | **5425** | | **3585** | |

| **Area Calculations** | | | |
|---|---|---|---|
| Length (in.) | 4.39 | 4.31 | 6.46 |
| Width (in.) | 4.16 | 4.16 | 4.15 |
| Area (in.²) | 18.26 | 17.93 | 26.81 |
| Area (cm²) | 117.8 | 115.7 | 173.0 |

**TABLE II.7 (Cont.)**

**DAMAGE RATING INDEX RESULTS**

**Alameda Piers 1, 2, and 3**

**AME Project 1160610C**

| Sample Identification | | Pier 2 Pile 55-F Face 4 | | | | | |
|---|---|---|---|---|---|---|---|
| | | Water-line | | Mid-Water | | Mud-Line | |
| | | Sample 22 | | Sample 23 | | Sample 24 | |
| **Petrographic Feature** | Weighing Factor | Feature | Weighed | Feature | Weighed | Feature | Weighed |
| Coarse aggregate with cracks | 0.25 | 2 | 0.5 | 3 | 0.75 | 3 | 0.75 |
| Coarse aggregate with cracks and gel | 2.00 | 1 | 2 | 1 | 2 | 0 | 0 |
| Coarse aggregate debonded | 3.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reaction rims around aggregate | 0.50 | 3 | 1.5 | 7 | 3.5 | 6 | 3 |
| Cement paste with cracks | 2.00 | 0 | 0 | 2 | 4 | 0 | 0 |
| Cement paste with cracks and gel | 4.00 | 2 | 8 | 1 | 4 | 0 | 0 |
| Air voids lined or filled with gel | 0.50 | 7 | 3.5 | 10 | 5 | 5 | 2.5 |
| | | | | | | | |
| Sum | | 15 | 15.5 | 24 | 19.25 | 14 | 6.25 |
| | | | | | | | |
| Area (cm²) | | 138.3 | | 143.4 | | 138.0 | |
| Normalized Area (cm²) | | 1.38 | | 1.43 | | 1.38 | |
| **Damage Rating Index (DRI)** | | **1121** | | **1342** | | **453** | |

| **Area Calculations** | | | |
|---|---|---|---|
| Length (in.) | 5.14 | 5.33 | 5.13 |
| Width (in.) | 4.17 | 4.17 | 4.17 |
| Area (in.²) | 21.43 | 22.23 | 21.39 |
| Area (cm²) | 138.3 | 143.4 | 138.0 |

**TABLE II.8 (Cont.)**

**DAMAGE RATING INDEX RESULTS**

**Alameda Piers 1, 2, and 3**

**AME Project 1160610C**

| Sample Identification | | Pier 2 Pile 61-A Face 2 | | | | | |
|---|---|---|---|---|---|---|---|
| | | Water-line | | Mid-Water | | Mud-Line | |
| | | Sample 25 | | Sample 26 | | Sample 27 | |
| **Petrographic Feature** | Weighing Factor | Feature | Weighed | Feature | Weighed | Feature | Weighed |
| Coarse aggregate with cracks | 0.25 | 2 | 0.5 | 3 | 0.75 | 2 | 0.5 |
| Coarse aggregate with cracks and gel | 2.00 | 4 | 8 | 7 | 14 | 1 | 2 |
| Coarse aggregate debonded | 3.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reaction rims around aggregate | 0.50 | 4 | 2 | 6 | 3 | 3 | 1.5 |
| Cement paste with cracks | 2.00 | 5 | 10 | 2 | 4 | 2 | 4 |
| Cement paste with cracks and gel | 4.00 | 10 | 40 | 20 | 80 | 2 | 8 |
| Air voids lined or filled with gel | 0.50 | 10 | 5 | 12 | 6 | 2 | 1 |
| | | | | | | | |
| Sum | | 35 | 65.5 | 50 | 107.75 | 12 | 17 |
| | | | | | | | |
| Area (cm²) | | 133.2 | | 144.7 | | 125.9 | |
| Normalized Area (cm²) | | 1.33 | | 1.45 | | 1.26 | |
| **Damage Rating Index (DRI)** | | **4918** | | **7444** | | **1350** | |
| **Area Calculations** | | | | | | | |
| Length (in.) | | 5.38 | | 4.68 | | 5.38 | |
| Width (in.) | | 4.17 | | 4.17 | | 4.17 | |
| Area (in.²) | | 22.43 | | 19.52 | | 22.43 | |
| Area (cm²) | | 144.7 | | 125.9 | | 144.7 | |

**TABLE II.9 (Cont.)**

**DAMAGE RATING INDEX RESULTS**

**Alameda Piers 1, 2, and 3**

**AME Project 1160610C**

| Sample Identification | | Pier 2 Pile 62-C Face 2 | | | | | |
|---|---|---|---|---|---|---|---|
| | | Water-line | | Mid-Water | | Mud-Line | |
| | | Sample 28 | | Sample 29 | | Sample 30 | |
| **Petrographic Feature** | Weighing Factor | Feature | Weighed | Feature | Weighed | Feature | Weighed |
| Coarse aggregate with cracks | 0.25 | 5 | 1.25 | 2 | 0.5 | 2 | 0.5 |
| Coarse aggregate with cracks and gel | 2.00 | 4 | 8 | 4 | 8 | 0 | 0 |
| Coarse aggregate debonded | 3.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reaction rims around aggregate | 0.50 | 4 | 2 | 3 | 1.5 | 4 | 2 |
| Cement paste with cracks | 2.00 | 1 | 2 | 2 | 4 | 0 | 0 |
| Cement paste with cracks and gel | 4.00 | 3 | 12 | 7 | 28 | 1 | 4 |
| Air voids lined or filled with gel | 0.50 | 12 | 6 | 9 | 4.5 | 3 | 1.5 |
| | | | | | | | |
| Sum | | 29 | 31.25 | 27 | 46.5 | 10 | 8 |
| | | | | | | | |
| Area (cm²) | | 125.9 | | 127.5 | | 127.3 | |
| Normalized Area (cm²) | | 1.26 | | 1.28 | | 1.27 | |
| **Damage Rating Index (DRI)** | | **2482** | | **3646** | | **629** | |

| **Area Calculations** | | | |
|---|---|---|---|
| Length (in.) | 4.68 | 4.74 | 4.73 |
| Width (in.) | 4.17 | 4.17 | 4.17 |
| Area (in.²) | 19.52 | 19.77 | 19.72 |
| Area (cm²) | 125.9 | 127.5 | 127.3 |

**TABLE II.10 (Cont.)**

**DAMAGE RATING INDEX RESULTS**

**Alameda Piers 1, 2, and 3**

**AME Project 1160610C**

| Sample Identification | | Pier 2 Pile 86-G Face 4 | | | | | |
|---|---|---|---|---|---|---|---|
| | | Water-line | | Mid-Water | | Mud-Line | |
| | | Sample 31 | | Sample 32 | | Sample 33 | |
| **Petrographic Feature** | Weighing Factor | Feature | Weighed | Feature | Weighed | Feature | Weighed |
| Coarse aggregate with cracks | 0.25 | 6 | 1.5 | 3 | 0.75 | 2 | 0.5 |
| Coarse aggregate with cracks and gel | 2.00 | 5 | 10 | 2 | 4 | 3 | 6 |
| Coarse aggregate debonded | 3.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reaction rims around aggregate | 0.50 | 4 | 2 | 8 | 4 | 4 | 2 |
| Cement paste with cracks | 2.00 | 4 | 8 | 1 | 2 | 1 | 2 |
| Cement paste with cracks and gel | 4.00 | 12 | 48 | 8 | 32 | 1 | 4 |
| Air voids lined or filled with gel | 0.50 | 18 | 9 | 11 | 5.5 | 9 | 4.5 |
| | | | | | | | |
| Sum | | 49 | 78.5 | 33 | 48.25 | 20 | 19 |
| | | | | | | | |
| Area (cm²) | | 141.8 | | 138.6 | | 125.4 | |
| Normalized Area (cm²) | | 1.42 | | 1.39 | | 1.25 | |
| **Damage Rating Index (DRI)** | | **5537** | | **3482** | | **1516** | |

| **Area Calculations** | | | |
|---|---|---|---|
| Length (in.) | 5.27 | 5.15 | 4.66 |
| Width (in.) | 4.17 | 4.17 | 4.17 |
| Area (in.²) | 21.98 | 21.48 | 19.43 |
| Area (cm²) | 141.8 | 138.6 | 125.4 |

**TABLE II.11 (Cont.)**

**DAMAGE RATING INDEX RESULTS**

**Alameda Piers 1, 2, and 3**

**AME Project 1160610C**

| Sample Identification | | Pier 2 Pile 88-F Faces 1 and 4 | | | | | |
|---|---|---|---|---|---|---|---|
| | | Water-line | | Mid-Water | | Mud-Line | |
| | | Sample 34 | | Sample 35 | | Sample 36 | |
| **Petrographic Feature** | Weighing Factor | Feature | Weighed | Feature | Weighed | Feature | Weighed |
| Coarse aggregate with cracks | 0.25 | 1 | 0.25 | 4 | 1 | 1 | 0.25 |
| Coarse aggregate with cracks and gel | 2.00 | 1 | 2 | 3 | 6 | 1 | 2 |
| Coarse aggregate debonded | 3.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reaction rims around aggregate | 0.50 | 5 | 2.5 | 2 | 1 | 10 | 5 |
| Cement paste with cracks | 2.00 | 4 | 8 | 1 | 2 | 0 | 0 |
| Cement paste with cracks and gel | 4.00 | 1 | 4 | 8 | 32 | 1 | 4 |
| Air voids lined or filled with gel | 0.50 | 5 | 2.5 | 13 | 6.5 | 3 | 1.5 |
| | | | | | | | |
| Sum | | 17 | 19.25 | 31 | 48.5 | 16 | 12.75 |
| | | | | | | | |
| Area (cm²) | | 150.9 | | 123.2 | | 127.8 | |
| Normalized Area (cm²) | | 1.51 | | 1.23 | | 1.28 | |
| **Damage Rating Index (DRI)** | | **1275** | | **3936** | | **998** | |

| **Area Calculations** | | | |
|---|---|---|---|
| Length (in.) | 5.61 | 4.58 | 4.75 |
| Width (in.) | 4.17 | 4.17 | 4.17 |
| Area (in.²) | 23.39 | 19.10 | 19.81 |
| Area (cm²) | 150.9 | 123.2 | 127.8 |

# APPENDIX C

# ENGEO Pile Input Parameters Memorandum

# TECHNICAL MEMORANDUM

**To:** Mr. Rune Iversen

**Date:** November 29, 2016

**Project No.:** 13206.000.000

**Project Name:** Alameda Point – Pier 2 and 3 Assessment

**Subject:** **PILE INPUT PARAMETERS**

**Total Pages** 8

The attached tables and figure provide a summary of generalized ultimate axial capacities, lateral p-y springs, and axial T-Z springs, as well as the approximate limits along the length of the pier that they should be utilized, for use in analysis of the existing Pier 2 and Pier 3 at Alameda Point in Alameda, California. Our idealized subsurface profile and soil-structure interaction springs are based on existing data.

The p-y springs represent incremental soil resistance at the defined pile depths. To develop springs at intermediate depths, linear interpolation can be used to modify the values of the resisting load. We provide an upper and lower bound based on p-multipliers of 0.5 and 2, respectively. This relatively wide range between upper bound and lower bound is based on the limited amount of strength information.

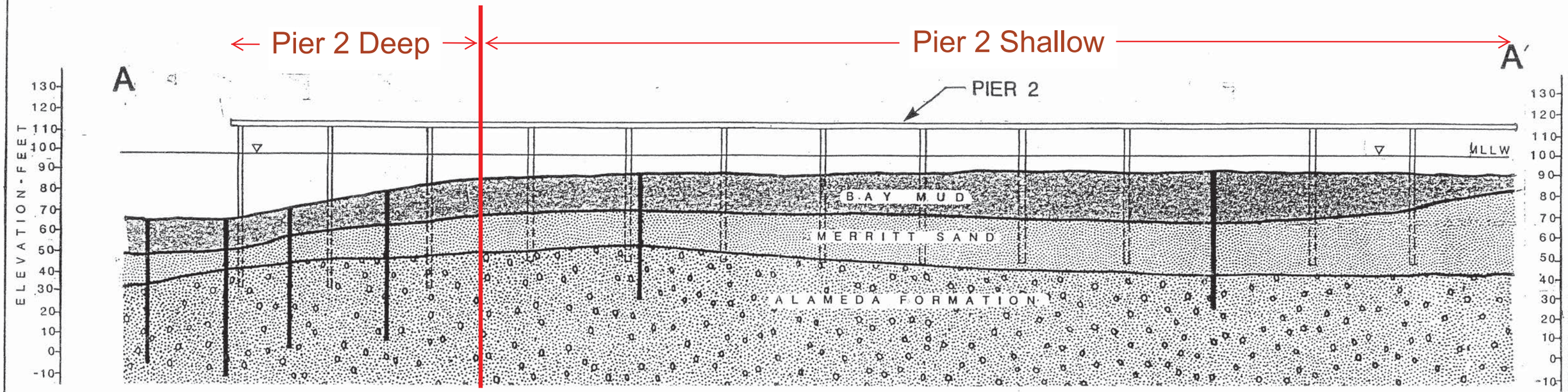
The T-Z springs estimate the axial load-displacement behavior of the piles; these pile springs represent our “best estimate” of pile axial behavior. The behavior provided presents pile tip deflection with varying load applied at the pile top. We also provide our estimate of ultimate axial geotechnical capacity.

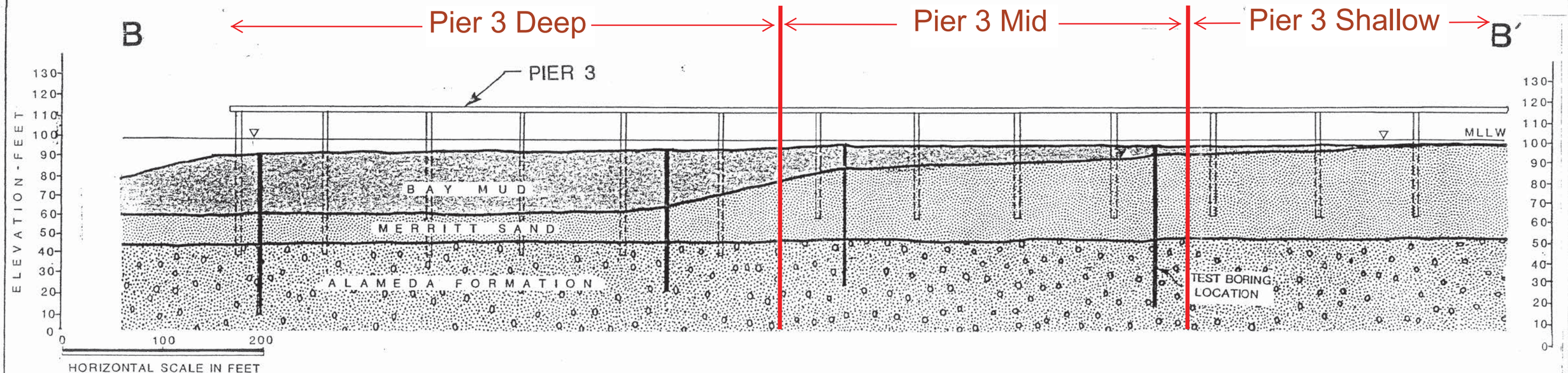
Please contact us if you have any questions.

Attachment: Figure 1: Approximate Limits of Generalized Pier Sections
Table I: Pier 2 Lateral p-y Springs
Table II: Pier 3 Lateral p-y Springs
Table III: Axial T-Z Springs
Table IV: Ultimate Axial Capacities

**Prepared By:** Mr. James Yang

**Reviewed By:** Mr. Jeff Fippin




NOTES:

1) ELEVATIONS ARE BASED ON ALAMEDA NAVAL AIR STATION DATUM

2) SOIL BOUNDARIES ARE INTERPOLATIONS BETWEEN BORINGS. ACTUAL BOUNDARIES MAY VARY FROM THOSE SHOWN.

3) THE BOTTOM PROFILE IS BASED ON TEST BORING INFORMATION, AND A HYDROGRAPHIC SURVEY PERFORMED BY M&M CONSULTANTS, NOV.1982.


Harding Lawson Associates
Engineers, Geologists
& Geophysicists


# Cross Sections A-A' and B-B'

Pier and Wharf Assessment
Alameda Naval Air Station
Alameda, California

PLATE 3-2

| DRAWN | JOB NUMBER | APPROVED | DATE | REVISED | DATE |
|---|---|---|---|---|---|
| RICE | 13134,001.0 | TV | 12/13/82 | | |

Table I: Pier 2 Lateral p-y Springs

| Section | Pier 2 Shallow | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Upper Bound | | | | | | | | |
| Material | Depth Below Mudline (ft.) | Elevation (MLLW ft.) | P1 (lbs/in) | Y1 (in) | P2 (lbs/in) | Y2 (in) | P3 (lbs/in) | Y3 (in) |
| YBM | 0.0 | 77.5 | 51.0 | 0.46 | 93.5 | 2.84 | 127.5 | 7.20 |
| YBM | 7.4 | 70.1 | 120.8 | 0.46 | 221.4 | 2.84 | 301.9 | 7.20 |
| Merritt | 6.5 | 71.0 | 2238.4 | 0.17 | 3130.4 | 0.35 | 3394.4 | 0.65 |
| Merritt | 32.5 | 45.0 | 15652.6 | 0.28 | 21890.7 | 0.56 | 23736.5 | 1.05 |

| Section | Pier 2 Deep | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Upper Bound | | | | | | | | |
| Material | Depth Below Mudline (ft.) | Elevation (MLLW ft.) | P1 (lbs/in) | Y1 (in) | P2 (lbs/in) | Y2 (in) | P3 (lbs/in) | Y3 (in) |
| YBM | 0.0 | 60.0 | 59.5 | 0.73 | 93.5 | 2.84 | 127.5 | 7.20 |
| YBM | 8.9 | 51.1 | 157.4 | 0.73 | 247.3 | 2.84 | 337.2 | 7.20 |
| Merritt | 9.0 | 51.0 | 2686.0 | 0.17 | 3863.6 | 0.39 | 4073.2 | 0.65 |
| Merritt | 18.9 | 41.1 | 7998.1 | 0.25 | 11504.4 | 0.55 | 12128.7 | 0.92 |
| Alameda | 19.0 | 41.0 | 11147.0 | 0.26 | 16033.9 | 0.58 | 16903.9 | 0.96 |
| Alameda | 25.0 | 35.0 | 21821.8 | 0.30 | 31388.5 | 0.67 | 33091.8 | 1.12 |

Table I: Pier 2 Lateral p-y Springs

| Section | Pier 2 Shallow | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Lower Bound | | | | | | | | |
| Material | Depth Below Mudline (ft.) | Elevation (MLLW ft.) | P1 (lbs/in) | Y1 (in) | P2 (lbs/in) | Y2 (in) | P3 (lbs/in) | Y3 (in) |
| YBM | 0.0 | 77.5 | 12.8 | 0.46 | 23.4 | 2.84 | 31.9 | 7.20 |
| YBM | 7.4 | 70.1 | 30.2 | 0.46 | 55.3 | 2.84 | 75.5 | 7.20 |
| Merritt | 6.5 | 71.0 | 559.6 | 0.17 | 782.6 | 0.35 | 848.6 | 0.65 |
| Merritt | 32.5 | 45.0 | 3913.1 | 0.28 | 5472.7 | 0.56 | 5934.1 | 1.05 |

| Section | Pier 2 Deep | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Lower Bound | | | | | | | | |
| Material | Depth Below Mudline (ft.) | Elevation (MLLW ft.) | P1 (lbs/in) | Y1 (in) | P2 (lbs/in) | Y2 (in) | P3 (lbs/in) | Y3 (in) |
| YBM | 0.0 | 60.0 | 14.9 | 0.73 | 23.4 | 2.84 | 31.9 | 7.20 |
| YBM | 8.9 | 51.1 | 39.3 | 0.73 | 61.8 | 2.84 | 84.3 | 7.20 |
| Merritt | 9.0 | 51.0 | 671.5 | 0.17 | 965.9 | 0.39 | 1018.3 | 0.65 |
| Merritt | 18.9 | 41.1 | 1999.5 | 0.25 | 2876.1 | 0.55 | 3032.2 | 0.92 |
| Alameda | 19.0 | 41.0 | 2786.7 | 0.26 | 4008.5 | 0.58 | 4226.0 | 0.96 |
| Alameda | 25.0 | 35.0 | 5455.4 | 0.30 | 7847.1 | 0.67 | 8272.9 | 1.12 |

Table II: Pier 3 Lateral p-y Springs

| Section | Pier 3 Shallow | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Upper Bound | | | | | | | | |
| Material | Depth Below Mudline (ft.) | Elevation (MLLW ft.) | P1 (lbs/in) | Y1 (in) | P2 (lbs/in) | Y2 (in) | P3 (lbs/in) | Y3 (in) |
| Merritt | 0.0 | 80.0 | 0.0 | 0.35 | 0.0 | 0.70 | 0.0 | 0.80 |
| Merritt | 29.9 | 50.1 | 7001.4 | 0.15 | 16482.2 | 0.52 | 18632.8 | 1.12 |

| Section | Pier 3 Mid | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Upper Bound | | | | | | | | |
| Material | Depth Below Mudline (ft.) | Elevation (MLLW ft.) | P1 (lbs/in) | Y1 (in) | P2 (lbs/in) | Y2 (in) | P3 (lbs/in) | Y3 (in) |
| YBM | 0.0 | 90.0 | 66.1 | 0.81 | 103.9 | 3.15 | 141.7 | 8.00 |
| YBM | 4.9 | 85.1 | 122.4 | 0.81 | 192.3 | 3.15 | 262.3 | 8.00 |
| Merritt | 5.0 | 85.0 | 1658.0 | 0.19 | 2384.9 | 0.43 | 2514.3 | 0.72 |
| Merritt | 38.9 | 51.1 | 21868.8 | 0.33 | 31456.2 | 0.74 | 33163.2 | 1.23 |
| Alameda | 39.0 | 51.0 | 30358.3 | 0.34 | 43667.4 | 0.77 | 46037.0 | 1.28 |
| Alameda | 44.0 | 46.0 | 48226.5 | 0.37 | 69369.0 | 0.84 | 73133.4 | 1.40 |

| Section | Pier 3 Deep | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Upper Bound | | | | | | | | |
| Material | Depth Below Mudline (ft.) | Elevation (MLLW ft.) | P1 (lbs/in) | Y1 (in) | P2 (lbs/in) | Y2 (in) | P3 (lbs/in) | Y3 (in) |
| YBM | 0.0 | 81.5 | 47.2 | 0.30 | 85.0 | 1.73 | 141.7 | 8.00 |
| YBM | 13.4 | 68.1 | 141.7 | 0.30 | 283.3 | 2.37 | 425.0 | 8.00 |
| Merritt | 13.5 | 68.0 | 4476.7 | 0.19 | 6260.8 | 0.39 | 6800.9 | 0.77 |
| Merritt | 31.4 | 50.1 | 15148.5 | 0.28 | 21185.7 | 0.56 | 23013.3 | 1.12 |
| Alameda | 31.5 | 50.0 | 21054.5 | 0.29 | 29445.4 | 0.59 | 31985.6 | 1.17 |
| Alameda | 40.5 | 41.0 | 39832.4 | 0.34 | 55707.1 | 0.67 | 60512.8 | 1.34 |

Table II: Pier 3 Lateral p-y Springs

| Section | Pier 3 Shallow | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Lower Bound | | | | | | | | |
| Material | Depth Below Mudline (ft.) | Elevation (MLLW ft.) | P1 (lbs/in) | Y1 (in) | P2 (lbs/in) | Y2 (in) | P3 (lbs/in) | Y3 (in) |
| Merritt | 0.0 | 80.0 | 0.00 | 0.35 | 0.00 | 0.70 | 0.00 | 0.80 |
| Merritt | 29.9 | 50.1 | 1750.35 | 0.15 | 4120.55 | 0.52 | 4658.20 | 1.12 |

| Section | Pier 3 Mid | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Lower Bound | | | | | | | | |
| Material | Depth Below Mudline (ft.) | Elevation (MLLW ft.) | P1 (lbs/in) | Y1 (in) | P2 (lbs/in) | Y2 (in) | P3 (lbs/in) | Y3 (in) |
| YBM | 0.0 | 90.0 | 16.53 | 0.81 | 25.97 | 3.15 | 35.42 | 8.00 |
| YBM | 4.9 | 85.1 | 30.60 | 0.81 | 48.08 | 3.15 | 65.57 | 8.00 |
| Merritt | 5.0 | 85.0 | 414.51 | 0.19 | 596.23 | 0.43 | 628.59 | 0.72 |
| Merritt | 38.9 | 51.1 | 5467.21 | 0.33 | 7864.04 | 0.74 | 8290.79 | 1.23 |
| Alameda | 39.0 | 51.0 | 7589.57 | 0.34 | 10916.85 | 0.77 | 11509.25 | 1.28 |
| Alameda | 44.0 | 46.0 | 12056.61 | 0.37 | 17342.26 | 0.84 | 18283.34 | 1.40 |

| Section | Pier 3 Deep | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Lower Bound | | | | | | | | |
| Material | Depth Below Mudline (ft.) | Elevation (MLLW ft.) | P1 (lbs/in) | Y1 (in) | P2 (lbs/in) | Y2 (in) | P3 (lbs/in) | Y3 (in) |
| YBM | 0.0 | 81.5 | 11.81 | 0.30 | 21.25 | 1.73 | 35.42 | 8.00 |
| YBM | 13.4 | 68.1 | 35.42 | 0.30 | 70.83 | 2.37 | 106.25 | 8.00 |
| Merritt | 13.5 | 68.0 | 1119.18 | 0.19 | 1565.21 | 0.39 | 1700.24 | 0.77 |
| Merritt | 31.4 | 50.1 | 3787.12 | 0.28 | 5296.43 | 0.56 | 5753.33 | 1.12 |
| Alameda | 31.5 | 50.0 | 7060.77 | 0.51 | 7960.84 | 1.02 | 7996.40 | 1.17 |
| Alameda | 40.5 | 41.0 | 9958.10 | 0.34 | 13926.78 | 0.67 | 15128.19 | 1.34 |

Table III: Axial T-Z Springs

| Section | Pier 2 Shallow |
|---|---|
| Top Load (kips) | Tip Movement (inches) |
| 0.2 | 0.00 |
| 2.3 | 0.00 |
| 11.7 | 0.01 |
| 23.5 | 0.01 |
| 116.3 | 0.05 |
| 174.4 | 0.10 |
| 229.8 | 0.50 |
| 263.3 | 1.00 |
| 301.7 | 2.00 |

| Section | Pier 2 Deep |
|---|---|
| Top Load (kips) | Tip Movement (inches) |
| 0.2 | 0.00 |
| 2.5 | 0.00 |
| 12.5 | 0.01 |
| 25.1 | 0.01 |
| 117.0 | 0.05 |
| 166.3 | 0.10 |
| 236.9 | 0.50 |
| 281.8 | 1.00 |
| 326.0 | 2.00 |

| Section | Pier 3 Shallow |
|---|---|
| Top Load (kips) | Tip Movement (inches) |
| 0.2 | 0.00 |
| 1.9 | 0.00 |
| 9.4 | 0.01 |
| 18.7 | 0.01 |
| 93.7 | 0.05 |
| 134.5 | 0.10 |
| 194.9 | 0.50 |
| 233.8 | 1.00 |
| 278.3 | 2.00 |

| Section | Pier 3 Mid |
|---|---|
| Top Load (kips) | Tip Movement (inches) |
| 4.0 | 0.00 |
| 19.8 | 0.01 |
| 39.8 | 0.01 |
| 197.2 | 0.05 |
| 267.5 | 0.10 |
| 354.6 | 0.50 |
| 410.3 | 1.00 |
| 474.1 | 2.00 |

| Section | Pier 3 Deep |
|---|---|
| Top Load (kips) | Tip Movement (inches) |
| 0.3 | 0.00 |
| 2.9 | 0.00 |
| 14.6 | 0.01 |
| 29.2 | 0.01 |
| 144.2 | 0.05 |
| 204.8 | 0.10 |
| 286.2 | 0.50 |
| 336.5 | 1.00 |
| 394.3 | 2.00 |

Table IV: Ultimate Axial Capacities

| Case | Pile Diameter and Type | Generalized Length | Ultimate Capacity |
|---|---|---|---|
| | | feet | kips |
| Pier 2 Shallow | 20-inch square precast | 71 | 312 |
| Pier 2 Deep | 18-inch square precast, prestressed | 81 | 326 |
| Pier 3 Shallow | 20-inch square precast | 59 | 353 |
| Pier 3 Mid | 20-inch square precast | 70 | 495 |
| Pier 3 Deep | 20-inch square precast | 72 | 416 |

| Pile Ultimate Tension Capacities | | |
|---|---|---|
| Location | Soil Level | Capacity (kips) |
| Pier 2 | Shallow | 114 |
| Pier 2 | Deep | 80 |
| Pier 3 | Shallow | 124 |
| Pier 3 | Mid | 167 |
| Pier 3 | Deep | 119 |

- Capacities provided by ENGEO