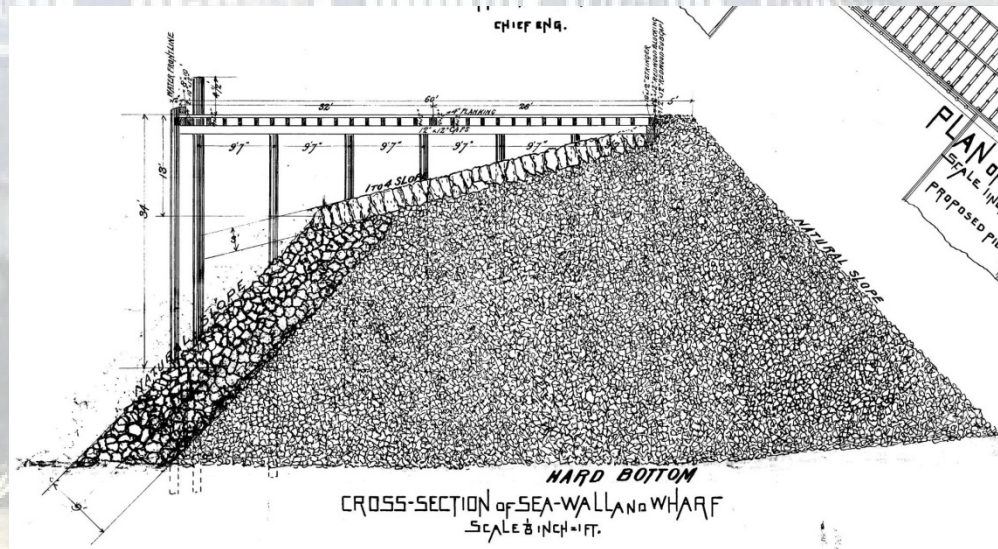


Informational Presentation

Earthquake Vulnerability Study of the Northern Waterfront Seawall

Progress Update



Port Commission Meeting - October 13, 2015

Steven Reel, Project Manager, Engineering Division

1850s San Francisco near downtown



387. Ebb Tide, South Beach, San Francisco.

Great Seawall 1878 - 1915

- Planned in 1870, constructed 1878 to 1915
- Four Miles Long, Located hundreds of feet Bayward of Shoreline
- Created 700+ acres of new land.

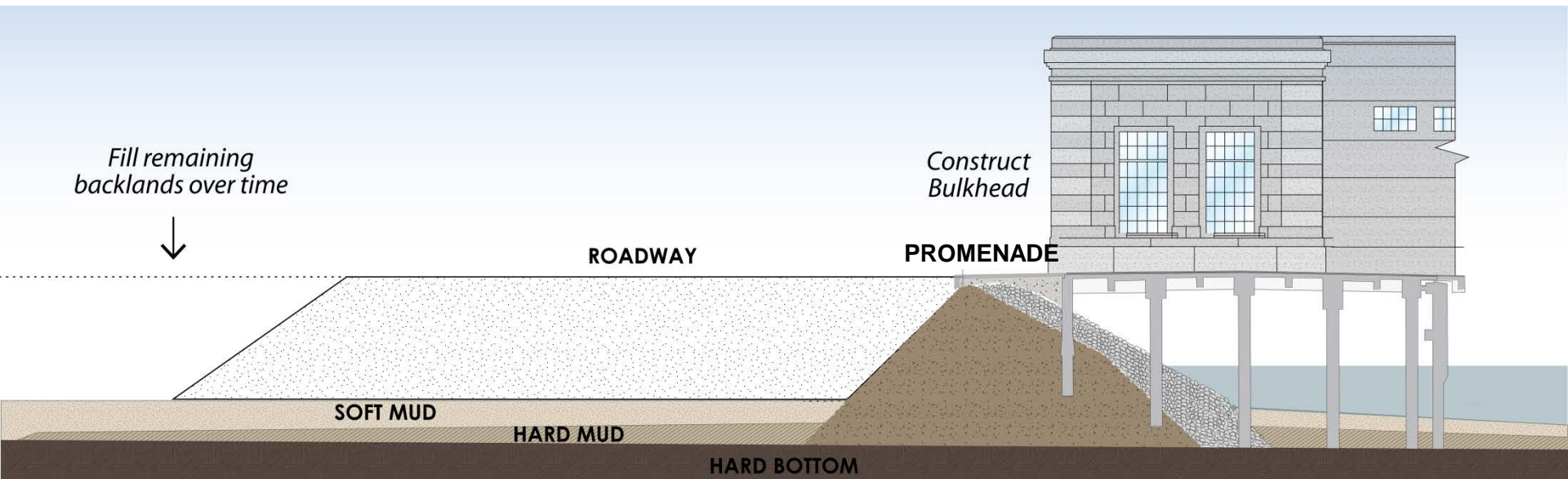


160 Years Later



Design & Construction

Choose elevation that has worked well, approximately 8-1/2 feet above Mean Sea Level
and 3 feet above the Highest Recorded Tide

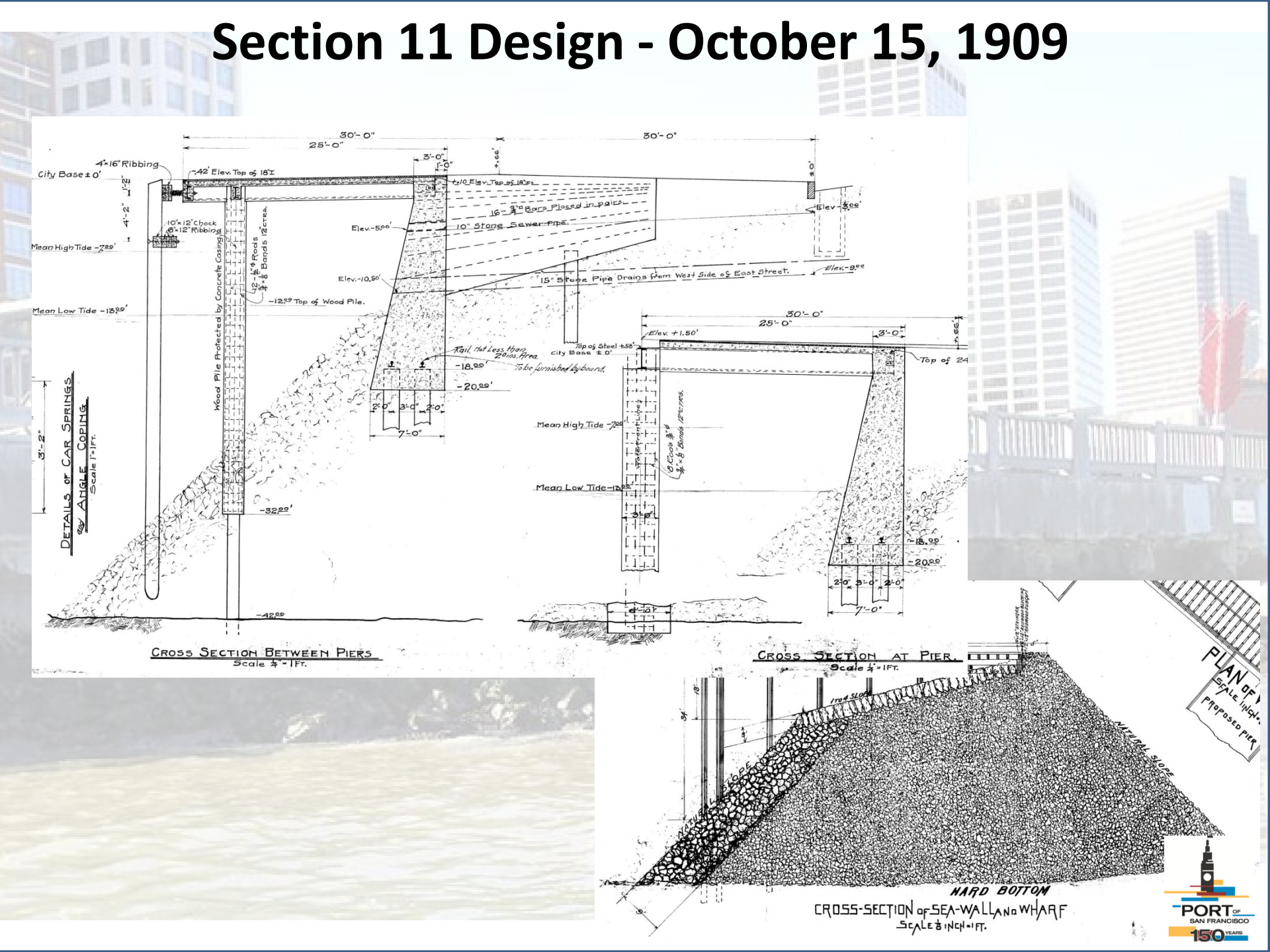


Section 11 Design - October 15, 1909

The image contains four architectural drawings for a pier design, dated October 15, 1909.

- DETAILS OF CAR SPRINGS AND ANGLE COPING:** A plan view showing a 3'-2" wide section with a 1/4" scale. It includes dimensions for the coping and the car springs.
- CROSS SECTION BETWEEN PIERS:** A cross-section showing the structure between two piers. It includes dimensions for the piers, the coping, and the car springs. The scale is 1/4" = 1 ft.
- CROSS SECTION AT PIER:** A cross-section showing the structure at a pier. It includes dimensions for the pier, the coping, and the car springs. The scale is 1/4" = 1 ft.
- CROSS-SECTION OF SEA-WALL AND WHARF:** A cross-section showing the structure of a sea-wall and wharf. It includes dimensions for the sea-wall, the wharf, and the coping. The scale is 1/4" = 1 ft.

The drawings are detailed with various annotations, including elevations, dimensions, and material specifications. The background of the page features a faint image of a city skyline.



Section 11 Design - October 15, 1909

CROSS SECTION BETWEEN PIERS
Scale $\frac{1}{4}$ " = 1 Ft.

CROSS SECTION AT PIER
Scale $\frac{1}{4}$ " = 1 Ft.

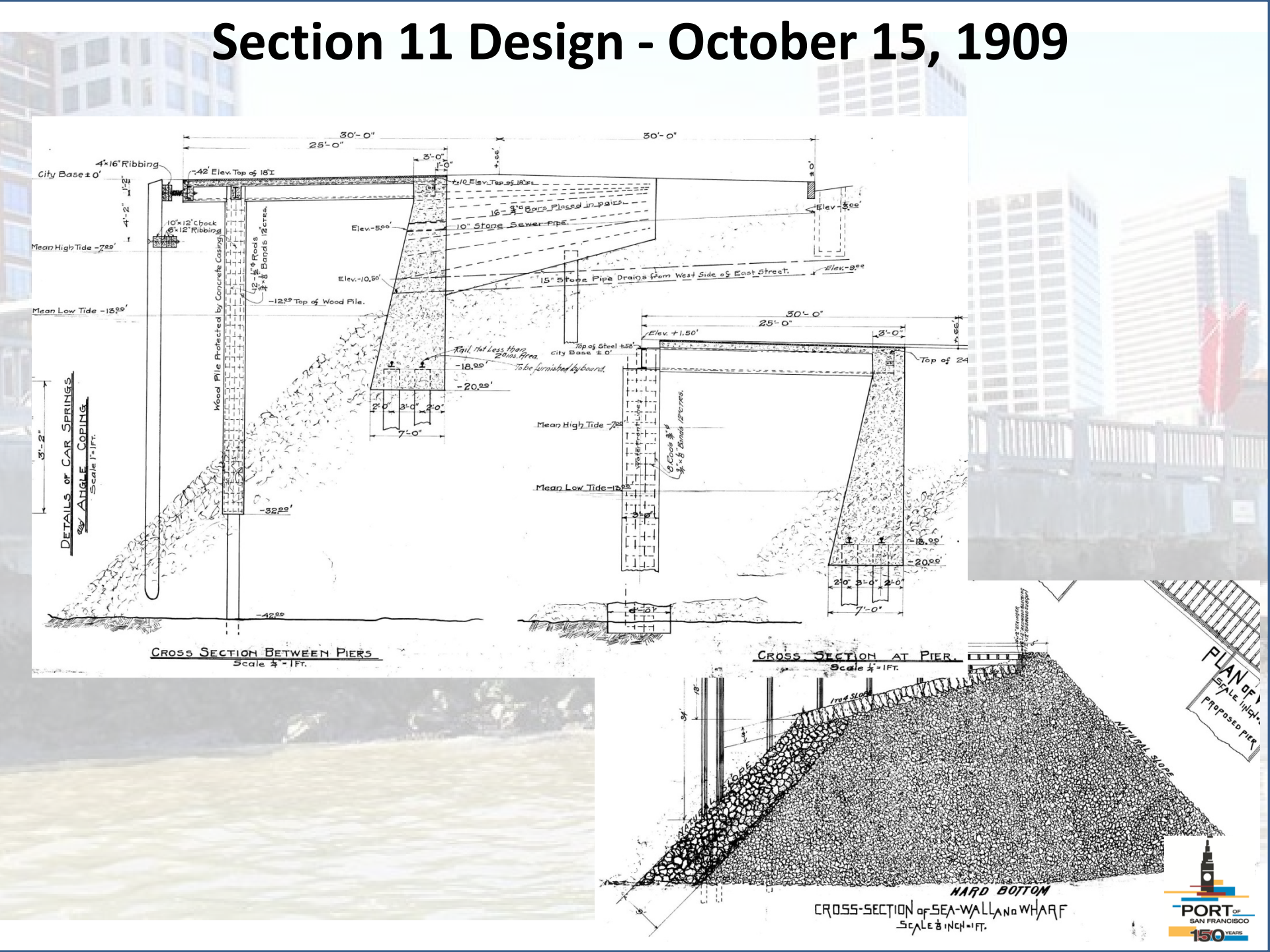
CROSS-SECTION OF SEA-WALL AND WHARF
Scale $\frac{3}{8}$ " = 1 Ft.

DETAILS OF CAR SPRINGS AND ANGLE COPING
Scale $\frac{1}{2}$ " = 1 Ft.

PLAN OF PROPOSED PIER
Scale 1" = 10 Ft.

HARD BOTTOM

PORT OF SAN FRANCISCO 150 YEARS

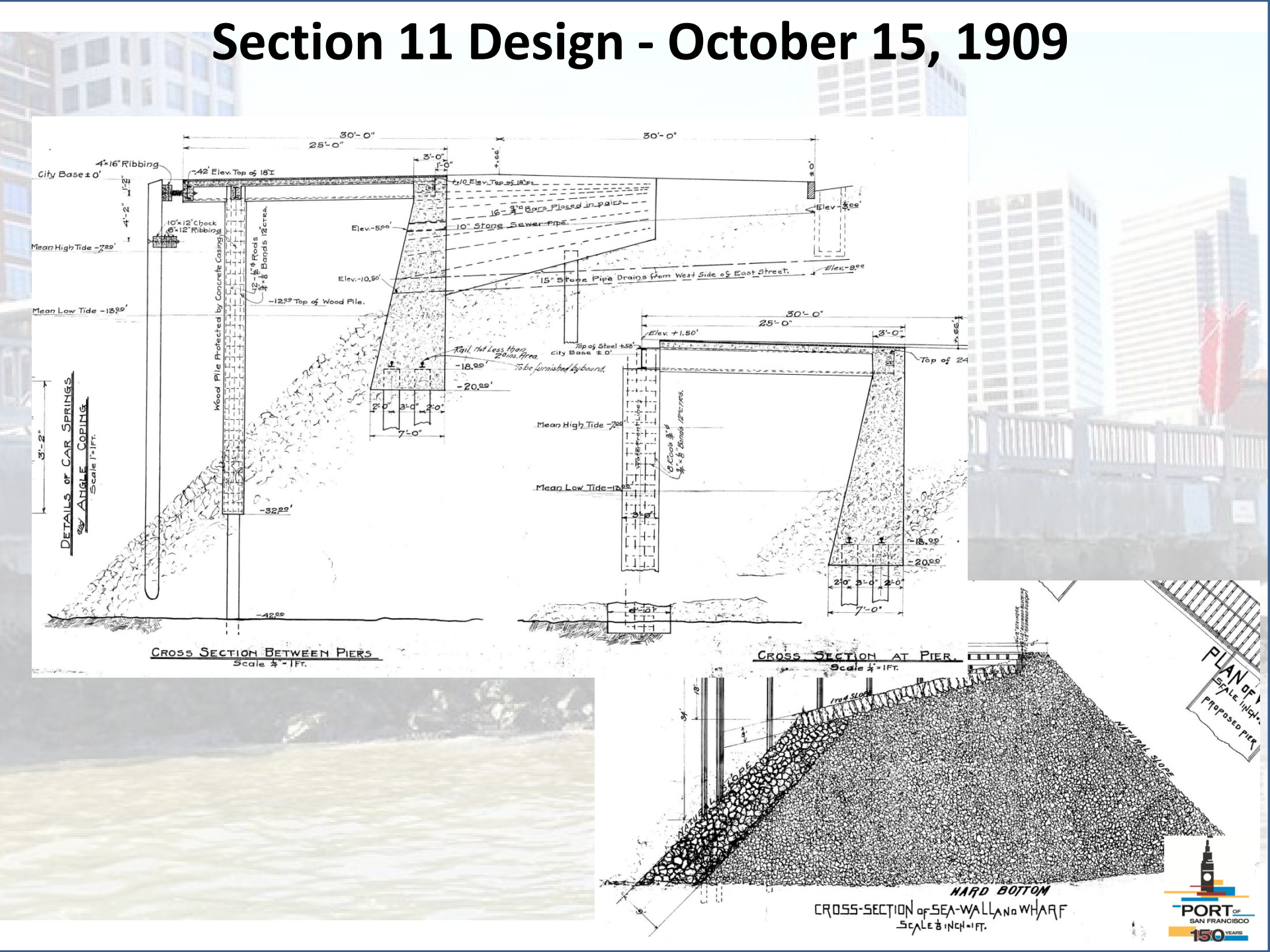


Section 11 Design - October 15, 1909

The image contains three main architectural drawings:

- CROSS SECTION BETWEEN PIERS:** This drawing shows a cross-section of the structure between two piers. It includes a concrete casing, a wood pile, and a steel trestle. The drawing is labeled with dimensions such as 25'-0", 30'-0", and 3'-0". It also shows elevation markers for Mean High Tide (-7.20') and Mean Low Tide (-13.20'). A detail of the car springs and angle coping is shown on the left.
- CROSS SECTION AT PIER:** This drawing shows a cross-section of the structure at a pier. It includes a concrete casing, a wood pile, and a steel trestle. The drawing is labeled with dimensions such as 25'-0", 30'-0", and 3'-0". It also shows elevation markers for Mean High Tide (-7.20') and Mean Low Tide (-13.20').
- CROSS-SECTION OF SEA-WALL AND WHARF:** This drawing shows a cross-section of the sea-wall and wharf. It includes a concrete casing, a wood pile, and a steel trestle. The drawing is labeled with dimensions such as 25'-0", 30'-0", and 3'-0". It also shows elevation markers for Mean High Tide (-7.20') and Mean Low Tide (-13.20').

The drawings are dated October 15, 1909, and are for Section 11 Design.



Section 11 Design - October 15, 1909

CROSS SECTION BETWEEN PIERS
Scale 1/4" = 1 FT.

CROSS SECTION AT PIER
Scale 1/4" = 1 FT.

CROSS-SECTION OF SEA-WALL AND WHARF
Scale 3/8" = 1 FT.

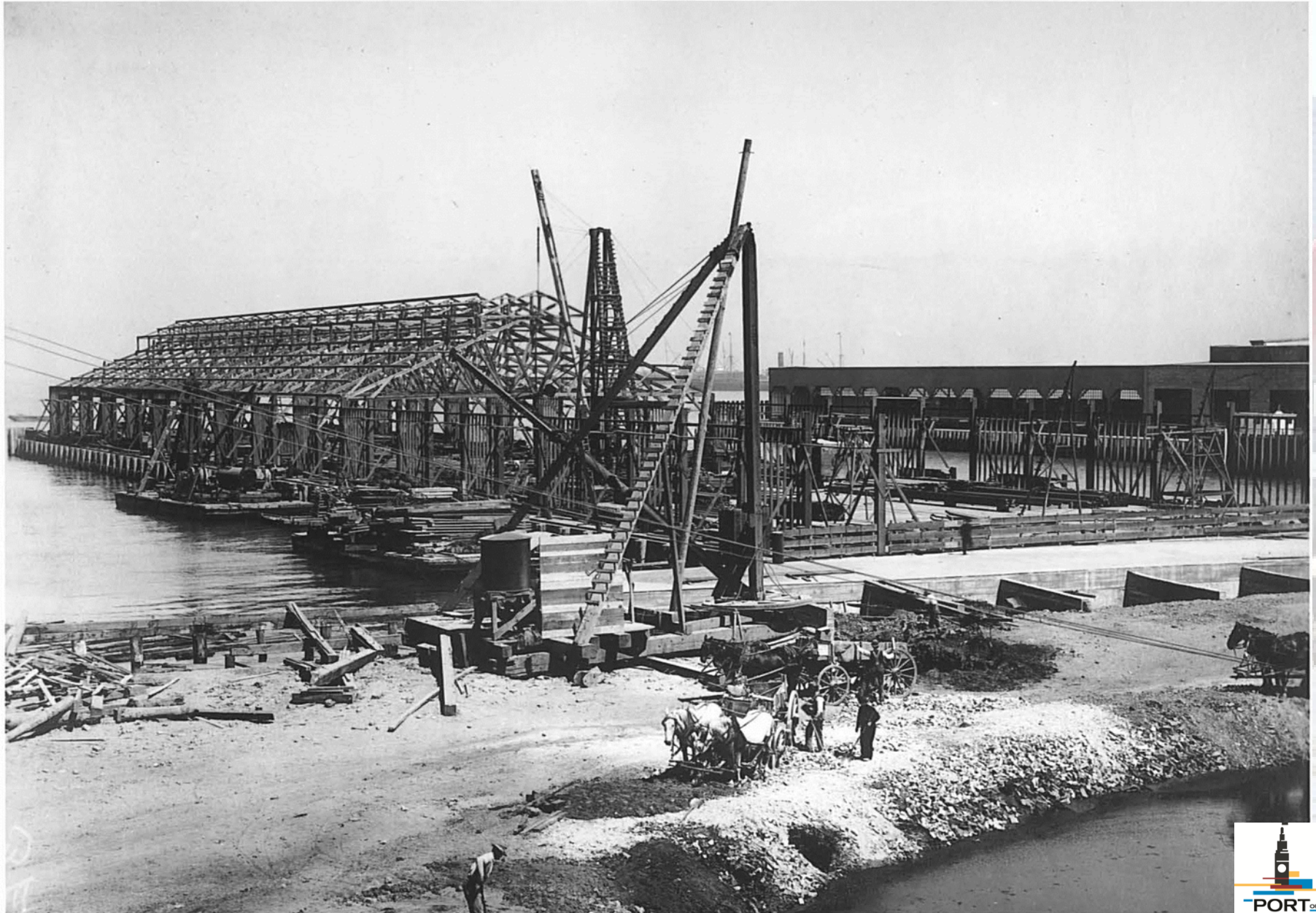
DETAILS OF CAR SPRINGS AND ANGLE COPING
Scale 1/2" = 1 FT.

PLAN OF PROPOSED PIER
Scale 1/4" = 1 FT.

HARD BOTTOM

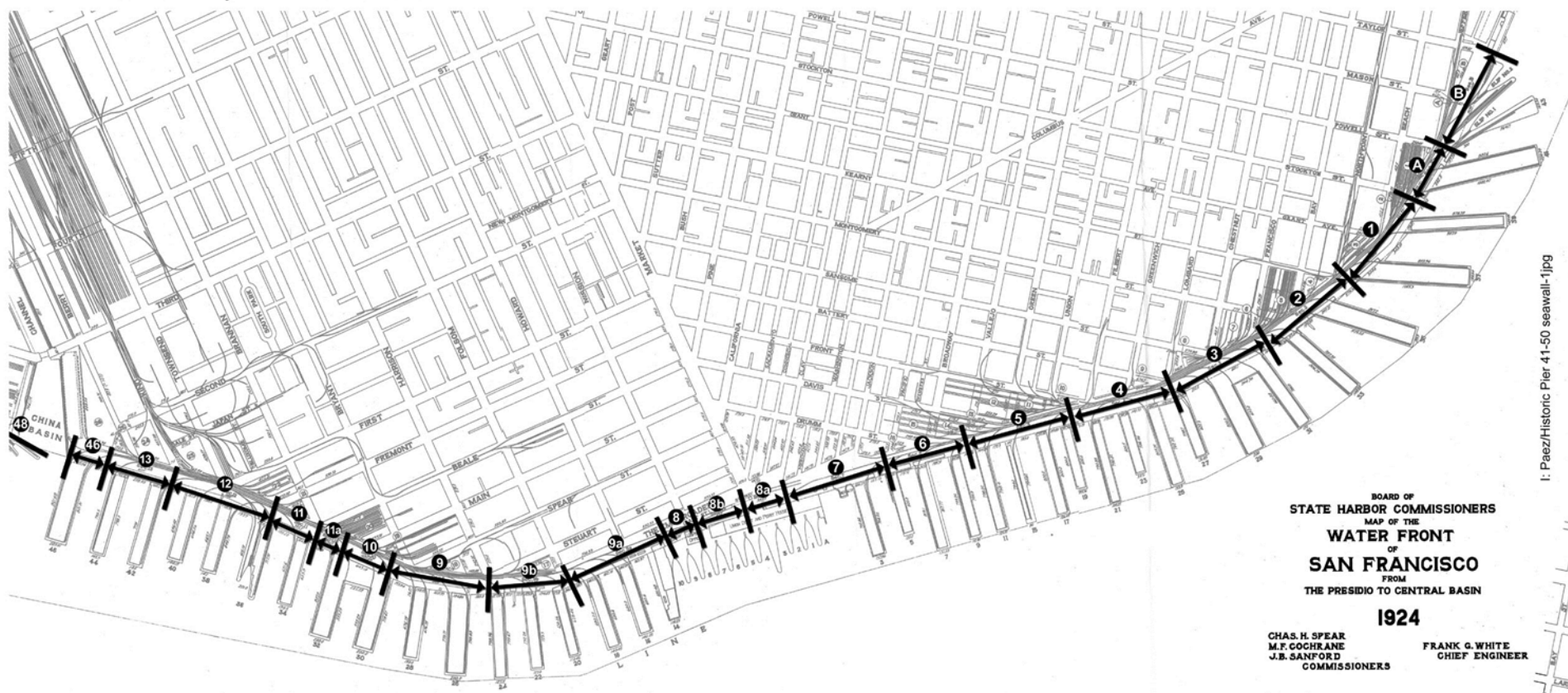
PORT OF SAN FRANCISCO 150 YEARS

Section 11 Construction – June 8, 1910



Section 11 - Today





22 Historic Seawall Sections – 1924 Map

B, A, 1, 2, 3, 4, 5, 6, 7, 8a, 8b, 8, 9a, 9b, 9, 10, 11a, 11,
12, 13, 46, 48

55 Combinations of Bulkheads and Wharves

Vulnerability Study Contract Information

Prime Consultant - GHD/GTC Joint Venture

GHD – Multinational Firm, SF Office

GTC – SF LBE Geotechnical Firm

25% LBE Subconsultant Participation Goal

\$425,000 Contract

Target Completion early 2016

Vulnerability Study Contract Scope

High Level Screening Approach based on
Available Information

Phase 1: Comprehensive Information Review
and Evaluation (COMPLETE)

Phase 2: Vulnerability Analysis (UNDERWAY)

Phase 3: Mitigation Alternatives and
Recommendations (UNDERWAY)

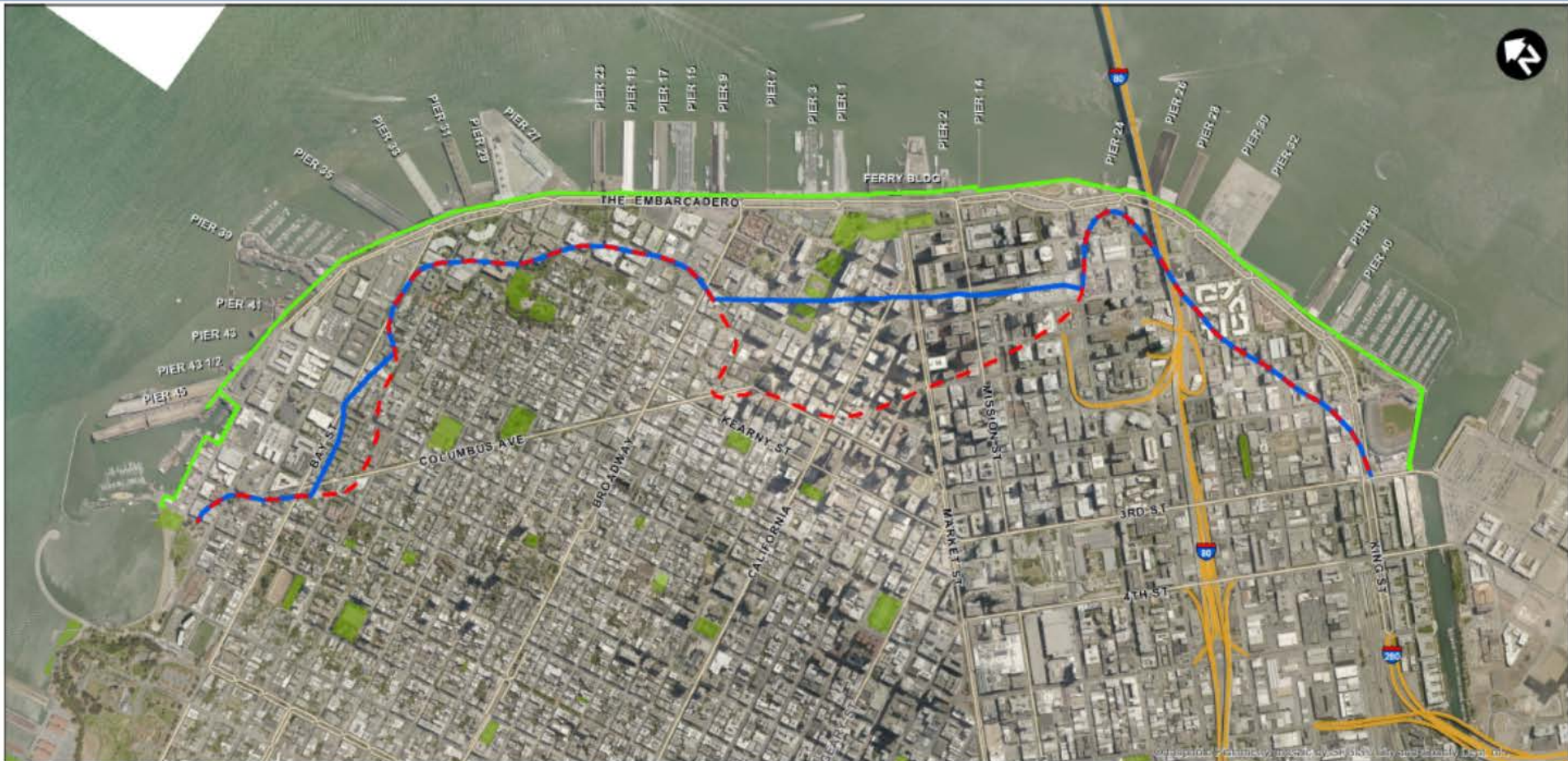
Peer Review by Separate Contract (PENDING)

Vulnerability Study Contract Scope




- Establish Zone of Influence
- Develop detailed subsurface maps & profiles
- Generate site specific earthquake hazard ground shaking data
- Analyze rock dike for stability and upland areas for lateral spreading and settlement
- Structural analysis of select bulkhead walls and wharves

Vulnerability Study Contract Scope

- Map utilities and assess impacts
- Assess post earthquake flood hazards
- High level economic impact analysis
- Develop conceptual level mitigation measures
- Rank and prioritize areas for mitigation and/or detailed investigation



LEGEND

-  Seawall Bulkhead
-  Lateral Spread Hazard Boundary (HLA et al., 1992)
-  Project Study Area, within 1200 feet of the Seawall Bulkhead and within the Lateral Spread Hazard Zone

0 500 1,000 2,000 Feet

Lateral Spread Boundary Source: Harding Lawson Associates (HLA), Dames & Moore, Kennedy/Jenks/Chilton, EGE Engineering, 1992. Final Report, Liquefaction Study, North Beach, Embarcadero Waterfront, South Beach, and Upper Mission Creek Area, San Francisco, California.

Zone of Influence – Study Boundary

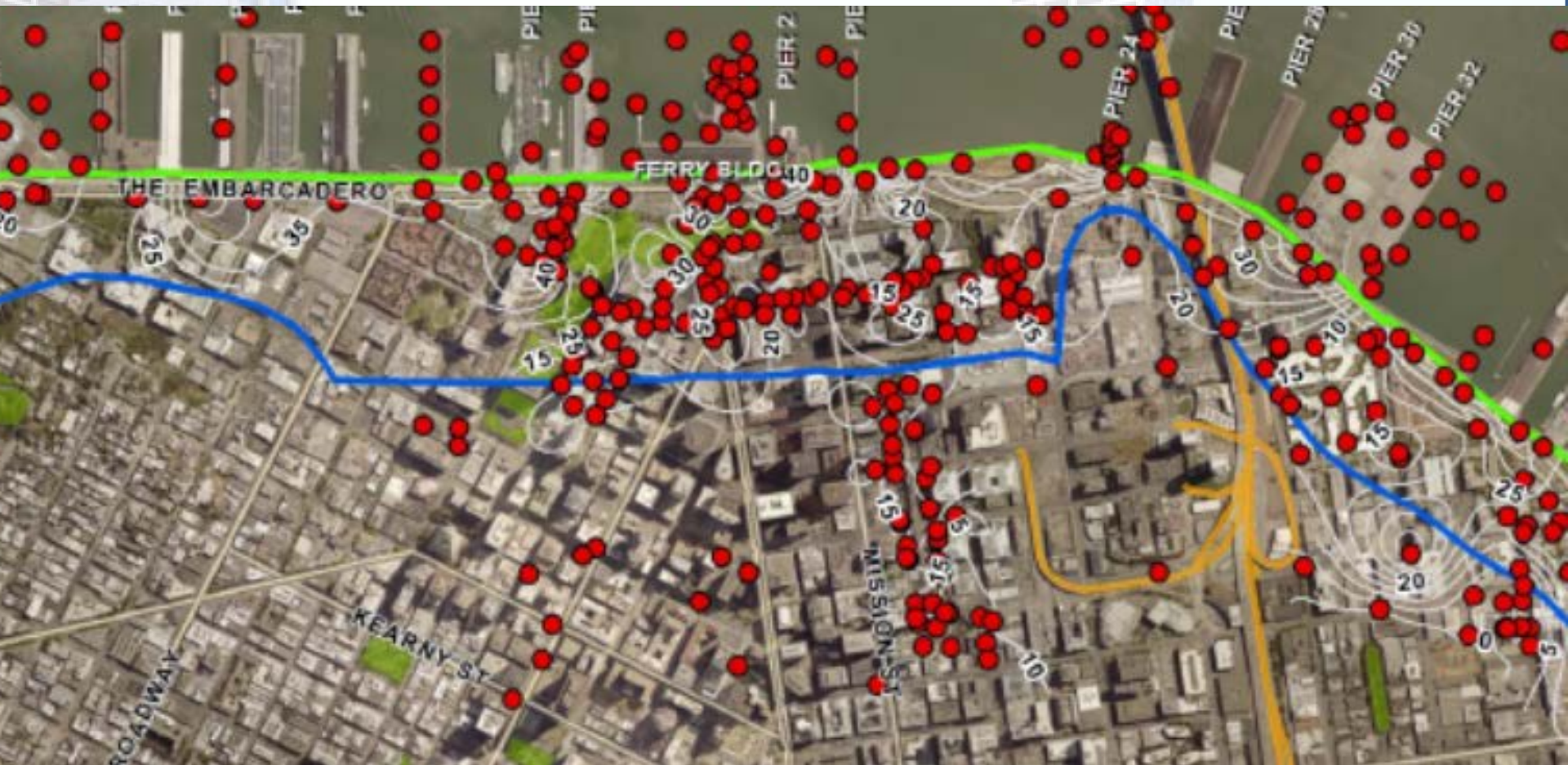


LEGEND

-  Seawall Bulkhead
-  Zone of Influence, within 1200 feet of the Seawall Bulkhead and within the Lateral Spread Hazard Zone
-  Historic Geotechnical Borings
-  5 foot Contour of Thickness of Artificial Fill

0 600 1,200 2,400 Feet

Subsurface Mapping – Artificial Fill Thickness



Subsurface Mapping – Artificial Fill Thickness



LEGEND

Seawall Bulkhead

Zone of Influence, within 1200 feet of the Seawall Bulkhead and within the Lateral Spread Hazard Zone

Historic Geotechnical Borings

10 foot Contours of Thickness of Young Bay Mud

0 600 1,200 2,400 Feet

Subsurface Mapping – Young Bay Mud Thickness



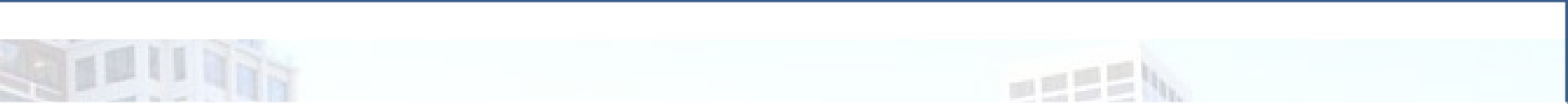
Subsurface Mapping – Young Bay Mud Thickness



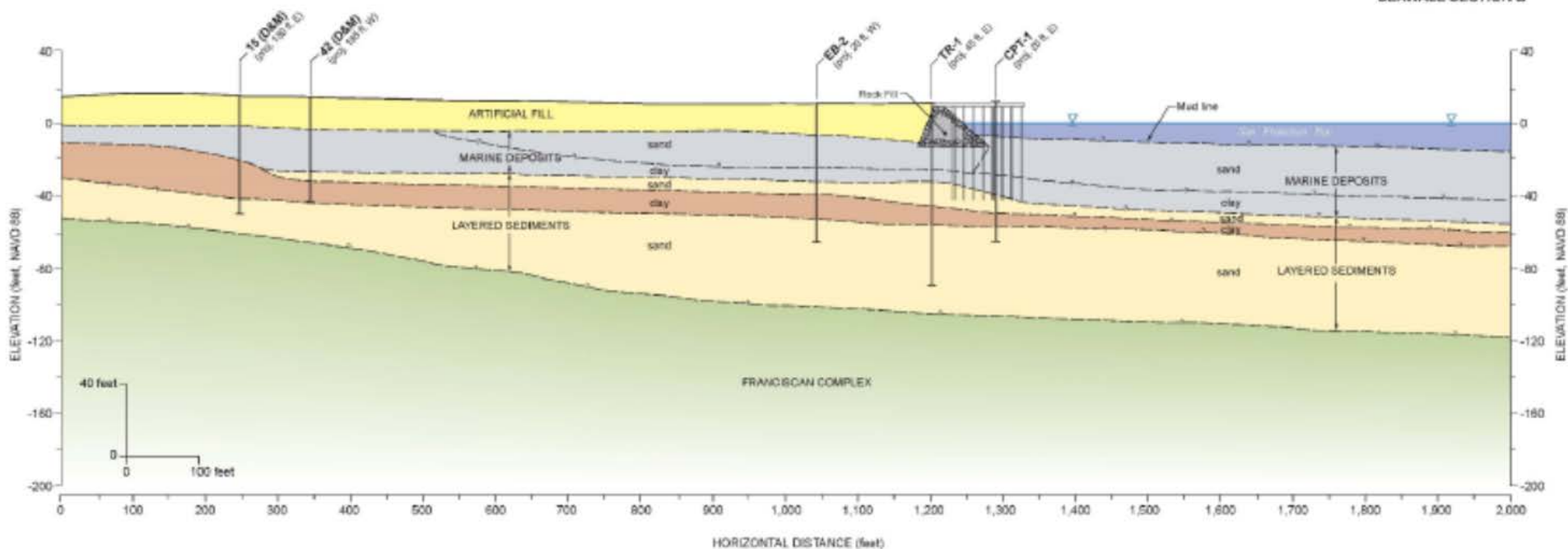
Subsurface Mapping – Bedrock Elevation



Subsurface Mapping – Bedrock Elevation



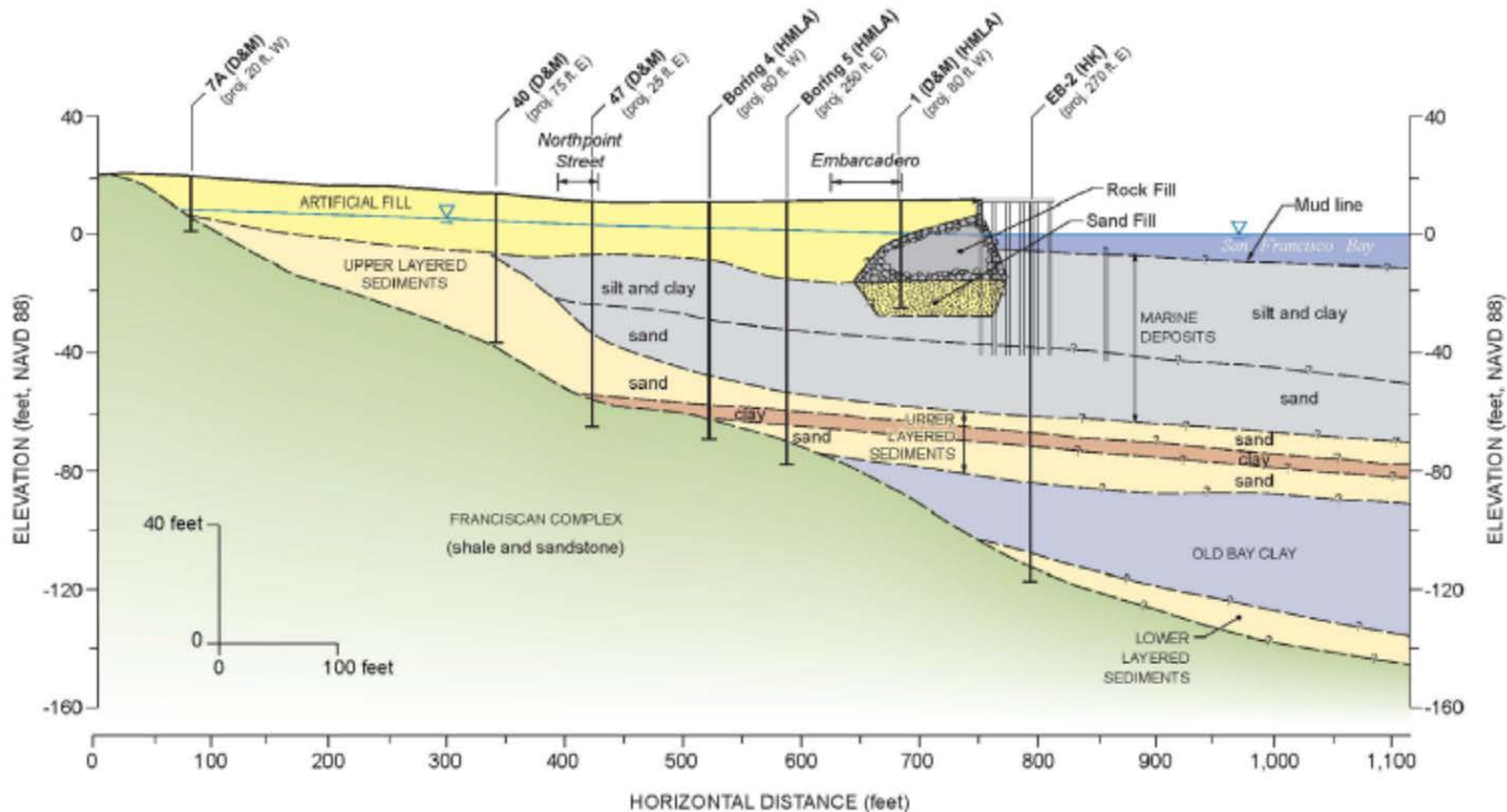
GEOLOGIC PROFILE
THROUGH
SEAWALL SECTION B



Representative Sections

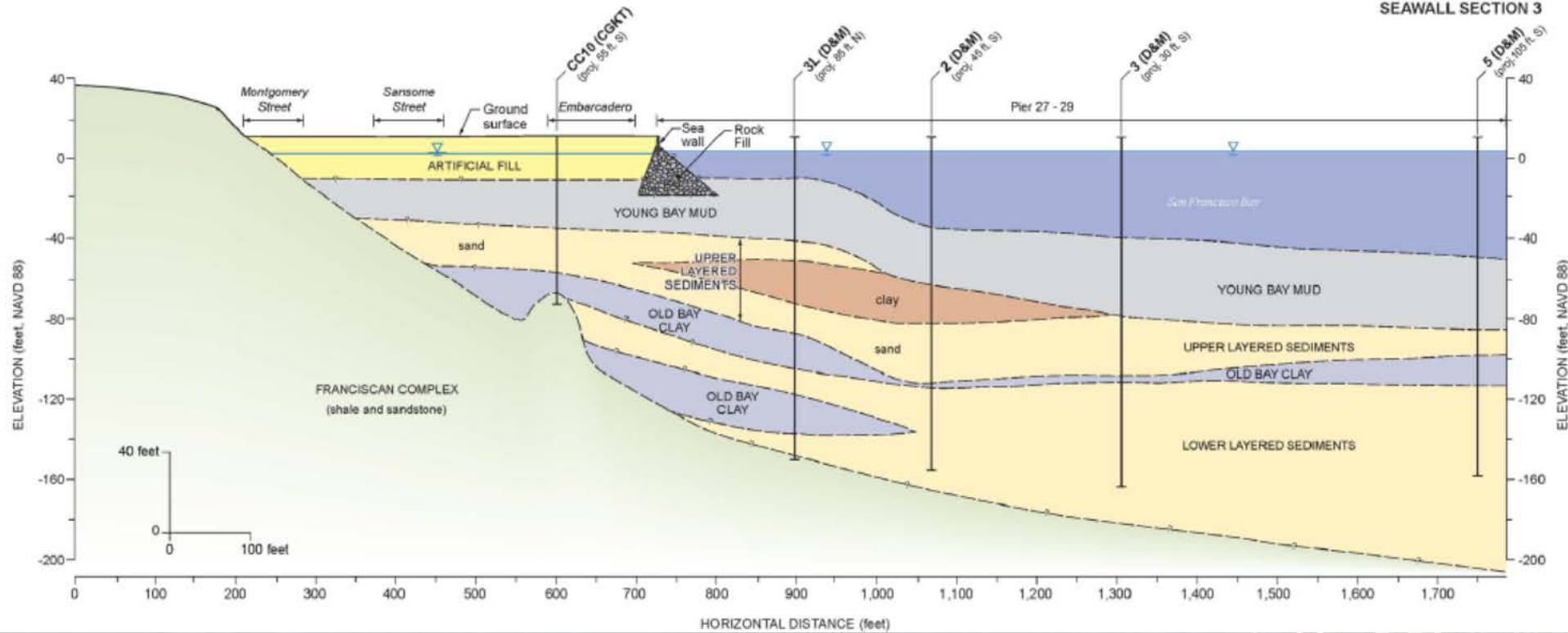
Section B - Vicinity of Pier 43

GEOLOGIC PROFILE THROUGH SEAWALL SECTION 1



Representative Sections Section 1 - Vicinity of Pier 39

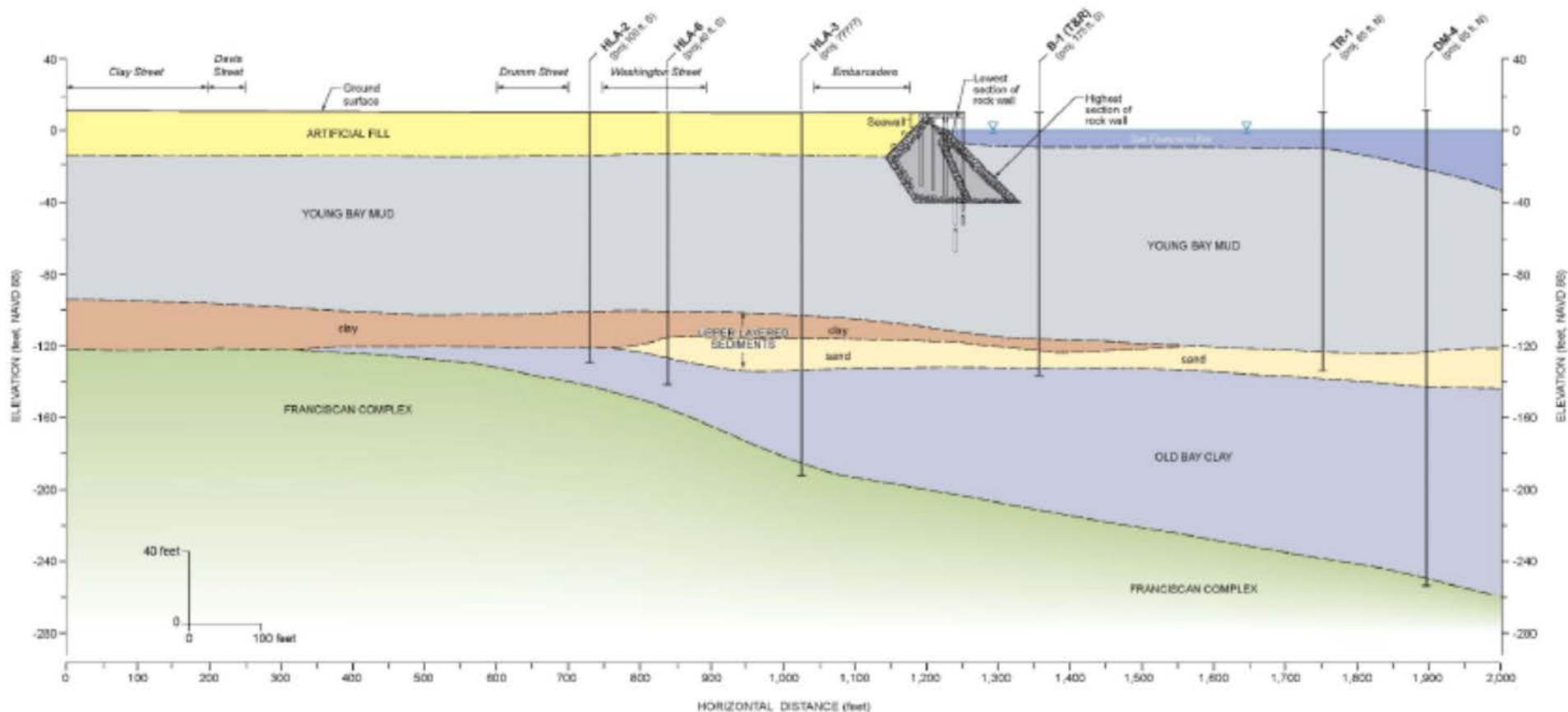
**GEOLOGIC PROFILE
THROUGH
SEAWALL SECTION 3**



Representative Sections

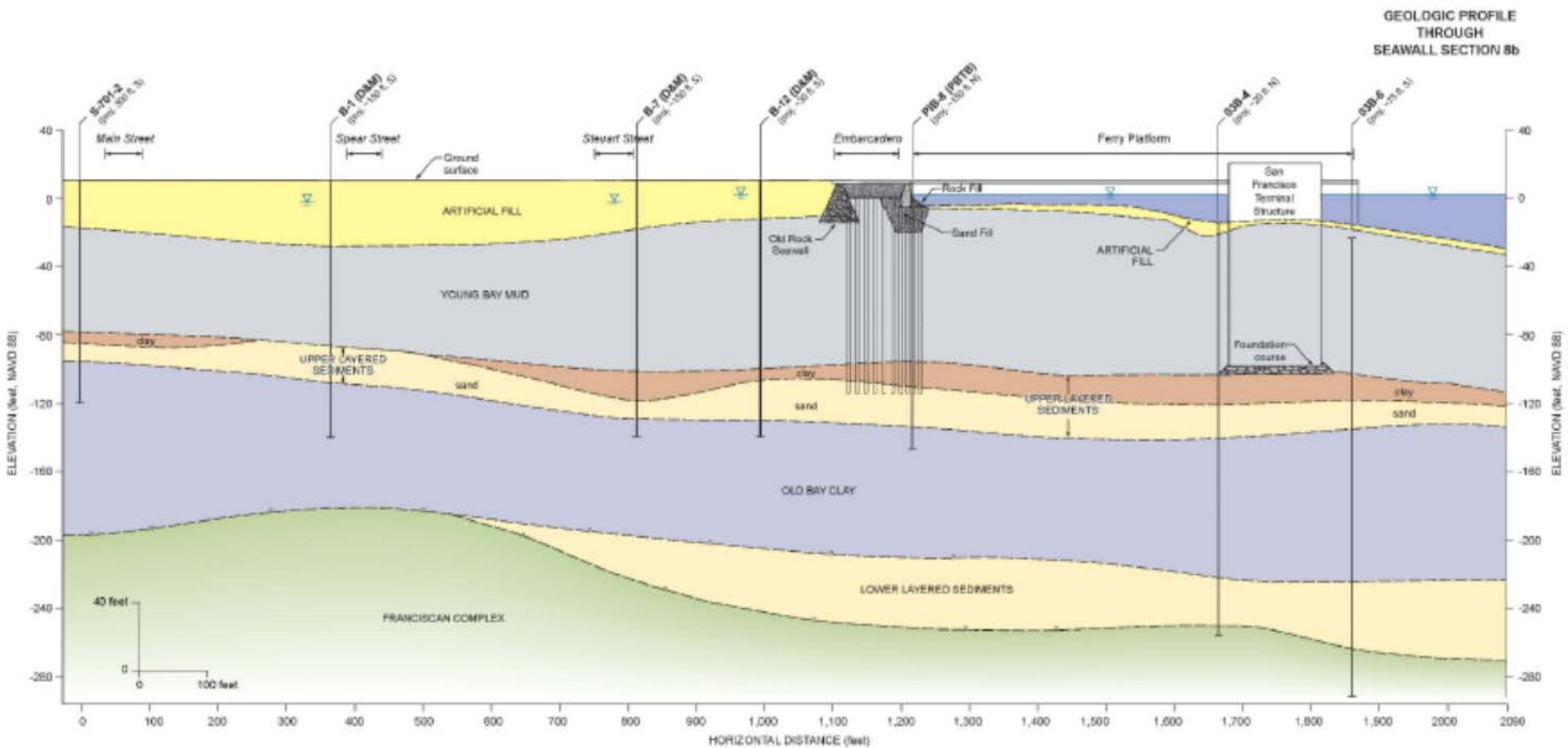
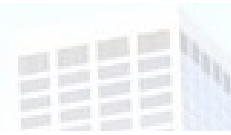
Section 3 - Vicinity of Pier 29

GEOLOGIC PROFILE
THROUGH
SEAWALL SECTION 7



Representative Sections

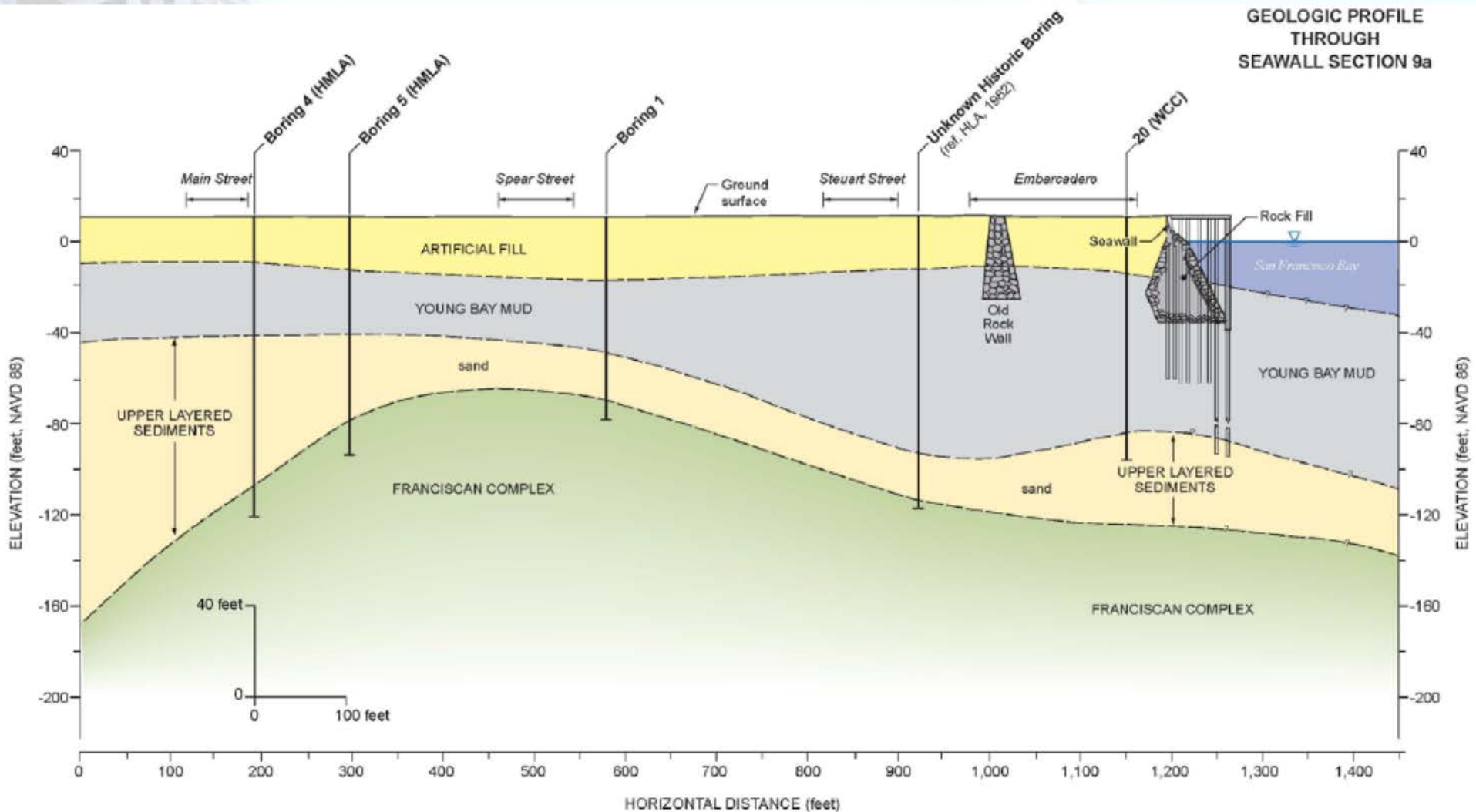
Section 7 - Vicinity of Pier 3



Representative Sections

Section 8b - Vicinity of Ferry Building

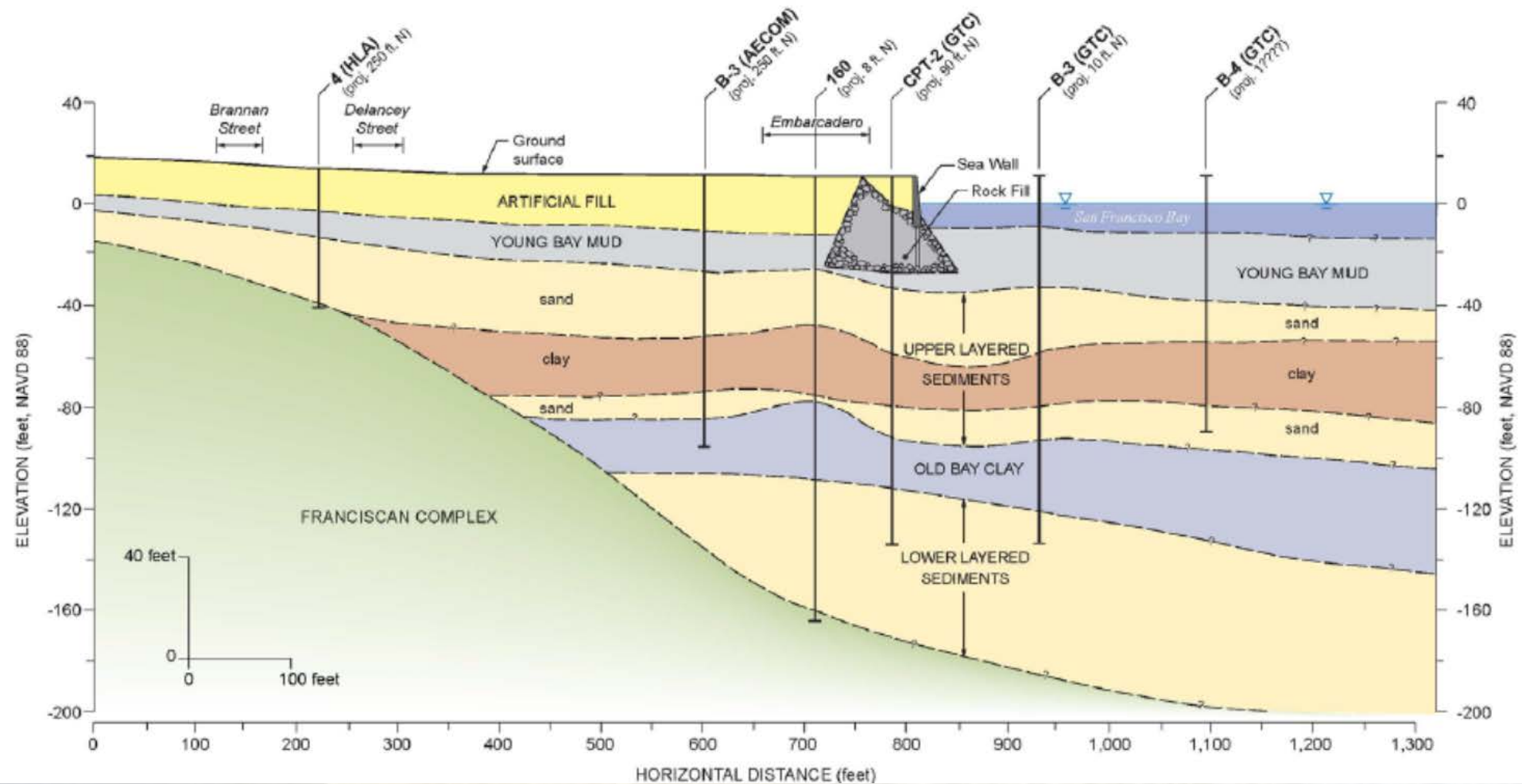
**GEOLOGIC PROFILE
THROUGH
SEAWALL SECTION 9a**



Representative Sections

Section 9a – Vicinity of Howard St.

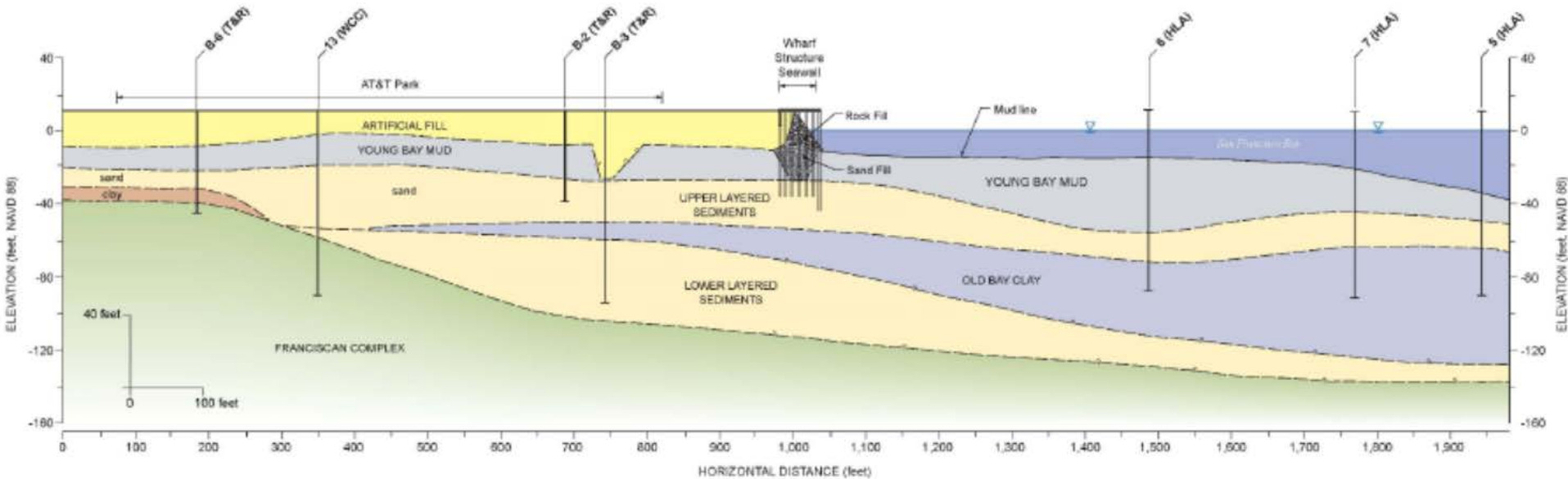
GEOLOGIC PROFILE
THROUGH
SEAWALL SECTION 12



Representative Sections

Section 12 – Vicinity of Pier 38

GEOLOGIC PROFILE
THROUGH
SEAWALL SECTION 46



Representative Sections

Section 46 – Vicinity of AT&T Park

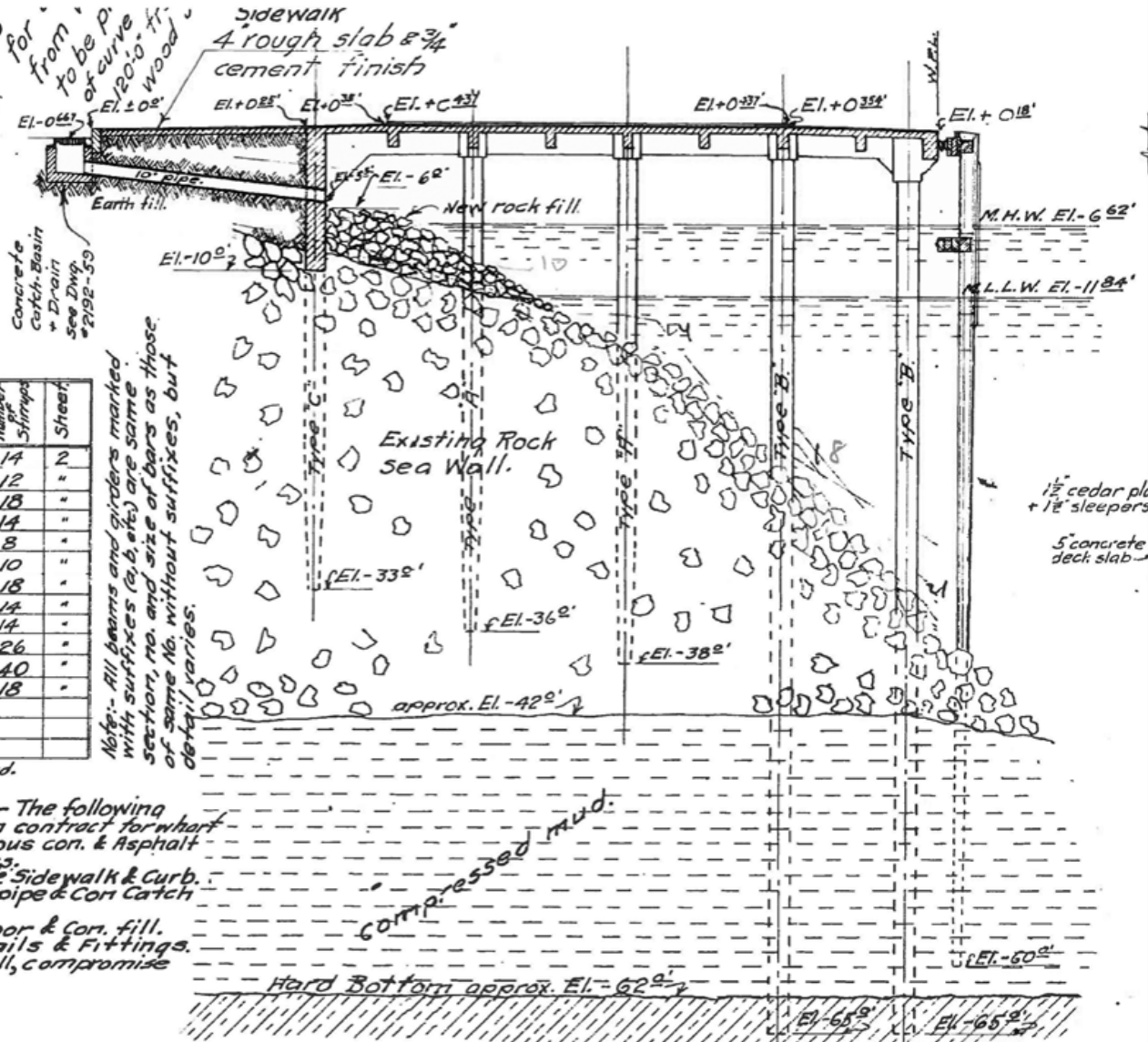
1. north,
11-9-1

Width	Depth	Main Rein.		Number of Stirrups	Sheet
		No	Size		
0'	23"	4	$\frac{3}{4}$ "	14	2
0'	23"	4	$\frac{3}{4}$ "	12	"
1'	42"	4	1"	18	"
0'	23"	4	$\frac{3}{4}$ "	14	"
5"	20"	3	$\frac{3}{4}$ "	8	"
5"	20"	3	$\frac{3}{4}$ "	10	"
3"	42"	3	1"	18	"
2"	23"	4	$\frac{1}{2}$ "	14	"
2"	23"	4	$\frac{3}{4}$ "	14	"
6"	43"	3	1"	26	"
6"	43"	3	$\frac{1}{2}$ "	40	"
5"	42"	5	1"	18	"

rb line.

Note :- The following are not in contract for what Bituminous con. & Asphalt pavements.
Concrete Sidewalk & Curb.
10" Drain pipe & Corn Catch basin.
Cedar Floor & Corn. fill.
Track Rails & Fittings.
Earth Fill, compromise joints

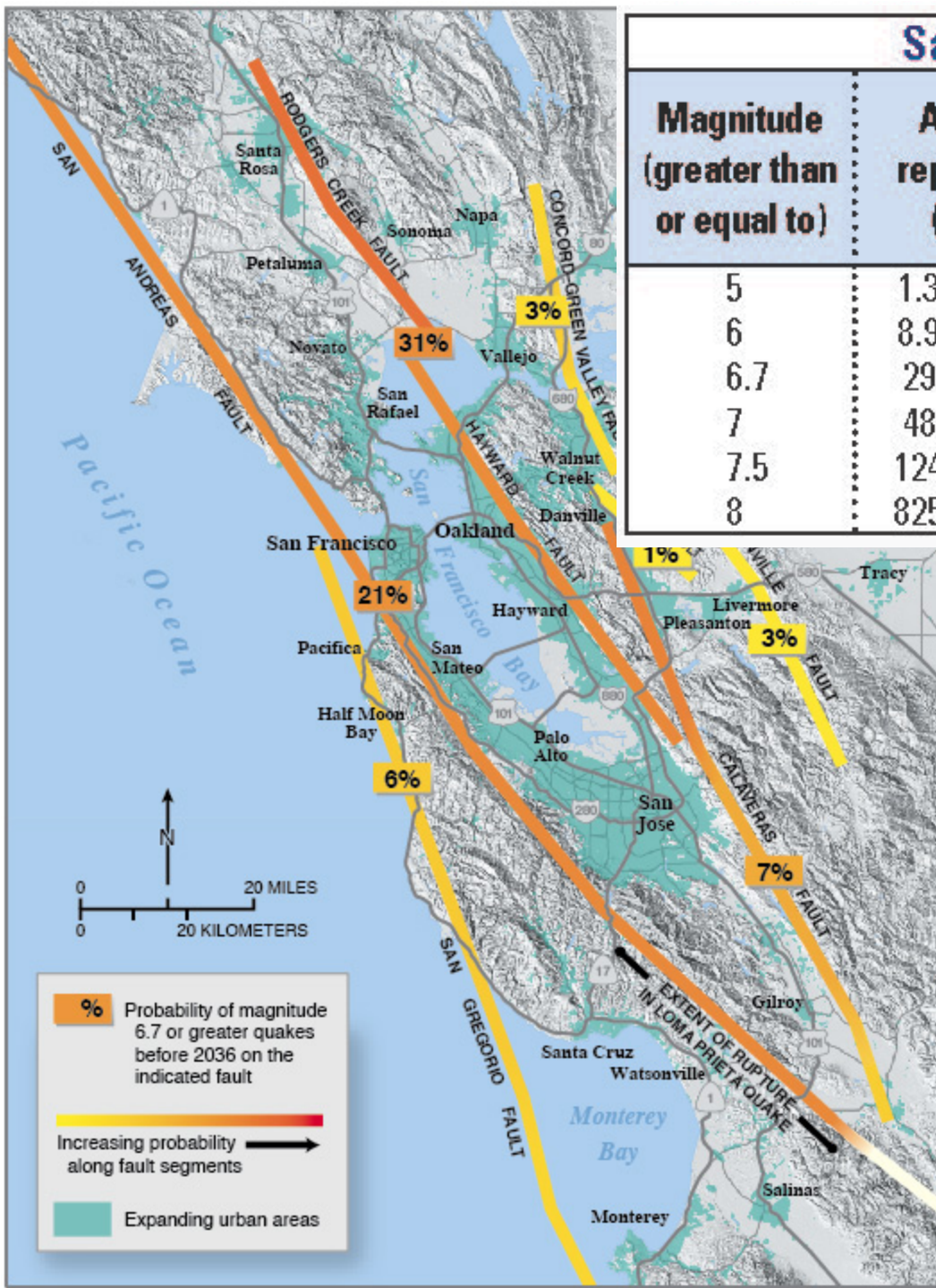
Note:- All beams and girders marked with suffixes (a, b, etc) are same section, no. and size of bars as those of same no. without suffixes, but detail varies.



Structural Sections

Bulkhead Wall & Wharf – Pier 9 Area





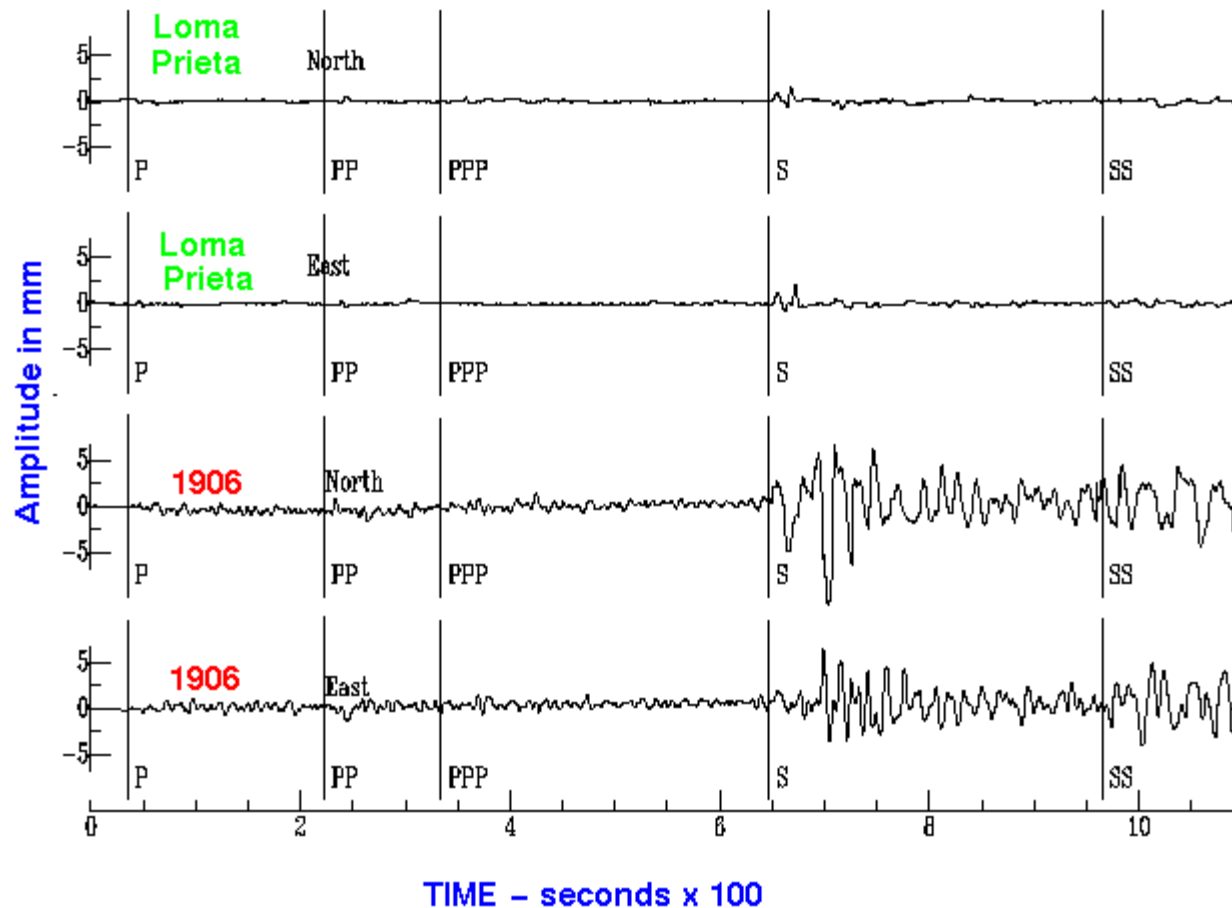
San Francisco region					
Magnitude (greater than or equal to)	Average repeat time (years)		30-year likelihood of one or more events		Readiness
5	1.3	(0.7)	100%	(1.0)	1.0
6	8.9	(1.0)	98%	(1.0)	1.0
6.7	29	(1.1)	72%	(1.1)	1.1
7	48	(0.9)	51%	(1.3)	1.1
7.5	124	(0.7)	20%	(1.6)	0.9
8	825	(0.7)	4%	(1.9)	1.0

USGS WORKING GROUP ON CALIFORNIA EARTHQUAKE PROBABILITIES 2014 UPDATE

**72% PROBABILITY OF
MAJOR EARTHQUAKE
BY 2044**

1906 vs 1989 Loma Prieta Earthquake Ground shaking recorded in Germany

Comparison of 1906 and Loma Prieta records at Gottingen, Germany



Waterfront Trends in SA0.2 versus ARP (Ground Surface)

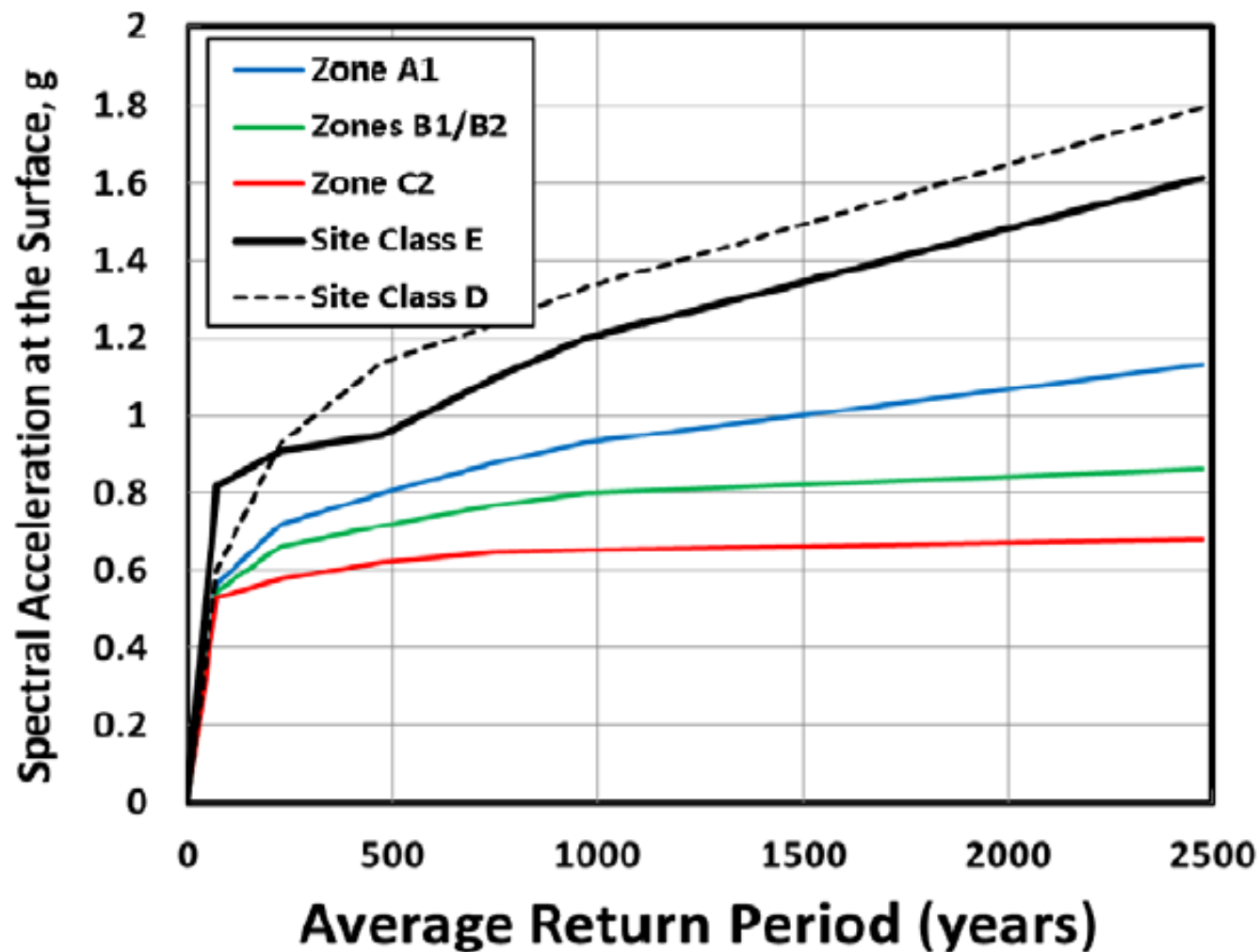


Figure 3-20: Trend of Ground Surface Spectral Acceleration at 0.2-second Period with Average Return Period.

Next Steps

- Complete Initial Draft of Vulnerability Results, end of 2015
- Peer Review, end of 2015
- Final Draft of Results & Recommendations early 2016
- Inform efforts to improve resiliency, Waterfront Land Use Plan Update, and Climate Change Planning

QUESTIONS

San Francisco - Brannan St Wharf CGS Sta 58559
Rcrd of Sun Aug 24, 2014 03:20:38.0 PDT
Frequency Band Processed: 8.0 secs to 40.0 Hz
CISN/CSMIP Preliminary Strong Motion Processing - Subject to Revision

