

CTC Item 26: Innovations in Transportation – San Francisco Oakland Bay Bridge Implosions

California Transportation Commission
December 6, 2017

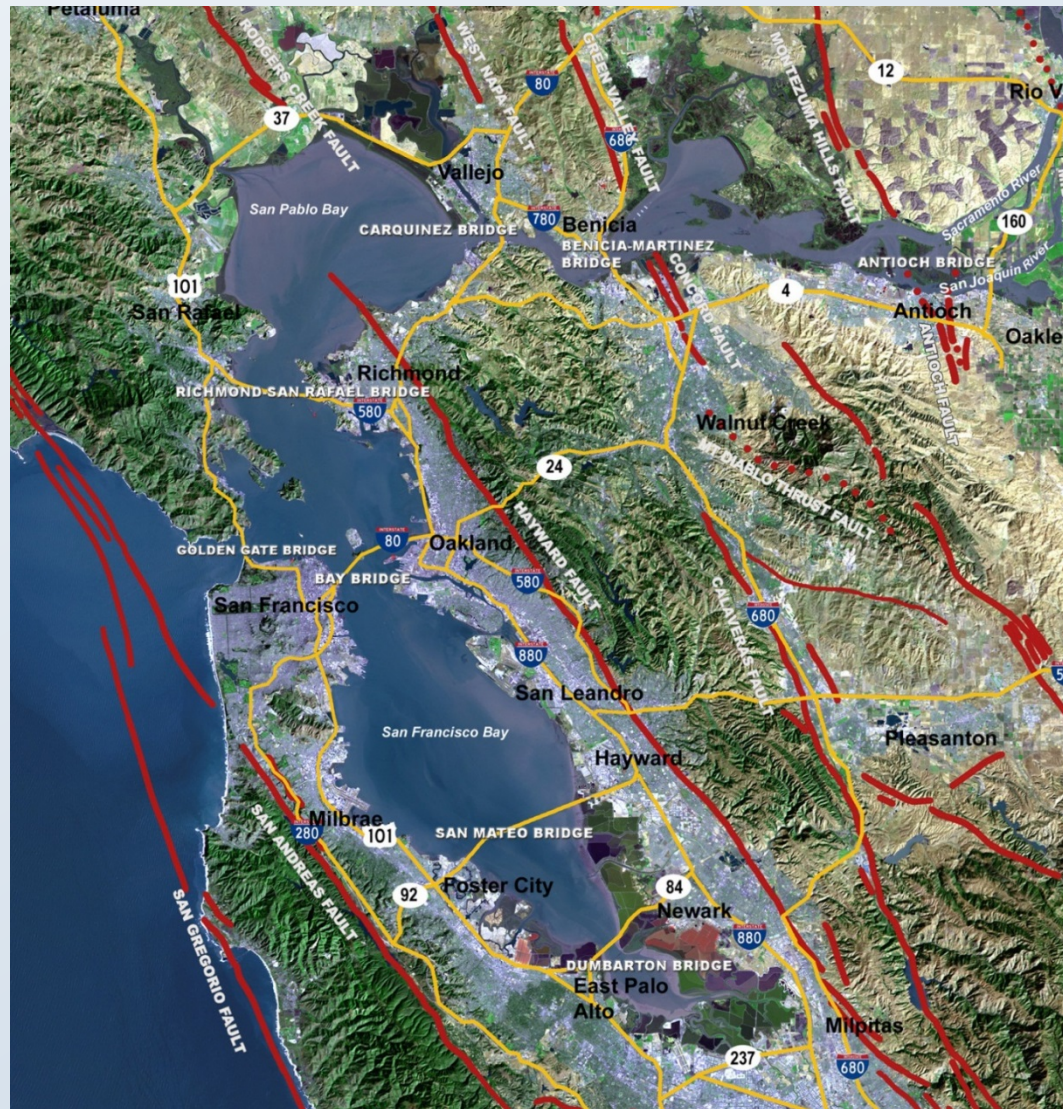


This is how it started



**SFOBB Pier E9 Following the
1989 Loma Prieta Earthquake**

Bay Area Faults and Major Roadways



Earthquake Reports

COMPETING AGAINST TIME

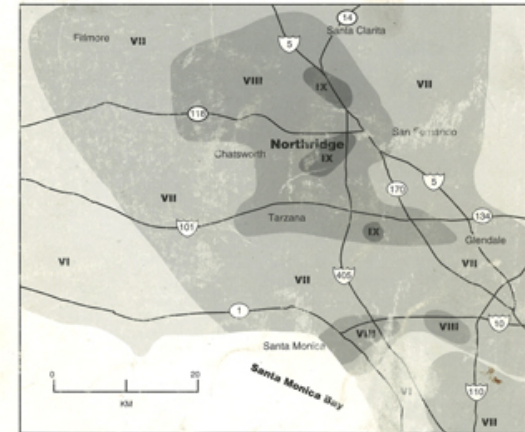


Report to Governor George Deukmejian
from
The Governor's Board of Inquiry
on the 1989 Loma Prieta Earthquake

George W. Housner, Chairman
May 1990

THE CONTINUING CHALLENGE

THE NORTHRIDGE EARTHQUAKE OF JANUARY 17, 1994



Report to the Director,
California Department of Transportation
by the
Seismic Advisory Board

George W. Housner, Chairman
October 1994

Innovation was the Direction Following the 1994 Northridge EQ

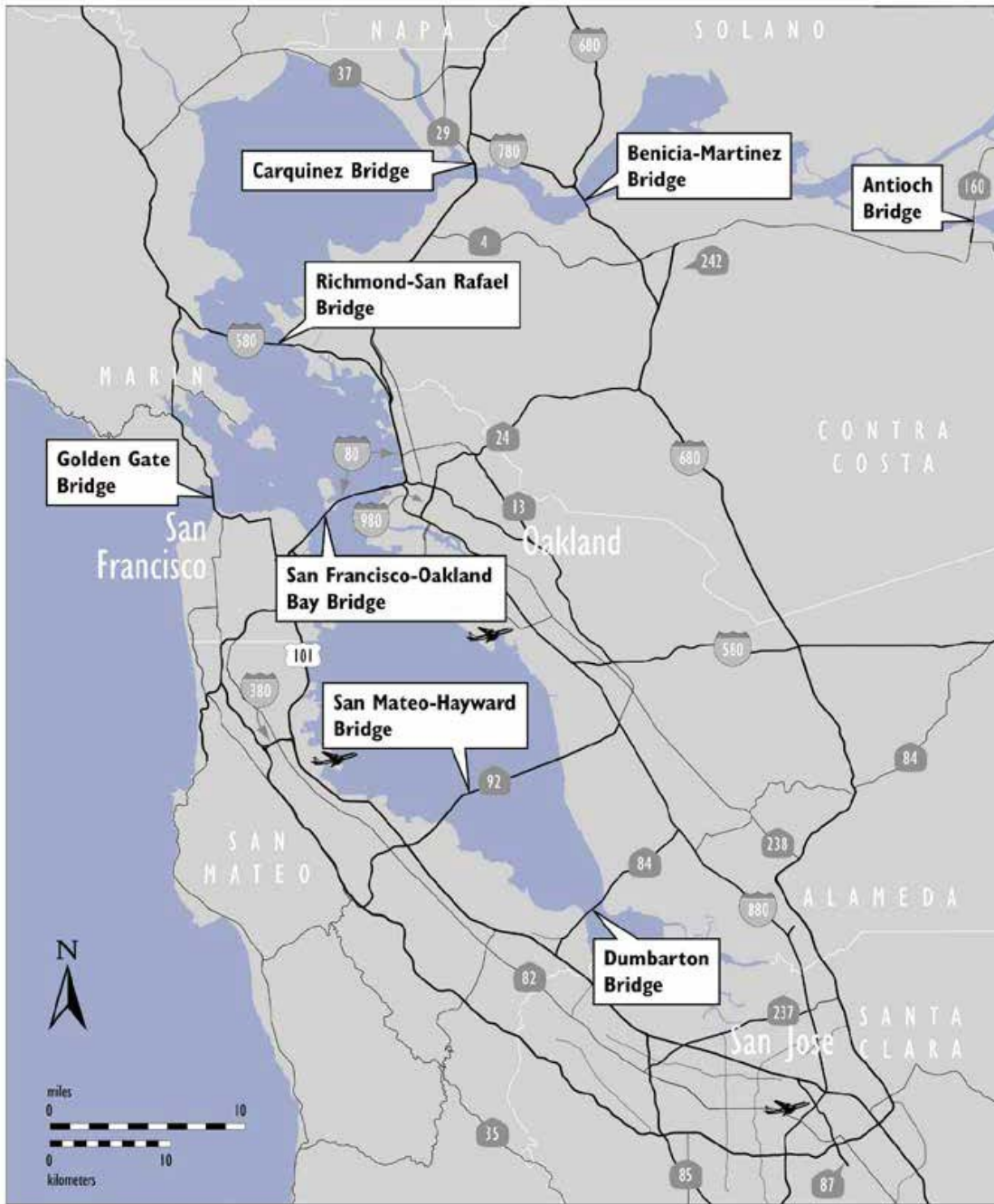


Brian Maroney, PE, Dr. Engr.
Chief Bridge Engineer for the Toll Bridge Seismic Retrofit Program
Deputy Toll Bridge Program Manager
California Department of Transportation



THE SAN FRANCISCO-OAKLAND
BAY BRIDGE
SEISMIC SAFETY PROJECTS

CALTRANS BAY AREA TOLL AUTHORITY CALIFORNIA TRANSPORTATION COMMISSION

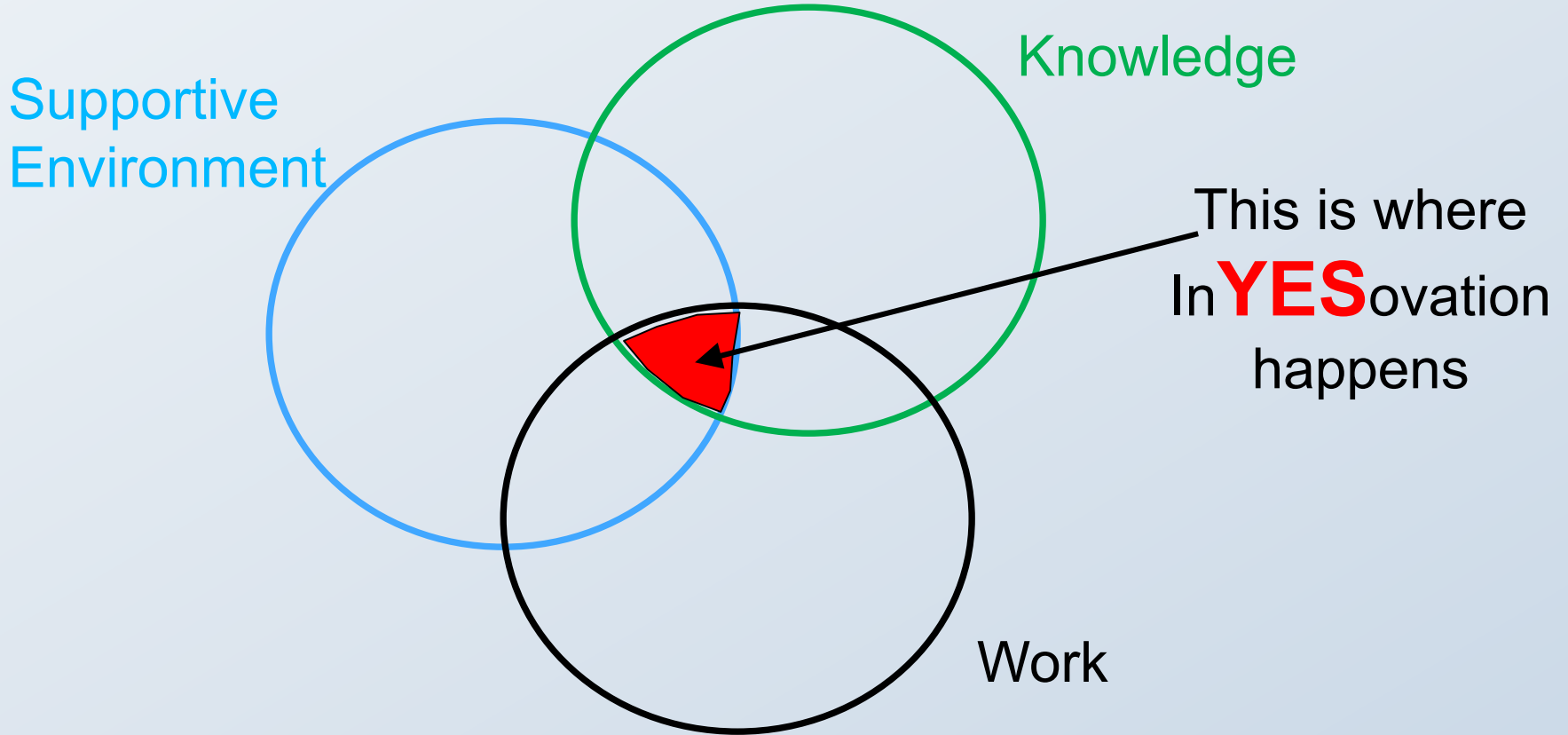


Examples of Innovation in the Toll Bridge Program



- The Toll Bridge Program
(from LP to NR earthquakes)
- AB144
- TBPOC
- Weekly cabinet Meetings
(environmental, design,
construction, PM)
- Peer Review in Design & Construction
(SFOBB East Spans, Dumbarton &
Antioch)
- Pre-bid Contractor Technical Outreach
- Pre-bid fabricator audits
- Pre-bid engineering approval
- (YBI rollout-rollin, OTD SSD, Cantilever)
- Pier E3 Implosion Demonstration Project
- Pile Driving Demonstration Project
- Caged Fish Study
- Pile Driving Energy Attenuator and
Demonstration
- Blast Attenuation System
- Probabilistic Seismic Ground Motions (SFOBB
East Spans, Dumbarton, Antioch and now spreading)
- Probabilistic Estimating
- High Performance Concrete (but not exotic)
- A706M Reinforcing Steel
- Large Diameter Battered Piles to control
Seismic Motions
- Pile tip Acceptance Criteria
- Overlapping staged Construction Contracts
- Quarterly Reports to the Legislature
- Concept of Project & Program Contingency
- Pier 7 (“Campus Concept”)
- Group Environmental Resource Agency
Meetings
- Contractor-Constructed proto-types and
proof tests
- BRIM (bridge information Management)
- Post-Future EQ User’s Manual
- Lane-by-Lane Deck Joint
- ...and many many more.

~~Innovation~~ Venn Diagram



The Environment Was of Extreme Value to All Involved



Cantilever





THE SAN FRANCISCO-OAKLAND
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CALTRANS BAY AREA TOLL AUTHORITY CALIFORNIA TRANSPORTATION COMMISSION



10/08/2014

504' Spans Being Prepared for Lowering Without a Single Pile



504 Truss on Two Barges



504' Spans Original Construction

2-18-35

SPAN E-8

7-459



288 Truss on Solid Piers



288 Truss on 2 floating Barges



288' Spans Original Construction

11-7-34

288 Ft. Span E-16

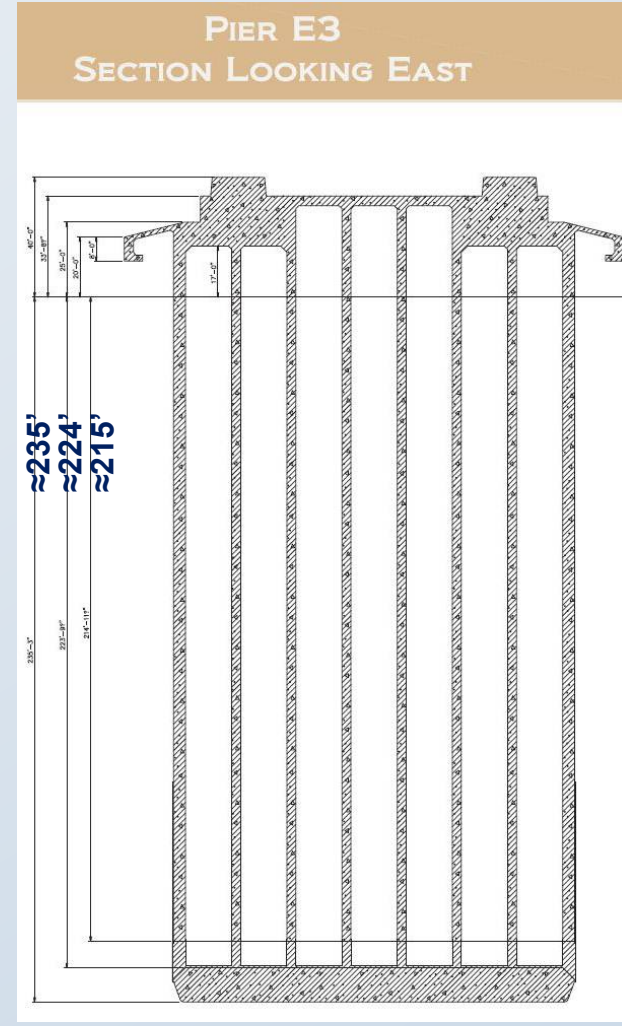
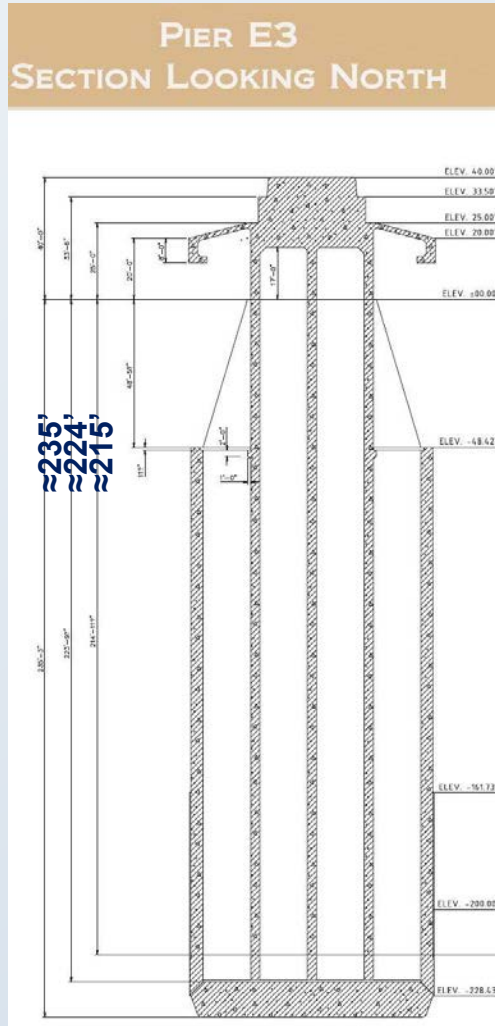
7-167

Work continues in
cantilever beyond the
temporary bent to
reach the next pier



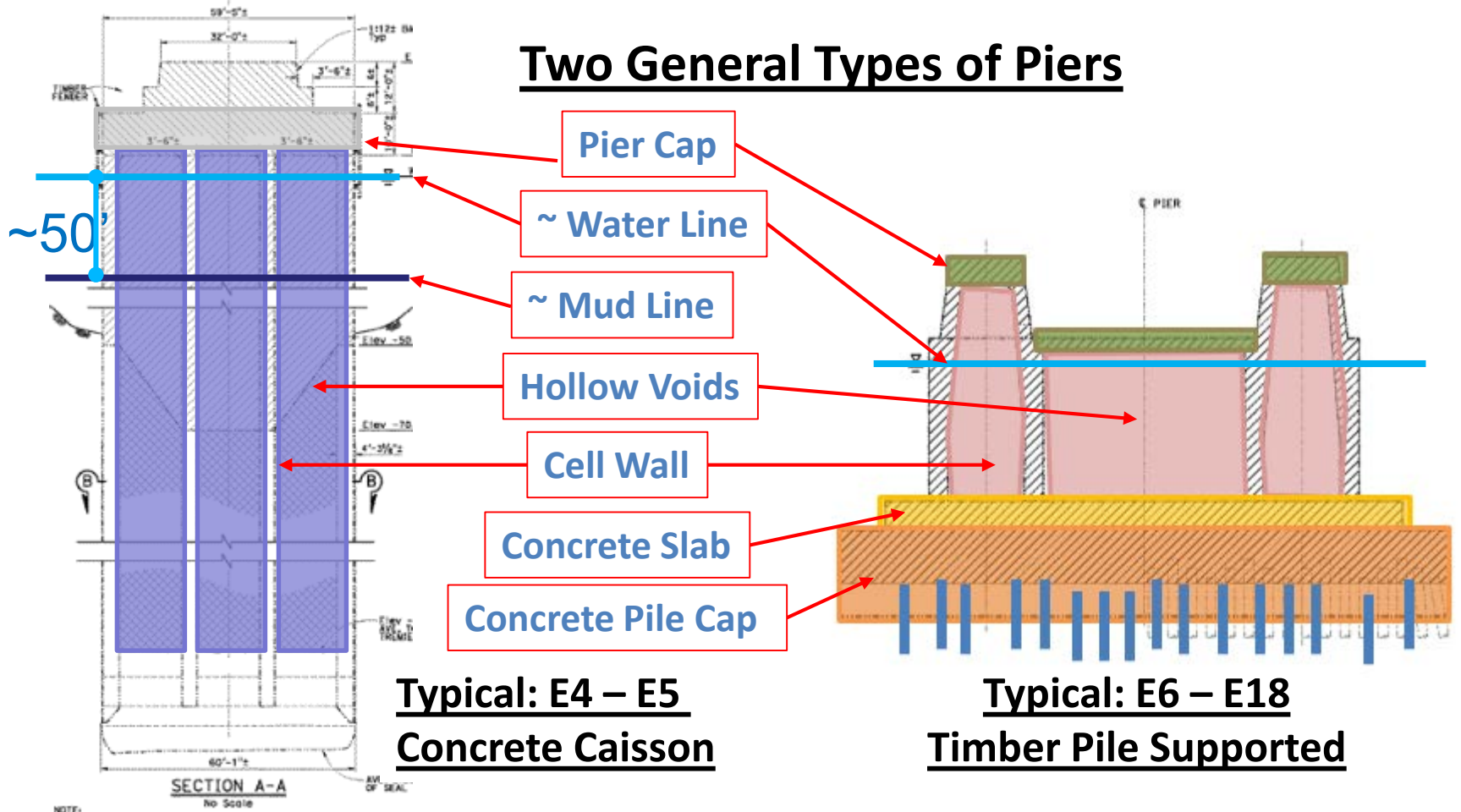
Temporary bent

Pier E3



Foundations Types

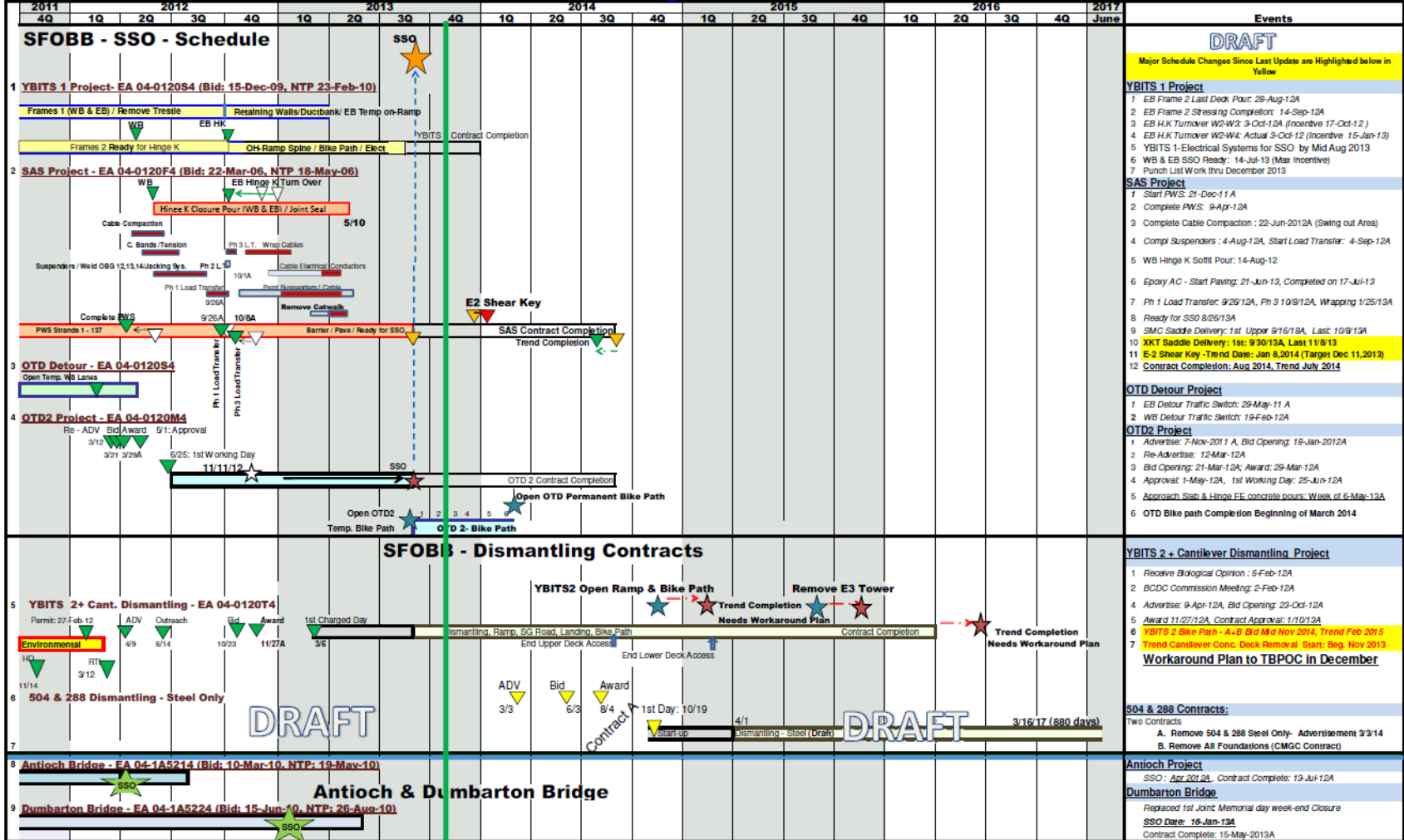
Two General Types of Piers



Weekly Schedule Updates

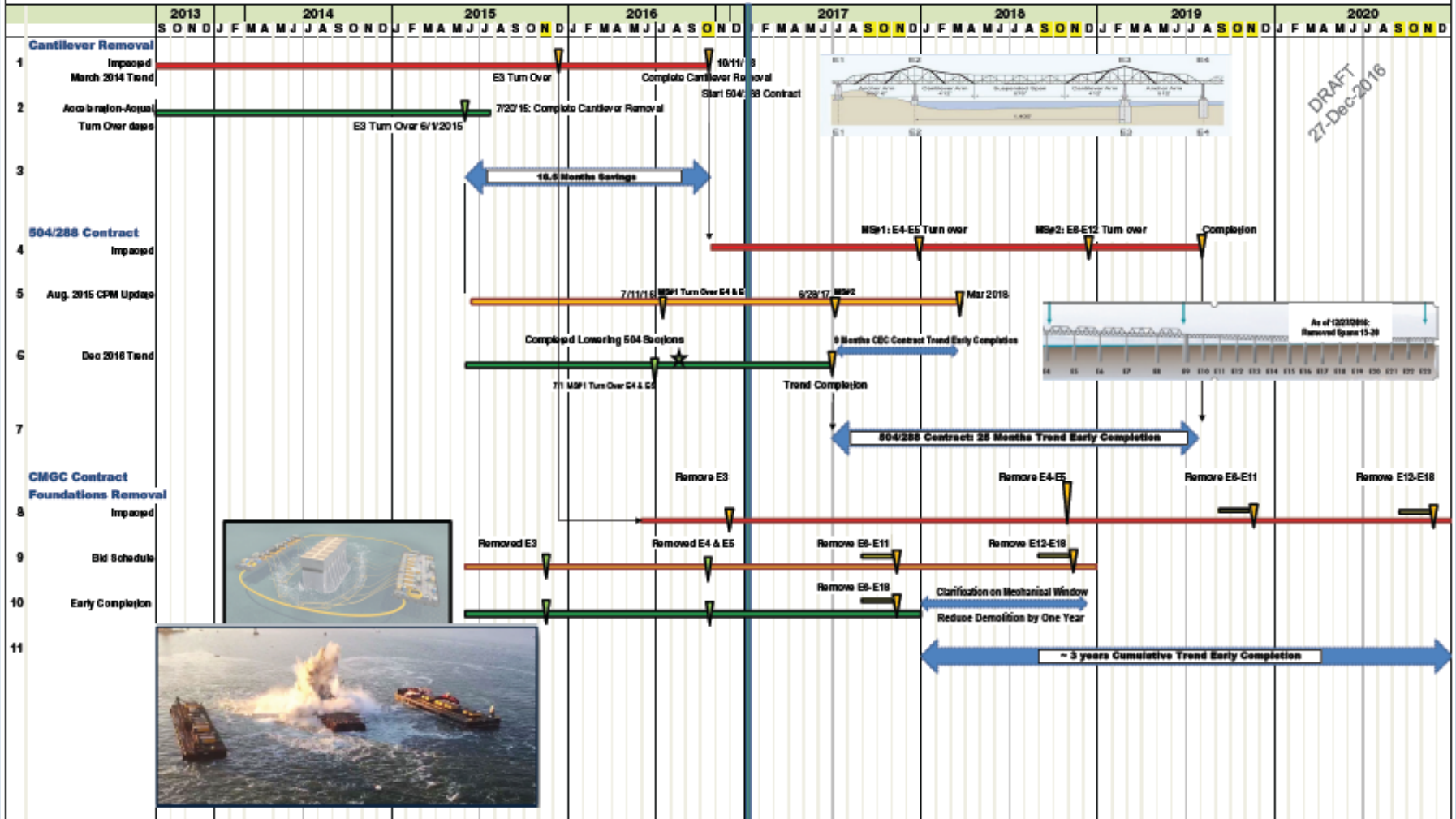
Toll Bridge Seismic Retrofit Program - Summary Schedule

10/29/2013

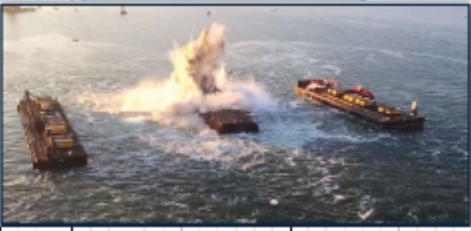
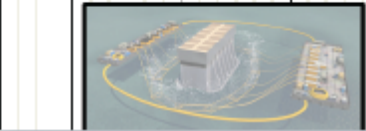


Weekly Schedule Updates

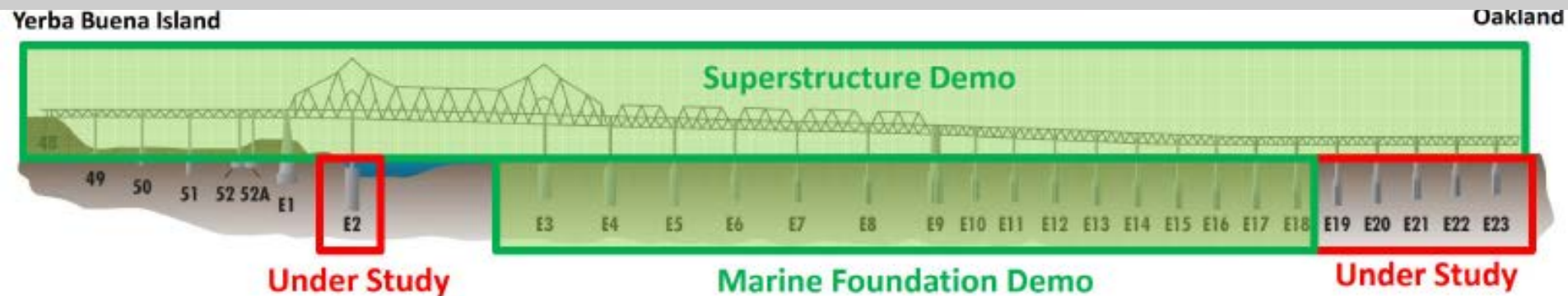
SFOBB - Demolition Schedule (DRAFT)



DRAFT
 27-Dec-2016



- **Major Marine Piers (E3 – E18)
Successfully Removed**
 - **With Environmental Responsibility**
 - **Under Budget**
 - **Ahead of Schedule**



Blast Event Video



Piers E9 and E10 Blast Event

- 1) Planning/Design Multi-Pier Implosion Video**
- 2) Actual Multi-Pier Implosion Video**



E14, E15, E16 Blast Day Plan

Marine Mammal Monitoring Buoys

Buoy	Northing	Easting
1	37° 49.275' N	122° 20.234' W
2	37° 49.259' N	122° 20.194' W
3	37° 49.222' N	122° 20.163' W
4	37° 49.185' N	122° 20.176' W
5	37° 49.155' N	122° 20.206' W
6	37° 49.143' N	122° 20.281' W
7	37° 49.132' N	122° 20.357' W
8	37° 49.149' N	122° 20.407' W
9	37° 49.181' N	122° 20.43' W
10	37° 49.225' N	122° 20.429' W
11	37° 49.251' N	122° 20.386' W
12	37° 49.263' N	122° 20.31' W
19 (Not Shown)	37° 49.526' N	122° 20.363' W
20 (Not Shown)	37° 48.875' N	122° 20.223' W

North Staging Area

Staging Buoy	Northing	Easting
13	37° 49.447' N	122° 20.407' W

Vessels	# of Boats
Support Crew Boat North	1
Water Quality Monitoring	2
Munition	2
Fish Monitor	2

South Staging Area

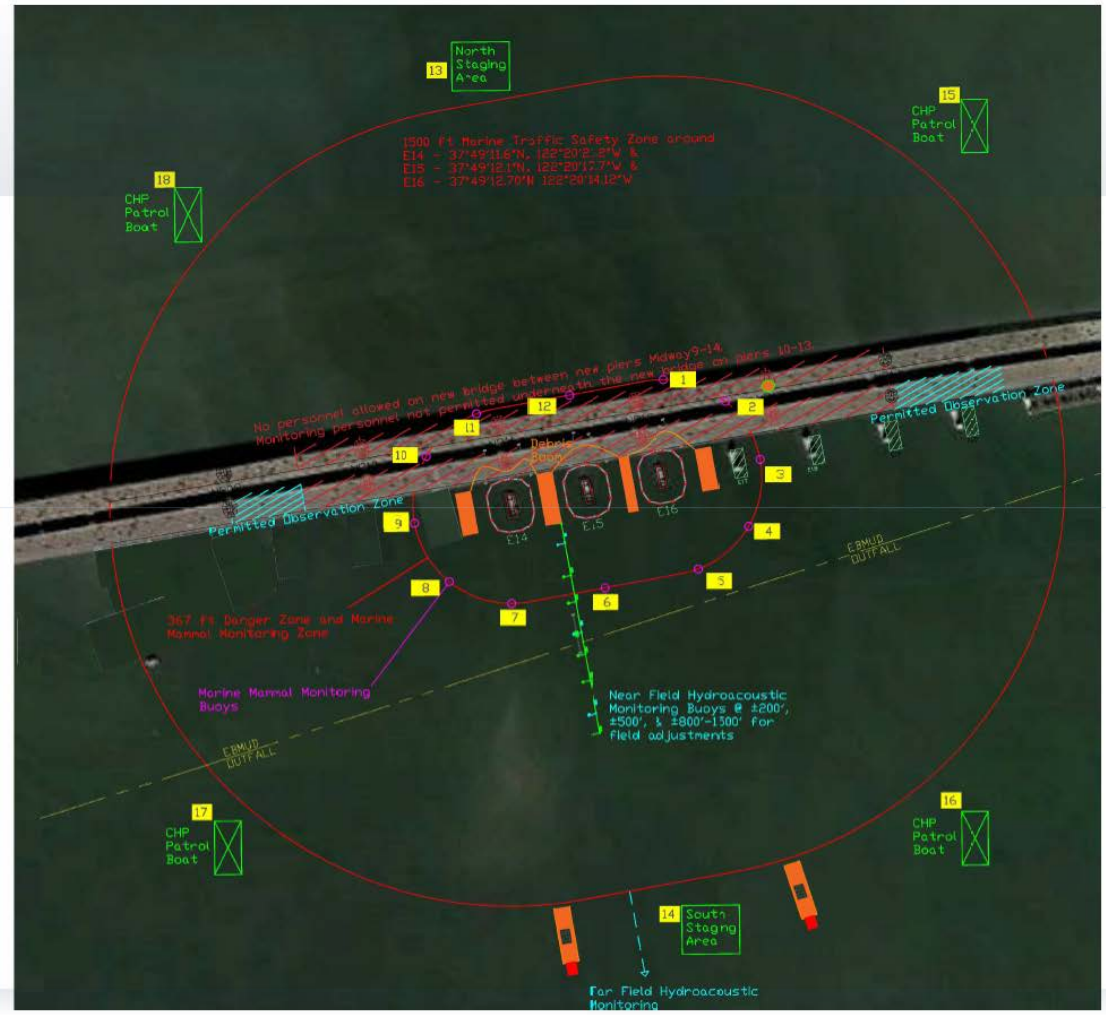
Staging Buoy	Northing	Easting
14	37° 48.96' N	122° 20.23' W

Vessels	# of Boats
Support Crew Boat South	1
Water Quality Monitoring	2
Munition	1
B3 Vancouver	1
Etrac	1

CHP Patrol Boat Locations

Buoy	Northing	Easting	Boat #
15	37° 49.384' N	122° 20.021' W	3
16	37° 49.02' N	122° 19.996' W	4
17	37° 48.971' N	122° 20.561' W	5
18	37° 49.328' N	122° 20.628' W	6

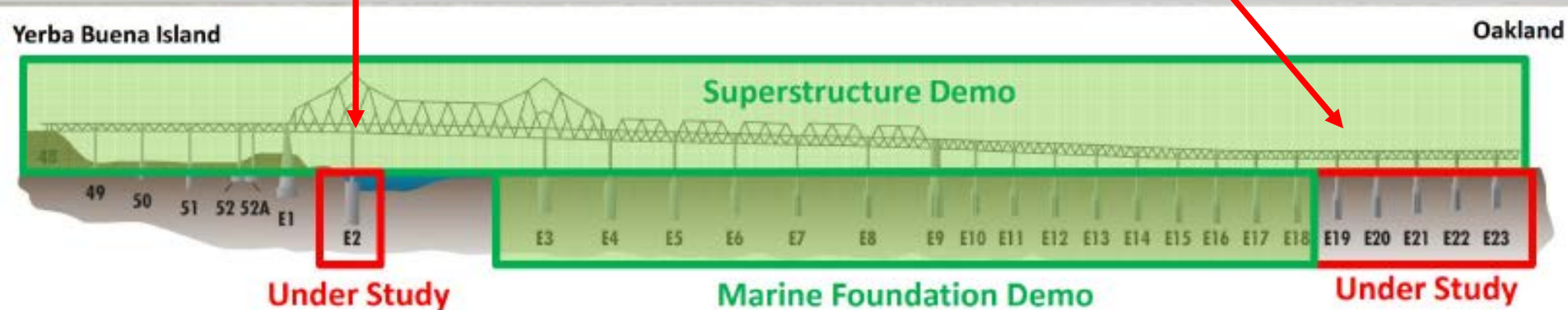
● Blasting Command Center WB13



THE SAN FRANCISCO-OAKLAND BAY BRIDGE EAST SPAN SEISMIC SAFETY PROJECT

- **What About the Remaining Marine Piers?**
- **Piers E2 (YBI) and E19-E22 (OTD) Under Consideration for Retention**

- Increase focus on restoring public access to the Bay
- Experience the new bridge
- Water access opportunities
- Connect with history
- Timeliness



Stakeholder Coordination



Thank you CTC and STA for your Leadership and Teamwork



Susan Bransen @SusanBransen · Sep 2

Great job @CaltransHQ @MTCBATA @California_CTC and team! It was a blast!

