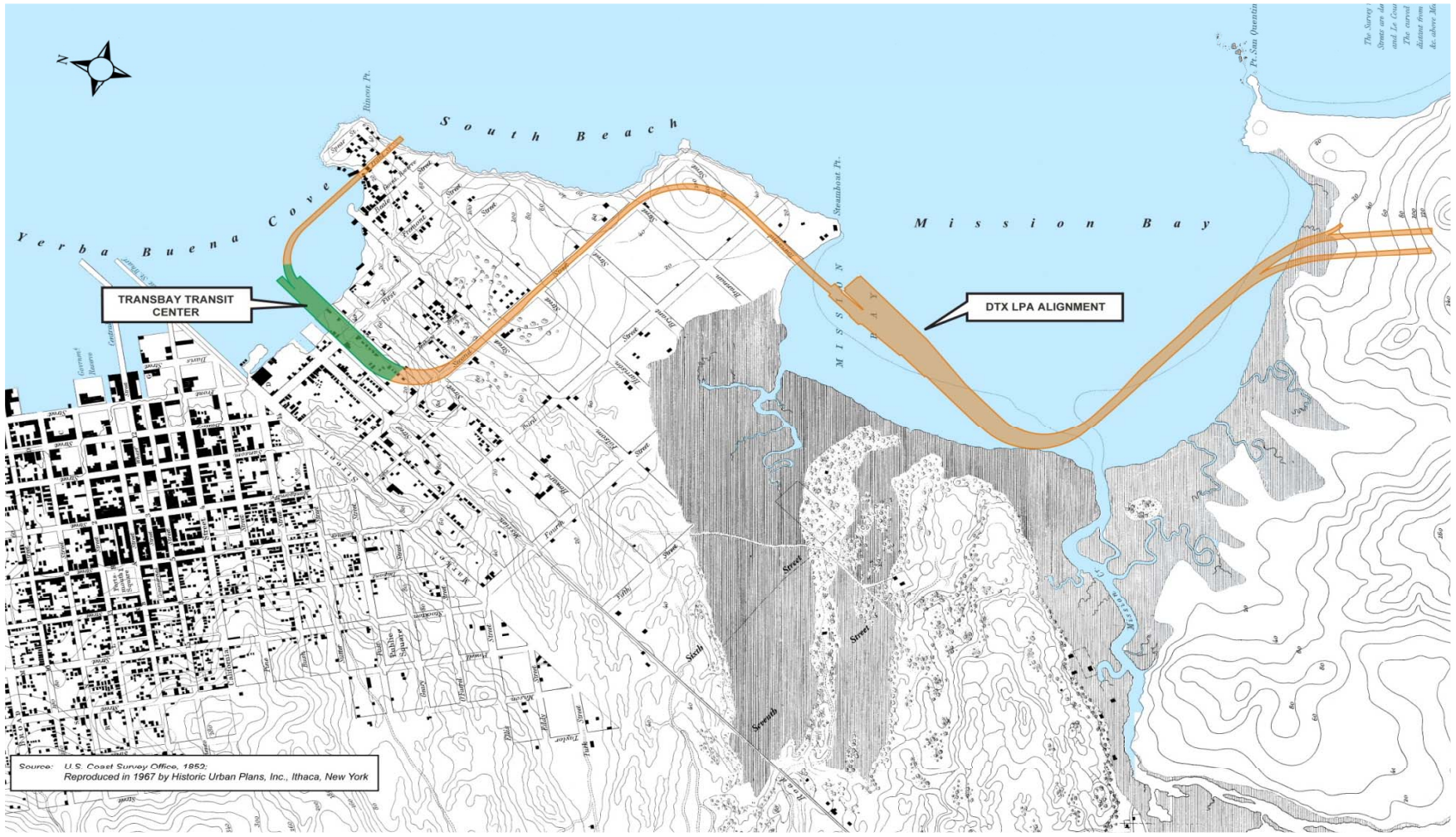
Transbay Transit Center Project
Shoring Wall and Excavation Construction

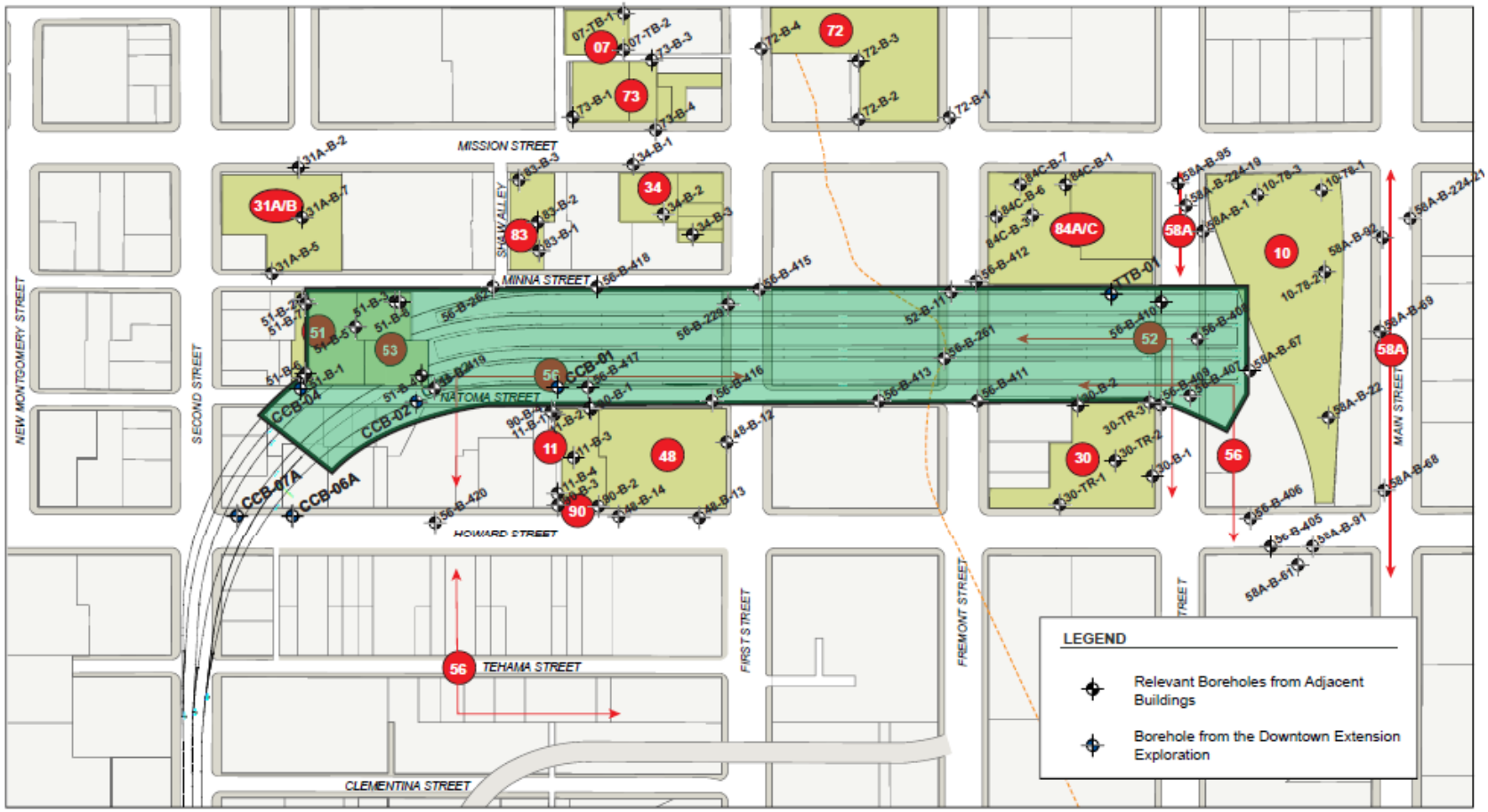
June 8, 2010

- Subsurface conditions and Transit Centre box
- Excavation process
- Movement analyses
- Movement monitoring
- Summary

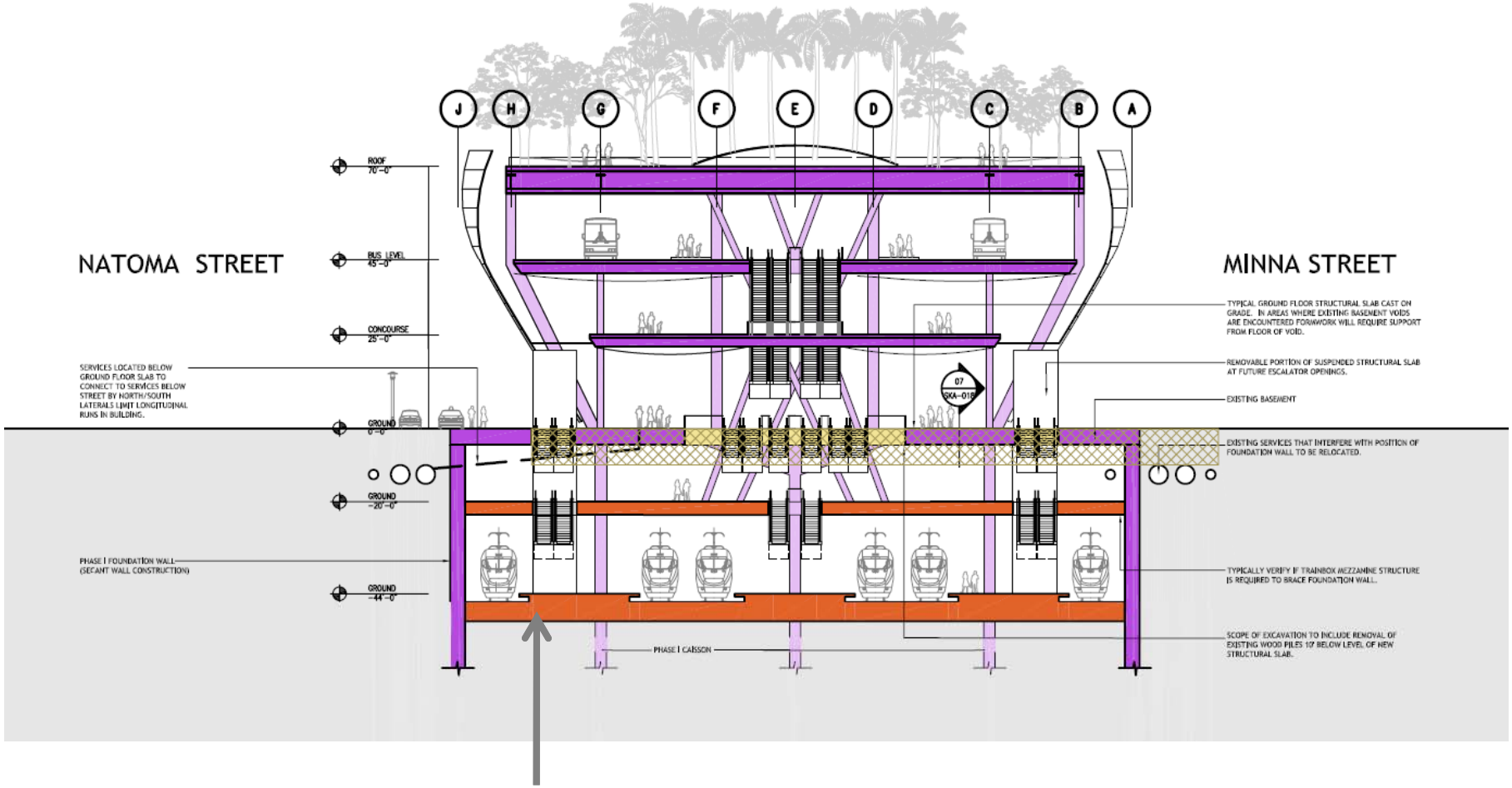
1852 Shoreline and Site Conditions Relative to the DTX and the Terminal



Borehole Locations and Adjacent 3rd Party Geotechnical Data

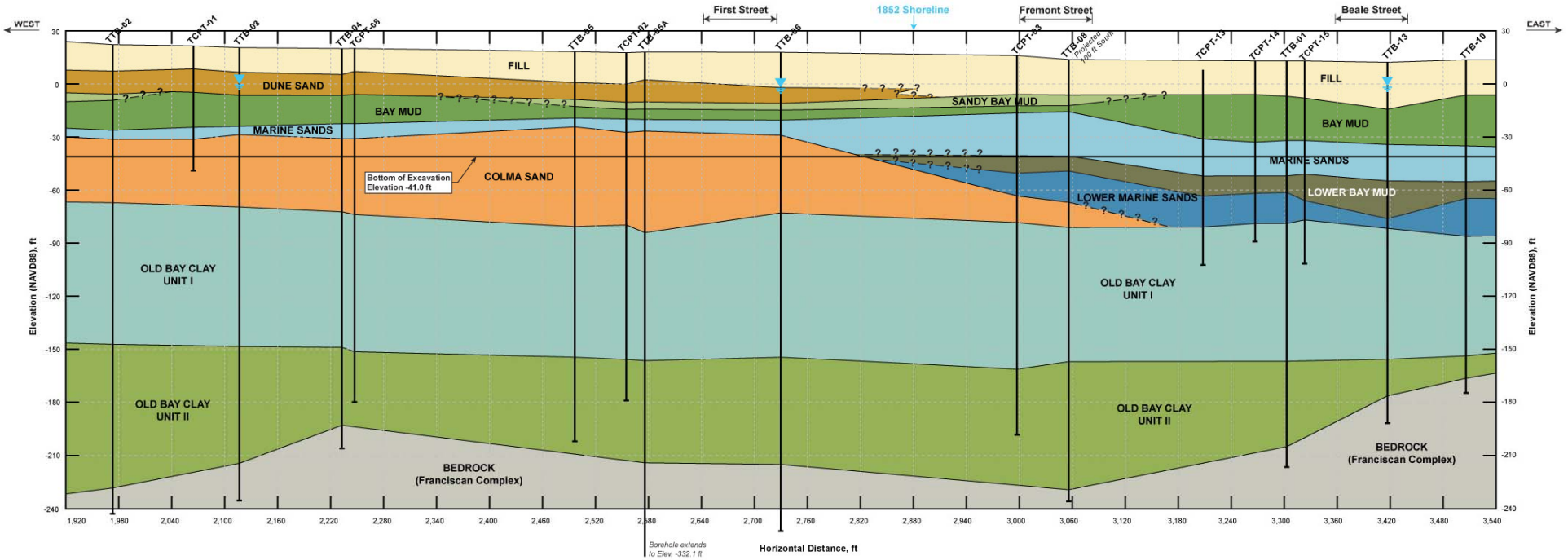


Train Box and Superstructure: Transverse Section



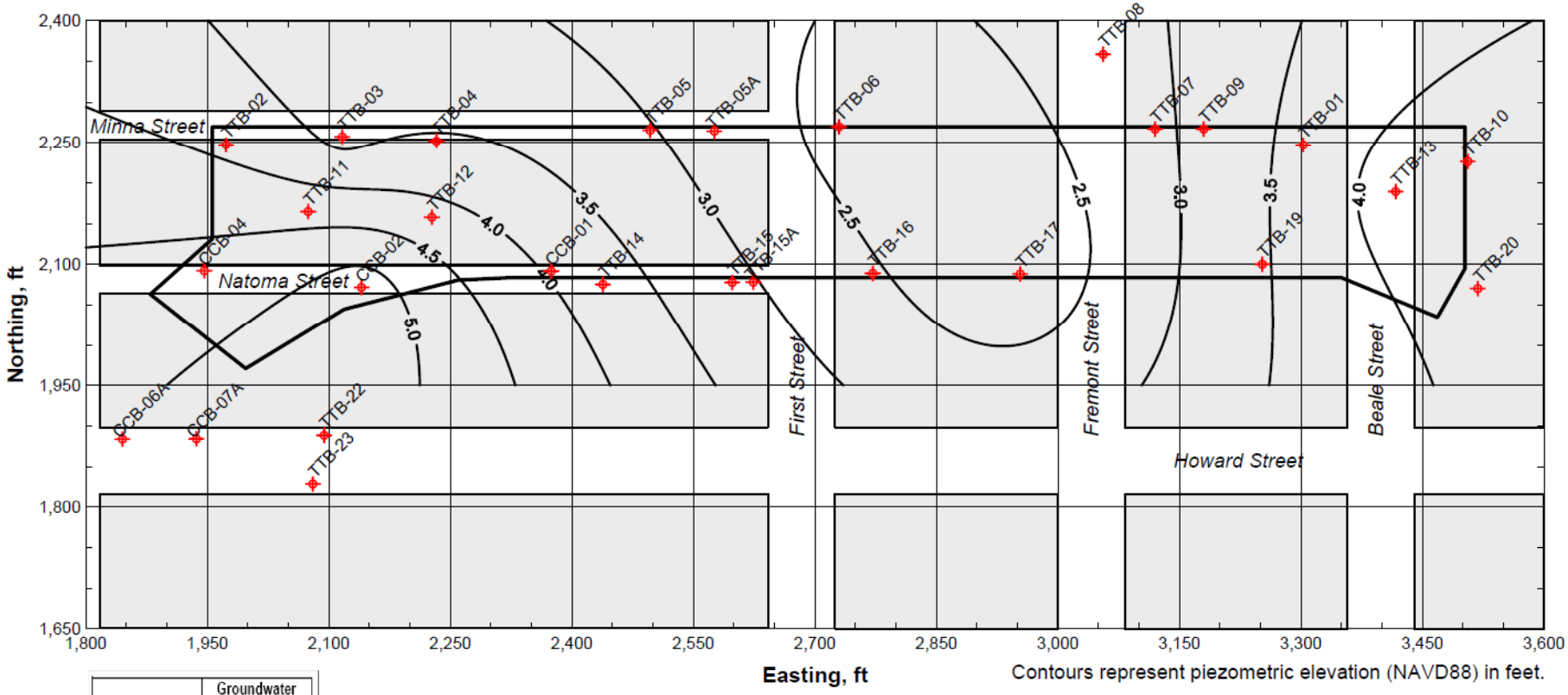
Underside of base mat: -41 ft NAVD88

Vertical Section Along Minna Street



ARUP

Water Level Contours



Borehole ID	Groundwater Elevation (NAVD88), ft
TTB-03	3.34
TTB-06	2.37
TTB-13	4.22
TTB-14	3.73
TTB-17	2.13
TTB-22	5.23
CCB-02	5.28

0 50 100 150 200 250 300

Scale 1 inch = 150 feet

ARUP

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Construction of train box inside temporary braced shoring wall

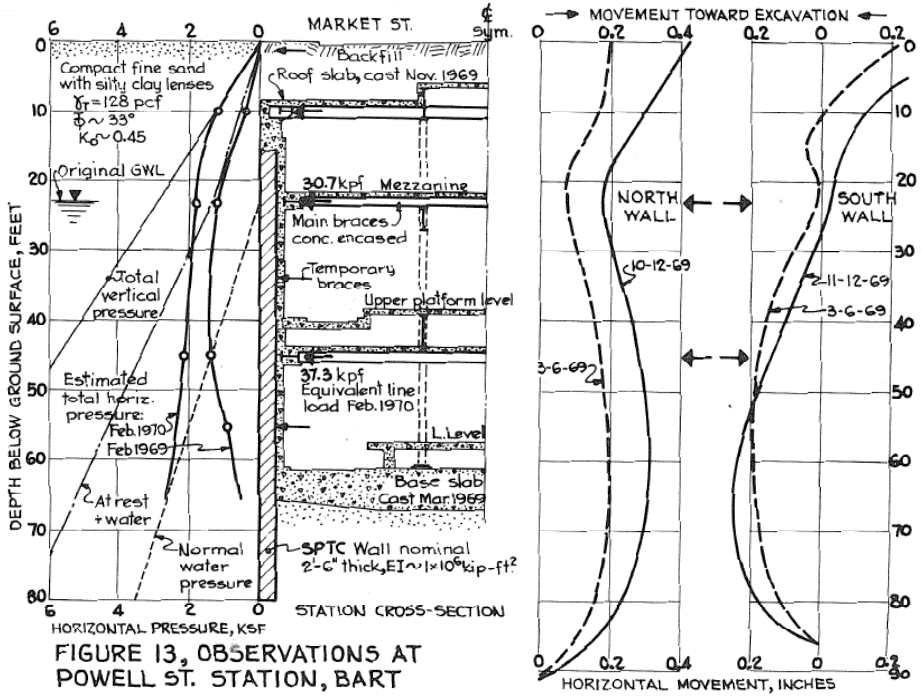
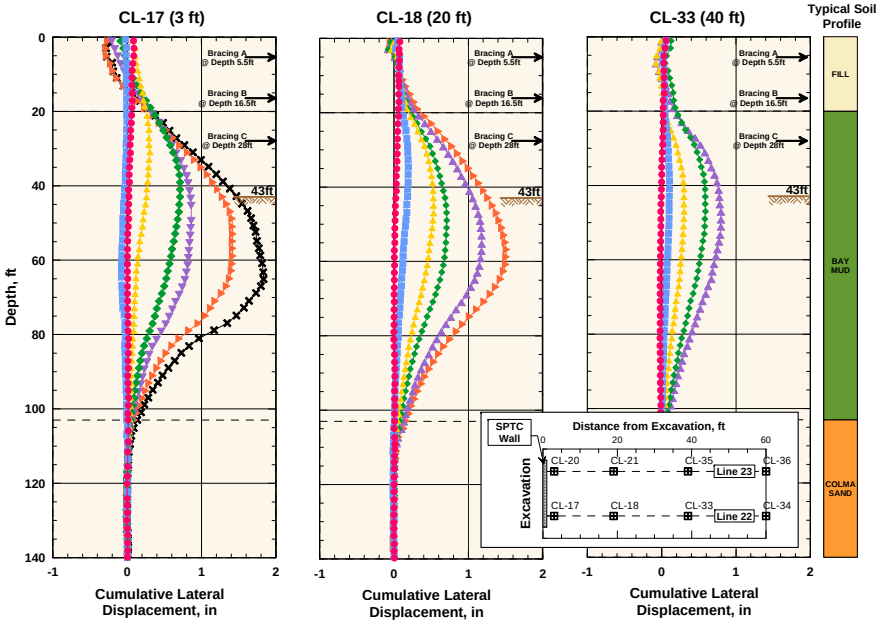


FIGURE 13, OBSERVATIONS AT POWELL ST. STATION, BART



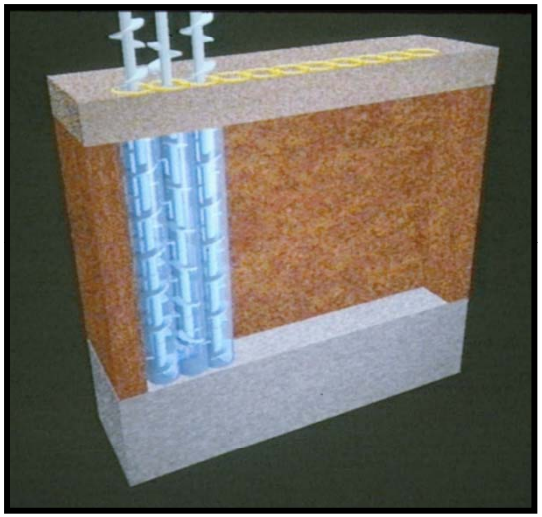
BART Project 1969/70

Photo courtesy of San Francisco Public Library

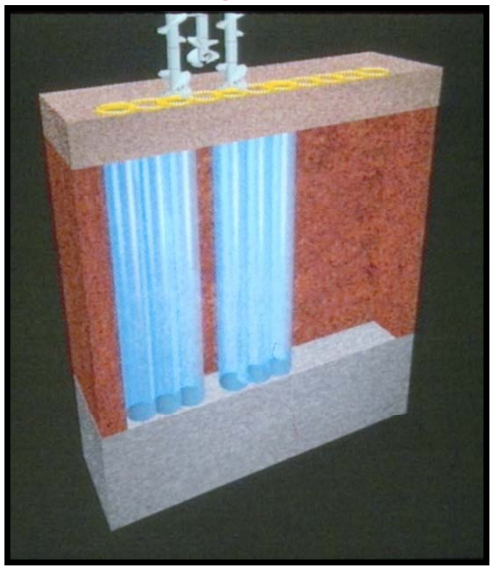
MMT Project 1994

Soil-Cement Walls – Sequence of Installation

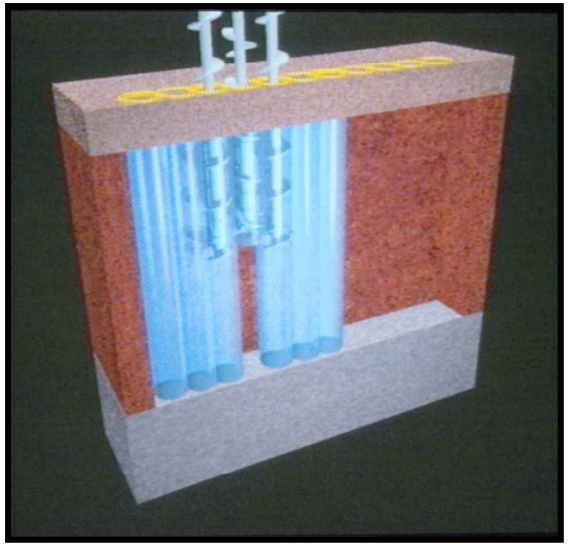
1) Mixing of First Primary Panel



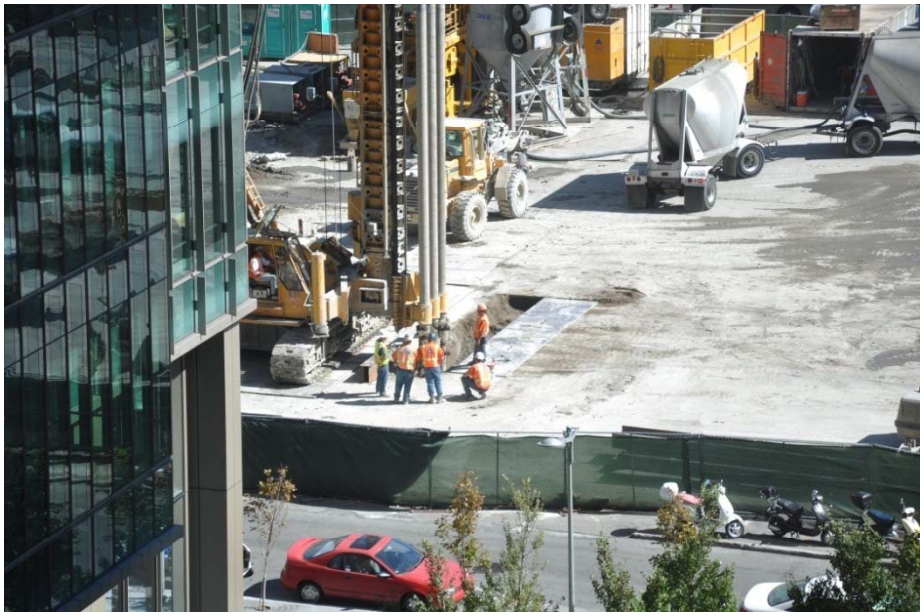
2) Mixing of Second Primary Panel



3) Mixing of Secondary Panel Between Two Primary Panels



DMM Rig during constructability trials

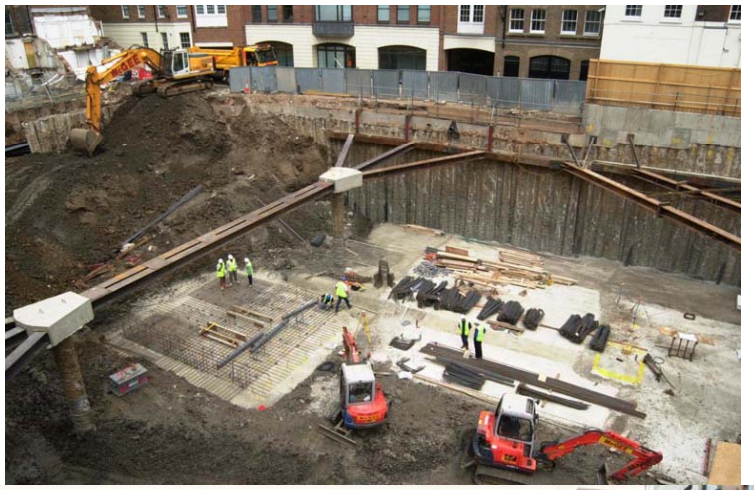


Installation of Beam

Typical Cross Lot Bracing
Deep Excavation Along The Embarcadero
Muni Metro Turnback Project

Typical Diagonal Bracing of Deep Excavations
Gap Building and EBMUD Wet Weather Building

Many ways of providing internal support to deep excavations



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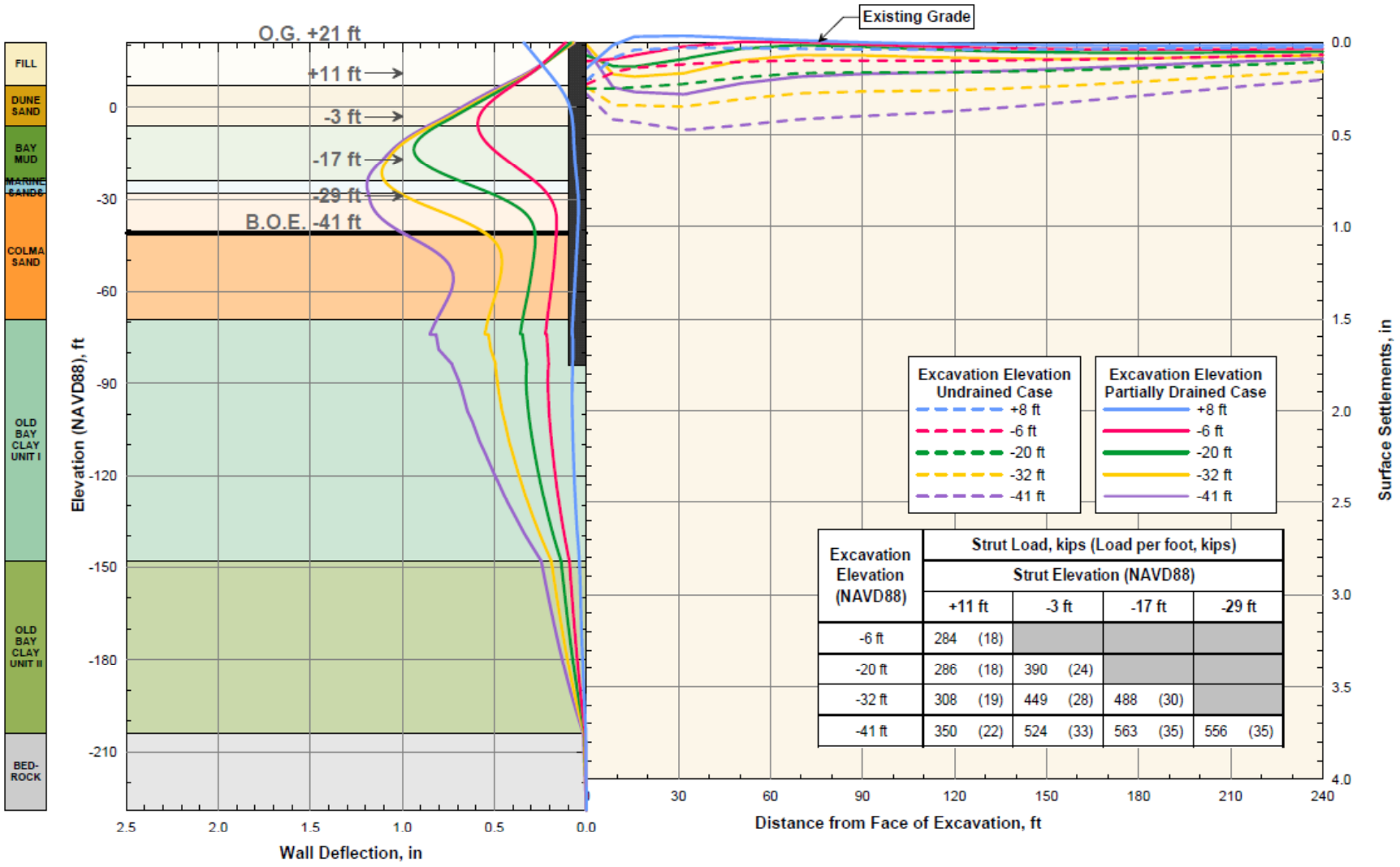
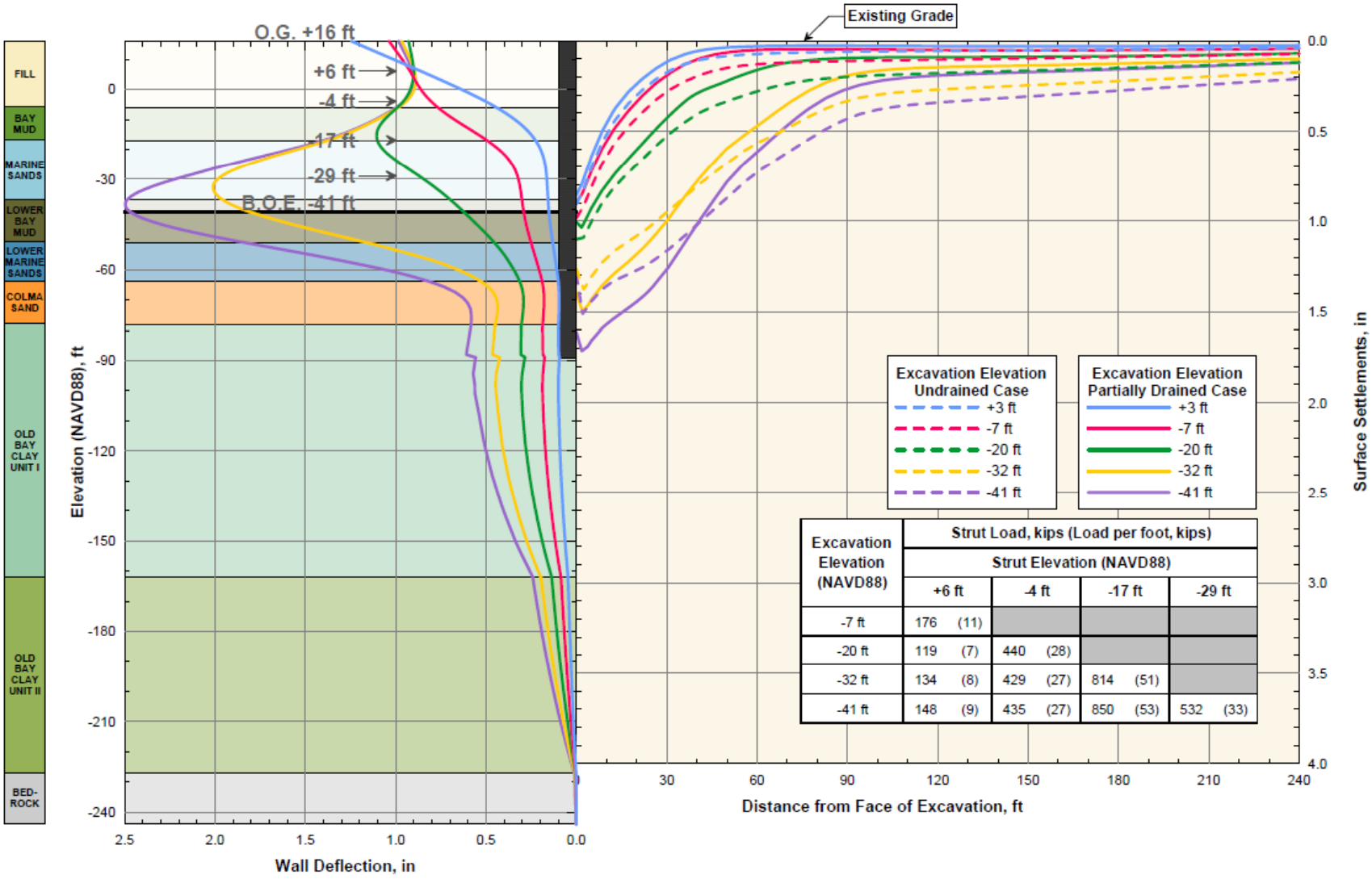
West Base Case I



Excavation Elevation (NAVD88)	Strut Load, kips (Load per foot, kips) Strut Elevation (NAVD88)			
	+11 ft	-3 ft	-17 ft	-29 ft
-6 ft	284 (18)			
-20 ft	286 (18)	390 (24)		
-32 ft	308 (19)	449 (28)	488 (30)	
-41 ft	350 (22)	524 (33)	563 (35)	556 (35)

East Base Case I



Excavation Elevation (NAVD88)	Strut Load, kips (Load per foot, kips)			
	Strut Elevation (NAVD88)			
	+6 ft	-4 ft	-17 ft	-29 ft
-7 ft	176 (11)			
-20 ft	119 (7)	440 (28)		
-32 ft	134 (8)	429 (27)	814 (51)	
-41 ft	148 (9)	435 (27)	850 (53)	532 (33)

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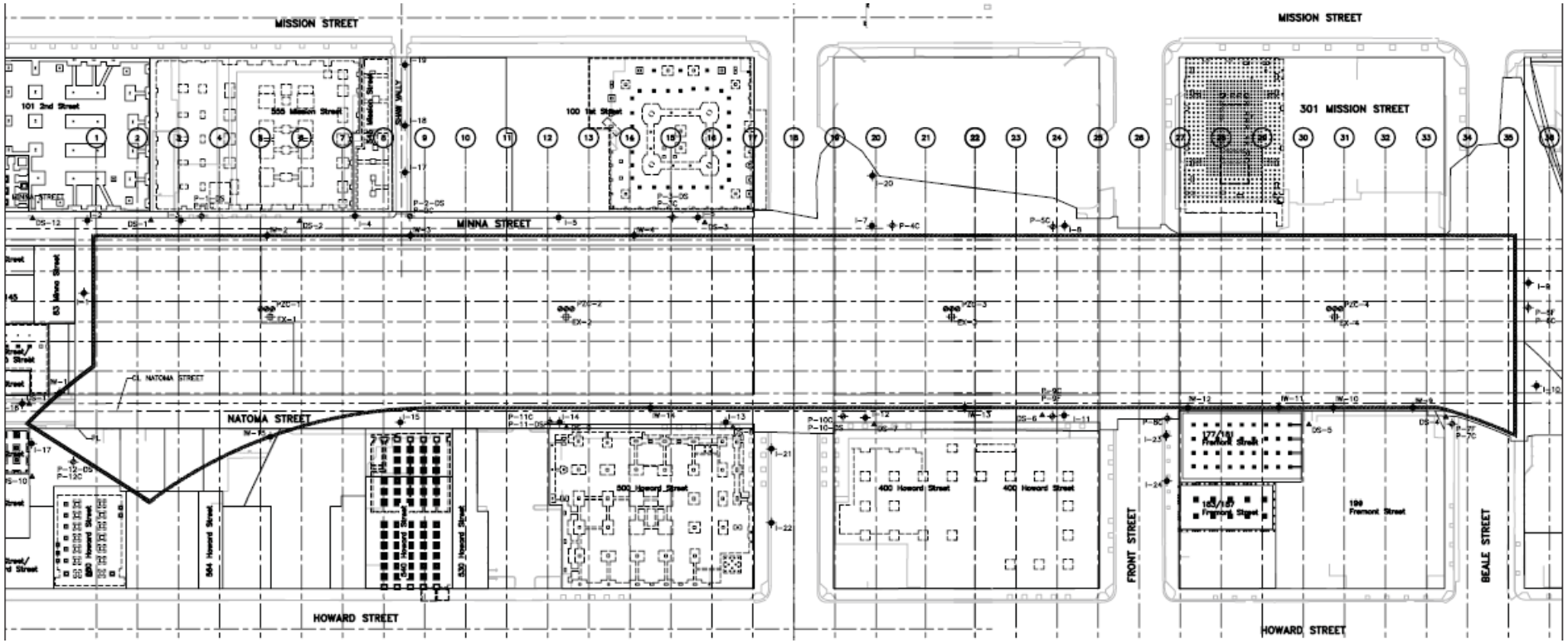
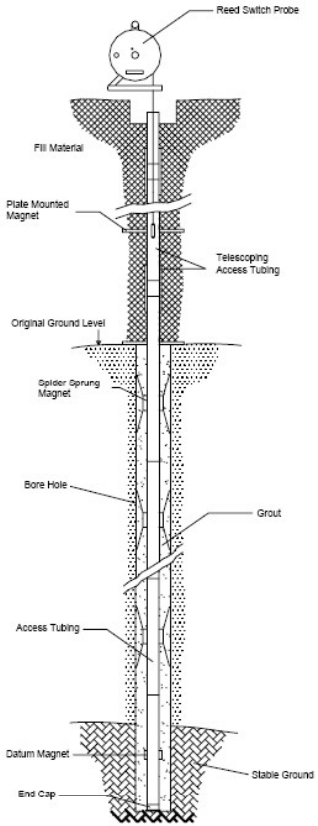
Ground and Wall Monitoring Instrumentation



I-3	INCLINOMETER No. 3 INSTALLED BEHIND THE SHORING WALL
IW-1	INCLINOMETER No. 1 INSTALLED THROUGH SHORING WALL
P-1-DS P-1C	STANDPIPE PIEZOMETER No. 1 INSTALLED IN DUNE SAND (P-1-DS) AND COLMA SAND (P-1C)
P-6F	PIEZOMETER No. 6 INSTALLED IN FILL

PZC-1	PIEZOMETER CLUSTER No. 1 – VIBRATING WIRE PIEZOMETERS INSTALLED AT VARIOUS DEPTHS ADJACENT TO TRESTLE PILES
EX-1	EXTENSOMETER No. 1 INSTALLED AT PIEZOMETER CLUSTER PZC-1
DS-1	DEEP SETTLEMENT MARKER No. 1 INSTALLED AT THE LEVEL OF THE FOUNDATION OF THE CLOSEST BUILDING

Monitoring ground movements



Extensometer

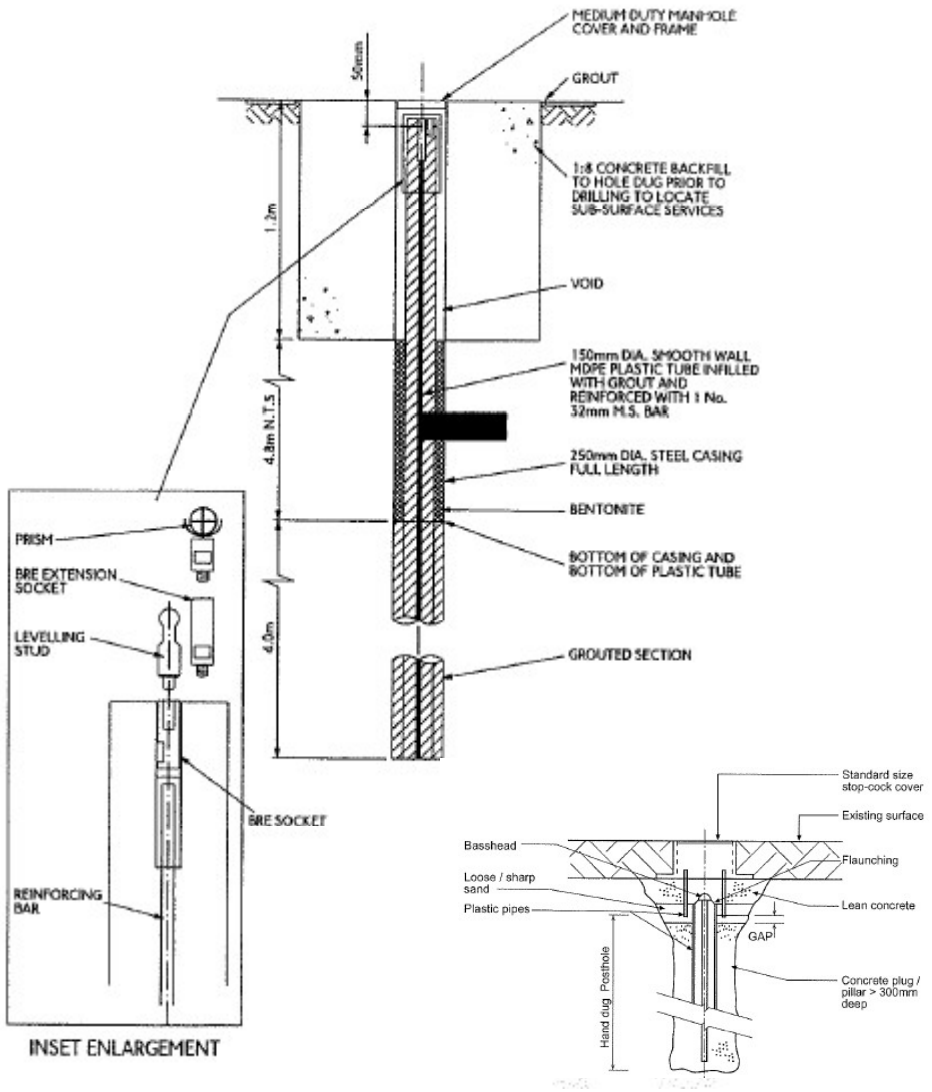
Real time extensometer & inclinometer installation

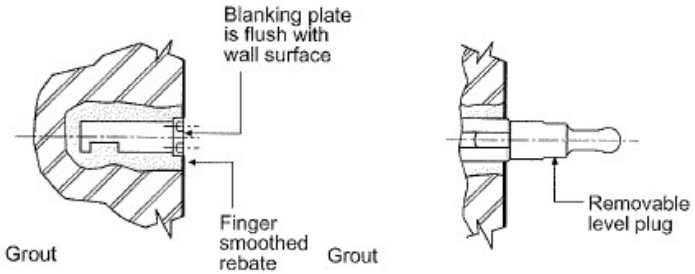
Inclinometer and logging device

Inclinometers and extensometers(sub surface displacements).

Can be real time or manual
Inclinometer (x, y, 0.002 in/ft)
Extensometer (z, +/- 0.01 inch)

Deep settlement marker and levelling points





Summary

- Established ground and groundwater conditions
- Successful constructability trials of shoring walls
- Excavation processes identified
- Calibrated soil models using numerical analysis methods
- Predicted ground movements
- General ground and water movement controls established for general conditions
- Shoring wall package is ready for market.