

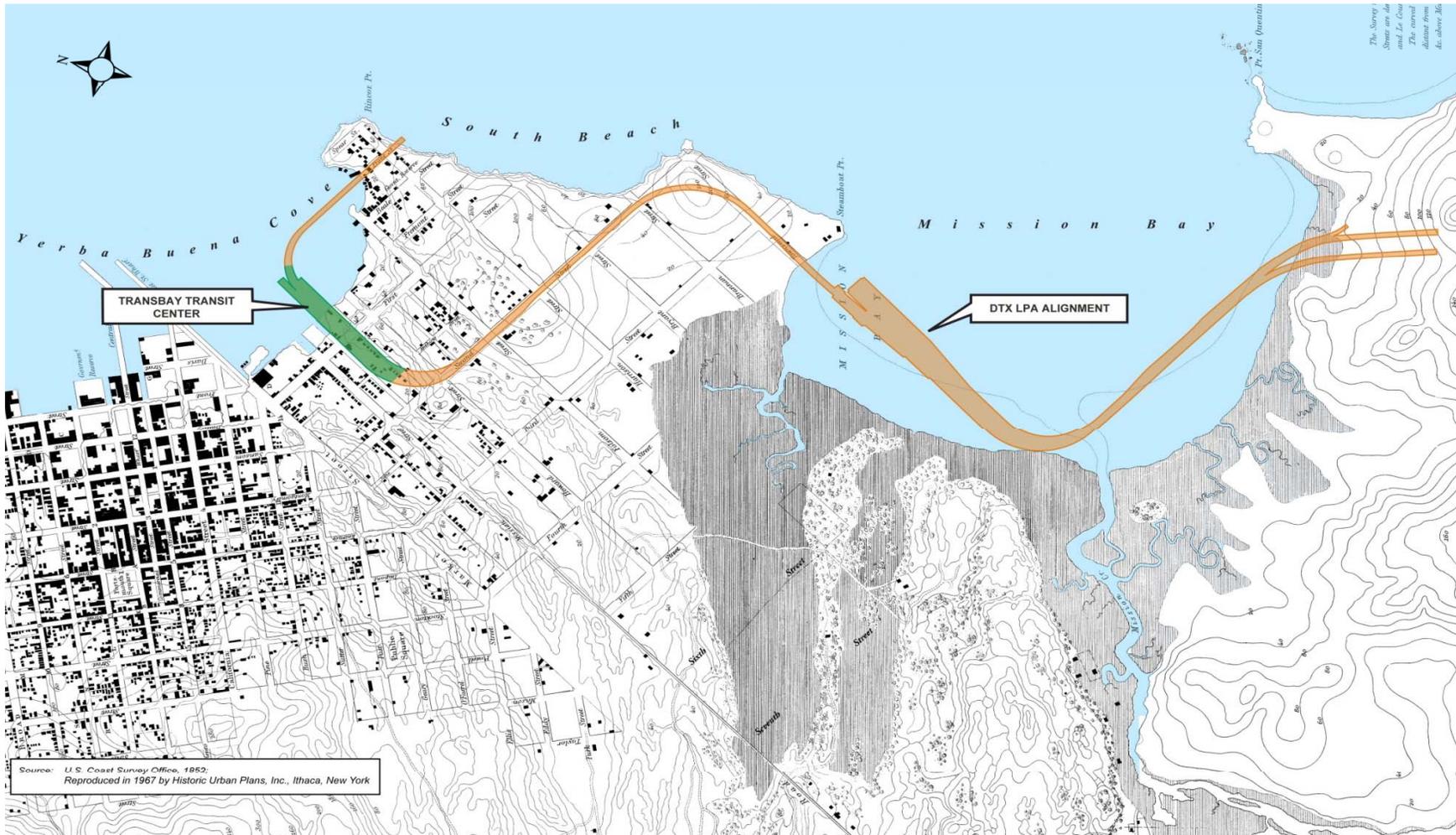
# Transbay Transit Center Project Shoring Wall and Excavation Construction



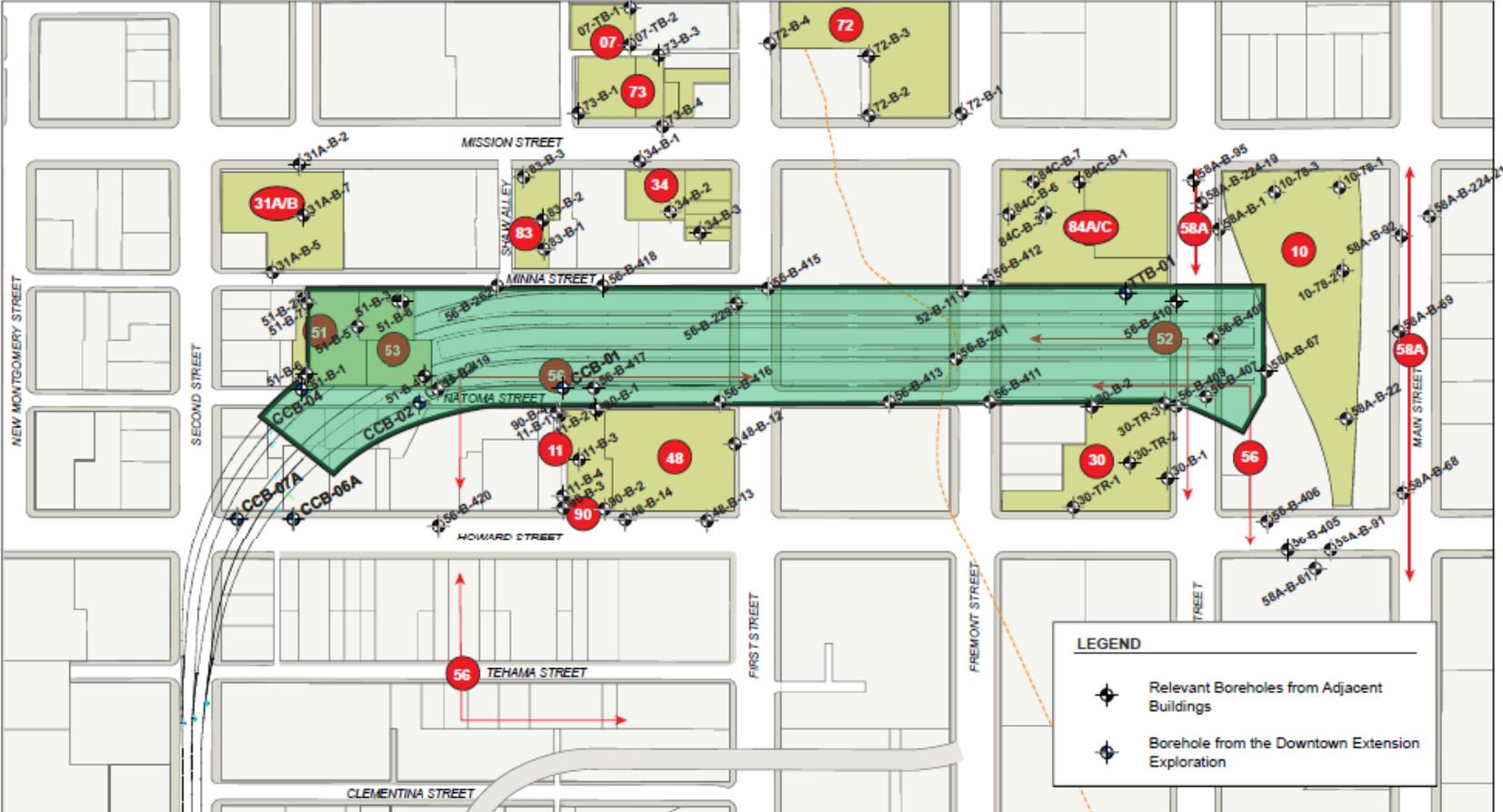
June 8, 2010

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

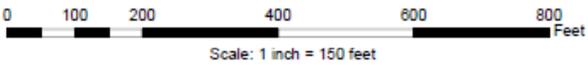
# 1852 Shoreline and Site Conditions Relative to the DTX and the Terminal



# Borehole Locations and Adjacent 3<sup>rd</sup> Party Geotechnical Data



- 52** Caltrain Downtown Station Relocation, Dames & Moore, 1995
- 56** San Francisco Terminal, Caltrans, 1936
- 58A**



**LEGEND**

- Relevant Boreholes from Adjacent Buildings
- Borehole from the Downtown Extension Exploration

LOCATIONS OF BOREHOLES WITH RELEVANT GEOTECHNICAL DATA IN THE VICINITY OF THE TRANSBAY TRANSIT CENTER  
 Transbay Transit Center  
 Final Geotechnical Data Report  
 Transbay Joint Powers Authority  
 San Francisco, California  
 February 2010

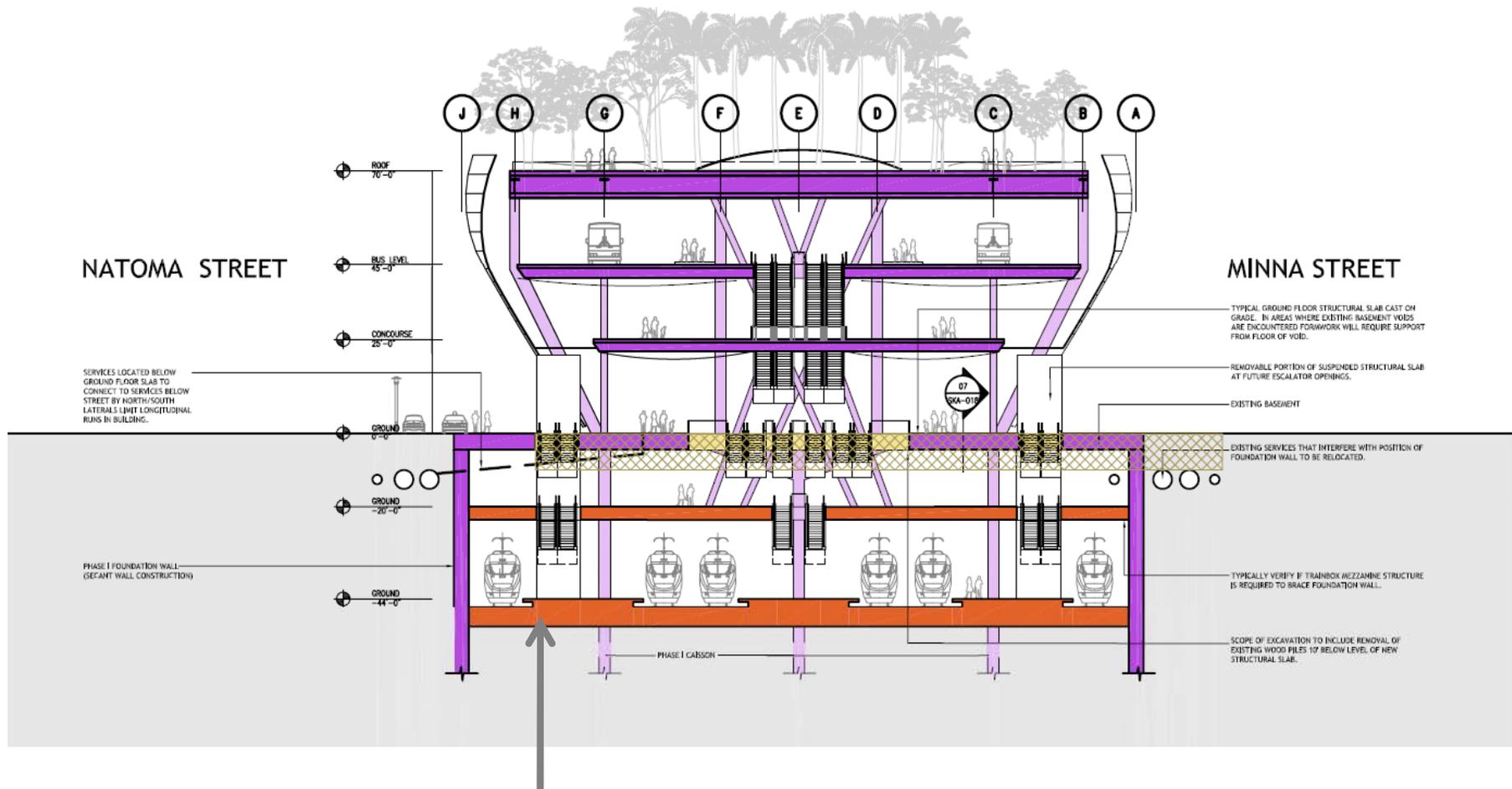
C:\1132-04 Internal Project Data\4-05 Reports & Narratives\060 Final Geotechnical Data Report\Plate 4 Relevant Boreholes GIS Map REV1.dwg

ARUP

PLATE 4

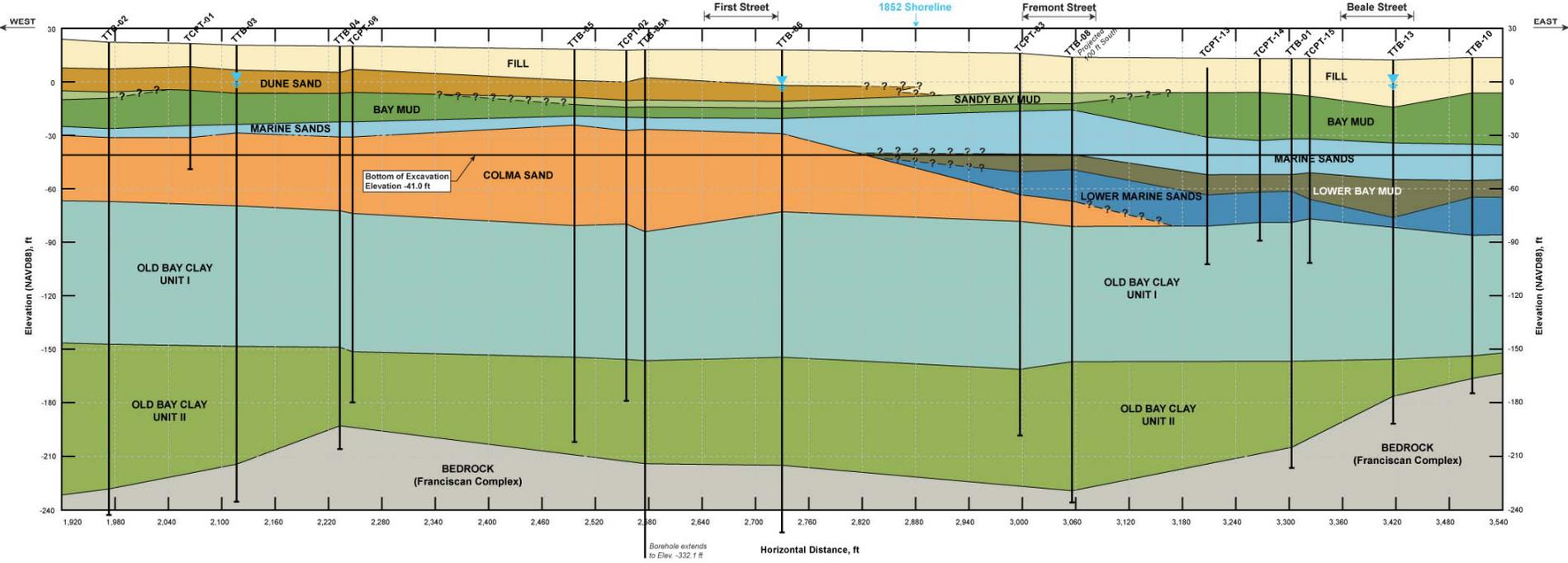


# Train Box and Superstructure: Transverse Section

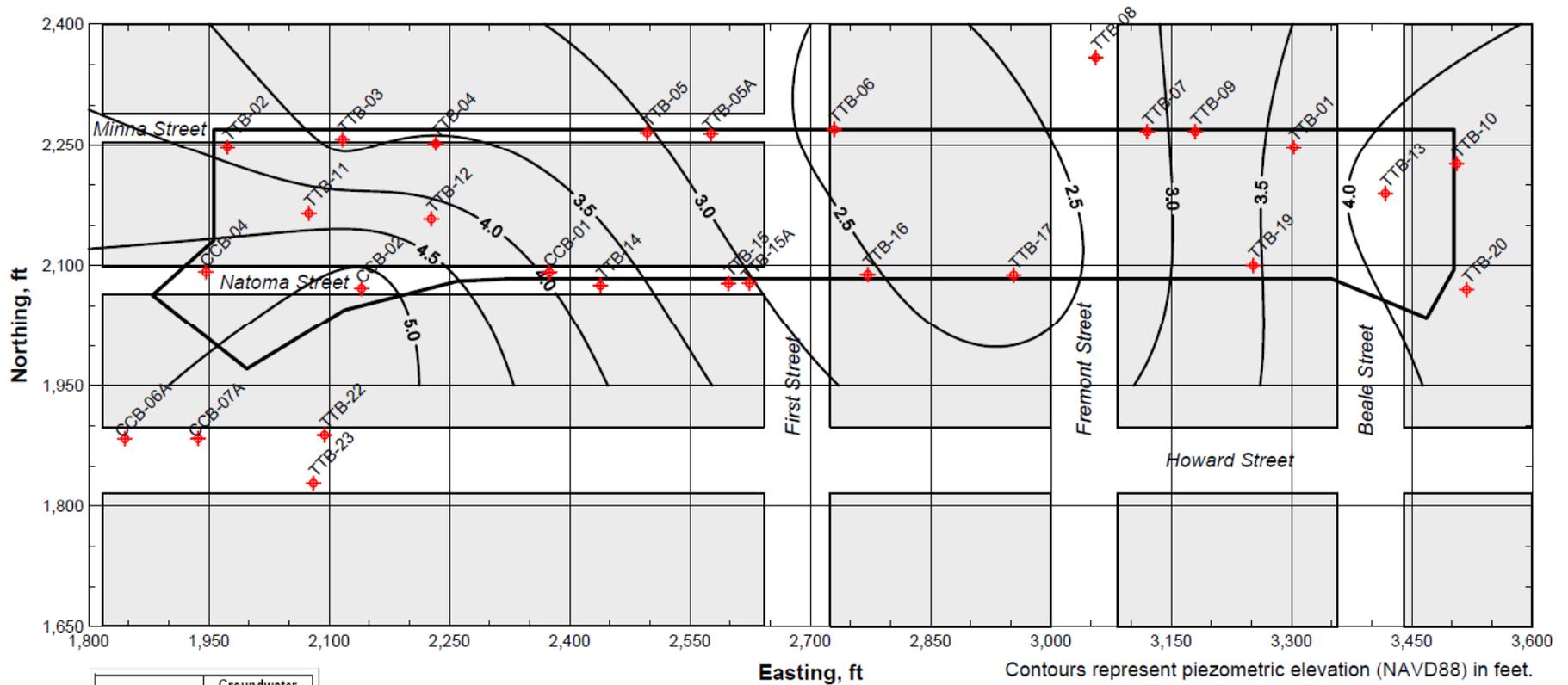


Underside of base mat: -41 ft NAVD88

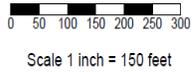
# Vertical Section Along Minna Street



# 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



- Subsurface conditions and Transit Centre box
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# Construction of train box inside temporary braced shoring wall

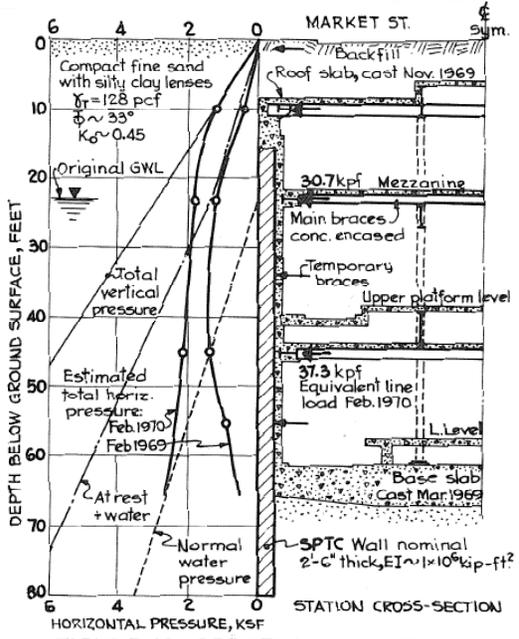
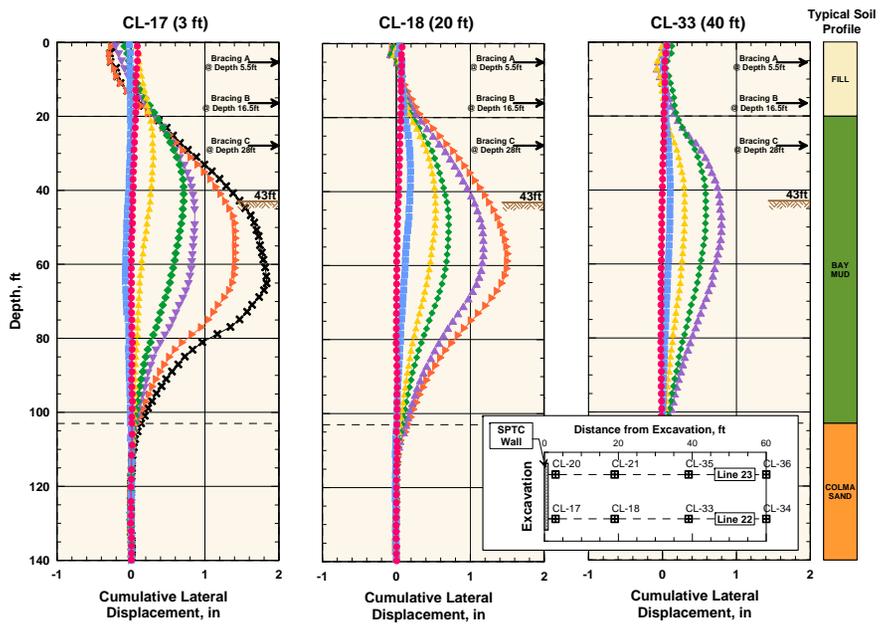
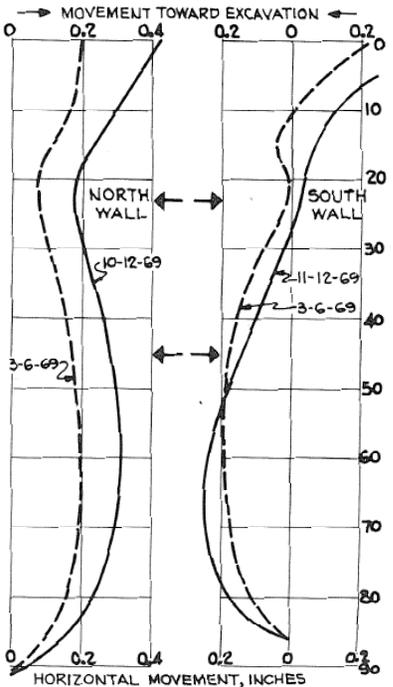


FIGURE 13, OBSERVATIONS AT POWELL ST. STATION, BART



BART Project 1969/70



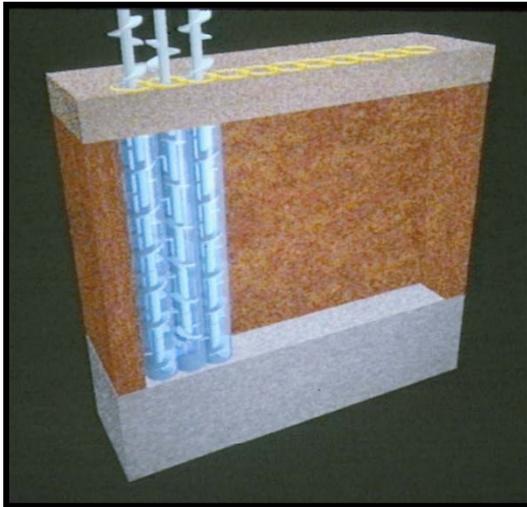
Photo courtesy of San Francisco Public Library

MMT Project 1994

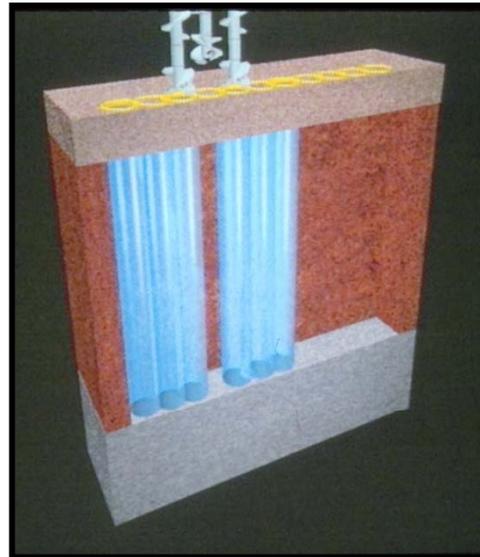


# Soil-Cement Walls – Sequence of Installation

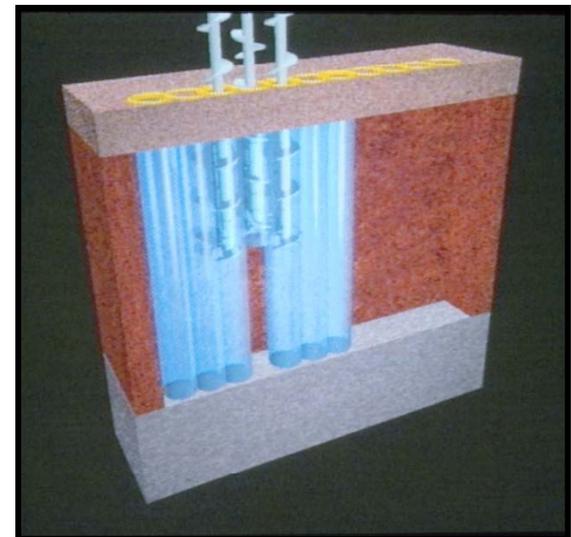
## 1) Mixing of First Primary Panel



## 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

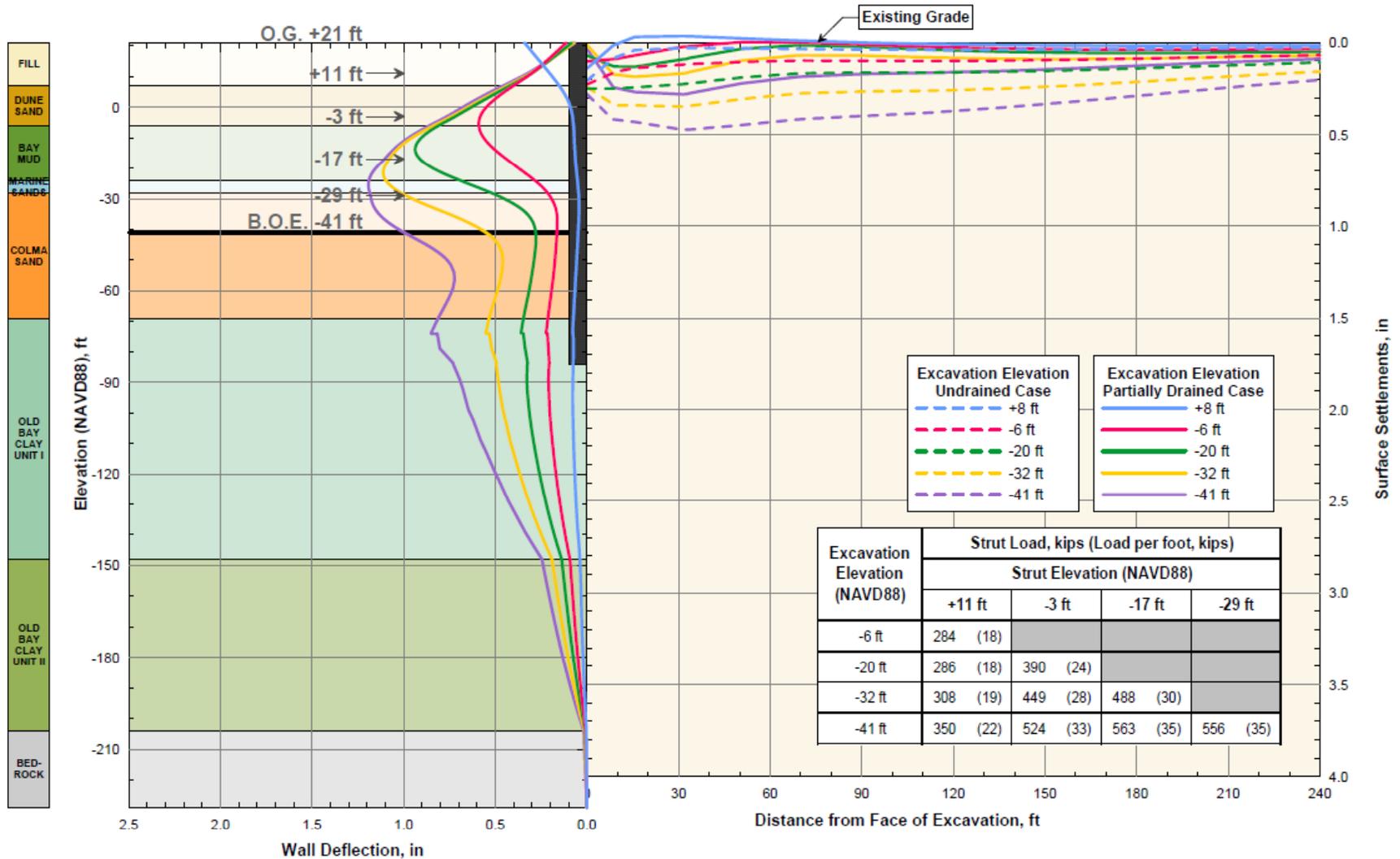


# Many ways of providing internal support to deep excavations

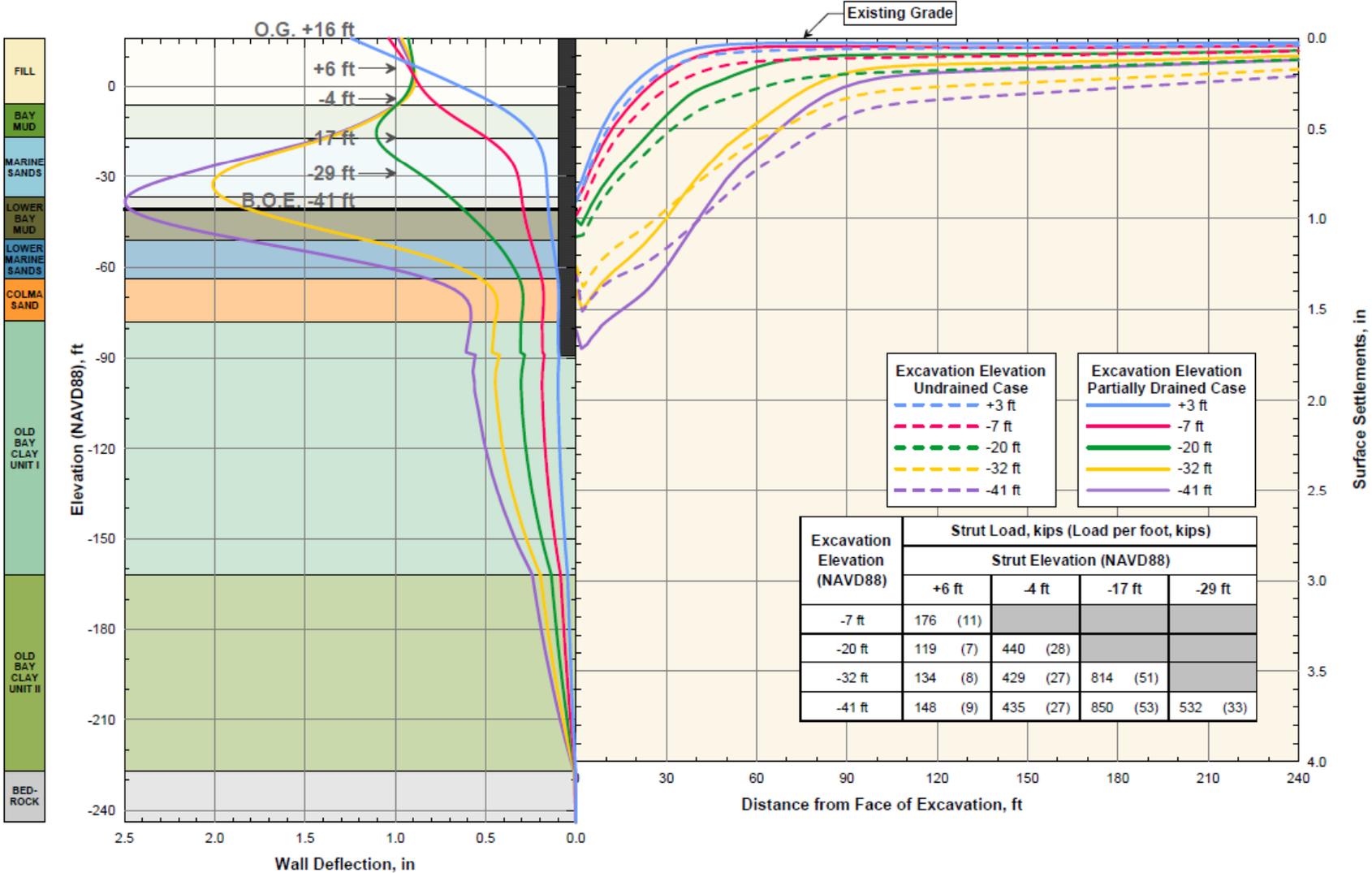


- Subsurface conditions and Transit Centre box
- Excavation process
- **Movement analyses**
- Movement monitoring
- Summary

# West Base Case I

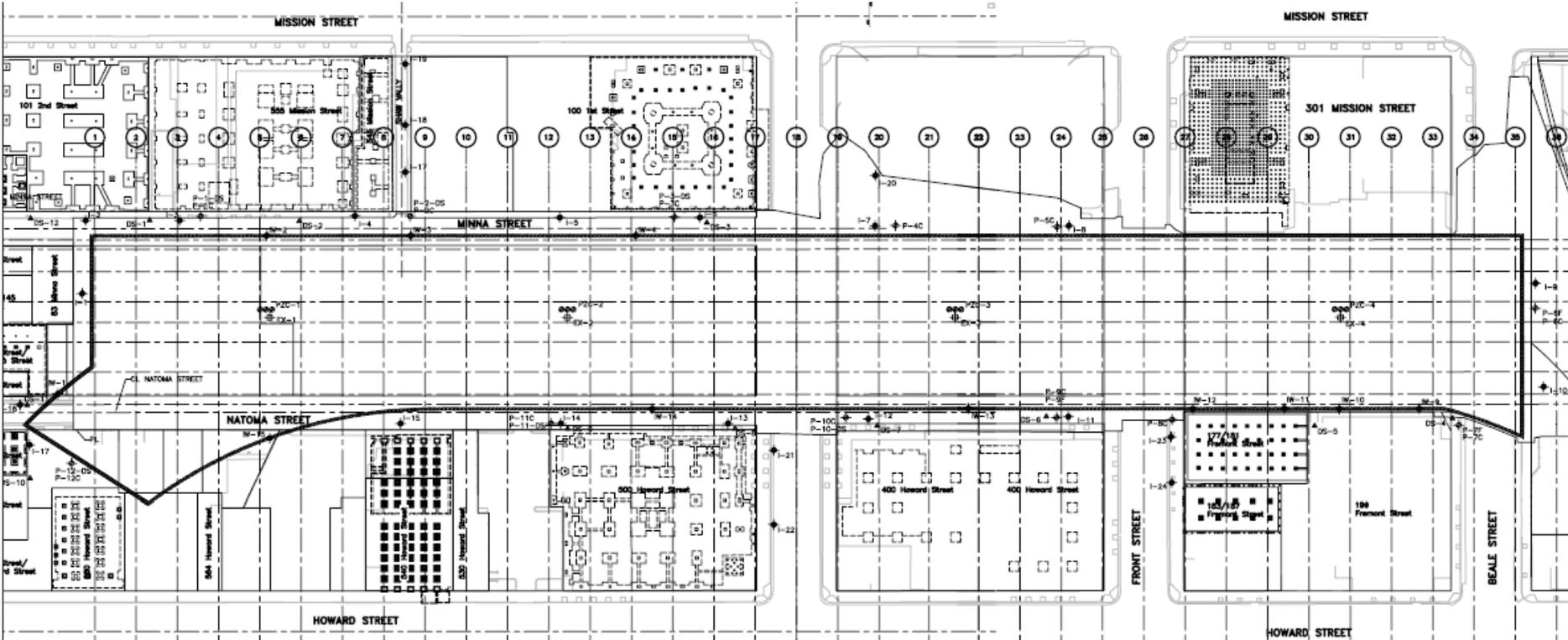


# East Base Case I



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

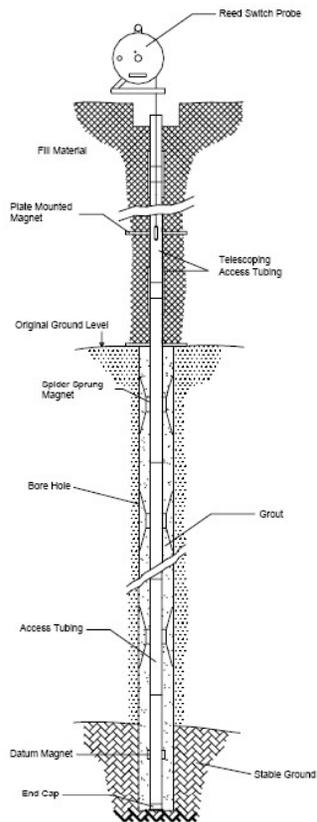
# Ground and Wall Monitoring Instrumentation



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

	PIEZOMETER CLUSTER No. 1 – VIBRATING WIRE PIEZOMETERS INSTALLED AT VARIOUS DEPTHS ADJACENT TO TRESTLE PILES
	EXTENSOMETER No. 1 INSTALLED AT PIEZOMETER CLUSTER PZC-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**

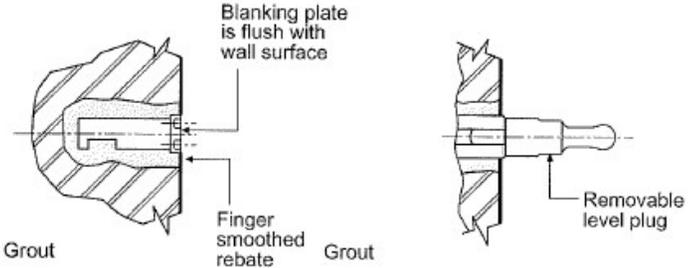
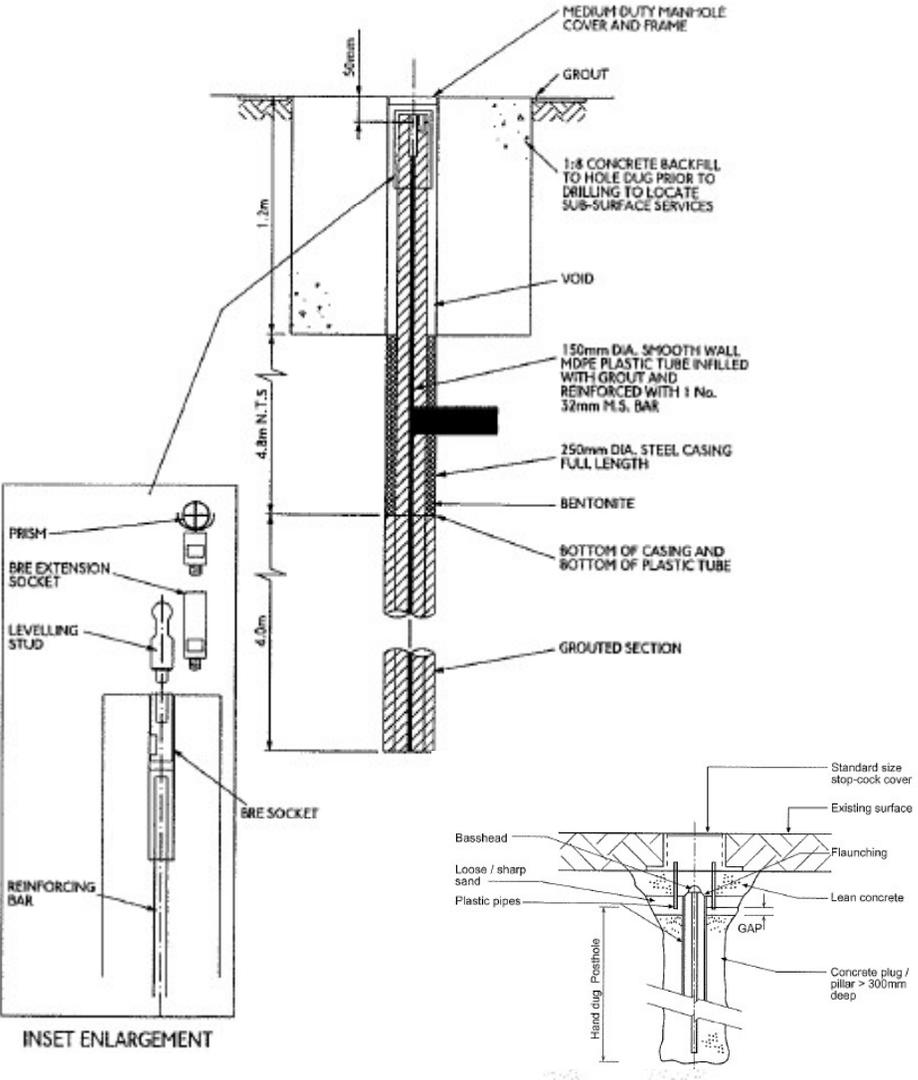


**Inclinometer and logging device**

**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.