

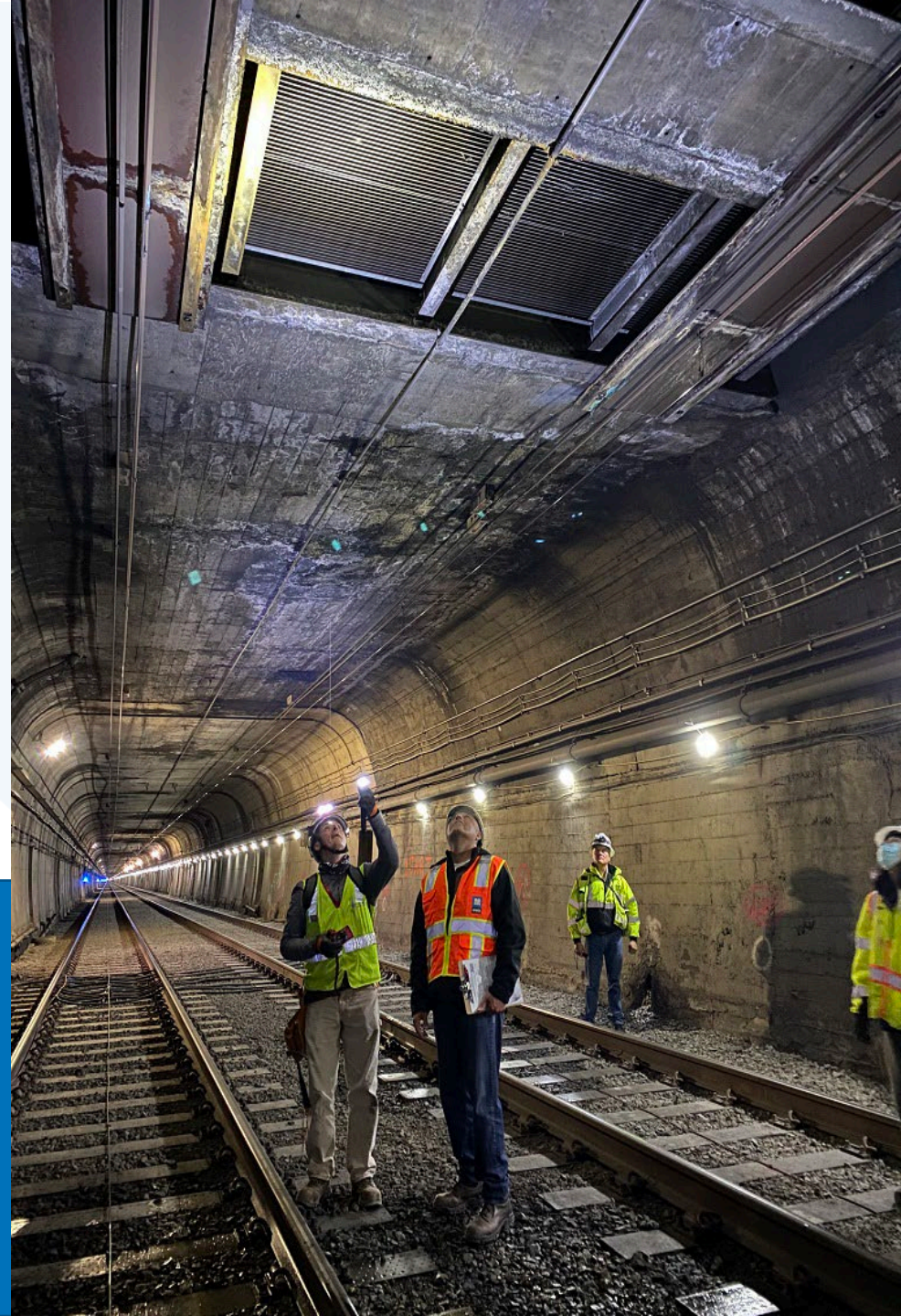


SFMTA

Tunnel Structure Program At CP&C

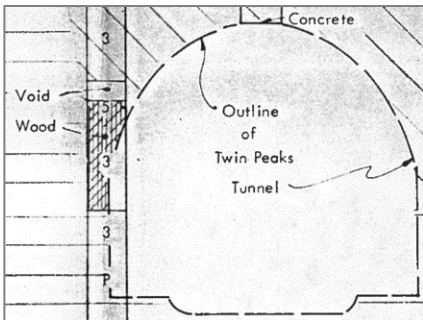
*Bijan Ahmadzadeh, Deputy
Director & Tunnel Structure
Program Manager*

*Sonny Au, Deputy Tunnel
Program Project Manager*



Twin Peaks Tunnel Overview

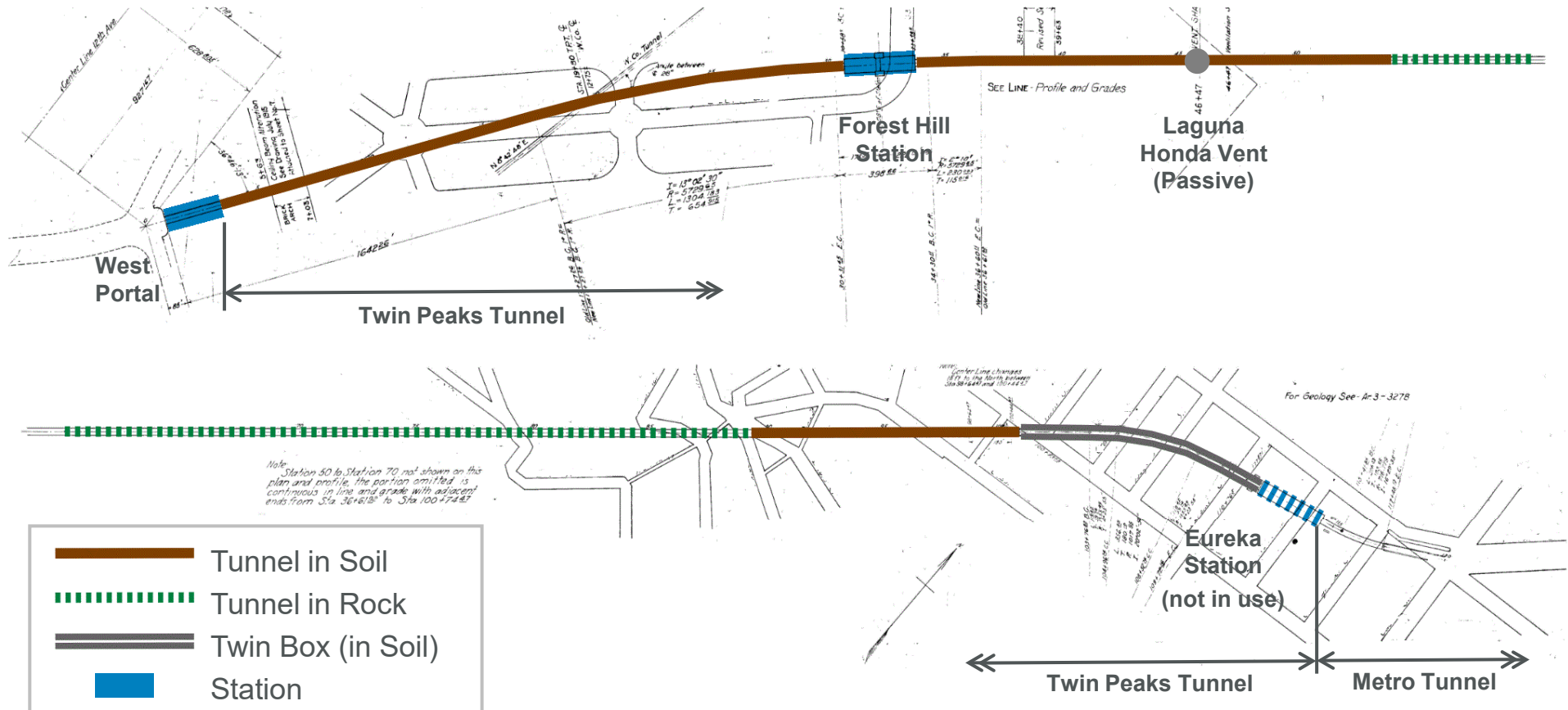
- Construction 1914-1917
- Timbers supported the excavation.
- Concrete liner was subsequently cast against the timber supports.
- Voids are present behind the tunnel liner, magnitude and extent unknown.



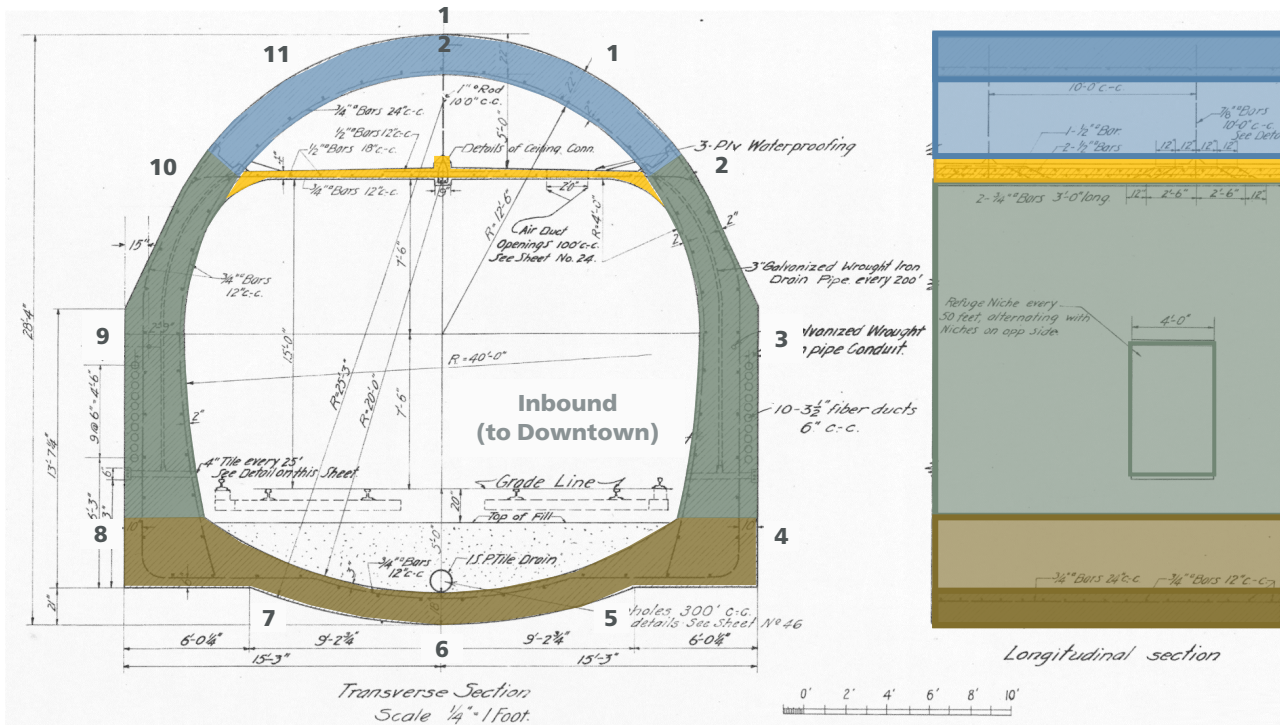
HMLA (1972) Log of Test Borings



Twin Peaks Tunnel Overview



Twin Peaks Tunnel Overview



- Crown / Roof
- Ceiling
- Wall
- Invert

Tunnel Liner structure includes the crown, walls and invert. Locations are described by clock position.

Twin Peaks Tunnel Inspection

- Completed the most extensive inspection of the Twin Peaks tunnel in almost 50 years, including the walls, ceiling, and plenum.
- Inspectors addressed issues such as loose concrete spalls in real time.



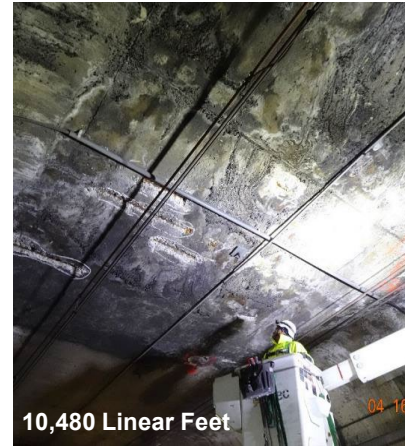
- One of the key findings of the inspection: over the 100-year life span of the tunnel, pressure due to ground water in the soil has caused movement in two identified critical sections of the Tunnel between West Portal and Forest Hill Station.



Summary of Inspection Activity



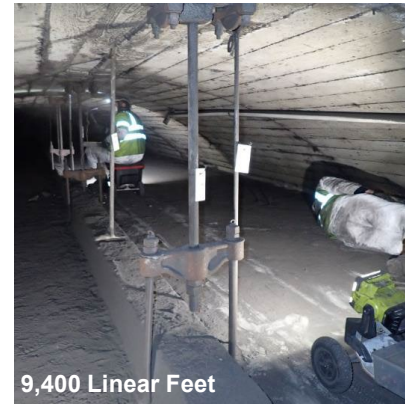
- Wall Inspections: August 2022
 - 3 regular non-revenue nights
 - 3 extended non-revenue nights (fix-it)



- Ceiling Inspections: Nov. 2022 – April 2023
 - 8 regular non-revenue nights
 - 1 extended non-revenue night (fix-it)
 - 54-hour weekend closure of TPT

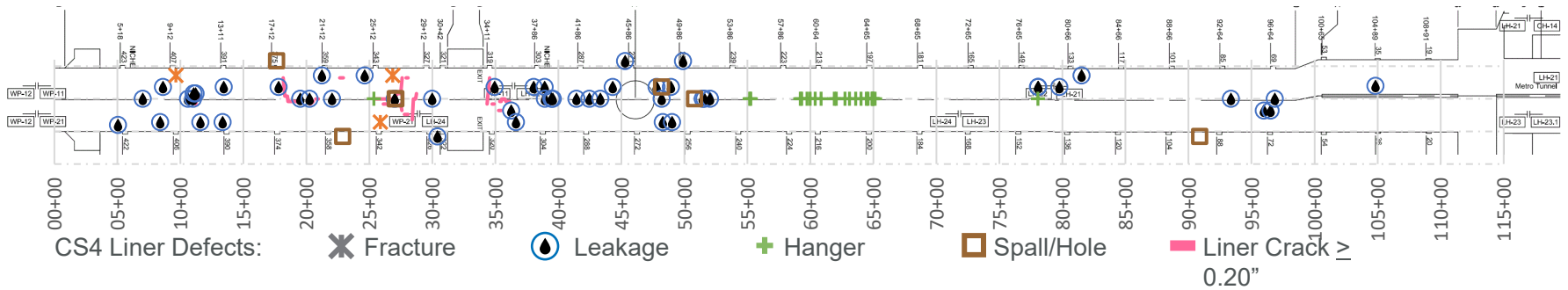


- Spall Removal by JOC: April & May 2023
 - 5 regular non-revenue nights



- Plenum Inspection: September 2023
 - 5 regular non-revenue nights for hazard evaluation and initial observations.
 - 8 extended non-revenue nights for 'crawl'

Representative CS-4 Defects



✕ 09+65 – Fractured Bar



● 48+27 – Leak @ 60 drops/min.



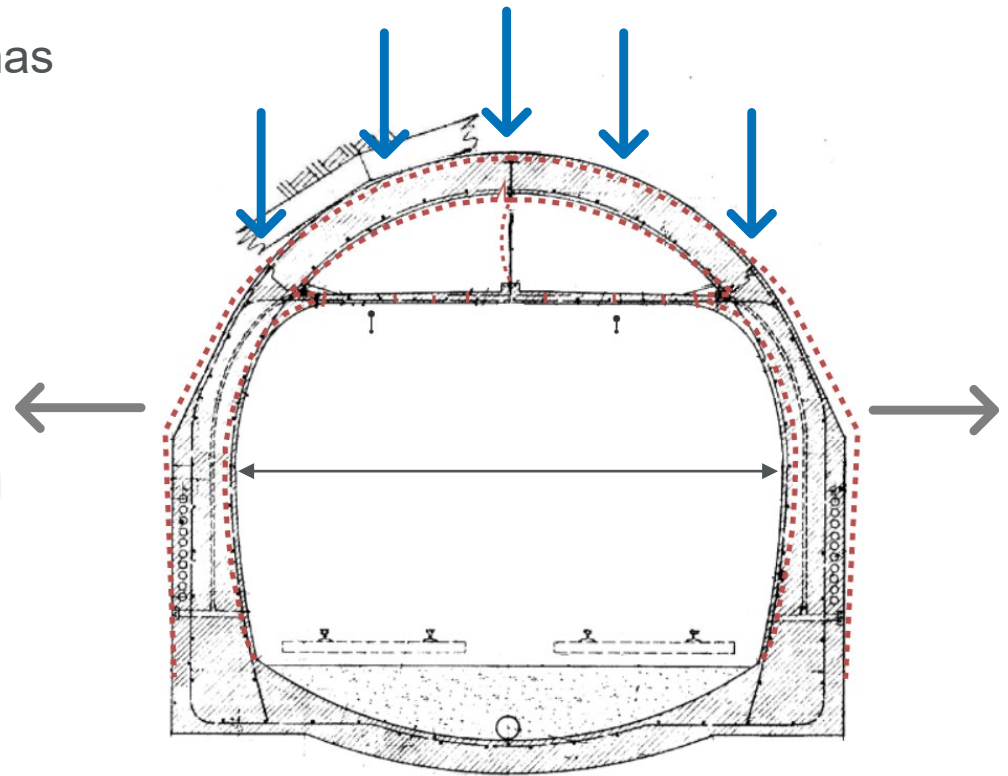
+ 61+90 – Hanger not secure



□ 90+90 – Hole in Niche 94

Findings

- Tunnel liner has distorted over time.
- Likely predates the 1970's and has progressed since then.
- Voids are likely a contributing factor.
- Visible signs include:
 - Measured width
 - Longitudinal cracks on ceiling
 - Fractured transverse rebar at ceiling
 - Longitudinal crack on crown
 - Distorted hanger rods



Twin Peaks Tunnel Short Term Mitigation

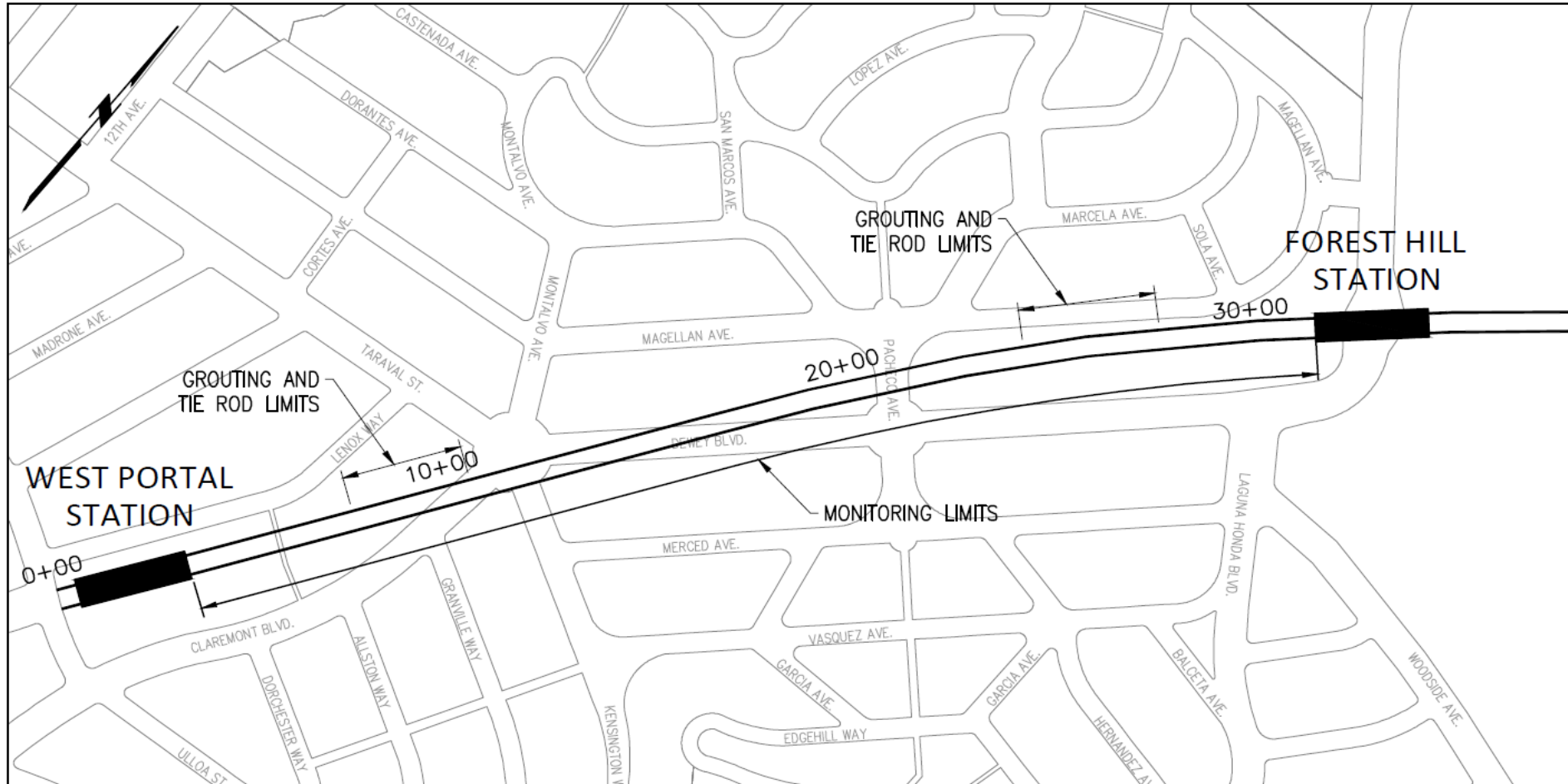
- We have identified and are working with a contractor to address/impece the movement at two locations between West Portal and Forest Hill Stations during planned shutdown this Summer.
- The work will consist of a combination of contact grouting to fill any possible voids and tie-rod installation to mitigate for this movement.
- Shutdowns this summer consisted of two-weekend shutdowns back in June 22/June 23rd; July 20th/July 21st; and an 8-day shutdown planned from August 22nd through August 29th.
- A Bus Substitution/Bridge was/will be provided during the three shutdown windows.



- While there are no immediate safety concerns, the inspection revealed significant state of good repair issues that will be costly to address and require tunnel shutdowns in the coming years.
- Plans for long-term repairs will be done in consultation with policymakers and the affected community.
- 5-Year Capital Plan will include ongoing/periodic inspections as well as seismic evaluation of the entire tunnel.
- Monitoring of the tunnel will be conducted quarterly to ensure status quo of the tunnel structure.

Two Locations Of Short-Term Mitigation

KEY MAP



Work Accomplished During June and July Shutdowns

- We completed the Stage 1 (Polyurethane Grout) under the SFUSD project limits
- We completed 20% of the Stage 1 (Polyurethane Grout) in the 2nd location near Forest Hill Station



- We installed all of the 7 anchors
- We installed the monitoring devices to detect/track for any liner displacement/movement

Work To Be Accomplished During 8-day Shutdown

- Complete Stage 1 grouting with polyurethane grout at both locations
- Complete Stage 2 grouting with cementitious grout at both locations
- Complete the Tie-Rod installation/assembly of the 7 locations



- Structural Re-Inspection of Ceiling/Plenum area to confirm no major changes since the last inspections
- Evaluate the data from the installed monitoring devices

THANK YOU!