



SAN FRANCISCO BAY AREA RAPID TRANSIT DISTRICT

GENERAL GUIDELINES FOR DESIGN AND CONSTRUCTION OVER OR ADJACENT TO BART'S SUBWAY STRUCTURES

- Structures over or adjacent to BART's subway structures shall be designed and constructed so as not to impose any temporary or permanent adverse effects on subway. The minimum clearance between any part of the adjacent structures to exterior face of substructures shall be 7'-6". Minimum cover of 8 feet shall be maintained wherever possible.
- In general, cut-and-cover subway structures were designed with an area surcharge applied at the ground surface both over and adjacent to the structures. The area surcharge was considered static uniform load with the following value:

D (ft)	Additional Average Vertical Loading (psf)
D>20	0
5<D<20	800-40D
D<5	600

Where **D** is the vertical distance from the top of the subway roof to the ground surface.

- In general, steel-lined tunnels were designed to support the weight of 35 feet of earth above the roof of the tunnel. Whenever the actual depth of cover is less than this amount, construction may be added imposing an additional average vertical loading of 120 lbs. per square foot for each foot of depth of reduced cover. Where basements are excavated, the allowable additional average vertical loading can be increased to the extent that it is balanced by the weight of the removed material. The effects of soil rebound in such cases shall be fully analyzed.
- Shoring is required for excavations in the Zone of Influence. Zone of Influence is defined as the area above a Line of Influence which is a line from the critical point of substructure at a slope of 1 1/2 horizontal to 1 vertical (line sloping towards ground level).
- Shoring shall be required to maintain at-rest soil condition and monitored for movement.
- Soil redistribution caused by temporary shoring or permanent foundation system shall be analyzed.
- Dewatering shall be monitored for changes in groundwater level. Recharging will be required if existing groundwater level is expected to drop more than 2 feet.



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8. Piles shall be predrilled to a minimum of 10 feet below the Line of Influence. Piles shall be driven in a sequence away from BART structures. No pile will be allowed between steel-lined tunnels.
9. Subway structures shall be monitored for vibration during pile driving operations for all piles within 100 feet of the structures. Steel –lined tunnels shall also be monitored for movement and deformation. Requirements for monitoring will be provided upon request.
10. Excavation shall be done with extreme care to prevent damage to the waterproofing membrane and the structure itself. Hand excavation shall be performed for the final one foot above the subway roof.

The above shall be considered as general information only and is not intended to cover all situations. Notwithstanding these guidelines, pertinent design and construction documents shall be submitted to BART for review and approval. In addition, the following shall be submitted as applicable:

- Geologic Hazards Evaluation and Geotechnical Investigation reports. The reports shall include engineering geology map, site plan showing the location of subway structures, BART easement, soil reworking plan and the geological conclusion and recommendations.
- Dewatering monitoring and recharging plans.
- Vibration monitoring plan and/or movement and deformation monitoring plans for steel-lined tunnels. Plans shall include locations and details of instruments in subways.
- Foundation plan showing the anticipated total foundation loads.
- Excavation plan for area within the Zone of Influence showing excavation slope or shoring system.
- Procedures and control of soil compaction operation.