

Posey-Webster Street Tubes, Oakland, CA



Alameda approach to the Posey Tunnel.

Ben C. Gerwick, Inc., worked with Parsons Brinckerhoff on the seismic retrofit design of two immersed tube tunnels in the San Francisco Bay area for the California DOT (Caltrans). The Webster Street and Posey Tubes connect the cities of Oakland and Alameda, passing in parallel under the Alameda Channel. Although the two tubes suffered little damage during the 1989 Loma Prieta earthquake, concerns with future earthquakes along the nearby Hayward and San Andreas Faults have prompted Caltrans to proceed with seismic analysis and retrofit design of the tubes.

The Posey Tube was constructed in the 1920s and a Ben C. Gerwick, Inc., construction joint venture, constructed the Webster Tube in the early 1960s. Each tunnel, including approaches, is approximately 4,500 ft long and carries two lanes of traffic. Both tunnels are historically unique. The Posey was the fifth immersed tube tunnel ever built, and at the time was the largest in the world. It was also the first immersed

roadway tunnel built without a steel shell. Of the 25 immersed tunnels in the U.S., the Posey and Webster Street Tubes remain the only two built without steel shells. Both tunnels are built of reinforced concrete with a bituminous coating to ensure water tightness. At the lowest crossing point under the Alameda Channel, the Posey and the Webster Tubes are 68 ft and 71 ft below sea level, respectively.

The project scope is the seismic analysis and retrofit design of both tunnels. The dynamic analysis indicated that the fixed tube joints would create large destructive moments and longitudinal forces in the tunnel during the design earthquake. The analysis also showed that releasing the joints would substantially reduce these forces. The retrofit design will create a hinge connection while maintaining water tightness and retaining shear capacity to prevent transverse displacements.

Dynamic analysis also identified potential for liquefaction of the backfill

Services Performed:

- Seismic Analysis
- Retrofit Design
- Structural Analyses
- Participation on the Technical Advisory Committee
- Supply of Historical Information on Construction of Webster Tube
- Survivability Analysis of the Piles under the Tremie Platforms and Portal Buildings
- Preparation of Plans, Specifications and Estimate for Jet Grout Support Columns at the Tremie Platforms
- Preparation of Plans, Specifications and Estimate for New Support System for Existing Posey Ceiling Slab
- Perform Constructability Evaluation of Tunnel Joint Retrofit Design
- Design of Isolation Joints for the Ramp Connection to the Alameda Portal Buildings
- Develop Preliminary Construction Schedule for the Entire Retrofit

around the immersed tube segments, which would lead to possible floatation of the tubes during an earthquake.

The third area highlighted by the dynamic analysis was the potential failure of the piles under the tremie platforms supporting three tube segments.

Year of Completion: 2001

Construction Cost: \$25M

Client: CALTRANS