GEOTECHNICAL STABILIZATION STRATEGY FOR
THE TREASURE ISLAND REDEVELOPMENT PROJECT

Project Background

- The Treasure Island redevelopment plan is the result of a public-private partnership between the Treasure Island Development Authority (TIDA), and Treasure Island Community Development (TICD). Under the current plan, the island's 400 acres of man-made land will be transformed by constructing up to 8,000 homes in low, mid and highrise buildings, a new retail district, an intermodal transit hub including a new ferry terminal to provide service to San Francisco, and 300 acres of parks and open space representing the largest addition of open space to the City, since the creation of Golden Gate Park.

Treasure Island Construction

- Treasure Island and the causeway that connects it to Yerba Buena Island were constructed in the late 1930s for the Golden Gate International Exposition, after originally being conceived as a future airport.
- To create the island, sand was dredged from various sources within San Francisco Bay. The dredged sand was placed hydraulically as fill over a natural sand shoal and a layer of weak, compressible clay, locally known as young Bay Mud. In the upper elevation the sand fill was retained by a series of rock dikes.
- Along the causeway most of the soft Bay Mud was dredged out. Sand fill was then placed in several stages. The first stages of fill were placed using hydraulic methods and, at higher elevations, fill was placed using conventional earthmoving equipment.

Geotechnical Challenges

- There are three main geotechnical challenges on Treasure Island:
  - ❖ Liquefaction/Settlement of the sand fill during earthquakes.
  - ❖ Settlement of the Bay Mud underlying the sand fill, induced by the addition of new fill and structures.
  - ❖ Seismic stability of the island perimeter and the causeway

Geotechnical Stabilization Strategy

- The proposed geotechnical stabilization strategy has received the support of the City's reviewer, URS Corporation, and an Independent Review Panel composed of world-renowned professors James K. Mitchell (Virginia Tech), Raymond B. Seed (University of California, Berkeley), I. M. Idriss (University of California, Davis), and Ross Boulanger (University of California, Davis).
- The geotechnical stabilization strategy consists of three parts: (1) create a long-term stable platform on Treasure Island for development and infrastructure, (2) strengthen the island's perimeter which serves as wave and flood protection, and (3) strengthen the causeway to provide a reliable access route and minimal damage to lifeline utilities following a major earthquake.

Creating a Long-Term Stable Development Platform.

- The purpose of densification is to improve the sand fill within the planned development area to serve as a long-term stable platform for buildings, roads, and utilities. A variety of proven techniques are available for densification; the most likely to be used on Treasure Island are deep dynamic compaction (DDC), which consists of repeatedly dropping a large weight onto the soil, and vibro-compaction, in which a vibrating probe is repeatedly inserted into the soil. With either of these techniques, the objective is to take most of the medium-dense sands and transform them into dense sands that are no longer susceptible to significant liquefaction and seismic settlement.
- Densification of the sands will cause a lowering of the current ground surface. Fill will be added to bring the ground surface elevation of the development area to a level that provides long-term protection against flooding and potential sea-level rise. To minimize the impact of gradual settlement resulting from new fill, the development areas will likely be surcharged with additional temporary fill, supplemented by the vertical (wick) drains as necessary.
- Surcharging the development area and having below-grade basements under the buildings will minimize the amount of long-term settlement triggered by the weight of the buildings. It is anticipated that the magnitude of differential settlements will be within acceptable tolerances for low-rise and mid-rise buildings on shallow foundations with full basements. High-rise buildings will be pile supported.

Strengthening the Perimeter Berm

- The sands underlying the perimeter of the island may also be densified (by vibro-compaction or DDC) in order to minimize deformation of the perimeter berm in earthquakes. In the northwest corner of the island, additional techniques may be employed to increase the strength of the young Bay Mud where it is thickest, by surcharging or placing high-shear-strength materials below the surface.

Strengthening the Causeway

- The issues potentially affecting the causeway are generally similar to those impacting the island perimeter except that most of the young Bay Mud had been removed as part of the original construction. The sands underlying the causeway may also be densified (by vibro-compaction or DDC) in order to minimize deformation in earthquakes.