BY CAROL EATON

Innovative Solution for Port of Oakland Soils

When the ship carrying the world's largest container cranes squeaked under the San Francisco-Oakland Bay Bridge with a mere 25 inches to spare late last year, officials at the Port of Oakland along with everyone else involved in the delicate operation breathed a collective sigh of relief. The cranes had completed their successful passage from Shanghai, China, to their new home at the Port's Hanjin Terminal, which was recently completed.

The high drama behind the cranes' passage across the Pacific Ocean to their final destination in the Bay Area received worldwide media attention. Behind-the-scenes, the Port of Oakland overcame a major hurdle that at one time threatened to delay construction.

The $57-million project to build Berths 55-56 included construction of a container wharf, dike and container yard in the Port's inner harbor. The Port of Oakland Constructors, a joint venture of General Construction Co. of Poulsbo, Washington, and Seaworks, Inc. of Oakland, was general contractor on the project, which represented the single largest contract to date on the Port's $560-million Vision 2000 expansion program-- a multi-year maritime program underway by the Port of Oakland to develop a 531-acre former Navy site.

Earthworks contractor McGuire and Hester, Oakland, encountered a critical problem as it was excavating soils necessary to place the six-foot deep base layer for the wharf for Berth 55. The area needed to be able to support the intense pressure of ship loading and unloading operations handled by specialized equipment with axle loads ranging up to 212,000 pounds. At the bottom of the excavation, however, the contractor discovered unacceptable poor soil conditions created by the combination of Bay mud and a high water table that made compacting the soils impossible. The project had to be temporarily shut down until a solution could be found.

The Chinese ship Zhen Hua carrying these massive cranes received worldwide media attention as it slipped under the Golden Gate Bridge with only 25 inches to spare!

In drier ground conditions, the addition of lime or cement to the soil might have solved the problem. This job site precluded that approach for several reasons, one being groundwater contamination concerns due to the sensitive San Francisco Bay estuary. The rigidity of concrete was also of concern, since a rigid concrete slab would likely crack under loading if placed directly on top of the saturated bay mud. Finally, there was the issue of ground settlement. The solution demanded a system that could address projected movement and differential settlement issues by flexing without failing.

The Port of Oakland quickly began looking for a solution and contacted Soil Stabilization Products Company, Inc., headquartered in Merced, California. They delivered the solution in the form of a simple technology – a plastic honeycomb structure. The GEOWEB System is actually an advanced load support technology that is now in use worldwide for uniquely challenging stabilization problems.

Soil Stabilization Products Company (SSPCo) is the primary western distributor for GEOWEB. This product was developed by Presto Products Company and the Army Corp of Engineers some 20 years ago for rapid deployment of U.S. Marines and their heavy equipment when landing on beaches. Used to build roads in the sand for Operation Desert Storm, the GEOWEB system's primary application to date has been to control erosion and stabilize steep slopes as well as to form natural fully vegetated retaining

walls and in channels. Its additional use for load support under pavements and rail lines is projected to grow dramatically in the coming years as improved design software tools that have been developed in recent years help engineers to become more familiar with the GEOWEB technology.

The GEOWEB system operates under the principal of passive resistance. For load support uses like the Port of Oakland project, the system - which is manufactured from high density polyethylene plastic (HDPE) - "re-routes" incoming forces from the heavy loading above, as the majority of the force is "shed" into the horizontal layer. Loads are spread across the system, and the three-dimensional webwork behaves like a stiff but flexible horizontal laminar element beneath the load-bearing surface. Unlike rigid slab-like layers, a GEOWEB reinforced layer can flex to accommodate sub-grade movement without loss of structural integrity.

According to Samuel Randolph, manager for SSPCo's GeoSystems Division, the technology is uniquely suited for stabilizing soil that will support heavy loading. "Once engineers find out about this and understand its principles, they realize the benefits," he said. "There really is no other technology out there like it."

With the clock ticking once the Pier 55-56 project had ground to a halt, the Port of Oakland and its consulting engineer, Harza Engineering Co., quickly evaluated their options and found the GEOWEB system to be the most viable alternative for the extreme soil condition on the site. The Port's application called for the GEOWEB system to be placed over geotextile separation fabric. Crushed concrete was used for in-fill and as a cover layer.

The material installed created a "working bottom" which could then be back-filled and compacted.

Approximately 213,000 square feet of the material was installed on the Port of Oakland project, creating a "working bottom" layer from which the contractor could then compact and build up the base section for the pavement layer above.

A bonus feature of the use of GEOWEB system on the Port of Oakland project was its compatibility with the brick pavers that are used above it. The project reportedly represents the largest brick pavers application in a U.S. Port to date. ■

Some 213,000 square feet of GEOWEB was installed on the project.

Port of Oakland soil is shown being prepared to receive GEOWEB soil stablization technology.