

Case Study

application	Subgrade Stabilization
location	West Hynes Tank Farm, Long Beach, CA
product	Mirafi® BXG12

job owner	Plains All American/Pacific Terminal, LLC
engineer	Spec Services/Geopentech
contractor	Lovco Construction, Inc.

TenCate™ develops and produces materials that function to increase performance, reduce costs and deliver measurable results by working with our customers to provide advanced solutions.

THE CHALLENGE

The upgrade of crude oil facilities has never been more crucial with the recent escalation of fuel costs. Oil refineries and storage yards must increase capacity to meet today's energy demands. This was the case at the West Hynes Tank Farm in Long Beach, CA, located at 5900 Cherry Avenue, between the 405 and the 91 freeways. A new 250,000 barrel crude oil tank with a 205 ft diameter was designed at the existing tank farm. The tank is designated T-0607 located just north of the entrance ramp over a spill containment dike. The enormous weight of such a large storage tank required careful evaluation of the foundation soils and a detailed foundation design plan.

THE DESIGN

The soils investigation determined that the native soils were not sufficient to carry a heavy storage tank load. The water table was located just 12 ft below existing grade. The option to locate the crude oil storage tank on piles was feasible, but expensive. Further complicating the design was the emphasis on potential seismic movement. The area is rated the highest UBC Seismic Zone 4 due to the presence of the nearby Newport-Inglewood Fault. In 1933, Long Beach experienced a 6.4 magnitude earthquake that caused major destruction to the city and port facilities (see photos). The additional concern with seismic shaking is the threat of soil liquefaction in sandy soils, and more recently discovered in some fine grained soils. The liquefaction occurs when the soil undergoes shaking while exposed to water infiltration.

This is a major concern option the high ground water table. The design chosen was overexcavation and removal of the unsuitable soil and replacement with a geogrid reinforced gravel platform. This platform would become the foundation for the 250,000 barrel crude oil storage tank.

THE CONSTRUCTION

The soil was removed at the site up to a depth of 10 feet. The subgrade was proof-rolled and prepared for placement of the geogrid reinforced gravel platform. Mirafi® 1120N nonwoven geotextile was placed on the subgrade. A series of 12 inch thick gravel layers were "placed in full by end-dump and push out method". A total of 7 geogrid layers of Mirafi® BXG12 biaxial geogrid were installed in one foot vertical lifts. The geogrid was located 30 feet beyond the 205 ft diameter tank footprint. An 18-inch overlap was used on roll edges and ends. A one-inch minus gravel was dumped, spread and compacted on the Mirafi® BXG12 geogrid.



A building and storage tank destroyed in the 1933 Long Beach Earthquake.

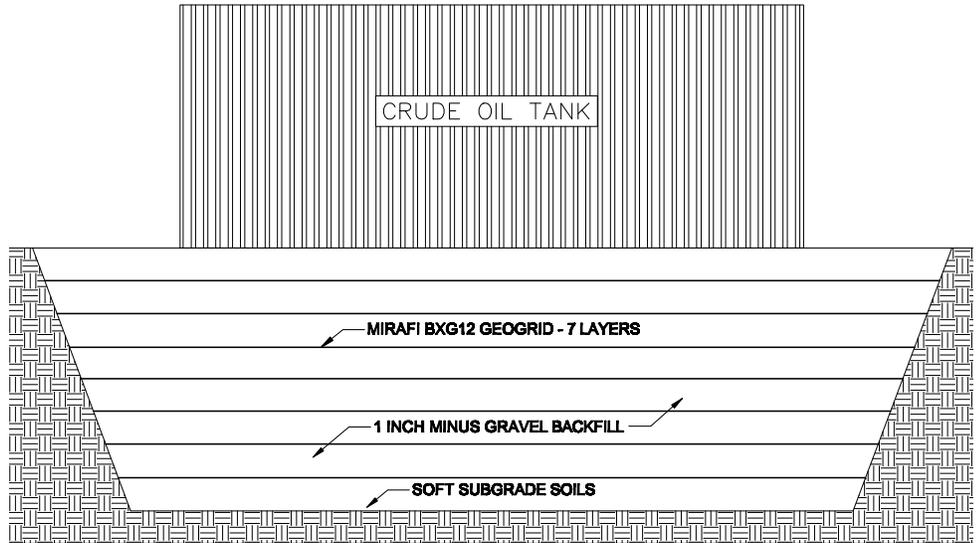


Gravel base spread over Mirafi® BXG12 geogrid.

The fully loaded rubber tired dump trucks and graders were allowed to operate directly on the Mirafi® BXG12 geogrid. The crushed gravel was spread directly on the geogrid with the grader (see photo). The crushed gravel was compacted to 95 percent maximum density with a heavy weight smooth drum vibratory roller. No installation damage occurred in the Mirafi® BXG12 geogrid as demonstrated in the construction of this gravel platform and as shown in Mirafi® Installation Damage Tests Reports.

THE PERFORMANCE

The use of a geogrid reinforced foundation platform saved thousands of dollars over the use of a pile supported tank structure. The Mirafi® BXG12 biaxial geogrid performed as designed in carrying the heavy load of the crude oil storage tank. No construction damage to the geogrid occurred during the gravel placement. The Mirafi® BXG12 geogrid provides the required interlock with the one-inch minus gravel to form a stable geogrid reinforced foundation platform to support the 250,000 barrel crude oil storage tank. Also, the use of the Mirafi® BXG12 geogrid provides the stability to the foundation platform in the event of seismic shaking and soil liquefaction.



Typical detail of subgrade stabilization using Mirafi® BXG12 geogrid.



Completed Crude Oil Storage Tank.



Rubber Tired Grader driving directly on the Mirafi® BXG12 geogrid.

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