TenCate Mirafi

Separation

Soil Reinforcement

Case Study

application	Reinforced Embankment on Weak Foundation
location	LaGuardia Airport, New York, NY
product	Mirafi® HS1150
job owner	New York LaGuardia Airport
engineer	*Port Authorities of New York and New Jersey.*
contractor	Yonkers Contracting, Inc. Yonkers, NY

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

By the spring of 1994, construction of a runway overrun at the east end of runway 13-31 at New York's La Guardia Airport (Figure 1) had been in the planning and permitting stages for several years. Three overrun incidents at the airport brought the project to the political forefront. With this notoriety came an imperative that the overrun area be functional by the next winter season, which was little more than nine months hence.

The project entailed the construction of 140 meters (460 feet) long overrun area at the east end of LGA's runway 13-31. The over-run area has a perimeter dike which ties into the existing storm surge diking system, which presently surrounds the airport. The finished area would be predominantly grass, with pavement limited to a jet blast area and an emergency access roadway.

The overrun area is constructed in a broad inter-tidal mud flat consisting of a 23m (75ft) thick stratum of soft, normally consolidated clay. The challenge of this project was to place fill on the soft normally consolidated clay without creating measurable mudwaves. The historical approach to land creation at LA Guardia had been by enddumping of fill. This past practice created massive, uncontrolled mud waves. Mud wave creation was deemed unacceptable for this project due to the proximity of a federal shipping channel and community concerns about increased "low-tide" odor.

THE DESIGN

A number of design concepts had been investigated for the overrun area. These included structural decking, predredging and filling, or geotextile reinforced construction. The latter was suggested because it was the most cost-effective and least disruptive construction methodology. In order to accomplish the filling in the inter-tidal area without creating mud-waves, the design prescribed detailed stage construction procedures. This staged design incorporated the deployment of a high-strength polyester geotextile prior to the placement of hydraulically pumped sand fill. The design specifications required that the geotextile be a woven polyester or polyester/polypropylene fabric with these physical properties:

Tensile Strength	
Machine Direction	131kN/m (750lbs/in)
Cross-machine	131kN/m (750lbs/in)
Minimum Seam Strength	61kN/m (350lbs/in)
Minimum Tensile Load @ 5% Strain	65kN/m (375lbs/in)
Elongation at Failure	20%
Minimum Friction Angle	25°
Specific Gravity	1.1

TenCate Mirafi®, which offers a wide range of woven geotextiles for soil reinforcement applications, was chosen as the supplier of the geotextile. The geotextile chosen to meet the design criteria was Mirafi® HS1150, which is woven of high tenacity, high molecular weight polyester fibers, capable of tensile reinforcement exceeding 200kN/m (1150 lbs/in).

Figure 1

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THE CONSTRUCTION

The contractor elected to use three steel barges coupled in tandem, with a total length of 230 meters (750 feet) for geotextile deployment. The barges were coupled alongside a bulkhead where the geotextile was subsequently unrolled and seamed (Figure 2). The contractor's deployment scheme called for the geotextile to be folded in an accordion-like fashion and then unfurled off the barges and onto the tidal mud flat.

Figure 2

The deployment of the two geotextile sheets took place on two weekends when both runway closures and midday high tides coincided. The 2.1m (7 ft) Tidal range at the airport provided the barges with sufficient draft at high water to come within 15 meters (50 feet) of the shoreline. The leading edge of the geotextile sheet was pulled to shore and secured (Figure 3).

Figure 3

The barge assembly was then slowly pulled from shore with the geotextile unfurling into the water and progressively sinking onto the bay bottom, where it was secured with sandbags. In the area immediately behind the runway, which is subject to severe blast winds from jet aircraft, fill was placed over the geotextile.

The initial filling over the geotextile was specified to be hydraulically placed sand fill, because this was the only placement method which could produce the flat slopes necessary for stability.

Strict criteria were prescribed for the fill placement. The fill had to be placed in lifts no thicker than 1 meter (3 feet) and the overall fill slope could not be steeper than 1V on 20H. The contractor was able to place to these limits with a combination of low water pumping and multiple outfalls.

Hydraulic filling commenced in mid-September of 1994 and was completed in late November of that year, thus meeting the project schedule for the construction of the interim overrun area prior to the winter season. With the initial hydraulic fill in place, vertical drains were then installed. The performance of the vertical drain has been very good. The actual settlement rates compared well with the design estimates.

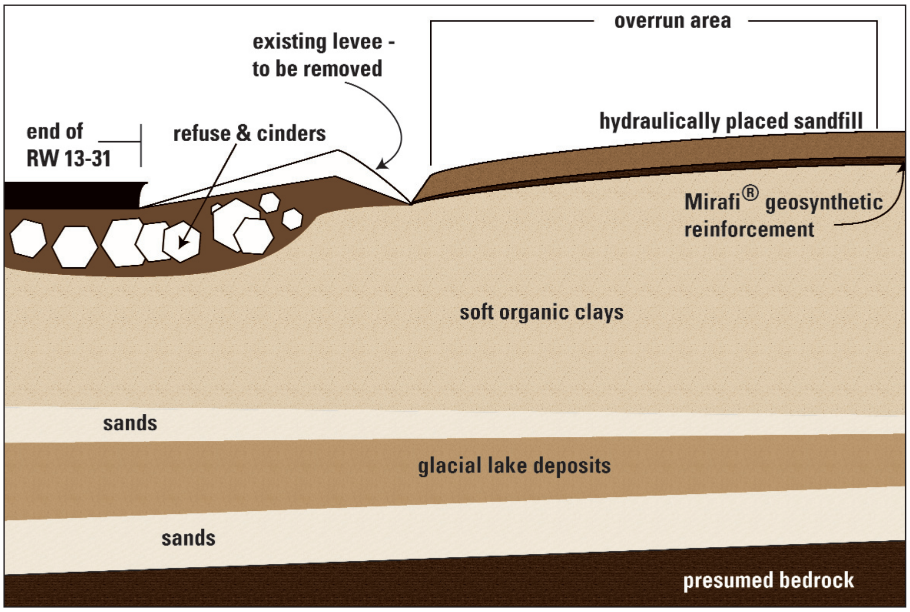
THE PERFORMANCE

The overall performance of the geotextile reinforced fill was excellent. There were no discernible mud waves created during the hydraulic filling. Subsoil displacements were minimal, being on the order of a few inches rather than multiple foot displacements which were typical of the previous end-dump methods. The vertical drains also performed well, with the field consolidation rates being only marginally less than the laboratory derived design values. The overrun area construction was scheduled for completion in the summer of 1996. It is anticipated that at the completion of construction the final settlement under the perimeter dikes will be approximately 4.5 meters (15 feet). To date, the dike areas have already settled on average 3.8 meters (12.5 feet). The top elevation of the dikes have been set 0.7 meters (2.5 feet) above the airport's storm dike elevation to provide for future consolidation and secondary compression settlements.

References

Sandiford, R.E., Law, S. and Roscoe, G. Application of Geosynthetics in the Construction of an Overrun Area at La Guardia Airport." Proceedings of the 9th Geosynthetic Conference, Philadelphia, December 1995.

Cross-section of LaGuardia Project



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