



Drainage



Separation



Soil
Reinforcement

Case Study

application | **Reinforced Soil Slope to guard against Terrorism**
location | **Minneapolis, MN**
product | **Miragrid® geogrids and Mirafi® N-Series geotextiles**

job owner | **General Services Administration**
contractor | **Arteka, Inc.**
engineer | **Gale-Tec Engineering, 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 threat of terrorist attacks against U.S. citizens and property both at home and abroad has been an issue of growing national concern. Soon after the 1995 bombing of the Alfred P. Murrah Federal Building in Oklahoma City, President Clinton issued Presidential Decision Directive 39 (PDD39), the central blueprint for U.S. counterterrorism strategy. The first of five strategies was to reduce vulnerabilities and prevent and deter terrorist attacks before they occur.

The Federal Building and U.S. Courthouse in Minneapolis, Minnesota has four (4) levels of underground parking beneath the front entrance plaza area. Obstructions needed to be designed



Berms 10 years after construction.

that would be imposing to potential terrorists contemplating a truck bomb attack yet lightweight because of the requirement to be supported on the parking deck.

THE DESIGN

The Architect chose a series of high mounds situated in a landscaped pattern that could provide both a green "park-like setting" and be a deterrent against vehicles capable of carrying



Federal Building.



Miragrid® was used to Maintain Steep Sand Slopes

explosives to the front of the building. A design was developed employing a Miragrid® reinforced soil slope (RSS) technology surrounding a core of EPS (Expanded Polystyrene) block molded geofoam and then planted with grass and trees to give the look of imposing soil berms.

THE CONSTRUCTION

Waterproofing, Concrete Curbs, Geofoam, Miragrid® geogrids, and Sand fill were used to Create Berms. Construction began with a waterproofing membrane being placed on the plaza deck. A composite drainage system was used. A concrete curb was then placed around each of the drumlin footprints and was later covered over with a thin veneer of select granular fill. The drumlin interior consisted of a core of EPS (Expanded Polystyrene) block geofoam. EPS blocks with a dimension of 4 ft x 8 ft x 1ft thick were delivered to the site and then cut in the field, as needed. A nonwoven geotextile, Mirafi® 140N, was placed over the geofoam.

A reinforced soil slope (RSS) technology was used to reinforce a veneer of select granular material that was placed over the geofoam and then final shaped.



EPS – Block Geofoam was Stacked Inside Sand Fill

In this technology, tensile reinforcing elements are placed in a regular horizontal pattern within a veneer of granular soils. Miragrid® 5XT was used.

THE PERFORMANCE

The resulting mounds are lightweight and create a visual obstacle and vehicle impediment to the front of the building.

A veneer of topsoil was placed. A sprinkler system was installed and then the sod was set with stainless steel wire into the surface in order to create very steep mounds.



New Federal Building.

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