

Pyramat®-reinforced vegetation helps South Carolina channels hold their ground



PROJECT FACTS

PRODUCT

Pyramat® HPTRM

QUANTITY

18,747 yd³

LOCATION

Columbia, SC

APPLICATION

Channel lining

MARKET

Transportation

OWNER

South Carolina DOT

INSTALLER

P&L Erosion Control

DISTRIBUTOR

General Materials

REPRESENTATIVE

Contech Construction Products

A storm water case study from



INTRODUCTION

Northeast of Columbia, S.C., in an area commonly referred to as the Sandhills, numerous residential areas have sprung up to accommodate the city's ever-growing population. Clemson Road, which links Interstate 20 to Interstate 77, serves as a major travel route to and from

downtown Columbia. In 1997, an influx of traffic prompted the South Carolina Department of Transportation (SCDOT) to plan a widening project for Clemson Road at Two Notch Road as well as the construction of an overpass spanning U.S. Route 1 and an existing railroad line. SCDOT even relocated a section of roadway from a previous location to the Clemson Road site for better alignment and to allow for the construction of the overpass.

The relocation required the construction of a 1,156-foot ditch on the northern side of Clemson Road and a 2,141-foot ditch on the southern side to manage water flow through the area, which has a healthy average yearly rainfall of 50.14 inches. Three rivers – the Saluda River, the Congaree River, and the Broad River – run through Columbia, and the 78-square-foot Lake Murray lies only 18 miles away. Water is in the ground here, and the SCDOT knows it has to plan for the ramifications of this condition, since the filtration of storm water has quickly become a major issue in the world of construction. The sandy soil indigenous to the Sandhills region also makes the erosion of ditches a serious issue due to the unstable foundation they provide.



Pyramat® was used to line two channels that totaled more than 3,000 feet in length.

WATER QUALITY CONSIDERATIONS

The Environmental Protection Agency's (EPA) Clean Water Act established the National Pollutant Discharge Elimination System (NPDES) program to control the discharge of pollutants into our nation's waterways. NPDES Phase II requires that any construction site larger than one acre must adhere to a Storm Water Pollution Prevention Plan. For this project, the SCDOT determined that practices such as seeding, planting, and other soil retaining measures were appropriate best management practices (BMPs) for compliance with the EPA legislation and for the health and longevity of their project and the community.

The EPA regards vegetation as the best method of erosion prevention as well as an extremely effective deterrent against sedimentation, which is the world's largest water pollutant. The EPA has published storm water technology fact sheets that describe how vegetation can help provide long-term water quality benefits and recommend the use of turf reinforcement mat (TRM) enhanced vegetation as a replacement for hard armor techniques. "Controlling erosion and minimizing

PROJECT FACTS

THE COST OF TURF REINFORCEMENT

TRMs ARE REGARDED AS A PERMANENT, SOFT ARMOR ALTERNATIVE TO MORE COSTLY HARD ARMOR TECHNIQUES. TRMS COST AN AVERAGE OF \$5 TO \$15 PER SQUARE YARD INSTALLED, WHEREAS RIPRAP COSTS AN AVERAGE OF \$25 TO \$60 PER SQUARE YARD INSTALLED, AND CONCRETE LINING LISTS AT AS MUCH AS \$80 PER SQUARE YARD INSTALLED. TRMS ARE DESIGNED FOR PERMANENT AND CRITICAL HYDRAULIC APPLICATIONS SUCH AS DRAINAGE CHANNELS, ROADSIDE DITCHES, LANDFILL DIVERSION DITCHES AND SPILLWAYS WHERE EXPECTED DISCHARGES RESULT IN VELOCITIES AND TRACTIVE SHEAR STRESSES THAT EXCEED THE LIMITS OF NATURAL VEGETATION.

sediment-laden runoff are the two major points to every storm water management program," said Lee Pierce, SI Geosolutions' National Sales Manager. "The use of vegetation as a source of soil stabilization and storm water filtration provides a natural, cost effective solution."

In addition to storm water and erosion concerns, there were also several geographic obstacles that SCDOT had to consider in the area. A large bridge embankment fill of approximately one million cubic yards exists at the end of the overpass with ditches excavated below natural ground on either side. A stream flows through the fill area, and there are numerous areas where underground springs are located. All of this water drains to an eight-acre pond immediately downstream. According to Ray Vaughan, SCDOT Storm Water Program Manager, the flow of this water was a major cause of concern for sedimentation. Left uncontrolled, sediment can clog vital waterways and destroy fish spawning and wildlife habitats. In order to preserve the natural order of the ecosystem and provide a larger roadway for a growing populace, SCDOT decided that an environmentally friendly channel liner should be employed.

MAKING THE TURF REINFORCEMENT CHOICE

Many varieties of reinforcement were considered by SCDOT, including riprap, asphalt, interlocking blocks, and TRMs. However, interlocking blocks are expensive, and asphalt interrupts the natural beauty of the area. The SCDOT had used rock riprap in the past but had been disappointed by the results. They decided the most economic and environmentally friendly choice for this project was SI Geosolutions' Pyramat® high performance turf reinforcement mat

(HPTRM). "SCDOT is making an effort to eliminate hard armoring where practical," said Vaughan. "Instead we will install turf reinforcement mats to allow vegetation to grow and provide treatment for storm water runoff."

"WE HAVE ALWAYS BEEN IMPRESSED WITH [PYRAMAT'S] ABILITY TO REINFORCE VEGETATION, WHICH PROVIDES FILTRATION OF STORM WATER RUNOFF AND SERVES AS AN OFFENSIVE MEANS OF EROSION PREVENTION."

— RAY VAUGHAN

The decision to use an HPTRM was reaffirmed

when, prior to the installation of the Pyramat, the SCDOT had to put riprap at an invert in the northern ditch due to construction scheduling. The riprap washed out several times, and they finally had to grout the invert. The invert in the southern ditch required similar attention; however, this time the construction team was able to place Pyramat instead of riprap. The Pyramat in the southern invert has held strong, and according to Vaughan, the area has not seen any failures.

Pyramat HPTRM is a permanent rolled erosion control product (RECP) that is designed for the most demanding slope and storm water channel applications. It is a patented three-dimensional woven geotextile that provides slopes and channels with long-term strength, dimensional stability, durability, functional longevity and erosion protection. It is also more than 10 times stronger than typical TRMs, possessing unmatched long-term survivability, which was particularly important for this project as maintenance equipment and possibly vehicle would cross reinforced areas. Heavy-duty HPTRMs are designed to withstand prolonged exposure on demanding job sites or inhospitable climates, such as those involving



Vegetation begins to grow through the Pyramat® matrix just a few weeks after installation.

sandy soils or arid climates. When fully vegetated, woven polypropylene HPTRMs will resist flow velocities of up to 7.6 m/sec (25 ft/sec) at shear stresses up to 528 Pa (11 lb/ft²).

Pyramat® serves the SCDOT's need of environmental preservation by promoting the growth of vegetation. Intertwining with the natural roots and shoots of plant life that are found in the area, Pyramat creates a stabilization matrix that keeps soil in place while allowing vegetation to flourish. Vegetation is nature's best filter for sediment and other pollutants, so by promoting vegetation, TRMs help rid storm water of pollutants. Research has shown that vegetated channels can capture as much as 700 percent more sediment than channels lined with hard armor. In addition, Pyramat was chosen because of its ability to withstand the high velocities of storm water that will flow through the ditches during precipitation events.

Pyramat is designed with a proprietary ultraviolet stabilizer that provides maximum protection against the sun's damaging rays when the mats are exposed. Ongoing test data has demonstrated that the new tan and green versions of this HPTRM will retain 100 percent of its original tensile strength after 3,000 hours in a Xenon Arc Weatherometer in accordance with ASTM test method D-4355. The highest quality conventional stitch-bonded polypropylene TRMs, under the same testing conditions, provide 80 percent strength retention after 1,000 hours.

INSTALLATION

To assure optimal long-term performance, RECPs must be installed in strict conformance with the manufacturer's installation procedures. Care must be taken to properly anchor and trench in the RECP to create intimate soil contact while avoiding any damage to the matrix. In areas with sandy soil, the seed bed must be prepared by loosening 50-75 mm (2-3 in.) of top soil, incorporating amendments such as lime and



fertilizer into the soil, and clearing the site of large stones, protruding roots, and other debris. Proper preparation and installation is important because optimal installation can accelerate establishment of the vegetation.

The Clemson Road project used about 19,000 yd³ of Pyramat in trapezoidal ditches, which had a standard six-foot flat bottom with 2H:1V side slopes. The longitudinal slopes varied from two percent to six percent in grade.

Installers P&L Erosion Control dug closed anchor trenches along the length of the ditches in order to keep moving storm water from getting underneath the HPTRM. The area was hydraulically seeded immediately after the ditches had

been graded and the trenches excavated in order to keep the sandy soil from eroding. The Pyramat was installed directly afterward. The edges of the Pyramat were buried in the 10-inch by 10-inch trenches, and the RECP was extended two or three feet above the crest of the channel side slopes. Topsoil was then manually broadcast over the area, which was permanently seeded again with a grass seed mixture consisting primarily of Bermuda grass seed.

P&L Erosion Control was very pleased with the performance of Pyramat during the installation. "This was the largest project we

Pyramat®-reinforced vegetation combats erosion by keeping soil in place and filtering sediment from storm water runoff.

PROJECT FACTS

PYRAMAT CONFORMS TO MOST ANY SITE

DURING THE INSTALLATION PROCESS, THE INSTALLERS ENCOUNTERED SITUATIONS WHERE THE WIDTHS OF PYRAMAT® DID NOT FIT THE VARYING DEPTHS OF THE CHANNEL. THEY WERE ABLE, HOWEVER, TO CUT THE PYRAMAT OR OVERLAP IT. THE HPTRM SECURED WITH A COMBINATION OF WOODEN STAKES AND LONG U-SHAPED WIRE STAPLES IN ORDER TO KEEP A CONSISTENT PATTERN ALONG THE ENTIRE LENGTH OF THE CHANNEL. OTHER THAN THIS EASILY RECTIFIED CHALLENGE, THE INSTALLATION PROCESS WENT SMOOTHLY.

"A LARGE AMOUNT OF WATER FLOWS THROUGH THE AREA, AND PYRAMAT DID A FABULOUS JOB."

— LYNN SIZEMORE

PROJECT FACTS

Do You Want to Know More?

TO FIND OUT MORE ABOUT HOW TO INCORPORATE LANDLOK® TURF REINFORCEMENT MATS OR PYRAMAT® HPTRM INTO YOUR NEXT PROJECT, CALL SI GEOSOLUTIONS AT (800) FIX-SOIL AND ASK FOR OUR NEW STORM WATER MANAGEMENT BROCHURE, ITEM LL-400. OR VISIT US ON THE WEB AT WWW.FIXSOIL.COM.

have installed using Pyramat®," said Lynn Sizemore, a partner with P&L Erosion Control. "A large amount of water flows through this area, and the Pyramat did a fabulous job."

CONCLUSIONS

The entire project came to a successful finish in 2001, and presently, the installation is still holding its ground. No erosion is occurring in the area, and vegetation has flourished, especially on the bottom of the ditches, where a great deal of storm water filtration takes place. SCDOT is pleased with the outcome of the project and wants to continue their practice of using vegetated solutions for soil stabilization and filtration. "We have used Pyramat on several projects throughout the state because of the natural



New vegetation grows through the Pyramat® matrix, which also keeps the sandy soil in place.

appearance when vegetation takes hold," said Vaughan. "We have always been impressed with its ability to reinforce vegetation, which provides filtration of storm water runoff and serves as an offensive means of erosion prevention."



4019 Industry Drive
Chattanooga, TN 37416
Ph: 423-899-0444
Fax: 423-899-7619
www.fixsoil.com