Innovative Use of Compost
In
Highway Construction

Project BLRI - 2S16

Excavated slope prior to the placement of the compost material.

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Introduction

Several State Departments of Transportation (DOT's) have used compost mixtures made of recycled organic materials for erosion and sediment control and establishing vegetation.

Research and field trials show that compost works effectively for erosion and sediment control and establishing vegetation. Composted organic material improves the chemical, physical and biologic characteristics of soil on the vegetation growing media.

Composted mixtures made of peat moss, bark, processed wood chips, lawn grass chippings, manure and other materials interact to adjust soil PH and fertility necessary for a healthy growing ecosystem.

The composting process minimizes concerns of three major threats. The health and environmental issues of introduction of exotic plants, weeds, insect larvae, and eggs are a major concern with the use of composted products. When compost is properly processed these threats are no longer a problem.

The purpose of using compost is to stabilize a steep slope with sustainable vegetation and to prevent erosion.

The use of compost in highway construction lacks identity as a Best Management Practice tool.

It all adds up to clean water and aesthetically pleasing roadside vegetation.

Objective

The objective was to: (1) test the effectiveness of compost blankets and berms for erosion and sediment control, (2) test the effectiveness of establishing vegetation on a steep slope, steeper than 2 to 1 ratio, and (3) test the effectiveness of mixing compost with 50 percent minus 3/8 crushed stone for a stabilization mixture.

The Project

The project was located on the Blue Ridge Parkway, 8 miles south of Asheville, North Carolina. The site is described as a steep excavated cut slide area with shallow soil layer over rock. Slide area dimensions are: horizontal length of 400 feet, width 130 feet, and a vertical height of 130 feet. Steepness of slope varies from a 1 to 1 ratio to a ½ to 1 ratio. The work required to correct the cut slope failure includes 1.5 acres of clearing and

grubbing, excavation of approximately 20,000 cubic yards of mostly rock material, preparing the seedbed as the slope was excavated, roadway paving, bituminous paved ditches, cleanup, placing lockdown netting, and applying blended compost with seed in one application on 1.5 acres, 1 to 3 inches in depth. Filter berms were constructed around the uppermost perimeter and on contours at 30-foot increments. The seeding mixture included perennial rye and fescues. The work began on May 14, 2002 and was completed on June 28, 2002.

After paving was completed, the roadway shoulders were covered with enriched compost mixed with AASHTO No. 78 (minus 3/8 inch) crushed stone and seed for shoulder stabilization.

Construction Methodology

The Contractor began by surveying, setting the slope stakes and marking the clearing and grubbing area limits.

Once the stakes were set the Contractor brought in the clearing crew using laborers, chain saws, track hoes, a dozer, and tandem dump trucks. The entire 1.5 acres was soon cleared and grubbed. All materials including trees, logs, limbs, and stumps were hauled away by tandem dump trucks (approximately 70 loads) some 25 miles off site to a shredder machine. All wood materials were shredded into wood chip mulch.

The Contractor began the excavation operation with a track hoe excavating a bench access road inside the slope stakes around the upper perimeter of the excavation limits. The access bench around the perimeter was cut below the slope stakes enough to allow the track hoe to excavate and shape the cut slope above the machine to the slope stake limits. The track hoe excavated the slope and cast the material downhill where it was pushed by a dozer onto the Parkway below. The excavated soil and rock was loaded into tandem dump trucks by a second track hoe. After approximately 2,500 tandem dump truck loads (7 to 8 cubic yards per load), 20,000 cubic yards of excavation was completed and the material disposed of at a dump site located 25 miles from the Parkway.

Most of the excavated material was rock. No blasting was permitted to eliminate vibrations from the blast and avoid possibly expanding the slope failure zone. Most of the excavated rock was reduced to loading size by the use of a hoe ram mounted on a track hoe.

Compost Blanket and Berms – Methodology

The compost blanket used for erosion control and establishing vegetation was applied pneumatically using an express blower. The seed was applied through a separate line that allowed for mixing with the compost prior to applying it with the compost blanket using proprietary equipment.

A loose compost berm was constructed around the uppermost perimeter by using the express blower. This berm causes the surface runoff from the upslope-wooded area to flow uniformly through the berm. It was used to prevent a concentrated flow from eroding the compost blanket below on the treated slope.

The filter berms placed on the slope served to uniform the surface runoff through the filters at a uniform rate.

The Filtrex compost blankets with the lockdown netting and Filtrex berms were used on this project. The compost blanket is a layer of compost loosely applied to the slope. The Filtrex berm is a netting constructed into a uniform sock containing the filtering compost.

The lockdown netting was placed on the slope prior to applying the compost. The netting increased the strength of the root system and reduced the risk of a blanket root system failure. As the roots penetrate the compost netting it serves to bind and tie the compost blanket and berms to the ground surface. Compost used on the project was a blended mixture of a nutrient enhanced compost with a more fiberous compost.

Nutrient compost was used for establishing vegetation and the fiberous compost was used for erosion and sediment control. A blended combination of these two compost mixtures perform biaxially as a blanket for erosion control and establishing vegetation.
Filtrex products used on this site were compared to conventional products for cost and performance. Due to the (1) ability to establish vegetation, (2) ability to prevent erosion, and (3) constructability. By using the express blower the Filtrex products was the selected method. Some of the considerations that influenced the use of the blended compost method were to: (1) increase the critical soil and seed contact with substrate, increase the contact that the blankets have with the soil surface, (3) include composted characteristics that aid germination, (4) aid vegetation establishment and, (5) improve sustainability of the vegetation. The growing conditions on this site, included inaccessibility with conventional equipment, rough, steep, with a shallow poor soil over rock as a substrate.

The substrate was prepared for the seedbed by using the track hoe bucket teeth making indented areas in the slope during the excavation operation. Smoothing of the slope was not permitted. Roughing of the substrate with the track hoe teeth parallel with the contours was required.

Economics

This was the first steep (1 to 1 or steeper) slope project to use compost on Eastern Federal Lands construction projects. Historical cost data was not available.

The cost range is estimated from $0.20 per square foot to $0.50 per square foot depending on accessibility and steepness of slope. The cost to stabilize steep slopes includes the total stabilization system. This includes seed, 1 to 3 inches of compost, turf reinforcement netting, compost berm around the perimeter and the contained filter berms constructed in increments on contours across the slope. The number of filter berms

across the slope depends on steepness of slope, substrate material and climatic conditions at the site.

This system is economical when we consider the benefits and the cost of alternate systems.

Results

Eastern Federal Lands staff is conducting site visits on a periodic basis.

The compost blanket with seed was completed on June 28, 2002. Through site visits and photographs the site was monitored for effectiveness of erosion control and vegetation establishment.

Since completing the project, drought conditions have prevailed through July and August. Less than normal rainfall and more than normal high temperatures have existed at the site.

From observations of one high intense rainfall event that occurred prior to completion of the compost application and no vegetation, the compost system is very effective as a Best Management Practice erosion control tool.

The vegetation density is less than desirable but is expected during a drought season. The vegetation in the shaded areas is dense and is considered effective. The slope is facing east and totally exposed to the hot dry season elements. The compost with the seed prescription was designed to account for seasonal climatic conditions. The effectiveness of vegetation establishment in a prescribed compost mixture varies with the physical

condition of the substrate as well as with the seasonal elements.

The use of compost in highway construction is evolving as a Best Management Practice tool. The tool is used for: (1) temporary erosion and sediment control during construction phases, and (2) permanent erosion and sediment control through establishing a sustainable vegetation.

Recommendations

- As the technology of compost in highway construction continues to evolve, it is recommended that FHWA develop technology transfer demonstration projects and incorporate this technology into our standard specifications and plans.

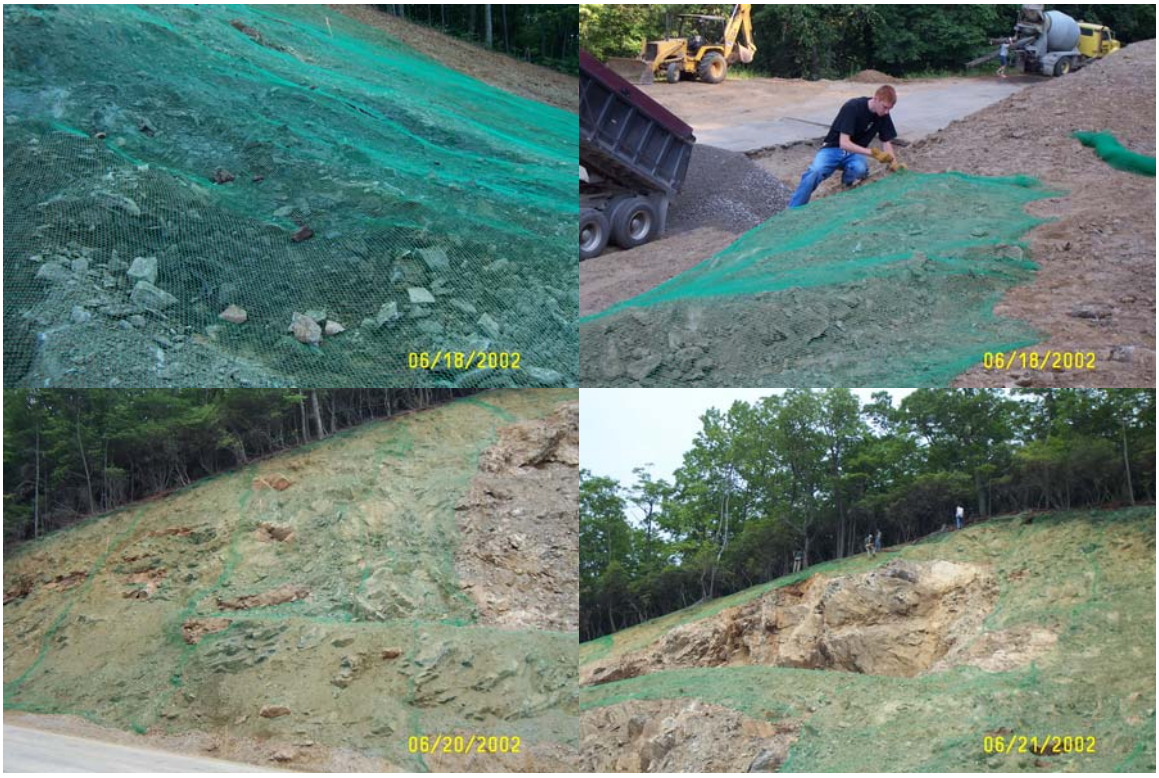
- It all adds up to clean water and aesthetically pleasing roadside environment.

- Remember – A swamp by any other name is not a swamp. It is a building block in the biosphere for the life support of the birds, the bees, the animals, and other critters. The subject of environmental protection has the highest priority. Each Engineer-in-Charge must bring thinking up to date.

Project Construction

The prime contractor was Taylor & Murphy Construction Company, Inc. Asheville, North Carolina. The compost was provided and placed by Carolina Mulch Plus, Inc. Asheville, North Carolina.

Following is a series of photographic observations demonstrating the use of compost in highway construction, particularly on this site.

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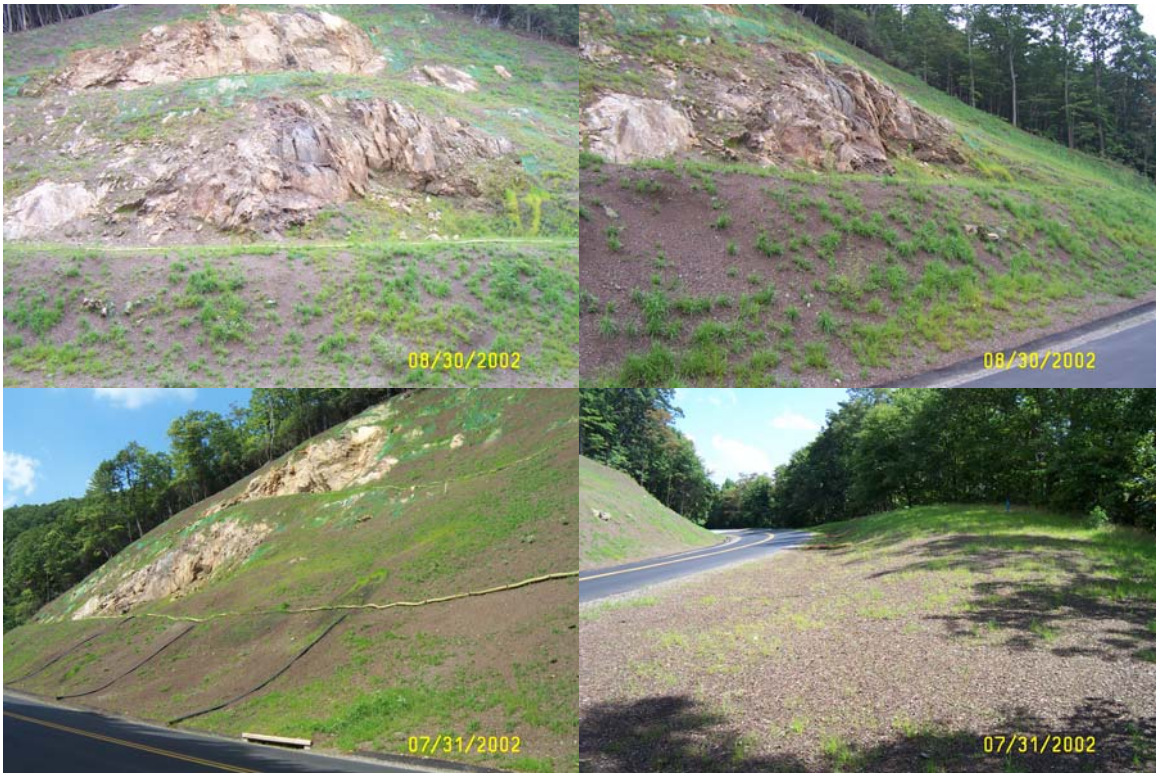
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