3.0 CURRENT COMPOST USAGE BY STATE DOTS

In order to determine the current usage of composted products by State DOTs, as well as their potential for increased usage, various information was gathered by surveying all 50 State DOTs. Once collected, this data was compiled into the following information sets: State DOT Compost Success Stories (case studies), Catalogue of State DOT Compost Usage Experience (50 State Summaries) and State DOT Compost Specifications tables. A list of the State DOT Landscape 'Contacts', as well as the a list of State DOT Environmental Officers, Maintenance Contacts and Directors, is found in the Appendix B.

To better illustrate the successful utilization of compost, and composted products, on State DOT and other highway related applications, a series of fact sheets which describe various compost utilization projects documented from across the United States were developed. We have provided case studies that illustrate a variety of potential applications for compost, as well as case studies from a variety of geographical regions, representing different climatic conditions and soil types. By providing these case studies, we hope to show highway managers that compost can be used successfully, across the country, in a variety of applications and conditions.

3.1 STATE DOT COMPOST SUCCESS STORIES (CASE STUDIES)

Case studies include:

- Connecticut DOT – Landscape Plantings
- Connecticut DOT – Wetlands Creation
- Florida DOT – Turf Establishment
- Idaho Transportation Department – Vegetation Establishment
- New Hampshire DOT – Wildflower & Roadside Plantings
- Oregon DOT – Erosion Control
- Texas DOT – On Site Topsoil Manufacturing
- Texas DOT – Revegetating Difficult Slopes
- Virginia DOT – Wildflower Plantings
- Washington State DOT – Soil Bioengineering

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CONNECTICUT DOT – ROADSIDE PLANTINGS

PROJECT SUMMARY

Many State Departments of Transportation (DOTs) are using composts made from recycled organic materials in their construction projects. The Connecticut Department of Transportation (ConnDOT) recently completed a project in Fall, 1997 using compost in planting backfill for trees and shrubs.

The objective of the use of compost on this project was to demonstrate that compost was effective in amending soils used in planting trees and shrubs.

Spent mushroom substrate compost was used in planting backfills for trees and shrubs. The planting backfill in the compost-amended areas consisted of one part compost to two parts planting soil. Follow-up surveys the following year identified no plant mortalities in the compost-amended soil, compared to 40% mortalities in the standard ConnDOT control plants.

METHODOLOGY

The project was located in Wethersfield, CT at the Interstate 91/Route 3 interchange construction project that was ready for landscaping. Two planting areas were designated, one having a southeastern exposure, the other having a northwest exposure. The plantings in these two areas were divided so that some plants received treatment with compost and others of the same species were designated as controls.

Compost used in this project was derived from spent mushroom substrate. Compost was donated by EarthGro, Inc. (Lebanon, CT).

In the Fall of 1997, several species of trees and shrubs were planted, including: Sugar Maple, Eastern White Pine, Doublefile Viburnum, Border Forsythia, Dwarf Winged Euonymus and Northern Bayberry, as shown in Figure 1.

Figure 1 – I-91/Route 3 Interchange Plantings

These were planted in accordance with the ConnDOT planting specifications, with the exception that, in the treated plants, compost was substituted for peat. Planting backfill in the treated areas consisted of one part compost to two parts planting soil. All plants were mulched with wood chips after installation.

RESULTS

Using compost to amend the planting soil was very successful according to ConnDOT and CTDEP. An inventory was conducted in May, 1998 which consisted of counting all the plant material and identifying which ones needed replacement. During this inventory, it was noted that none of the plants planted with compost needed replacement (i.e. the mortality rate was zero percent), compared to a mortality rate of approximately 40% in the standard ConnDOT control plants. Another inspection conducted in September, 1998 confirmed that the survival rate for the compost amended plants was still 100% (Figures 2 and 3). There were no apparent differences in the condition between plants planted with compost and those planted without compost. Another survey is planned for Summer 2001.

Figure 2

In July 1998, ConnDOT adopted Supplemental Specifications, which contain revisions that allow compost to be substituted for peat on any ConnDOT construction project designed after that date. Specifications can be found at http://www.dot.state.ct.us/814aSections/index _menu.html under Division III Materials Section, Sections M.13.06 – Compost & M.13.07.13 – Peat.

Figure 3

ECONOMICS

As this was a research project and the compost was donated, no project-specific data is available.

For More Information

"Field Trial – Compost Used with Planting Soil, Project 159-177, I-91/Route 3 Interchange, Wethersfield, CT", Report No. 116(42)-2-99-3, January, 1999, Connecticut Department of Transportation

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CONNECTICUT DOT – WETLANDS CREATION

PROJECT SUMMARY

Many State Departments of Transportation (DOTs) are using composts made from recycled organic materials in their construction projects. The Connecticut Department of Transportation (ConnDOT) recently completed a project in October 1999 using compost for wetlands creation on a project at Bradley International Airport in Windsor, CT.

The objectives of the use of compost on this project were to:

- Provide additional organic matter to site soils to support growth of wetland vegetation that is free of invasive plants
- Improve soil fertility to eliminate the need for supplemental fertilizers

The site was a 4.4 acre agricultural field near the airport. The site was excavated 1 to 2 feet deep, and the stockpiled topsoil was mixed with 14,000 cubic yards of compost. The mix was regraded over the site and seeded with a wetlands seed mix. ConnDOT returned in the second year to plant wetlands species trees and shrubs. First year results show good vegetation growth over the site. Total project costs were $185,283.

METHODOLOGY

The project was located in north central Connecticut and included the establishment of new wetland areas to remediate wetlands that were impacted during the construction of a new ethylene glycol deicing facility at the airport. The general contractor was Lane Construction Co. (Meriden, CT). Work consisted of excavating an existing agricultural field to a depth of approximately 1 to 2 feet, and then blending compost with topsoil to convert it into a "wet meadow" and forested wetland area.

The glycol facility impacted about 3 acres of existing wetlands along Seymour Hollow Brook. ConnDOT decided to convert 4.4 acres of an old field into a new wetlands area. Compost was obtained from the City of Manchester about 15 miles from the job site and also obtained from a nearby commercial composting facility. Both composts were derived from yard trimmings.

Compost testing is required for typical agronomic parameters (pH, moisture, organic matter content) as well as odor and maturity. In general, for compost use as a soil amendment, ConnDOT draft specifications require a ?" to 2" layer, rototilled to a depth of 3". In this project, however, ConnDOT wanted to formulate a specific soil blend of 15-20% organic matter, which was accomplished by sampling soil and compost to create a blending recipe of 3 parts soil to 1 part compost (on a volume basis).

The contractor scraped and stockpiled topsoil from the 4.4 acre wetland creation site with a 5 CY bucket payloader. The site was excavated 1 to 2 feet. The topsoil was then mixed with 14,000 cubic yards of compost and the blended soil reapplied. The compost-soil mix was spread with a payloader and a bulldozer, as shown in Figure 1. The site was then regraded.

Figure 1 – Spreading Compost

In order to ensure proper hydrologic function of the wetland, the microtopography was created by the tracks of the bulldozer driven erratically throughout the site, as shown in Figure 2.

Figure 2 – Bulldozer Microtopography

Once the site was graded to the desired contours, the contractor spread a wetlands seed mix over the area with a hydroseeder. In wetlands creation projects, ConnDOT applies only wetlands seed mixture for the first year, to ensure that good germination and wetlands performance occurs. Once verified, ConnDOT contractors will return and plant wetland species trees and shrubs in accordance with the wetland landscaping plan. In this case, the plantings are designed to evolve into a scrub shrub/forested wetland. In Spring 2000, ConnDOT contractors planted wetland species manually using an all-terrain vehicle (ATV) with a trailer. This was used to avoid damage to the site by heavy equipment

RESULTS

First year results showed good grass growth in the wet meadow as it was a normal precipitation year in that part of Connecticut. Figure 3 illustrates the results.

Figure 3 – Wetlands Result

ECONOMICS

Costs for composts used in this project were $10-$12 per CY. Installation cost was $3 - $4 per CY. Total project cost was $185,283. CT DOT uses a unit price for compost purchase and installation, and a lump sum bid for installation (which includes contractor overhead). Seeding and vegetation planting are a lump sum bid item.

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FLORIDA DOT – TURF ESTABLISHMENT

PROJECT SUMMARY

Many State Departments of Transportation (DOTs) are using composts made from recycled organic materials in their construction projects. The Florida DOT (in association with the University of Florida) has recently completed a three-year project to evaluate the use of composted materials on Florida roadsides.

The objectives of this project were to:

- Provide fundamental information for proper utilization of composted wastes on roadsides
- Assist FDOT in establishing standards and specifications for using composts
- Provide FDOT with educational and promotional materials on using composts

Composts typical of those available in Florida were characterized in the laboratory and tested in greenhouse and roadside trials over a two-year period.

Amendment of road-shoulder soil with composts improved grass seeding establishment and subsequent growth. An application rate of 45 tons per acre was generally sufficient to improve establishment and persistence of utility turf. There were no adverse effects observed with applications up to 135 tons/acre.

Bid prices for compost and transportation were $18/cubic yard. Labor was paid for separately and varied from $10/CY to $25/CY of compost.

METHODOLOGY

Three composts typical of those that might be generally available were used in this project. One was made of biosolids and yard trimmings, the second with biosolids and municipal solid waste (MSW), and the third with yard trimmings only. Composts were obtained from Bedminster Bioconversion Corp. (Sevierville, TN), Enviro-Comp Services, Inc. (Jacksonville, FL), and Palm Beach Solid Waste Authority (West Palm Beach, FL).

Three roadside test sites on major highways were selected:

- Copans Rd. interchange with Interstate 95 – shoulders of off/on ramps where grass cover was poor and planting was in the limestone road base without topsoil;
- State Road 50 two miles west of I-75 – an area of deep, droughty sand with sparse vegetative cover;
- U.S. Route 19/98 north of Salem – an area of high water table and good soil cover of grasses, sedges and broadleaf plants

Figures 1 and 2 show the nature of native soils in the FDOT project area.

Figure 1

Figure 2

These highway shoulders were amended with compost as shown in Figure 3.

Figure 3

Compost materials were added at rates of 45, 90, and 135 tons per acre. Site soils and compost samples were analyzed for physical and chemical characteristics. FDOT specifications for the use of compost require that the material meet the health and safety requirements of the Florida Dept. of Environmental Protection and it contain no visible foreign matter with a permitted size range of ?” to 6”. In addition, the Project Engineer may elect to sample the in-place compost for texture, pH and organic matter content.

The upper 8” of road-shoulder soil was rototilled with a 6 ft. wide PTO driven machine after compost application and broadcast seeded with the FDOT standard mixture of bahiagrass (80%) and bermudagrass (20%) at a rate of 200 kg/ha. The areas were lightly mulched with straw after seeding, cut into the soil with a coulter, and the soil firmed with a rubber wheel.

RESULTS

Compost application to these roadside soils initially decreased soil bulk density, but the effect was mostly lost within six months. This was attributed to the more rapid breakdown of added organic matter in the subtropical Florida climate. The amount of Plant Available Water held by amended soil was greater than that held by unamended soil. Much of this increase was lost after about six months (with the exception of the 135 tons/acre application). This appeared to be due to the better vegetation growth and less erosion at one of the sites. Figure 4 shows the effect of compost-amended soil on vegetation.

Figure 4

Compost application had no effect on soil pH at the end of the 6-month evaluation period. Electrical conductivity was increased following application (due to soluble salts in the composts), but decreased markedly by the 3-month sampling due to leaching by rainfall.

Compost application increased the fertility status of the soils as evidenced by the increases in concentration of plant nutrients like phosphorus (P), potassium (K), calcium (Ca) and magnesium (Mg), with biosolids composts adding more nutrients than yard trimmings composts. Concentrations of all nutrients increased with increasing compost application rates. Compost application also increased the concentrations of the micronutrients iron (Fe), zinc (Zn), copper (Cu) and manganese (Mn), but not to levels that would be injurious to plants.

One year after compost was incorporated and seed planted on the road shoulder, vegetative cover remained greater for all plots that received compost than for those which had not. Vegetative cover was generally not improved significantly above the 45 tons/acre rate of compost amendment.

ECONOMICS

Bid prices for compost and transportation were $18/cubic yard. Labor was paid forseparately and varied from $10/CY to $25/CY of compost.

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IDAHO TRANSPORTATION DEPT. – VEGETATION ESTABLISHMENT

PROJECT SUMMARY

Many State Departments of Transportation (DOTs) are using composts made from recycled organic materials in their construction projects. The Idaho Transportation Department (ITD) recently completed a project in fall, 2000 using compost for mulch on a project in Southwestern Idaho

The objectives of this project were to:

- Provide additional organic matter to roadside soils to support growth of vegetation
- Add fertility to substandard soils

Composts were successfully used as a soil amendment and mulch in this project. Dairy manure compost was spread onto shallow slopes at a 20 CY/acre rate and anchored to the surface with a cultivator. A formulated organic soil amendment product was hydro-applied on steeper slopes at a rate of 2000 lbs/acre. Cost for furnishing and installing (and anchoring) the dairy manure compost mulch was $530.14/acre. Cost for furnishing and installing the organic soil amendment product was $1,011.71/acre.

The material was successfully applied in the fall of 2000. Results in Spring, 2001show excellent seed germination and plant growth.

METHODOLOGY

The project was located in southwestern Idaho along Interstate 84 from the Oregon State Line to the Black Canyon interchange. The General Contractor was Idaho

Sand and Gravel (Boise, ID) and the reclamation subcontractor was Wildlands, Inc. (Richlands, WA).

Work consisted of applying soil amendment to two different types of roadside areas: slopes greater than 3:1 and slopes less than 3:1. There were 18.6 hectares (45.96 acres) of slopes greater than 3:1, and 98.8 hectares (244.13 acres) of slopes less than 3:1.

Project Specifications required two different work elements for two different slope conditions:

For slopes less than 3:1 – Furnish and install approved compost mulch at the rate of 37.373 cubic meters/hectare (m3/ha) (approx. 20 CY/acre). Anchor the mulch by incorporating it into the underlying soil at a 2" depth.

For slopes greater than 3:1 – Furnish and install Quattro Fertile Fiber at the rate of 2,000 lbs/acre.

Approved composts for use by ITD must meet the EPA 40 CFR Part 503 requirements for a Class A compost and must meet Solvita maturity levels of 5 or higher. Maturity testing is required for every 2 hectares of compost use.

The approved compost for slopes less than 3:1 was dairy manure compost obtained from Compost West (Nampa, ID). The Quattro Fertile Fiber used on the steeper slopes is a compost-based product made from chicken manure with a guaranteed analysis (N-P-K) of 6-4-1. This product also included seed, tackifier and soil stimulant in the mix. Quattro Fertile Fiber was obtained from Quattro Environmental (Coronado, CA). Haul distance from the source of compost to the job site was less than 30 miles.

On the slopes less than 3:1, compost was spread over the working areas with a truck-mounted manure spreader (Ag Equipment, Inc. Caldwell, ID). The spreader had a capacity of 18 cubic yards. The compost application rate was 20 cubic yards/acre. The compost mulch was anchored by incorporating it with a Triple K cultivator to a depth of 2". Grass was then seeded into this layer by drill seeding.

On the steeper slopes (over 3:1), the Quattro Fertile Fiber was hydroapplied with a Finn 330 hydroseeder equipped with mechanical agitation to keep the organic soil amendment product in suspension.

RESULTS

The slopes were treated with both products in Fall, 2000. As of May 2001, good germination and early growth was observed, however it has been a dry and hot Spring in Idaho, and continued growth and vigor is dependent on rainfall.

ECONOMICS

The bid prices for the work specified was:

- $1,200/hectare ($485.62/acre) to furnish and install dairy manure compost on the slopes of less than 3:1 pitch
- $2,500/hectare ($1,011.71/acre) to furnish and install Quattro Fertile Fiber on the steeper slopes
- $110.00/hectare ($44.52/acre) to anchor the compost mulch on the lesser slopes

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NEW HAMPSHIRE DOT – WILDFLOWER & ROADSIDE PLANTINGS

PROJECT SUMMARY

Many State Departments of Transportation (DOTs) are using composts made from recycled organic materials in their construction projects. The New Hampshire Department of Transportation (NHDOT) has been using compost on projects for both wildflower and roadside landscape planting projects.

The objective of this effort is:

- To use compost to enhance existing soils

METHODOLOGY

NHDOT uses compost in both wildflower and roadside plantings. NHDOT constructs about 10 acres/year of wildflower beds, using 2700 cubic yards of compost annually. In the wildflower beds, a 2" layer of compost is applied over the site, then it is rototilled into the soil to a depth of 4". It is then graded using a York rake, or an equivalent method, to establish a somewhat firm but still friable seedbed. The success of each wildflower bed varies due to the existing ground conditions. In most cases, wet areas produce a totally different result than areas that are dry. This can also be true when considering the planting zones.

Although the wildflower program has utilized municipally generated compost, the bulk of compost has been purchased from commercial compost dealers throughout the Northeast.

NHDOT's specifications for compost used in wildflower beds calls for material made from "source-separated compostable materials". Biosolids are excluded at present. The specifications also require a minimum organic content of 30%, particle size of less than 0.5 inch, and product that is stable and completely composted.

In roadside plantings, NHDOT requires the use of compost in the planting pits. Approximately 1,000 cubic yards are used annually. NHDOT requires that 6 cubic feet of compost and 3 cubic feet of sphagnum peat moss be thoroughly mixed with one cubic yard of acceptable loam. This mix is then used to backfill around the root ball in the planting pit. Compost used in this application must contain a minimum of 50% organic matter.

RESULTS

NHDOT has had good experience with the use of compost in wildflower beds, especially in areas of poor soils. Without doubt, the areas that use compost have continuously achieved higher results. Another benefit is that sites can be re-planted when the existing planting has become non-productive. NHDOT has also observed more vigorous and extensive vegetation on abandoned sites, previously amended with compost, when compared to other surrounding lands (not amended with compost). In roadside plantings, NHDOT has noticed that the compost has substantially improved the existing soils without causing the plant roots to become pot bound.

ECONOMICS

As the use of compost has been paid for under the specific item for which it has been used (i.e. lump sum bids for wildflower bed construction); no specific cost data exists.

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OREGON DOT – EROSION CONTROL

PROJECT SUMMARY

Many State Departments of Transportation (DOTs) are using composts made from recycled organic materials in their construction projects. The Oregon Department of Transportation (ODOT) has been using compost on projects for controlling erosion.

The objectives of this demonstration project were to test the effectiveness of compost blankets and berms on a long, steep slope that was in close proximity to an environmentally sensitive resource.

METHODOLOGY

The project was located in Portland, Oregon on the southwest corner of Scholls Ferry Road and SW Raab Road. The project site is a long fill associated with a road realignment. The site had an average slope of three to one.

Compost was used both as an erosion control blanket and as a filter berm. The total area treated was approximately 45,000 square feet. Approximately 900 linear feet of filter berms were installed. Yard trimmings compost was obtained from Lakeside Reclamation, about 8 miles distant from the site. The compost was applied to four plots, each approximately 100 ft. by 100 ft (10,000 sq. ft.). Compost blankets were applied in October 2000 to each plot. Two plots received a 2” thick blanket (one was seeded with perennial rye, one was unseeded). Two plots received a 1” blanket (one was seeded with perennial rye, the other was unseeded). Filter berms were installed parallel to the base of the slope and the top of the slope.

The compost was tested for pathogens, toxins, and salts in compliance with the U.S. Composting Council’s Test Methods for the Examination of Compost and Composting (TMECC). The compost was applied pneumatically, using an Express Blower. The seed was applied at the same time through a separate line that allowed for mixing with the compost prior to ground placement, using proprietary equipment from Rexius Forest Products, Inc. Figure 1 illustrates one of the project sites.

Figure 1 – Project Site

RESULTS

ODOT staff conducted a site visit in late November 2000, approximately 3 weeks after compost installation. Rainfall was normal for the period. The seeded plots showed good vegetation growth (see Figure 2). No erosion was observed in the plots.

Figure 2 – Emerging Grass Growth

Another site visit is planned for Fall 2001.

ECONOMICS

As this was a demonstration project, there was no cost for the compost. ODOT staff estimated project costs would have been $9,300 if ODOT had to pay for the compost and installation. On a per linear foot basis, the filter berm cost was estimated at $2.50 per linear foot.

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TEXAS DOT – ON SITE TOPSOIL MANUFACTURING

PROJECT SUMMARY

Many State Departments of Transportation (DOTs) are using composts made from recycled organic materials in their construction projects. The Texas Department of Transportation (TxDOT) recently completed a project in January 1999 to improve vegetation growth with onsite topsoil manufacturing.

The objective of this project was to demonstrate how the utilization of compost could effectively improve soil quality to support grasses vegetation.

The slope was treated with 500 cubic yards of a feedlot manure compost. The compost was mixed in with native soils and seeded. Forty days after application, the site was showing good germination.

This project was done by TXDOT maintenance personnel. Compost cost was $15 per cubic yard. Labor costs were $1,010 for transportation and application.

METHODOLOGY

State Highway 108, 10 miles north of Stephenville, TX was widened in 1997. Two years later, TXDOT officials were concerned that vegetation had not been established on the roadsides. In January 1999, they purchased 500 cubic yards of manure compost from Compost Performance Systems in Stephenville, approximately 25 miles from the project site.

TXDOT maintenance personnel hauled the compost to the site in dump trucks. They initially planned to use a fertilizer spreader to spread the material, but found that the moisture content of the compost would not allow it (was too high). As an alternative, they applied the compost in a series of smaller piles, then used a motorgrader to spread the compost to a 2" depth across the 3+ acre site. They then disked the compost into the soil to a depth of 3" using a tractor-pulled disk harrow, dragged the site smooth with an I-beam pulled behind a tractor and seeded the site with a winter grass seed mix (triticale). Only one side of the road was treated with compost in order to evaluate its effectiveness against an untreated control area.

Compost use in TxDOT projects is defined by TxDOT Special Specification Item 1027, "Furnishing and Placing Compost". This specification defines three grades of compost use and requires testing for particle size, organic matter, soluble salts, maturity, pH, time and temperature standards and EPA Part 503 testing for biosolids compost.

RESULTS

Rainfall in that part of Texas that spring was sparse, with only 0.6" of rain falling during the 45-day germination period. TXDOT maintenance personnel noted that seed germination was much better in the compost-amended areas than in the control areas. A year later, TXDOT personnel noted that strong vegetation growth continues in the compost-amended areas.

ECONOMICS

The compost cost $15/cubic yard. TXDOT personnel hauled the compost to the site and applied the compost. Labor costs for transportation and application were $1,010.

TXDOT has committed to using more compost in the future on roadside vegetation and erosion control projects.

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TEXAS DOT – REVEGETATING DIFFICULT SLOPES

PROJECT SUMMARY

Many State Departments of Transportation (DOTs) are using composts made from recycled organic materials in their construction projects. The Texas Department of Transportation (TxDOT) recently completed a project in July 1999 using compost for revegetating a badly eroded and bare slope along IH 20 in Big Spring, Texas.

The objective of this project was to demonstrate how the utilization of compost could effectively revegetate a barren slope

The slope was treated with 100 cubic yards of a feedlot manure compost, further amended with wood chips for erosion control (TxDOT's "Erosion Control Compost"). The compost-chip mix covering the site successfully resisted a 2" heavy rainfall which occurred soon after application. Two months after application, the site was heavily vegetated by a healthy, stable grasses vegetation community.

This project was done as a demonstration project at no cost to TXDOT. The Texas Natural Resources Conservation Commission (TNRCC) paid for the compost and the contractor applied the material at no charge.

METHODOLOGY

In May 1999, TxDOT (working with the Texas Natural Resource Conservation Commission) undertook a project to reclaim and revegetate a badly eroded and bare overpass slope along IH 20 in Big Spring.

The site was constructed in 1968 and had been barren for nearly 30 years. The site was approximately ? acre in size (about 50 ft. by 650 ft.). TxDOT had seeded, hydromulched and blanketed the site many times without success. Figure 1 shows the pre-remediation eroded site and sparse vegetation.

Figure 1 – Original Slope

Compost use in TxDOT projects is defined by TxDOT Special Specification Item 1027, "Furnishing and Placing Compost". This specification defines three grades of compost use and requires testing for particle size, organic matter, soluble salts, maturity, pH, time and temperature standards and EPA Part 503 testing for biosolids compost.

Compost was obtained from South Plains Compost (Lubbock, TX). The compost was produced from feedlot manure, cotton burrs and yard trimming wood chips. The wood chips (3" minus screen size) were added to the compost to help resist wind erosion at the site. The mix ratio was 3 parts compost to 1 part wood chips (on a volume basis).

The compost-wood chip mix was applied to the site with a Rexius blower truck (EcoMulch, Bossier City, LA) to a depth of 3" overall and at a depth sufficient to fill in the erosion gullies on the site. Approximately 100 cubic yards of compost was applied. Figure 2 shows the application of the compost.

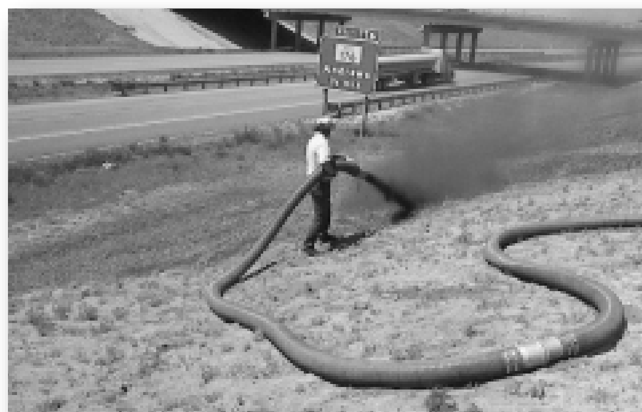

Figure 2 – Applying Compost

As the compost was applied, the seed was fed through a hopper attached to the Rexius Truck. The TxDOT specified mix (for western Texas) of Blue Grama, Sideoats Grama, Buffalograss, and Green Sprangletop was used. Normal precipitation in the area during May is 3"; a 2" rainfall occurred in late May 1999. The wood chip-amended compost resisted erosion and washoff during this storm. An ancillary benefit of the compost/chip mix was to retain moisture for longer periods, which was a benefit to grass germination.

RESULTS

By July, 1999, a thick stand of grass was established on the slope, as shown in Figure 3.

Figure 3 – Vegetation Established on Slope

The untreated area can be seen on the right of the photo in Figure 3. This was the first time vegetation had been established on this slope since it was constructed in 1968.

ECONOMICS

This project was done as a demonstration project at no cost to TXDOT. The Texas Natural Resources Conservation Commission (TNRCC) paid for the compost and the contractor applied the material at no charge.

TXDOT has committed to using more compost in the future on roadside vegetation and erosion control projects.

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"Texas Makes Inroads With Highway Use of Compost", *Biocycle*, Vol. 42, No. 2, February 2001

Big Spring Site Compost Demonstration Pictures at **http://www.dot.state.tx.us/insdtdot/orgchart/des/landscape/compost/examples.htm**

Texas Compost Use Specifications at **http://www.dot.state.tx.us/insdtdot/orgchart/des/landscape/compost/specifications.htm**

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VIRGINIA DOT – WILDFLOWER PLANTINGS

PROJECT SUMMARY

Many State Departments of Transportation (DOTs) are using composts made from recycled organic materials in their construction projects. The Virginia DOT (VDOT) has completed several projects using compost in wildflower bed and grass establishment.

The objectives of these projects were to:

- To add organic matter to the existing soil, which had been compacted after the removal of topsoil

Eight sites were treated between March and May 2000 with 2,233 cubic yards of lawn and yard trimmings compost from a regional authority. A two-inch compost layer was incorporated to a depth of 6" with a rototiller. Wildflower mix was applied on seven sites and grass seed mix on one site.

Good germination and growth occurred at all but one site. Project costs were $0.18 per square foot. The total area treated was 360,000 square feet. Total project costs were $64,800. These costs included all labor, equipment, materials, and hauling involved in getting the work completed.

METHODOLOGY

VDOT selected eight sites in the southeastern portion of the state, including sites in Williamsburg, Portsmouth, Suffolk, and Chesapeake. Sites varied in size from 0.46 acres to 2 acres. One site was to have grass established on it, while the other seven were to be planted with wildflower seeds. All of the sites were flat and possessed compacted subsoils (topsoils had been stripped away during construction).

Yard trimmings compost was provided by the Southeastern Public Service Authority (SPSA) in Suffolk, VA. Distance from the compost source to the construction sites varied from less than 5 miles to 49 miles one-way.

VDOT specifications for compost include standards for pH, moisture, particle size, stability, maturity, soluble salts and nutrients, among other things. VDOT also requires compost meet the heavy metal limitations of the 40 CFR Part 503 regulations.

Project bid specifications included eliminating existing vegetation by disking, spreading 2" of compost over the area to be treated, and rototilling the compost into the existing soil to a 4" depth. The compost was spread by the delivery dump trucks and leveled with a landscape box. The treated area was rototilled (after compost spreading) to a total depth of 6". Grass seed was hydroseeded, while wildflower mix was broadcast.

RESULTS

Results to date are good, according to VDOT staff. Comparing the grass establishment to other grass sites, VDOT estimates a 30% to 40% increase in coverage.

ECONOMICS

Project costs were $0.18 per square foot of surface treated. The total area treated was 360,000 square feet. Total project costs were $64,800. These costs included all labor, equipment, materials, and hauling involved in getting the work completed.

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WASHINGTON STATE DOT

PROJECT SUMMARY

Many State Departments of Transportation (DOTs) are using composts made from recycled organic materials in their construction projects. The Washington State DOT (WSDOT) recently completed a project involving soil bioengineering on problematic slopes. Compost was used as part of the soil bioengineering solution.

The objectives of this project were to:

- Provide viable alternatives called soil bioengineering or "living" approaches for slope and shallow rapid landslide stabilization along different roadside environments.
- Educate WSDOT personnel in site selection and evaluation, and soil bioengineering techniques including construction, monitoring, and maintenance.
- Provide soil bioengineering decision making skills.
- Produce a report of the research project results.
- Educate the public about soil bioengineering alternatives.

The soil bioengineering work involved:

- Willow wall construction
- Willow walls with a brushlayer base
- Live cribwall construction
- Cordon construction
- Brushlayering
- Cedar bender board fencing
- Planting diverse native vegetation
- Seeding
- Biosolids compost application on two sites.

The following conclusions are based on experience acquired during the design and construction phases of this project:

- Class A composted biosolids used on the Chelan site correlate to enhanced plant growth.
- Soil bioengineering projects can be constructed and used successfully on WSDOT projects. All three project sites are revegetating and appear stable.
- Communication and education are important components of any "new" technology.
- An interdisciplinary team, continuously involved in the project, is critical for success.

METHODOLOGY

Three sites were selected for this project:

- State Route 971 – above Lake Chelan at Mile Post 8.22; a north facing slope, 630 ft. long by 70 ft. high; a chronic source of surface erosion and ditch maintenance needs (the Chelan site)
- State Route 101 – near Lost Creek at Mile Post 174; a west facing slope, 180 ft. long by 86 ft. high; a site characterized by heavy marine clays (the Lost Creek Site)
- State Route 101 – near Raymond at Mile Post 60.35; an east facing slope, 591 ft. long by 112 ft. high; a site characterized by lacustriine soils and continual erosion (the Raymond site)

Class A Biosolids compost was used on the Chelan and Lost Creek sites. WSDOT specifications for compost require that the material be a "stable, decomposed organic solid waste that is the result of the accelerated, aerobic biodegradation and stabilization". The material must meet compost quality standards for pH, particle size, maturity, soluble salts, organic matter and inerts. Product acceptance is based upon the submittal of test results as well as feedstock verification. An additional requirement at the Chelan site was that the composted biosolids have a carbon to nitrogen ratio of 35:1. The use of a high carbon ratio product was used to suppress weeds and to enhance long-term survival of woody vegetation.

At the Chelan site, GroCo biosolids compost, obtained from Mt. Rainier Blower Services, was blown with a pneumatic blower truck onto two-thirds of the slope in December 1999 (see Figure 1).

Figure 1 – Applying Compost (Chelan Site)

The project specification was for a one-inch layer, but the contractor laid on a thicker cover because of the moisture content in the compost, and ran out of material before covering the entire site. The uncovered area was used as a control. The compost was incorporated into the soil using hand labor, but only within the terraces; the rest of the area had compost applied to the surface. The contractor building the terraces reported that the soil was much easier to work after compost application. The entire Chelan site was vegetated in April 2000, using Idaho fescue and annual ryegrass and was planted with a mixture of native shrubs and trees.

Compost was applied to the Lost Creek site in November 1999. Due to scheduling difficulties, compost was blown on by blower truck before the willow wall terraces were constructed, causing erosion problems and difficult footing for the construction crew.

RESULTS

At the Chelan site, when work resumed in March 2000, erosion had occurred in the control section, but in the section treated with compost, no erosion was observed. By the end of June, grass was established on all terraces, however, where the composted biosolids were applied, the annual ryegrass was thicker, greener, and withstanding drought conditions better than the control section (Idaho fescue) without compost (see Figure 2).

Figure 2 – Chelan Site Vegetation Established

During the first year the shrubs and trees showed no measurable difference in growth rate between the two sections of the slope. In March of 2001 the control section, without compost, experienced a small slope failure. The remainder of the slope, with compost, was stable through the spring thaw. The terraces were repaired and additional compost was applied to the former control area.

ECONOMICS

A summary of the costs for the Chelan project follows:

Item	***Cost***
Total WCC Crew Time (10.5 weeks)	$26,250.00
Total Materials Cost	$ 3,945.24
Vegetation Costs	$ 2,640.80
Biosolid Compost Application	$ 1,329.00
RA'S Salary and Per Diem	$ 5,522.00
Contractor/Excavation Costs	$ 7,296.10
Total Cost for Project	$46,983.14
Cost per Square Foot	$ 1.96

Costs for the Lost Creek Project were as follows:

Item	***Cost***
Total WCC Crew Time (8 weeks)	$20,000.00
Total Materials Cost	$ 210.82
Vegetation Costs	$ 1,131.64
Biosolid Compost Application	$ 3,200.00
RA Salary and Per Diem	$ 3,712.00
Geotechnical Rock Apron	$15,020.00
Total Cost for Project	$30,774.46
Cost per Square Foot	$ 3.55

A cost benefit study was conducted on these sites. Preliminary results indicate that soil bioengineering is approximately 60% of the cost of traditional engineering for surface erosion and shallow rapid landslides, has additional environmental benefits, and is equally effective at stabilizing these features. Final results are pending and will be published on the WSDOT website.

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