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BLANKETS AND BERMS

NATIONAL SPECIFICATIONS FOR HIGHWAY USE OF COMPOST

Specifications for using compost to prevent and manage erosion have been drafted and are being reviewed by the American Association of State Highway and Transportation Officials for inclusion in its manual of accepted materials.

Ron Alexander

THE RECYCLED Materials Resource Center (RMRC) at the University of New Hampshire has been successful in sponsoring the development of specifications for recycled products, which in turn have allowed their use on state and federal highway projects. The RMRC's efforts are funded through the Federal Highway Administration. In the fall of 2001, the RMRC agreed to sponsor the development of specifications for the use of composted products in erosion control. The project was proposed, and is being completed, by R. Alexander Associates, Inc.

The three major objectives of the project are to: 1) Develop product and usage specifications for the use of compost products in erosion control; 2) Gain approval of the specifications, as well as their placement, in the American Association of State Highway and Transportation Officials' (AASHTO) Standard Specifications for Transportation Materials and Methods of Sampling and Testing manual; and 3) Promote the specifications throughout associated industries.

Tasks to complete the project include: Gather and evaluate current state Departments of Transportation (DOT) compost/mulch erosion control specifications, as well as existing specifications developed by other public and private sources, past research and field demonstration data pertaining to the use of compost/mulch materials as both a soil blanket and filter berm material; Gather and evaluate existing research, and document "field" experience on composts used in erosion control; Develop specifications for compost usage as a soil blanket and filter berm material; Develop a formal information package for publication on erosion control using compost, and distribute it to each state's DOT; and Promote specifications to state DOTs and work with them to adopt the specifications.

A critical step in evaluating the information gathered was to correlate the research and field experience data with the specifications that currently exist to see how well the two matched up and determine what variables needed to be put into a national specification. The specifications have two components – numerical standards for the compost product (an actual product spec) and end use standards that detail how the product should be used, e.g. application rates. Currently, 11 states have specifications for compost use in erosion control. Typically, compost is specified as a soil blanket, as that concept has been around longer than a compost blanket. There has been less discussion of compost berms up until now, which are actually less expensive than blankets and very cost-competitive with silt fence, which is the dominant product in the erosion control market.

A project advisory board, which includes state Departments of Transportation, composters, and pertinent national organizations, entities and researchers within the erosion and sediment control arena, was assembled to provide technical review of the proposed specifications, as well as greater acceptance and dissemination of the data. Steps in the process to develop specifications for using compost as a soil blanket and filter berm material include: Submitting the specifications to the project advisory board for review, then adjusting the specifications as necessary; Submitting the draft specifications to the Technical Section within the AASHTO Subcommittee on Materials; and assisting the Technical Section and the Subcommittee in the review and evaluation of the draft specifications, then adjusting the specifications as necessary. Once approved by the AASHTO subcommittee, the specifications will be distributed for national review within AASHTO. Once reviewed and adjusted, as necessary, the specifications will be voted on a ballot in the fall of 2002 (if the process is not delayed before then). Currently, the draft specifications are under review by the Technical Section, and are expected to go out for national review within AASHTO soon. Tables 1, 2 and 3 summarize

The specifications have numerical standards for the compost product and end use standards that detail how the product should be used.

Table 1. Compost filter berm media and compost blanket parameters

Parameters[1,6]	*Reported As (Units of Measure)*	*Vegetated*	*Unvegetated*
pH[2]	pH units	5.0 – 8.5	N/A
Soluble salt concentration[2] (electrical conductivity)	dS/m (mmhos/cm)	Maximum 5	**Filter Berm**: N/A **Compost Blanket**: Maximum 5
Moisture content	%, wet weight basis	30 – 60	30 – 60
Organic matter content	%, dry weight basis	25 – 65	25-100
Particle size	% passing a selected mesh size, dry weight basis	**Filter Berm**: Minimum 100% passing 3" (75 mm), 90% passing 1" (25mm), 70% passing 3/4" (19mm), and no more than 30-75% passing 1/4" (6.4 mm). Maximum particle size length of 6" (152mm) (No more than 60% passing 1/4" (6.4 mm) in high rainfall/flow rate situations) **Compost Blanket**: Minimum 100% passing 3" (75 mm), 90% passing 1" (25mm), 65% passing 3/4" (19mm), and no more than 75% passing 1/4" (6.4 mm). Maximum particle size length of 6" (152mm)	**Filter Berm**: Minimum 100% passing 3" (75 mm), 90% passing 1" (25mm), 70% passing 3/4" (19mm), and 30-75% passing 1/4" (6.4 mm). Maximum particle size length of 6" (152mm) (No more than 50% passing 1/4" (6.4 mm) in high rainfall/flow rate situations) **Compost Blanket**: Minimum 100% passing 3" (75 mm), 90% passing 1" (25mm), 65% passing 3/4" (19mm), and no more than 75% passing 1/4" (6.4 mm). Maximum particle size length of 6" (152mm)
Stability[3] Carbon dioxide Evolution rate	mg CO_2-C per g OM per day	< 8	N/A
Physical contaminants (man-made inerts)	%, dry weight basis	< 1	<1
Chemical contaminants[4]	mg/kg (ppm)	Meet US EPA Class A standard, 40 CFR § 503.13, Tables 1 and 3 levels, and/or applicable state standards (whichever is less)	Meet US EPA Class A standard, 40 CFR § 503.13, Tables 1 and 3 levels, and/or applicable state standards (whichever is less)
Biological contaminants[5] Fecal coliform bacteria, or salmonella	MPN per gram per dry wt., MPN per 4 grams per dry wt.	Meet US EPA Class A standard, 40 CFR § 503.32(a) levels, and/or applicable state standards (whichever is less)	Meet US EPA Class A standard, 40 CFR § 503.32(a), levels, and/or applicable state standards (whichever is less)

[1] Recommended test methodologies are provided in Test Methods for the Examination of Composting and Compost (TMECC, The US Composting Council); [2] Each specific plant species requires a specific pH range. Each plant also has a salinity tolerance rating, and maximum tolerable quantities are known. When specifying the establishment of any plant or turf species, it is important to understand their pH and soluble salt requirements, and how they relate to the compost in use.; [3] Stability/Maturity rating is an area of compost science that is still evolving, and as such, other various test methods could be considered. Also, never base compost quality conclusions on the result of a single stability/maturity test.; [4] US EPA Class A standard, 40 CFR § 503.13, Tables 1 and 3 levels = Arsenic 41ppm, Cadmium 39ppm, Copper 1,500ppm, Lead 300ppm, Mercury 17ppm, Molybdenum 75ppm, Nickel 420ppm, Selenium 100ppm, Zinc 2,800ppm.; [5] US EPA Class A standard, 40 CFR § 503.32(a) levels = Salmonella <3 MPN/4grams of total solids or Fecal Coliform <1000 MPN/gram of total solids.; [6] Landscape architects and project (field) engineers may modify the allowable compost specification ranges based on specific field conditions and plant requirements.

Table 2. Compost filter berm dimensions

Rainfall/ Flow Rate	Total Precipitation And Rainfall Erosivity Index	Dimensions For The Compost Filter Berm (height x width)
Low	1 - 25", 20 - 90	1'x 2' - 1.5' x 3' (30.5cm x 61cm - 47.75cm x 91.5 cm)
Average	26 - 50", 91 - 200	1'x 2' - 1.5' x 3' (30.5cm x 61cm - 47.75cm x 91.5 cm)
High	51" and above, 201 and above	1.5'x 3' - 2' x 4' (47.75cm x 91.5cm - 61cm x 122cm

Table 3. Compost blanket application rates

Rainfall/ Flow Rate	Total Precipitation And Rainfall Erosivity Index	Application Rate For Vegetated* Compost Surface Mulch	Application Rate For Unvegetated* Compost Surface Mulch
Low	1 - 25", 20 - 90	1/2 - 3/4" (12.5 mm x 19 mm)	1" - 1 1/2" (25 mm - 37.5mm)
Average	26 - 50", 91 - 200	3/4 - 1" (19 mm x 25 mm)	1 1/2" - 2" (37 mm - 50 mm)
High	51" and above, 201 and above	1 - 2" (25 mm x 50 mm)	2-4" (50mm - 100mm)

These lower application rates should only be used in conjunction with seeding, and for compost blankets applied during the prescribed planting season for the particular region.

the draft specifications for filter berms and compost blankets.

To gain support from the Technical Section of AASHTO's Subcommittee on Materials to assist in the development of the specifications, it was necessary to submit a working paper and background information on the use of compost/mulch in erosion control, and the importance of developing an AASHTO specification for it. Once support was gained, a task force within the subcommittee was formed to provide review and input into the draft specifications. The RMRC project team was then identified as the primary technical resource for the development of the specification.

State DOTs and other public entities, as well as private companies that developed specifications and completed research, were very willing to provide our project team with copies and follow up information for this effort. Further, some public (e.g., University of Georgia, Iowa State University) and private (e.g., Rexius Forest By-Products) entities also were extremely helpful, as they were willing to provide preliminary findings from their erosion control research projects that were not yet completed.

REAL WORLD CHALLENGES

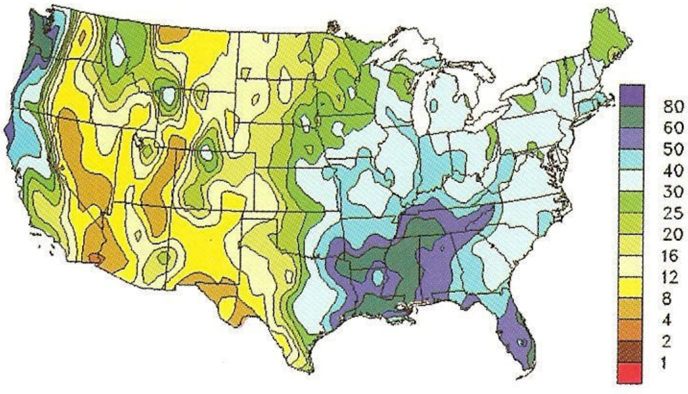
Development of erosion control specifications for compost is difficult because a variety of factors must be considered, including precipitation related factors, compost product variations and soil characteristics, and plant requirements (if vegetation is to be established). The key is to reflect these factors and what is working in the field in a document that will be used on a national basis.

In the case of precipitation or rainfall, the overall amount of rain that falls in a specific region is not the predominant factor when it comes to erosion. Both the intensity of the rainfall and the soil characteristics also have a great effect. For this reason, an erosivity index — which considers all of these factors — is used to characterize the potential for erosion in a specific region.

Figure 1 is a map showing total precipitation in the U.S. Figure 2 is the rainfall index in the U.S., which also provides an erosivity index. For example, the maps show that the Northwest receives a great amount of rainfall on an annual basis, but the erosivity index for the Northwest is low, because most rain incidents in the Northwest are of low intensity. They receive slow drenching rain storms whereas the Northeast receives less rainfall overall, but the storms are intense. That is why a company marketing compost filter berms in Oregon has successful performance with berms that are one-foot tall and two-feet wide, whereas a company in Maine needs to go with a larger berm.

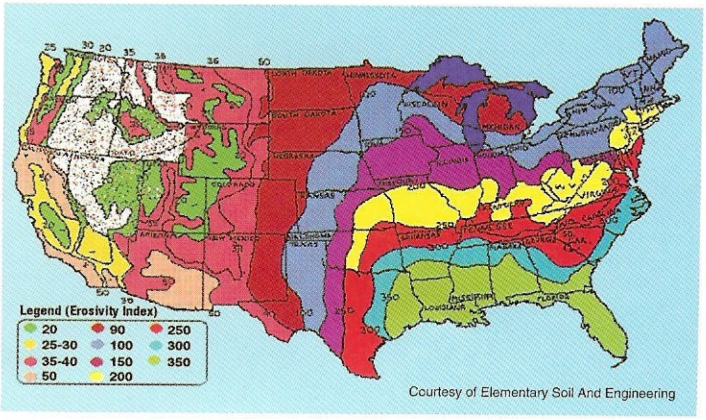
With this understanding, suggested compost application rates within the specifications (Tables 2 and 3) take into account rain-

Figure 1. Total U.S. precipitation 2001 (inches)



Courtesy of Climate Production Center, NOAA

Figure 2. U.S. Rainfall index



Courtesy of Elementary Soil And Engineering fall rates and the erosivity index. The specifications actually provides three different application rates, or berm sizes, based on these conditions.

The characteristics of a specific compost product also will affect its efficacy in specific erosion control applications. Both coarser composts and higher application rates are necessary in areas possessing a high erosivity index. The coarser particles absorb the energy of the rain and reduce flow velocity, both of which are causes of rill erosion. The particles are also larger and heavier, making them more difficult to move. We have seen excellent examples of this where compost has been used as a soil blanket on severe slopes. Coarse particles that are 'stringy' in nature — allowing them to overlap and intertwine — create a stable mat, and have proven to provide superior results. This explains why composts that possess a woody fraction, or even contain some actual bark or wood mulch, have worked well "in the field."

Research also illustrates that "correct" particle size distribution is more critical in the use of compost as a filter berm media than as a soil blanket. Too many small particles in a berm compost will reduce the rate of water flow through the berm, increasing the potential for it to blow out. However, research also has shown that a certain amount of finer particles are necessary in the berm media in order to allow it to effectively capture the suspended solids in the water passing through it. What is obvious from research and field experience is that some compost products are going to be more effective than others in the two erosion control applications, and the greatest factor is likely to be particle sizing.

Research and field experience also have shown that vegetating an area prone to erosion will have a significant effect, so this factor also was included in the specification. For years, one of the goals of conventional erosion control practices has been to vegetate the slope in question. Vegetation on the soil surface reduces flow velocity of the water, and its root system helps to stabilize the soil surface, which also reduces erosion. These same effects also help reduce the erodability of the compost placed on the soil surface, and can therefore reduce the compost application rates necessary to stabilize the slope.

EXPANDING MARKETS FOR COMPOST

The end result of our analysis of existing state DOT specifications for compost, research data and field experience – then correlating the data and double checking by testing products around the country — is boiler plate language that appears in the accompanying tables. If all goes well, by the end of 2002, a set of AASHTO-approved specifications for compost used in erosion control will be available. When AASHTO publishes the specifications, they will serve as guidance documents that states can modify to best suit their needs.

The development and approval of the specifications will help to add credibility to this exciting compost application. Hopefully, the specifications will be used by the composting industry to educate the erosion control industry, and at the same time, expand the market for composts used in erosion control. ■

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The predominant factor when it comes to erosion is both the intensity of the rainfall and the soil characteristics.