Using Compost for Erosion Control

Results from 2 Years of Observations of Compost Performance on a Highway Project in Monterey County, California

Caltrans Landscape Architecture Department
Prunedale Improvement Project

45,000 cubic yards of compost covering over 108 acres.
Existing Site Conditions

Aromas Sand Soil - Highly erosive cross-bedded sand with clayey layers.
Erosion Control Applications
Compost Blanket, Hydroseed, Coir Netting
Erosion Control Applications
Compost Blanket, Hydroseed, Coir Netting

Six Months Later
Erosion Control Applications
Compost Blanket, Blown Straw (Tacked)
Erosion Control Applications

Compost Blanket, Blown Straw (Tacked)

Six Months Later
Erosion Control Applications
Compost Blanket, Blown Straw (Punched)
Erosion Control Applications
Compost Blanket and Chipped Material
Erosion Control Applications

Linear Sediment Barriers – Compost Berms
Erosion Control Applications
Linear Sediment Barriers – Compost Berms

Netting installed **over** the compost berm
Erosion Control Applications
Linear Sediment Barriers – Compost Socks

Cotton Sock

Burlap Sock

6 Months After Installation
Erosion Control Applications
Linear Sediment Barriers – Compost Socks

Staking required on “downhill side” of slope only
Erosion Control Applications
Linear Sediment Barriers – Fiber Rolls
Temporary Erosion Control Applications
Fiber Rolls and BFM
Erosion Control Performance Comparisons
Compost vs. BFM and Fiber Rolls
Erosion Control Performance Comparisons
BFM with and without Compost
Permanent Erosion Control Failures
Subsurface seeps encounter clay soil lens
Permanent Erosion Control Failures

Subsurface seeps encounter clay soil lens

Isolated failures represent less than 15% of the total large cut slope area.
Permanent Erosion Control Failures

Concentrated Flows
Permanent Erosion Control Failures

Concentrated Flows
Restoration

Compost Incorporation

Before
Restoration

Compost Incorporation

After Compost Incorporation
Restoration
Compost Incorporation

Before

Two Years Later
Restoration
Compost Incorporation

Before

After
Invasive Weed Suppression

Compost Incorporation

Compost

Herbicide
Invasive Weed Suppression
Compost Incorporation
Scientific Characteristics of Compost

- Reduces storm water runoff volume and velocity by:
  - Increasing infiltration rates.
  - Improving soil water holding capacity. Up to 4 inches per hour.
  - Enhancing soil structural properties - soil structure, porosity and texture.

- Promotes long term vegetation establishment by:
  - Improving plant rooting depth.
  - Improving soil chemical properties - providing proper pH, carbon, nitrogen, potassium and phosphorus levels.
  - Enhancing soil biology - activity by bacteria, mycorrhizal fungi, nematodes, protozoa, microarthropod and earthworms.
  - Increasing soil nutrient levels and nutrient cycling.
Compost Use Trends

Compost Use – Caltrans Division of Design

Over 540% increase in use from 2008.
### Material Specification

**21-1.02M Compost**

Compost must be derived from one or a combination of the following types of materials:

1. Green material consisting of chipped, shredded, or ground vegetation or clean, processed, recycled wood products
2. Biosolids
3. Manure
4. Mixed food waste

Compost must not be derived from mixed municipal solid waste and must not contain paint, petroleum products, pesticides, or other chemical residues harmful to plant or animal life. Metal concentrations in compost must not exceed the maximum listed under 14 CA Code of Regs § 17868.2. Process compost materials under 14 CA Code of Regs § 17868.3.

The quality characteristics of compost must have the values shown in the following table:

<table>
<thead>
<tr>
<th>Compost</th>
<th>Quality Characteristic</th>
<th>Test method*</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pH</td>
<td>TMECC 04.11-A</td>
<td>6–8.5</td>
</tr>
<tr>
<td></td>
<td>Soluble salts (dS/m)</td>
<td>TMECC 04.10-A</td>
<td>0–10</td>
</tr>
<tr>
<td></td>
<td>Moisture content (% wet weight)</td>
<td>TMECC 03.09-A</td>
<td>30–60</td>
</tr>
<tr>
<td></td>
<td>Organic matter content (% dry weight)</td>
<td>TMECC 05.07-A</td>
<td>30–70</td>
</tr>
<tr>
<td></td>
<td>Maturity (seed emergence) (% relative to positive control)</td>
<td>TMECC 05.05-A</td>
<td>80 or above</td>
</tr>
<tr>
<td></td>
<td>Maturity (seedling vigor) (% relative to positive control)</td>
<td>TMECC 05.05-A</td>
<td>80 or above</td>
</tr>
<tr>
<td></td>
<td>Stability (mg CO₂-C/g OM per day)</td>
<td>TMECC 05.08-B</td>
<td>8 or below</td>
</tr>
<tr>
<td></td>
<td>Particle size for fine compost&lt;sup&gt;b&lt;/sup&gt; dry weight</td>
<td>TMECC 02.02-B</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>Pass 2-inch sieve (% min)</td>
<td></td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>Pass 3/8-inch sieve (% min)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Particle size for medium compost&lt;sup&gt;b&lt;/sup&gt; dry weight</td>
<td>TMECC 02.02-B</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>Pass 2-inch sieve (% min)</td>
<td></td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Pass 3/8-inch sieve (% min)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Particle size for coarse compost&lt;sup&gt;b&lt;/sup&gt; dry weight</td>
<td>TMECC 02.02-B</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>Pass 2-inch sieve (% min)</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Pass 3/8-inch sieve (% max)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pathogen Salmonella (most probable number per 4 grams dry weight basis)</td>
<td>TMECC 07.01-B</td>
<td>&lt; 3</td>
</tr>
<tr>
<td></td>
<td>Pathogen Fecal coliform (most probable number per gram dry weight basis)</td>
<td>TMECC 07.01-B</td>
<td>&lt; 1,000</td>
</tr>
<tr>
<td></td>
<td>Physical contaminants (% dry weight) Plastic, glass, and metal</td>
<td>TMECC 02.02-C</td>
<td>combined total: &lt; 0.5</td>
</tr>
<tr>
<td></td>
<td>Physical contaminants (% dry weight) Sharps</td>
<td>TMECC 02.02-C</td>
<td>None detected</td>
</tr>
</tbody>
</table>

<sup>*TMECC refers to "Test Methods for the Examination of Composting and Compost," published by the United States Department of Agriculture and the United States Compost Council (USCC).</sup>

<sup>*Maximum particle length must be 6 inches.</sup>
## Particle Size Specification

<table>
<thead>
<tr>
<th>Property</th>
<th>Test method a</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particle size:</td>
<td>TMECC 02.02-B Sample sieving for aggregate Size classification % dry weight basis</td>
<td></td>
</tr>
</tbody>
</table>

### Fine Compost
- For soil amendment and incorporation.

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass 2”-inch sieve</td>
<td>98%</td>
<td>--</td>
</tr>
<tr>
<td>Pass 3/8-inch sieve</td>
<td>95%</td>
<td>--</td>
</tr>
<tr>
<td>Maximum particle length: 3 inches</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Medium Compost
- For soil protection and native plant establishment.

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass 2-inch sieve</td>
<td>90%</td>
<td>--</td>
</tr>
<tr>
<td>Pass 3/8-inch sieve (minimum 50% retained)</td>
<td>50%</td>
<td>75%</td>
</tr>
<tr>
<td>Maximum particle length: 6 inches</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Coarse Compost
- For filter sock and berm applications.

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass 2-inch sieve</td>
<td>90%</td>
<td>--</td>
</tr>
<tr>
<td>Pass 3/8-inch sieve (minimum 70% retained)</td>
<td>--</td>
<td>30%</td>
</tr>
<tr>
<td>Maximum particle length: 6 inches</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Physical Contaminant Specification

<table>
<thead>
<tr>
<th>Property</th>
<th>Test method a</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical contaminants</td>
<td>TMECC 02.02-C Man-made inert removal and classification:</td>
<td>combined total:</td>
</tr>
<tr>
<td></td>
<td>Plastic, glass, and metal</td>
<td>&lt; 0.5%</td>
</tr>
<tr>
<td></td>
<td>% &gt; 4 mm fraction</td>
<td></td>
</tr>
<tr>
<td>Physical contaminants</td>
<td>TMECC 02.02-C Man-made inert removal and classification:</td>
<td>none detected</td>
</tr>
<tr>
<td></td>
<td>Sharps (sewing needles, straight pins and hypodermic needles) % &gt; 4mm fraction</td>
<td></td>
</tr>
</tbody>
</table>

Compost can contain plastics and should be evaluated for use in environmentally sensitive areas.
The US Composting Council’s Seal of Testing Assurance Program (‘STA’) is a compost testing, labeling and information disclosure program.
Recommendations

- **Compost Blanket With Coir Netting**
  - Very effective and aggressive erosion control material combination for large steep slopes.
  - Install over compost berms when used.

- **Compost Blanket With Blown Straw**
  - Very reliable and more cost effective than punched straw.
  - Erosion control material combination that can be used in a variety of conditions.

- **Hydroseed Application**
  - Apply under netting and over compost to protect seeds and provide good germinating conditions.
  - Consider including seed in compost application to reduce application steps and equipment.

- **Incorporating Compost**
  - Rip soil 2 to 3 times the depth of compost applied.
  - Limit to slopes 4:1 or flatter.
Recommendations

- **Compost Berms**
  - Use as linear sediment barriers on slopes in lieu of fiber rolls.
  - Out perform fiber rolls, hands down!

- **12” Compost Socks**
  - Install at the toe of slopes in lieu of fiber rolls or silt fence.
  - Excellent at capturing sediment.

- **8” Compost Socks in Vegetative Swales and Drainage Ditches.**
  - Install in vegetative swales and drainage ditches as check dams.

- **Fiber Rolls**
  - Use primarily for temporary sediment control applications.
Summary

- Accelerates the natural systems required to restore sites.
- Builds healthy soils by mimicking the natural environment.
- Provides optimum vegetation growth.
- Protects the soil surface from splash erosion.
- Has a high water holding capacity which slows down and disperses the energy of sheet flow.
  - No runoff
  - No erosion
  - No pollutant discharges
- High carbon to nitrogen ratios result in low discharge of nitrogen.
- Has natural bio-filtration characteristics.
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