

Landscape Design Increasing Compost Use

Debra Darby, CCP
Organics Sustainability Solutions Manager
Tetra Tech

George Batchelor, Supervisor
MassDOT Highway Landscape Design

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Overview

Compost Use Study

- Scope of Work
- Goals & Outcomes
- Barriers to increasing compost use
- Key Findings
- Recommendations & Conclusions



Photo courtesy of USCC

Increasing Compost Use



Prepared for



Project team



Scope of Work



- Develop a Compost Use Report as a resource document.
- Identify strategies to ensure consistency with the state-of-the industry standard practices.
- Provide tools to help with increasing use of compost and organics diversion.

Primary intent of this Project is to align state agencies and municipalities with MassDOT Technical Specifications for procurement of consistent compost materials and application of compost.

Goals & Outcomes

- Evaluate current MassDOT Technical Specifications.
- Provide recommendations for the technical specifications revisions that take in consideration key compost industry standard practices and testing methods.
- Provide a guide that state agencies and municipal leaders can use for procurement and implement compost use applications.



What is Compost

Compost is the product manufactured through the controlled aerobic, biological decomposition of biodegradable materials. Key function is sanitization.

Process to Further Reduce Pathogens (PFRP)

- Mesophilic $\pm 40^{\circ}\text{C}$ (104 $^{\circ}\text{F}$) and Thermophilic $\pm 55^{\circ}\text{C}$ (131 $^{\circ}\text{F}$) temperatures to reduce the viability of pathogens and weed seeds (EPA 40 CFR 503 standards)
- Typically used as a soil amendment (i.e., reduces wood chips, food waste and other feedstocks into a form that is useful to plants)
- Stabilizes the carbon, beneficial to plant growth, and may contribute plant nutrients



Finished mature compost shows little physical resemblance to the feedstock materials from which it originated.

[Source: US Composting Council Compost Definition \(compostingcouncil.org\)](https://www.compostingcouncil.org/)

Feedstock Materials

- Yard debris, leaves, grass & garden clippings
- Tree stumps, limbs and wood chips
- Food scraps (pre- and post-consumer)
- Industrial and Commercial food materials
- Agricultural wastes, animal material and manure
- Biosolids



Biosolids

MassDEP does not allow use of biosolids-based compost in environmentally sensitive areas

- Biosolids are a source of higher levels of nutrients; problematic for water quality (i.e., nitrogen, potassium, and phosphorus)
- Per- and polyfluoroalkyl substances (PFAS)



Biosolids: Photo courtesy of Biocycle

Technical Specifications Revisions



1. Division III Materials
2. Compost Blanket / Topdressing, Item 751.72
3. Compost Berm
4. Sediment Barrier Control, Item 767.121
5. Biodegradable Materials
6. Jute Mesh Erosion Control Fabric, Item 767.731
7. Composted Mulch for Modified Rock, Item 767.78

Goal: Revise specifications for consistent use of compost.

Division III Materials



Section M1 Soils and Borrow Material Specification

Basis for the other compost use specifications. Originally designed as an organic amendment for loam.

Key recommendations for revisions

- Item name change to Compost
- Compost material to meet newly revised AASHTO specifications

Parameters	Reported as (Units of Measure)	General Range ^a
pH	pH units	6.0 - 8.5
Soluble Salt Concentration ² (Electrical Conductivity)	dS/m (mmhos/cm)	5 up to 10 maximum depending on application rate
Moisture Content	%, wet weight basis	30 – 60
Organic Matter Content	%, dry weight basis	30 – 65
Particle Size	% passing a selected mesh size, dry weight basis	95% pass through 3/8" screen or smaller
Stability Carbon Dioxide Evolution Rate	mg CO ₂ -C per g OM per day	< 4
C: N	Ratio	< 25:1
Maturity (Bioassay) Seed Emergence and Seedling Vigor	%, relative to positive control %, relative to positive control	Minimum 80% Minimum 80%
Physical Contaminants	%, dry weight basis	< 0.5% (0.25% film plastic)
Chemical Contaminant	mg/kg (ppm)	Meet or exceed US EPA Class A standard, 40 CFR § 503.13, Tables 1 and 3 levels
Biological Contaminants Indicator Organisms Fecal Coliform Bacteria, and /or Salmonella	MPN per gram per dry weight MPN per 4 grams per dry weight	Meet or exceed US EPA Class A standard, 40 CFR § 503.32(a) levels

Organic Amendment

Subsection M1.06.0 Organic Soil Additives

Key recommendations for revisions

- Change the subsection name to Compost; delete Organic Soil Additives. The goal is to be specific and consistent about the use of compost.
- Recommend for testing to be conducted by an approved STA Program testing laboratory with the goal to develop a consistent program for compost use and compost testing.
- Include the definition of compost
- Use material specification from Division III Compost Parameters



Compost Blanket / Topdressing

Key recommendations for revisions

- Change item name to Compost Blanket to conform with industry standard; delete use of Topdressing
- Consistent with national industry standard practices and expectations
- Change material specifications to conform with AASHTO parameters
- Application rates



Photo courtesy of USCC

Compost Berm



Use of Compost Berm is very limited; there is no current specification. Compost filter tube continues to be the default standards for Sediment Barrier Control (SBC).

Key recommendations for revisions

- Continue to build out use for Compost Filter Tube.

Sediment Barrier Control

Compost Filter Tubes

Key recommendation for revisions

- Synthetic materials should not be used for the mesh netting. Only fully biodegradable materials should be specified for the mesh netting of sediment control barriers.
- Compost material inside the filter tube shall meet M1.06.0 Division III specification for Compost
- Adopt the AASHTO parameters



Photo courtesy of Groundscapes Express

MassDOT is one of the first states to specify use of the compost filter tube and has reduced use of plastics in the environment.

Biodegradable Materials

Biodegradable: The process of microorganisms consuming organic carbon in a material. Biodegradation is an important test condition in the ASTM D6400 compostability standard specifications.

- Cotton
- Burlap / Jute
- Wood Fiber
- Hemp
- Biodegradable Plastics (soil-biodegradable)
- Filter Tube Fabric is the most extensive application



Wood Fiber and Cotton Photos Courtesy: Filtrex



Soil Biodegradable Mulch Film, Photo Courtesy: D Darby

Jute Mesh Erosion Control Fabric

- Used in erosion control for compost blanket applications due to it naturally biodegrades in the soil environment.
- Can be blended with cotton.
- Potential to be reinforced with thermoplastic composites that would preclude the natural biodegradability properties.
- Growing use of Wood Fiber
 - Locally sourced from recycled scrub pine and spruce wood; and locally produced
 - Consistent with the goals of Executive Order 14005: Ensuring the Future is Made in All of America by All of America's Workers.



Photo courtesy of Caltrans

Key recommendation for revisions

- Reduce or eliminate use of plastics and other contaminants; minimize applications where there are obsolete management practices

Composted Mulch for Modified Rock

- Compost is pneumatically applied with blower equipment to fill voids of the riprap to a minimum of 2-inches deep.
- Retains soil particles from water moving off site into adjacent waterways or environmentally sensitive areas.
- Meets visual quality requirements, National Environmental Policy Act (NEPA).
- Meets natural site design, Department of Natural Resources (DNR)
 - Wildlife can still burrow for habitat



Spring: Photo courtesy of MassDOT



Late Summer: Photo courtesy of MassDOT

Stakeholder Interviews

- State DOTs
- Compost Manufacturers/Facilities
- Industry Experts
- DOT Contractors

“STA certifications without it, things fail...projects are not functioning...because it is not the compost that fails.” -- State DOT

“How to stabilize & control erosion; traditional topical was costly for slope repair. Needed to change & restructure using compost as a solution.” -- State DOT

“There’s a learning curve for all stakeholders.” -- State DOT

“Need to educate inspectors & engineers to be on the same page.” -- Contractor

“There are different types of compost, how do you classify the material? -- Contractor

“Blended product & finished compost are different products. Basic compost is used to make blended products.” -- Contractor

“Municipal project requirements should meet MassDOT specifications.” -- Contractor

“Contractors need a general understanding of compost materials & use.” -- Compost Manufacturer

Stakeholder Key Findings

1. Contractors indicate there are issues with procurement of compost material.
2. USCC STA Certification and TMECC testing methods - Levels the playing field for procurement of consistent quality compost.
3. Feedstock is not as important as the finished compost material.
4. Adopt the AASHTO table that captures the different applications.
5. Shift to volumetric payment for Compost Blanket and Compost For Mod Rock.
6. Particle size and structure of compost is important to Sediment Barrier Control.
7. Contractors need education around compost use and proper application.
8. Loophole for contractors; if they don't have access to STA certified composters then the contractor is not required to purchase STA certified compost and can submit an exemption (specific to CDOT).



Compost Testing

US Composting Council (USCC) recommends regular testing of compost materials for product quality and consistency.

Test Methods for the Examination of Compost and Composting (TMECC).

TMECC methods and procedures are the basis for the USCC Seal of Testing Assurance (STA) for the commercial composting industry in the United States.

- STA Program
 - Platform for consistent testing and reporting of compost products by the STA certified compost manufacturer
 - Provides transparency during compost material procurement.
- TMECC and STA are correlated
 - TMECC recommends usage of the selected test methods identified in the STA Program for compost manufacturing.



STA-Certified Compost Suppliers*

*as of December 2022



Conclusions & Recommendations



1. Include the STA Certification for specifications, stating with Division III Materials and apply to all Compost Use Specifications. Allow phase in (lead time) for compost manufacturers to become certified.
2. Develop Education program for engineers, contractors and specialty soil suppliers on compost materials. Include compost manufacturers to build relationships and trust.
3. Coordinate with MassDEP and other state agencies to implement policies to increase compost use; to ensure that the quality of finished compost materials are consistent and meets national industry standards and practices.
4. Recommend for the State Operational Services Division (OSD) to adopt MassDOT revised specifications for procurement of compost materials. This will help drive end-markets and consistent use of compost.
5. Collaborate with an educational institution to implement a compost and soil testing laboratory.
 - Develop technical skills; establish an STA-certified lab in MA (i.e., Essex North Shore Agricultural and Technical School in Danvers).
6. Key Takeaway: MassDOT to lead by example. Recommendations from this study and revised Technical Specifications can be presented to policy makers and utilized by other New England states.

Ongoing Research



- Future research should be considered to study PFAS in compost as utilized for Sediment Barrier Control to understand the fate and transport of PFAS near environmentally sensitive areas. The challenge is that PFAS are ubiquitous and commonly detected in compost due to their presence in materials used in its production.
 - PFAS leaching from compost to establish guidelines for compost use in environmentally sensitive areas and to transfer into potable water sources.
 - Ability of compost to capture and retain PFAS contained in stormwater run-off.
- Conduct an organics analysis to determine the feasibility of MassDOT to operate a composting facility to manufacture compost for roadside applications and other state uses.

Benefits of Compost Use

- Soil protection and erosion prevention
- Reduces persistent degradation of ecosystems
- Sequesters carbon dioxide in soil
- Binds and degrades pollutants
- Increases soil moisture retention
- Best management practices

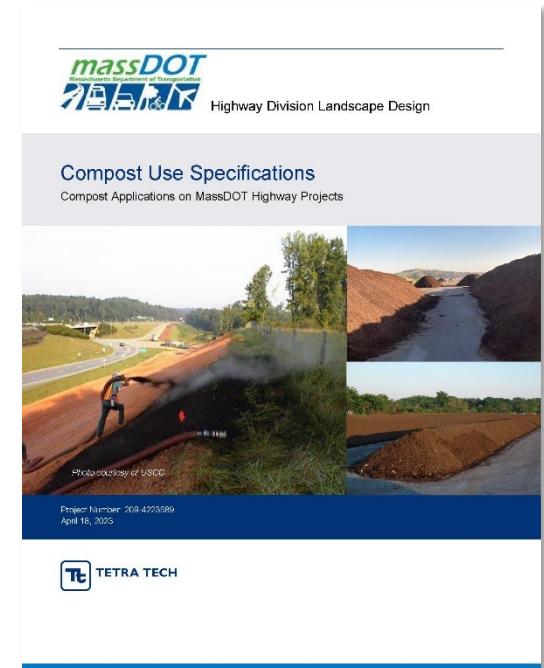


Photo courtesy of USCC

Resources and Publications

- [US Composting Council](#)
- [BioCycle | The Organics Recycling Authority](#)
- [Organic Recycled Products - R.Alexander Associates \(alexassoc.net\)](#)
- [AASHTO](#)
- [The Composting Handbook 2021](#)
- [Compost Use Application: A Return on Investment \(ROI\)](#)
- [Improving Roadside Revegetation and Stormwater Quality with Compost-Based BMPs](#)
- [Connections: Compost and Rainwater Filtration](#)
- [Phosphorus and Compost](#)

New Report! MassDOT Highway Division Landscape Design
Compost Use Specifications



Debra Darby, CCP

Debra.darby@tetratech.com



USCC Certified Compost Professional

George Batchelor

George.Batchelor@dot.state.ma.us



Thank You!