Field Trial
Compost-Amended Soil (Manufactured-in-Place)
Project 163-141
ROUTE 6
Windham & Chaplin, CT

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January 1999

Report No.
116(42)-1-99-2

Connecticut Department of Transportation
Bureau of Engineering and Highway Operations
Office of Research and Materials

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Disclaimer

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SI* (MODERN METRIC) CONVERSION FACTORS

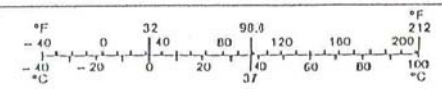
APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
in	inches	25.4	millimetres	mm
ft	feet	0.305	metres	m
yd	yards	0.914	metres	m
mi	miles	1.61	kilometres	km
AREA				
in²	square inches	645.2	millimetres squared	mm²
ft²	square feet	0.093	metres squared	m²
yd²	square yards	0.836	metres squared	m²
ac	acres	0.405	hectares	ha
mi²	square miles	2.59	kilometres squared	km²
VOLUME				
fl oz	fluid ounces	29.57	millilitres	mL
gal	gallons	3.785	litres	L
ft³	cubic feet	0.028	metres cubed	m³
yd³	cubic yards	0.765	metres cubed	m³
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg
TEMPERATURE (exact)				
°F	Fahrenheit temperature	5(F-32)/9	Celcius temperature	°C

NOTE: Volumes greater than 1000 L shall be shown in m³.

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
mm	millimetres	0.039	inches	in
m	metres	3.28	feet	ft
m	metres	1.09	yards	yd
km	kilometres	0.621	miles	mi
AREA				
mm²	millimetres squared	0.0016	square inches	in²
m²	metres squared	10.764	square feet	ft²
ha	hectares	2.47	acres	ac
km²	kilometres squared	0.386	square miles	mi²
VOLUME				
mL	millilitres	0.034	fluid ounces	fl oz
L	litres	0.264	gallons	gal
m³	metres cubed	35.315	cubic feet	ft³
m³	metres cubed	1.308	cubic yards	yd³
MASS				
g	grams	0.035	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams	1.102	short tons (2000 lb)	T
TEMPERATURE (exact)				
°C	Celcius temperature	1.8C + 32	Fahrenheit temperature	°F



* SI is the symbol for the International System of Measurement

(Revised April 1999)

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Field Trial
Compost –Amended Soil (Manufactured-in-Place)
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ROUTE 6
WINDHAM & CHAPLIN

To meet the requirements of Tasks 4 and 5 of the EPA Workplan for the study entitled: "Field Testing CONEG Model Procurement Specifications for Source-Separated Compost," two sections of Connecticut DOT Project 163-141, specifically between construction stations 122+18 & 124+68 and Stations 266+38 & 268+88 (Figures 1A and 1B), were chosen to demonstrate the amendment of existing backfilled soil with compost, in order to create a topsoil that would meet the DOT specification. The test sites are situated along the edge of pavement, primarily within the drainage swale at the bottom of slope cuts (Photo #1). Within each of these two sections, five (5) fifty-foot subsections were established for comparison of different treatments (varying quantities of compost mixed with existing soil). The various treatments used along with the final ratios of compost to soil (C:S) are given in Tables 1 and 2. In each subsection, there is a control section where no compost was applied. Three sections contain compost at 2 inches (2:3), 1 inch (1:3), and ½ inch (1:6) applications, tilled with a rototiller to 3 inches deep, (thus obtaining the ratios indicated in parentheses.) One section contains 1/2 inch of compost placed as a top dressing only. Each section is fifty feet long by 6 feet wide.

The study sections were identified in conjunction with the project Chief Inspector on June 2, 1998. They were labeled on the pavement on June 8, 1998. Approximately 18 cubic yards (cy) of leaf compost was donated by the Town of Manchester for this project. The contractor for Route 6 picked up the compost and delivered it to the project on June 4, 1998. All compost was placed and mixed, and the sites seeded under the inspection of personnel from DEP Recycling, DOT Research, and the project inspector on June 9, 1998. All of the compost-amended soils and the control sections were seeded by hand to ensure meeting the June 15th ConnDOT requirement for seeding.

Approximately 10 cy of compost was used for the two study sites. Another 8 cy was placed by the contractor on a 2 horizontal to 1 vertical "dead-sand" slope near station 267+00 on the south side of the easterly direction of Route 6 (Photo #2). This slope had been seeded and mulched several times before with poor results. The compost was placed in a 1 to 1-1/2 in. layer over the surface of the sand. This section was hydro-seeded and mulched on June 23, 1998. Additional photographs showing the compost placement procedures are given as photos #3-9.

Laboratory test results for the Manchester compost, compost-amended soil, and the sand from the slopes are given in Tables 3, 4 & 5, respectively. The samples were obtained at the time of installation. The tests include pH, particle size, and organic content for all samples; moisture content, soluble salts, stability and organic content for Manchester Leaf Compost; textural classification, organic content and percent of particles classified as sand, silt and clay for the soils. The ConnDOT specifications for topsoil require an organic content of 6-20 percent, and certain soil classifications as

Figure 1A
Study Area 1

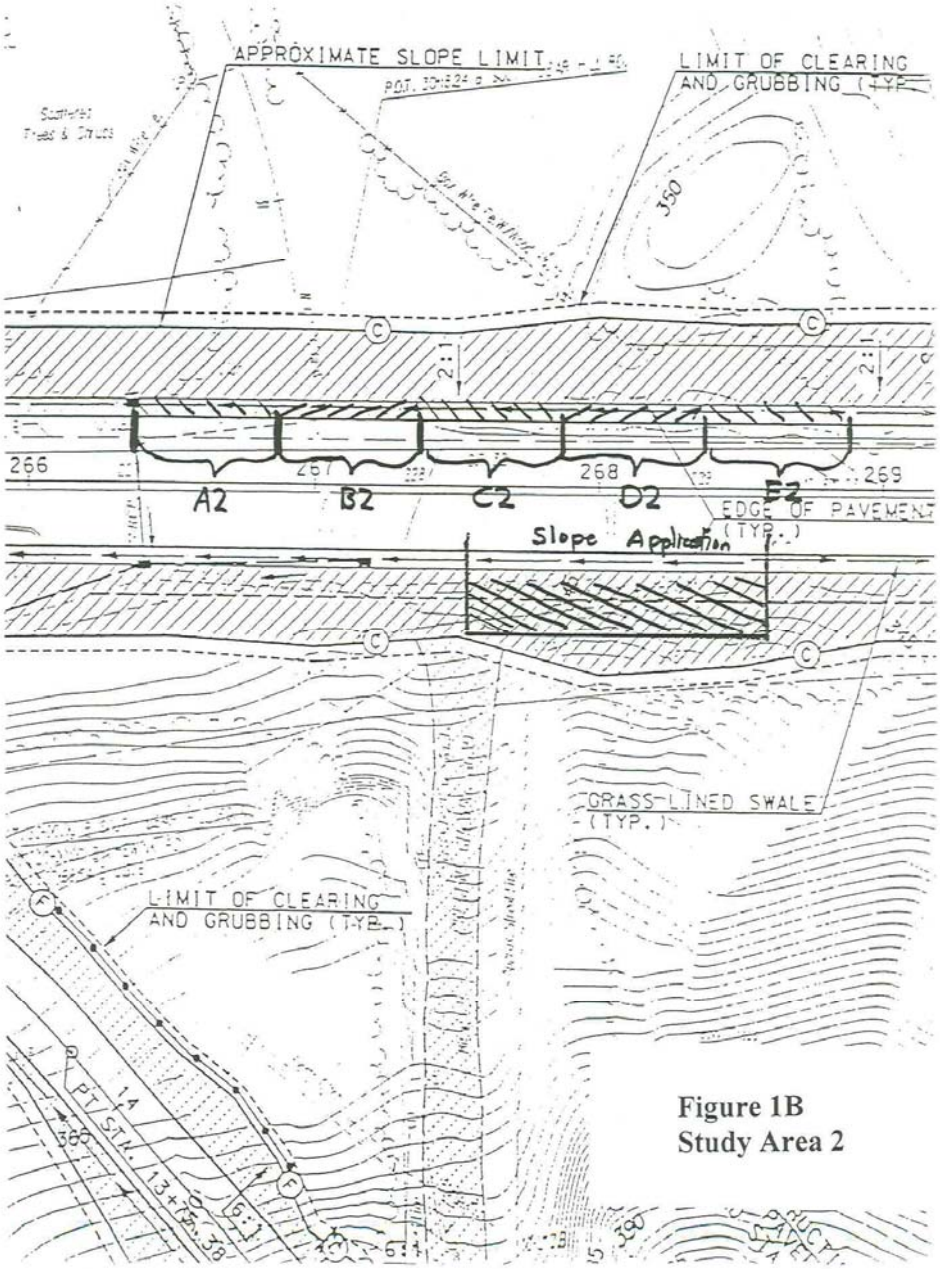

Figure 1B
Study Area 2

determined with the US Department of Agriculture Classification System (Appendix A).
As can be seen in Table 4, under the ConnDOT specifications, the control sections (A1 and A2) do not pass due to low organic content. The same is true for the sand slope material tested and reported in Table 5. All of the compost-amended test sections, with the exception of section C1, pass the specifications for topsoil. In C1, the classification indicates that the percentage of sand is slightly too high to be classified as topsoil. It is noteworthy that the compost improved the properties of the soil by increasing the organic content, by improving the pH to the point of eliminating or significantly reducing the requirement for the addition of lime, and increasing the moisture holding capacity. All of these are likely to be significant factors that aided in the establishment and maintenance of healthy turf.

The study areas were monitored for plant growth (turf establishment) during the remaining growing season through October 1998. Visual observations of the sections along with photographic documentation were obtained on June 29, 1998, July 24, 1998, August 11, 1998, and October 19, 1998. Sample photographs taken during these field visits are given as photos # 10-17. The sections will be monitored again in the spring of 1999. There was a significant difference in plant growth between the control sections and the sections containing compost. On the other hand, there was very little difference in growth or appearance between the different application rates (treatments.) A report of the field visits is given in Appendix B. Because of the lack of significant difference between the treatments, it is recommended that a 1/2-inch topdressing or 1 inch tilled to three inches be used on future projects of this type. The same result can most likely be accomplished by blending one part compost to three parts soil off-site and then using the mix as backfill or topsoil. Overall, the use of compost-amended soil (manufactured-in-place) for establishing turf along shoulders and behind backfilled curbs is a success.

Table 1
Compost Amended Soil Treatments - Section 1
Station 122+18 – 124+68 right side (eastbound side)
(starts 100 ft east of CL&P Pole #1480)

Subsection	Treatment	Project Station
A1	Control Section	122+18-122+68
B1	2 in. compost tilled to 3 in. deep	122+68-123+18
C1	1 in. compost tilled to 3 in. deep	123+18-123+68
D1	½ in. compost tilled to 3 in. deep	123+68-124+18
E1	½ in. compost, top dressing only	124+18-124+68

Table 2
Compost Amended Soil Treatments - Section 2
Station 266+38 – 268+88 left side (westbound side)
(starts 242 ft east of sign “stop ahead when flashing”)

Subsection	Treatment	Project Station
A2	Control Section	266+38-266+88
B2	2 in. compost mixed to 3 in. deep	266+88-267+38
C2	1 in. compost mixed to 3 in. deep	267+38-267+88
D2	½ in. compost mixed to 3 in. deep	267+88-268+38
E2	½ in. compost, top dressing only	268+38-268+88

Table 3
Manchester Leaf Compost Laboratory Test Results

% Moisture	47
Soluble salts	0.49 mmhos/cm
Stability	Stable
PH	6.99
% Organics	49.5
Particle size	100% passing the 1 inch size

Photo #1. Two-inch Layer of Compost Placed in Drainage Swale Prior to Rototilling (station 122+68)

Table 4

Control and Compost-Amended Soil Mixture
Laboratory Test Results for ConnDOT Topsoil

Sample	A1 Control Section (No Compost)	A2 Control Section (No Compost)	B1 2 in. Compost Layer Tilled to 3 in. Deep (2:3 Mix)	B2 2 in. Compost Tilled to 3 in. Deep (2:3 Mix)	C1 1 in. Compost Tilled to 3 in. Deep (1:3 Mix)	C2 1 in. Compost Tilled to 3 in. Deep (1:3 Mix)	D1 1/2 in. Compost Tilled to 3 in. Deep (1:6 Mix)	D2 1/2 in. Compost Tilled to 3 in. Deep (1:6 Mix)
% Organics	5.03%	5.24%	12.58%	19.39%	13.53%	16.67%	13.78%	11.13%
Particle size*	11.42%	11.07%	7.89%	14.17%	14.46%	12.79%	26.07%	14.87%
pH	5.13	4.54	6.66	6.83	6.62	6.76	6.42	6.30
Textural classification	SANDY CLAY LOAM	SANDY LOAM	LOAMY SAND	SANDY LOAM	SAND	SANDY LOAM	SANDY LOAM	SANDY LOAM
% Sand	66.6%	68.79%	80.68%	68.08%	88.48%	57.14%	76.56%	54.78%
% Clay	20.95%	19.09%	2.59%	3.34%	2.73%	2.23%	9.82%	13.05%
% Silt	12.38%	12.12%	16.74%	28.58%	8.78%	40.63%	13.62	32.17%
Lime needed	1.5 tons/acre	1.5 tons/acre	None	None	None	None	¼ton/acre	¼ton/acre
ConnDOT Topsoil Spec.	Fail	Fail	Pass	Pass	Fail	Pass	Pass	Pass

*PERCENT PASSING THE NO 200 SIEVE, CLAY % LISTED SEPERATELY

Table 5
Native Soil (Dead Sand Slope)
Laboratory Test Results for ConnDOT Topsoil

Sample	Sand Slope at Station 267+00 Left	Sand Slope at Station 267+00 Right
% Organics	0.75%	0.41%
Particle size*	2.31%	2.9%
pH	6.57	6.38
Textural classification	Loamy sand	Sand
% Sand	87.51%	98.62%
% Clay	7.00%	1.07%
% Silt	5.49%	0.31%
Lime needed	None	None
ConnDOT Topsoil Spec.	Fail	Fail

*PERCENT PASSING THE NO 200 SIEVE, CLAY % LISTED SEPERATELY

Photo #2. Extra Compost Being Placed on 2:1 “Dead Sand” Slope Near Station 267+50

Photo #3. Tilling the Compost into the Existing Soil

Photo #4. Spreading the Compost for Top Dressing onto Section E1 (station 124+18)

Photo #5. Placing the Compost in Section D1 (station 123+68) to ½ inch Thickness before Rototilling

Photo #6. Placing the Compost in Sections B2 and C2 (station 266+88 – 267+88) in Drainage Swale at Bottom of Slope

Photo #7. Spreading the Compost at Section C2

Photo #8. View of Tilled Compost and Soil

Photo #9. Station 267+50, Excess Compost Placed on 2:1 Slope (see also Photo #2)

Photo #10. Control Section A1 (June 29, 1998). Dark Areas are Compost that Washed into Section

Photo #11. Left Half of Photo Shows Compost up to 2 Inches Deep that Washed into Section A1 (June 29, 1998)

Photo #12. Lower Half of Photo is Control; Upper Half is Section with 2 in. of Compost (July 24, 1998)

Photo #13. Interface Between 2 in. and 1 in. Compost Sections (July 24, 1998)


Photo #14. Lower Area is Control; Upper Area is Compost Amended Soil (August 11, 1998)

Photo #15. Overview Looking West; ½ Inch Top Dressing in Foreground (E1) (October 19, 1998)

Photo #16. Interface of ½ Inch and 1 Inch Compost Sections (October 19, 1998)

Photo #17. Interface of ½ Inch Top Dressing and ½ Inch Tilled Compost Sections (October 19, 1998)

APPENDIX A

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS FOR ROADS, BRIDGES AND INCIDENTAL CONSTRUCTION

SECTION 9.44
TOPSOIL

9.44.01--Description: This work shall consist of furnishing, placing and shaping topsoil in areas shown on the plans or where directed by the Engineer. The topsoil shall be placed to the depth stated in the contract.

9.44.02--Material: The material shall conform to the requirements of Subarticle M.13.01-1.

9.44.03--Construction Methods: The areas on which topsoil is to be placed shall be graded to a reasonably true surface. Topsoil shall then be spread and shaped to the lines and grades shown on the plans, or as directed by the Engineer. The depth stated in the contract to which the topsoil is to be placed is that required after settlement of the material has taken place. All stones, roots, debris, sod, weeds and other undesirable material shall be removed. After shaping and grading, all trucks and other equipment shall be excluded from the topsoiled area to prevent excessive
compaction. The Contractor shall perform such work as required to provide a friable surface for seed germination and plant growth prior to seeding.

During hauling and spreading operations, the Contractor shall immediately remove any material dumped or spilled on the shoulders or pavement.

It shall be the Contractor's responsibility to restore to the line, grade and surface all eroded areas with approved material and to keep topsoiled areas in acceptable condition until the completion of the construction work.

9.44.04--Method of Measurement: This work will be measured for payment by the number of square meters of area on which the placing of topsoil has been completed and the work accepted.

9.44.05--Basis of Payment: Payment for this work will be made as follows:

1--Furnishing and Placing Topsoil: This work will be paid for at the contract unit price per square meter for "Furnishing and Placing Topsoil" which price shall include all materials, equipment, tools, labor and work incidental thereto.

Pay Item	Pay Unit
Furnishing and Placing Topsoil	m^2

SECTION M.13
ROADSIDE DEVELOPMENT

M.13.01--Topsoil:

The term topsoil used herein shall mean a soil meeting the soil textural classes established by the United States Department of Agriculture Classification System based upon the proportion of sand, silt, and clay size particles after passing a 2 millimeter (mm) sieve and subjected to a particle size analysis. The topsoil shall not contain less than six (6) nor more than twenty (20) percent organic matter as determined by loss-on-ignition of oven dried samples dried at 105 degrees centigrade.

The following textural classes shall be acceptable:

Loamy sand, including coarse, loamy fine, and loamy very fine sand
Sandy loam, including coarse, fine and very fine sandy loam
Loam
Silt loam, with not more than sixty (6) percent silt

The topsoil to be furnished by the Contractor shall be loose and friable and free from refuse, stumps, roots, brush, weeds, rocks and stones over 30 mm in diameter. The Topsoil shall also be free from any material that will prevent the formation of a suitable seed bed or prevent seed germination and plant growth.

The Contractor shall notify the Engineer of the location from which he proposes to furnish topsoil to the project at least 15 calendar days prior to delivery.

The topsoil and its source shall be inspected and approved by the Engineer before the material is delivered to the project. Any material delivered to the project which does not meet specifications, or which has become mixed with undue amounts of subsoil during any operation at the source or during placing and spreading, will be rejected and shall be replaced by the Contractor with acceptable material.

When topsoil is not furnished by the Contractor, it shall be material that is stripped under roadway excavation items, or is furnished by the State from areas adjacent to the project, and shall meet the above specifications.

APPENDIX B

Report of Field Visits from June through October 1998

June 29, 1998

On June 29, 1998, Mr. Jeff Scully, Mr. John Henault both of ConnDOT and Ms. K. C. Alexander of DEP visited the field sites to observe the condition of the test sites and to take photographs. It was noted that due to heavy rains of several days earlier, during one of which as much as six inches of rain fell in a single day, some erosion of the compost within the drainage swale at both locations had occurred. Of particular note is the fact that compost from the two-inch-tilled-to-three-inches-deep (B1) section washed into the control section (A1), where no compost was placed originally. It was also learned that the study subsections in area 2 had been reseeded using hydromulch, at the time that the other slopes in the surrounding area were done, on June 23, 1998.

The most notable difference was that the control sections with no compost contained much less growth than the compost sections. The difference between the various compost sections was very minor. The top dressing sections looked best. On the 2:1 dead-sand slope the compost "stuck like glue" even after the 6 in. of rain.

July 24, 1998

Mr. Donald Larsen and Jeff Scully visited the sites, observed and took additional photographs. There was an obvious difference in vegetation growth between sections A1 (control) and B1 (2-inch compost). Any difference in growth between the various compost sections (B1, C1, D1, E1, B2, C2, D2, E2) was not as obvious.

August 11, 1998

Mr. Larsen, Ms. Alexander, and Mr. Paul Corrente and Ms. Beverly Washington of ConnDOT Environmental Planning met at the site for a field review. Paul demonstrated the correct procedure for measuring plant growth. This is specified to be 100 plants per sq. ft or 1100 plants per sq. meter, measured after the plants are 6 in. tall. Although actual plant counts were not performed, it was noted that from experience, all the compost sections easily surpassed the growth requirement.

The few weeks prior to August 11 delivered very little precipitation to eastern Connecticut, and thus the ground was extremely dry. However, the compost areas still showed a much greener color compared with surrounding turf.

October 19, 1998

The final field inspection for 1998 occurred on October 19th. The inspection was done by Mr. Larsen, Ms. Alexander, Ms. Kathy Wynkoop (ConnDOT Landscape Design) and Dr. Abbie Maynard (CT Agricultural Experiment Station). On this particular inspection, it was very obvious that all the compost sections (both swale areas and the slope) were much greener and thicker than any surrounding turf that had been established by hydroseeding the non-amended ground.