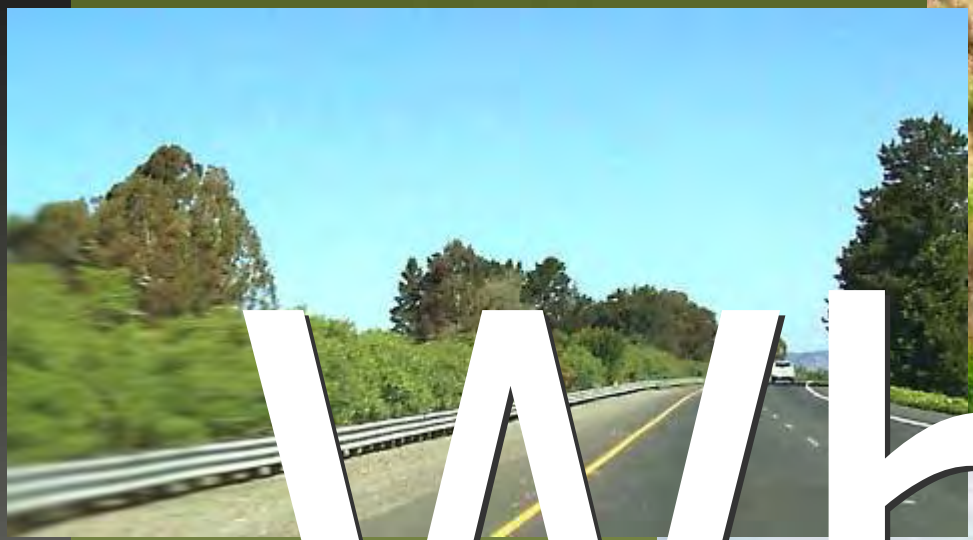
Using Compost to Improve Erosion Control and Highway Planting

Caltrans Office of Roadside Management
& Landscape Architecture Standards

Highway Planting & EC



Why?

Why Highway Planting & EC?

- Safety
  - Headlight Glare Screen
  - Roadway Delineation
  - Fire Suppression
  - Wind Breaks

Why Highway Planting & EC?

- Environmental Compliance
  - Re-Vegetation
  - Required Mitigation Planting
  - Erosion Control

What's the Common Thread?

- Safety
  - Headlight Glare Screen
  - Roadway Delineation
  - Fire Suppression
  - Wind Breaks
- Environmental Compliance
  - Re-Vegetation
  - Required Mitigation Planting
  - Erosion Control

What's the Common Thread?

Plants

Soils Resource Eval. System

- Factors Limit Plant Growth?
- Treatments That Address Limits?

Key Problem

- Key Factors That Limit Plant Growth
  - Slope Stability
  - Protection From Erosion
  - Available Water/Infiltration
  - Nutrient Availability
  - Biological Activity

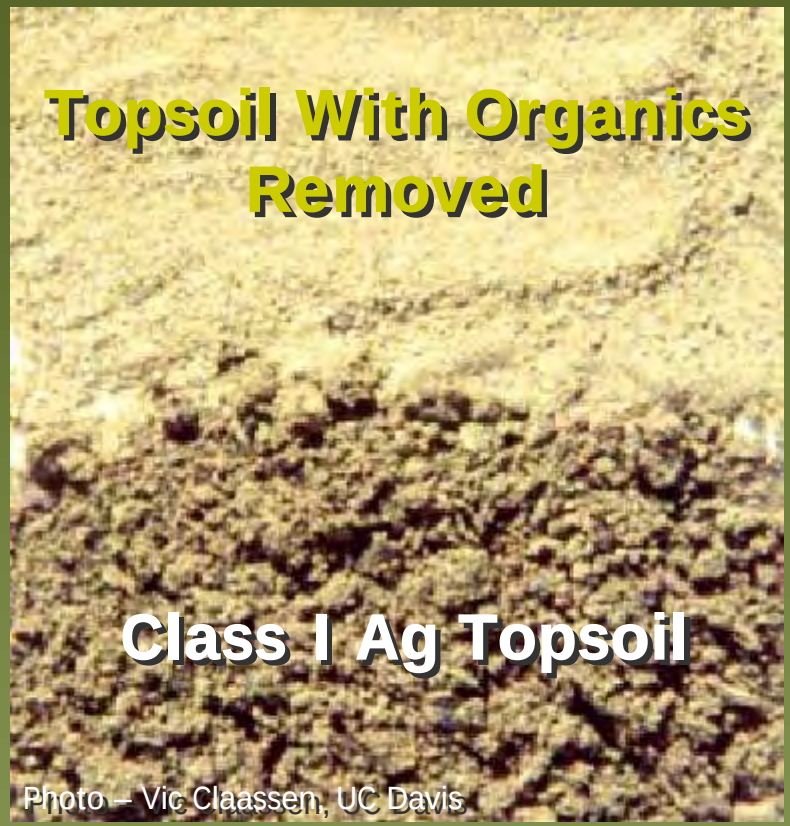
How Do We Fix These Problems?

- Key Factors That Limit Plant Growth
  - Slope Stability
  - Protection From Erosion
  - Available Water/Infiltration
  - Nutrient Availability
  - Biological Activity

Key Treatment

Compost

Compost and Soil Structure



- Soil Soaked in Bleach
  - No Organics
  - Collapsed Structure
  - Rainfall = Erosion
  - Limited Infiltration
  - Little Retained Moisture
- Class I Ag Topsoil
  - Plenty of Organics
  - Strong Structure
  - Limited Erosion
  - Significant Infiltration
  - Moisture Retention

Compost and Soil Structure

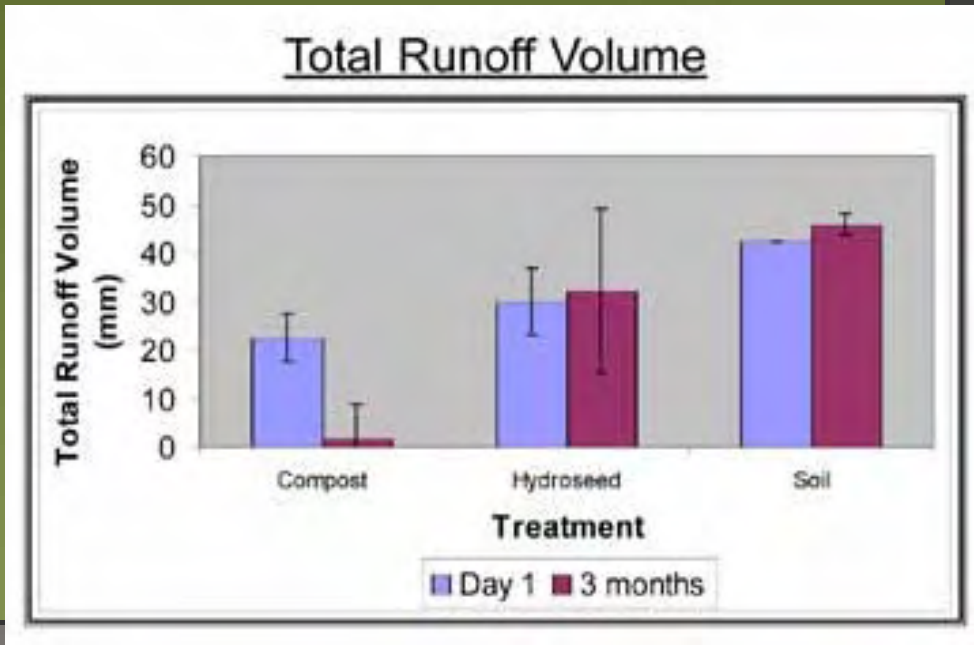
- Reduced Splash/Rill Erosion
- Reduced Runoff Volume & Rate
- Increased Infiltration
- Increased Water Holding Capacity

Compost and Soil Structure

- Reduced Splash Erosion

Compost and Soil Structure

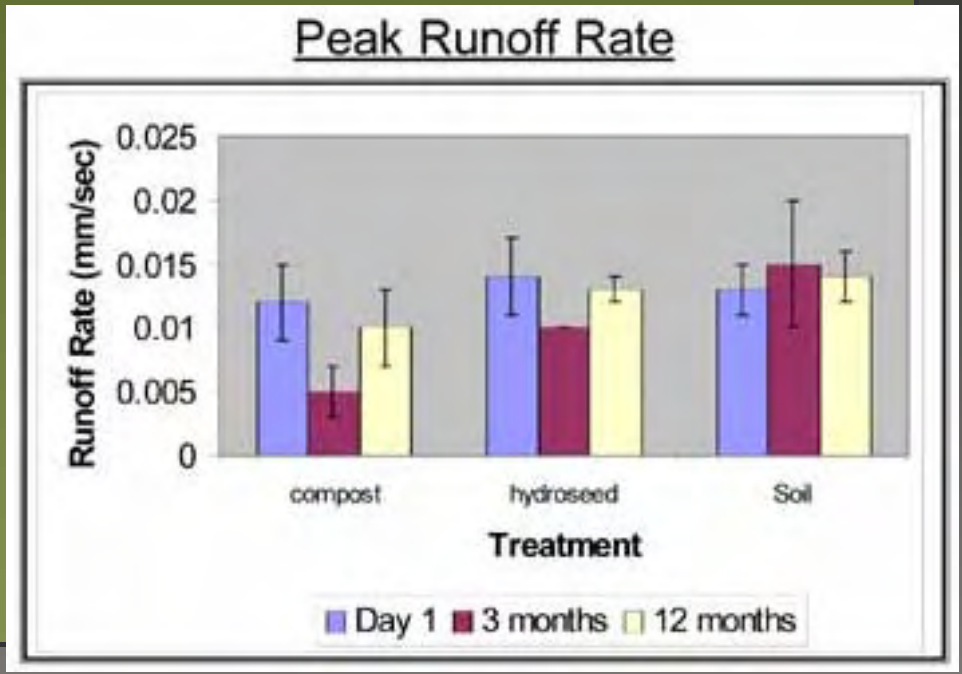
- Reduced Runoff Volume



Source: Britt Faucette, Univeristy of Georgia

Compost and Soil Structure

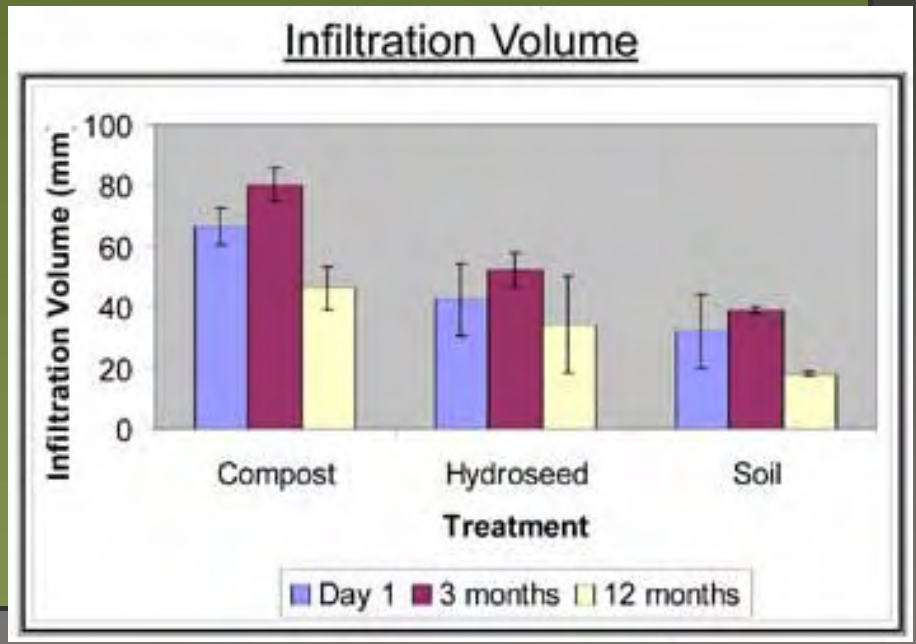
- Reduced Runoff Rate



Source: Britt Faucette, Univeristy of Georgia

Compost and Soil Structure

- Increased Infiltration Volume



Source: Britt Faucette, Univeristy of Georgia

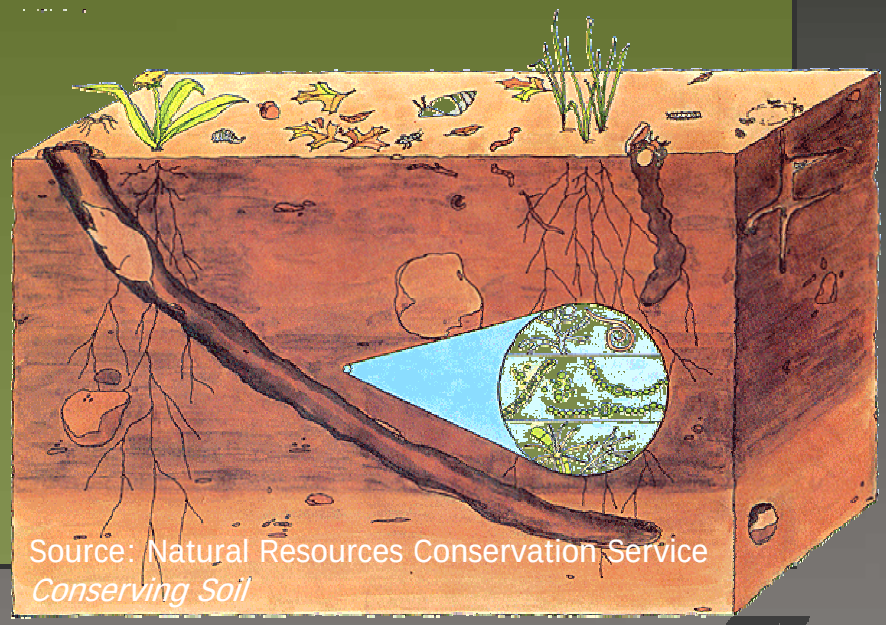
Compost and Soil Structure

- Doubled Water Holding Capacity

Source: 1999 US EPA National Risk Management Research Laboratory Study *"Infiltration Through Disturbed Urban Soils and Compost-Amended Soil Effects on Runoff Quality and Quantity"*

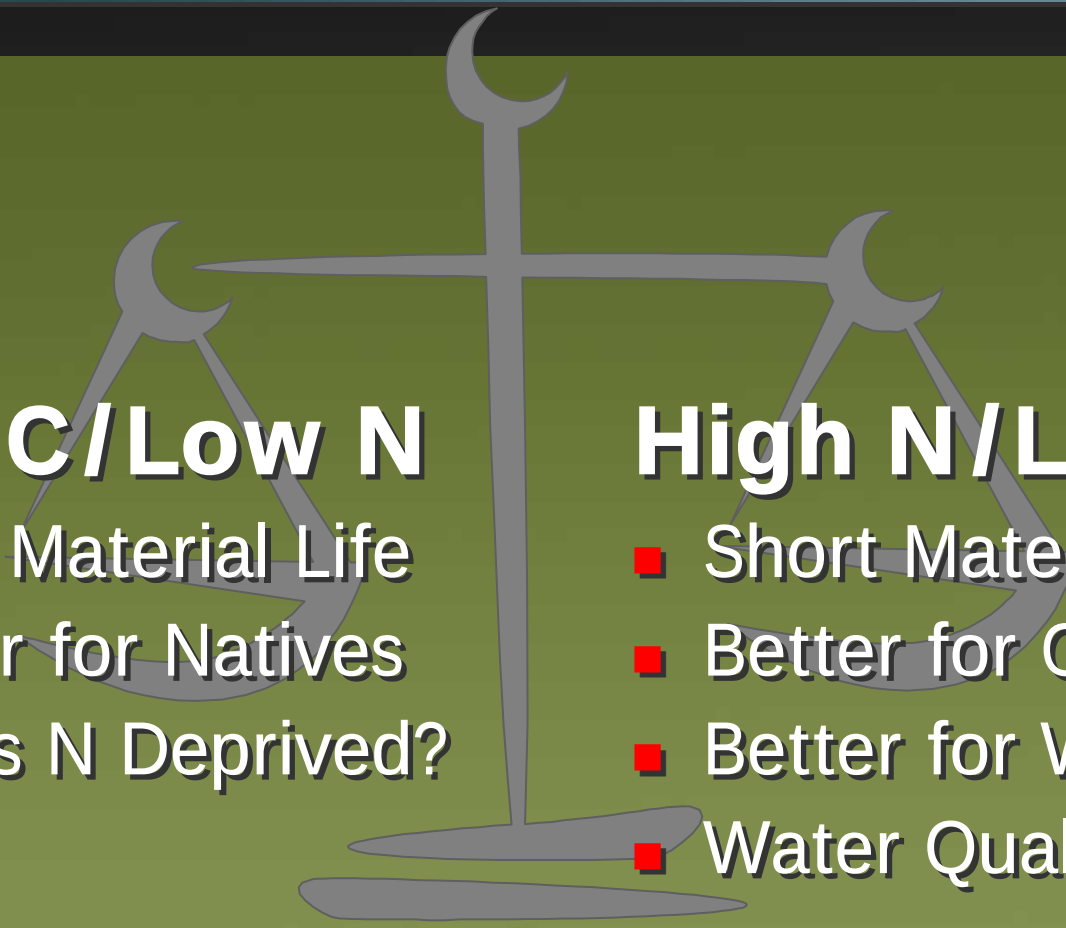
Other Compost Benefits

- Improved Biological Activity
  - Food & Air
    - Soil Bacteria
    - Actinomycetes
    - Fungi
- Plant Nutrients



Source: Natural Resources Conservation Service
Conserving Soil

Carbon & Nitrogen



High C/Low N

- Long Material Life
- Better for Natives
- Plants N Deprived?

High N/Low C

- Short Material Life
- Better for Grasses?
- Better for Weeds?
- Water Quality?

Recap

- Healthy Plants
- Healthy Soil
- Compost

What Is Compost?

What is Compost?

What Is Compost?

Time

+

Temperature

=

Compost

What Is Compost?

Is This Compost?

What Is Compost?

Or This?

What Is Compost?

Or This?

What Is Compost?

Time

+

Temperature

=

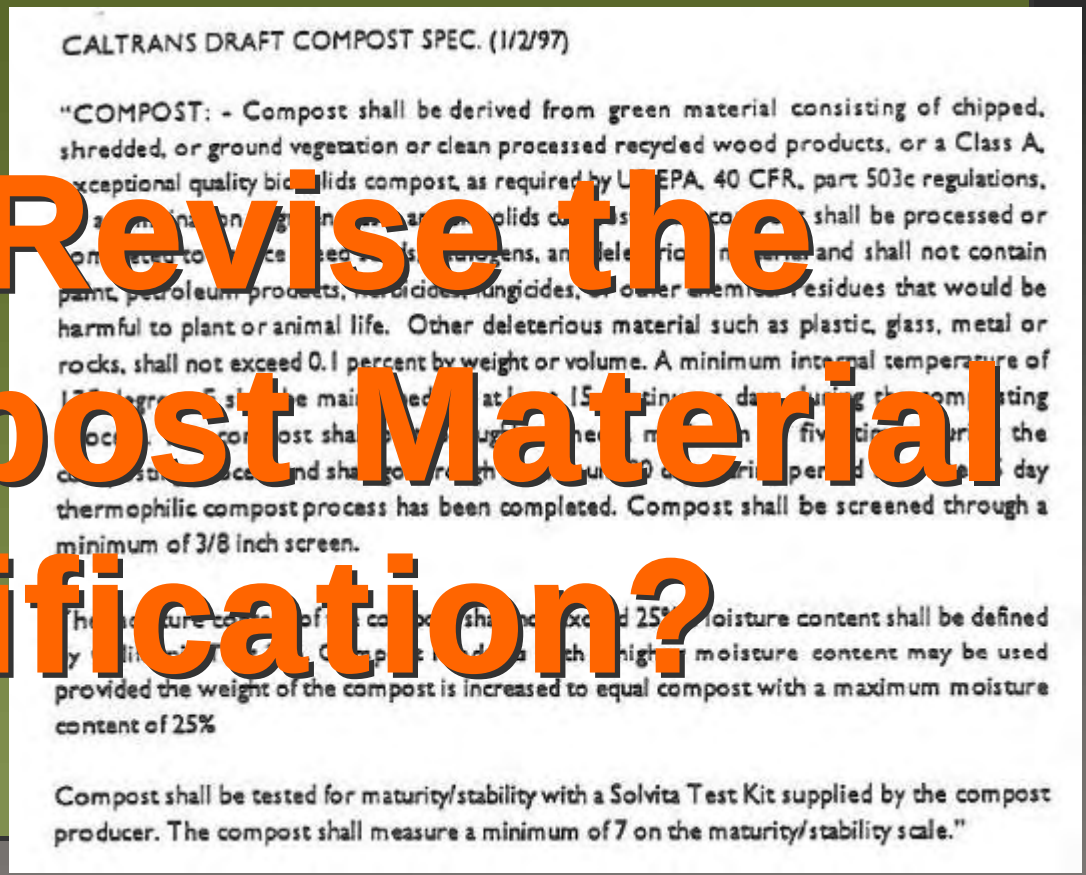
Compost

New/Revised Specifications

Specs

Why Revise The Spec?

Why Revise the Compost Material Specification?



CALTRANS DRAFT COMPOST SPEC. (1/2/97)

"COMPOST: - Compost shall be derived from green material consisting of chipped, shredded, or ground vegetation or clean processed recycled wood products, or a Class A, exceptional quality biosolids compost, as required by U.S. EPA, 40 CFR, part 503c regulations, ... shall be processed or ... and shall not contain ... residues that would be harmful to plant or animal life. Other deleterious material such as plastic, glass, metal or rocks, shall not exceed 0.1 percent by weight or volume. A minimum internal temperature of ... thermophilic compost process has been completed. Compost shall be screened through a minimum of 3/8 inch screen.

... moisture content shall be defined ... moisture content may be used provided the weight of the compost is increased to equal compost with a maximum moisture content of 25%

Compost shall be tested for maturity/stability with a Solvita Test Kit supplied by the compost producer. The compost shall measure a minimum of 7 on the maturity/stability scale."

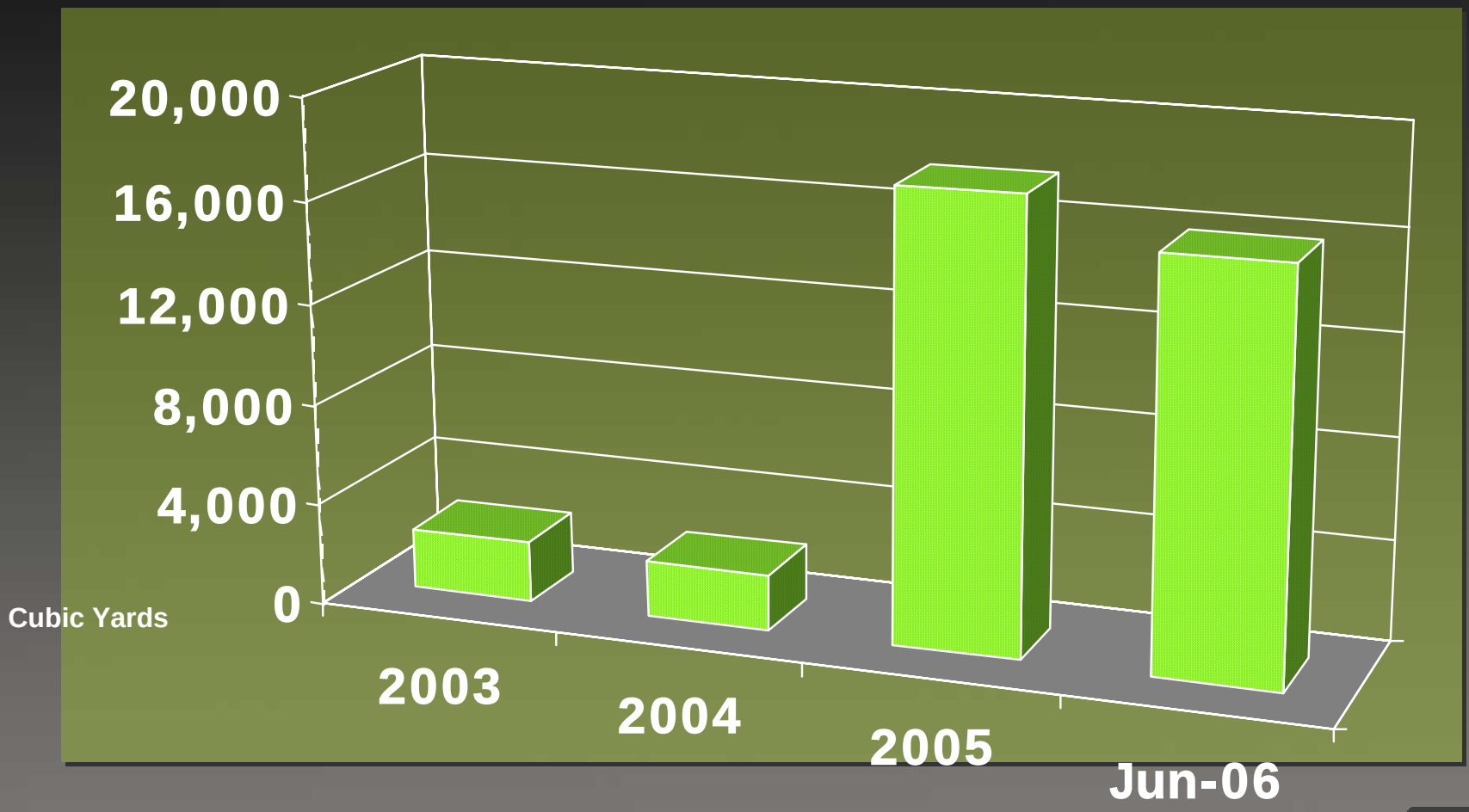
Why Revise The Spec?

- Lower Cost
- Improve Quality Control
- New Ideas

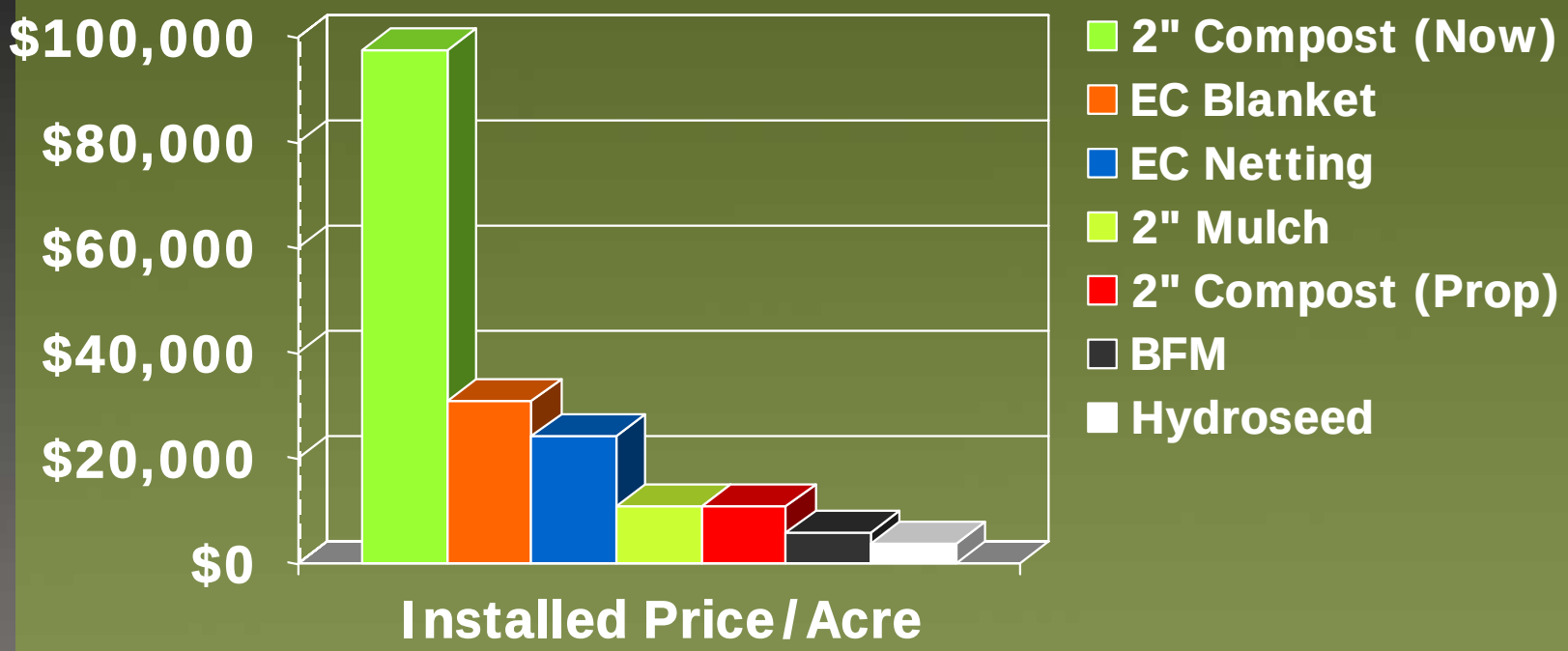
Why Revise The Spec?

Cost

Compost Use Increasing



Costs Remain High



Why Revise? Lower Cost

- Current Weighted Avg >$300/CY
- High Price Due To:
  - Bagged (vs Bulk) Materials
  - Application Method (Hydroseeding)

Revisions Promote:

- Use Bulk (vs. Bagged) Materials
- Alternative Application Methods
  - Bulldozer
  - Slinger Spreader
  - Snow-Blower

Goal: Reduce Cost to $40/CY

Cost Recap

Application Flexibility = Lower Costs

Why Revise The Spec?

QC

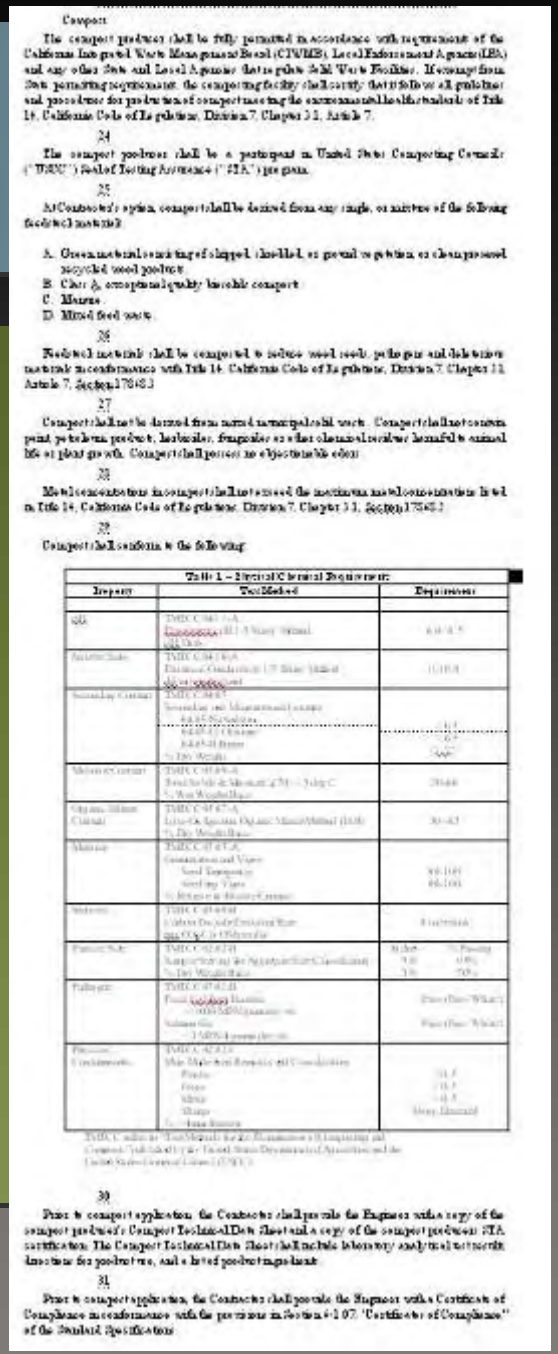
Tighter Spec = QC

CALTRANS DRAFT COMPOST SPEC. (1/2/97)

"COMPOST: - Compost shall be derived from green material consisting of chipped, shredded, or ground vegetation or clean processed recycled wood products, or a Class A, exceptional quality biosolids compost, as required by US EPA, 40 CFR, part 503c regulations, or a combination of green waste and biosolids compost. The compost shall be processed or completed to reduce weed seeds, pathogens, and deleterious material and shall not contain paint, petroleum products, herbicides, fungicides, or other chemical residues that would be harmful to plant or animal life. Other deleterious material such as plastic, glass, metal or rocks, shall not exceed 0.1 percent by weight or volume. A minimum internal temperature of 135 degrees F shall be maintained for at least 15 continuous days during the composting process. The compost shall be thoroughly turned a minimum of five times during the composting process,and shall go through a minimum 90 days curing period after the 15 day thermophilic compost process has been completed. Compost shall be screened through a minimum of 3/8 inch screen.

The moisture content of the compost shall not exceed 25%. Moisture content shall be defined by California Test 226. Compost Products with a higher moisture content may be used provided the weight of the compost is increased to equal compost with a maximum moisture content of 25%

Compost shall be tested for maturity/stability with a Solvita Test Kit supplied by the compost producer. The compost shall measure a minimum of 7 on the maturity/stability scale."



Compost

The compost producer shall be fully permitted in accordance with requirements of the California Integrated Waste Management Board (CIWMB), Local Enforcement Agencies (LEA) and any other State and Local Agencies that regulate Solid Waste Facilities. In compliance with these permitting requirements, the composting facility shall certify that it follows all guidelines and procedures for production of compost meeting the environmental health standards of Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7.

24

The compost producer shall be a participant in United States Composting Council's ("USCC") Seal of Testing Assurance ("STA") program.

25

At Contractor's option, compost shall be derived from any single, or mixture of the following feedstock materials:

A. Green material consisting of chipped, shredded, or ground vegetation or clean processed recycled wood products
B. Class A, exceptional quality biosolids compost
C. Manure
D. Mixed food waste

26

Feedstock materials shall be composted to reduce weed seeds, pathogens and deleterious materials in conformance with Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7, Section 17868.3

27

Compost shall not be derived from mixed municipal solid waste. Compost shall not contain paint, petroleum products, herbicides, fungicides or other chemical residues harmful to animal life or plant growth. Compost shall possess no objectionable odors.

28

Metal concentrations in compost shall not exceed the maximum metal concentrations listed in Title 14, California Code of Regulations, Division 7, Chapter 3.1, Section 17868.3

29

Compost shall conform to the following:

Table 1 – Physical Chemical Requirements

Property	Test Method	Requirement
pH	TMECC 04.11-A Electrometric pH 1:5 Slurry Method with DI H2O	6.0 - 8.5
Soluble Salts	TMECC 04.10-A Electrical Conductivity 1:5 Slurry Method dS/m (mmhos/cm)	10.0 dS/m
Moisture Content	TMECC 03.09-A Total Solids & Moisture at 70 +/- 5 deg C % Wet Weight Basis	30 - 60 %
Particle Size	TMECC 02.02-B Sieve Size Distribution - Manual Method % Dry Weight Basis	98-100 % Passing 3" (75 mm) 90-100 % Passing 1" (25 mm)
Pathogens	TMECC 07.01-B Fecal Coliform Bacteria < 1000 MPN/gram dry wt. Salmonella < 3 MPN/4 grams dry wt.	Pass/Fail Criteria Pass/Fail Criteria
Physical Contaminants	TMECC 02.02-B Man-Made Inert Removal and Classification Plastics Glass Metal Sharps >4 mm fraction	1.0 % 1.0 % 1.0 % Zero Tolerance

30

Prior to compost application, the Contractor shall provide the Engineer with a copy of the compost producer's Compost Technical Data Sheet and a copy of the compost producer's STA certification. The Compost Technical Data Sheet shall include laboratory analytical test results for producer's, and a listed producer tags/batch.

31

Prior to compost application, the Contractor shall provide the Engineer with a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Why Revise? Quality Control

Old Spec Tests For:

- Maturity

Why Revise? Quality Control

New Spec Tests For:

- Maturity
- pH
- Soluble Salts
- Stability
- Pathogens
- Stability
- Phytotoxicity
- Particle Size
- Physical Contaminants
- Heavy Metals

Old QC/QA Submittals

- Contractor Performs Solvita Test (For Maturity) in the Field
- Contractor Submits Results to the Engineer

New QC/QA Submittals

- Producer Submits Samples to STA Lab
- Samples Tested via STA Methodologies
- Results Returned to Compost Facility
- Paperwork Submitted by Contractor:
  - Compost Lab Test Results
  - Certificate of Compliance
  - Compost Technical Data Sheet (CTDS)

QC Recap

- Improved (Standardized) Testing
- Improved Submittals
- Greater Quality Assurance

New/Revised Specifications

New Ideas

New Ideas

Cost Effective Bulk Application Methods

EC (Type C) vs EC (Cultivate)

Which Is The More Permanent Solution?

Rotary Spading Machines

- Rotary Spading Machines
  - 22” Depth – Single Pass
  - 8’ Wide
  - 3800 LBS
  - 1-3 MPH
  - 90 HP Tractor

Rotary Spading Machines

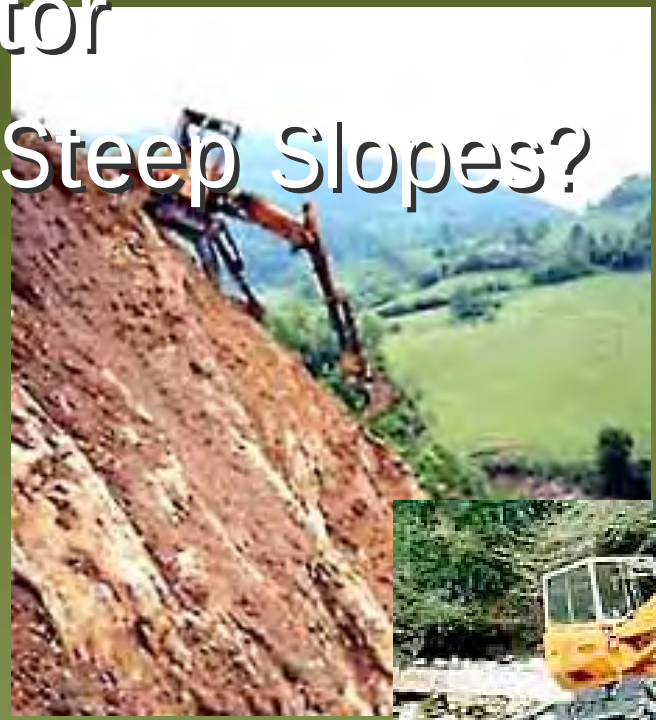
- Incorporate Large Quantities of Compost Into Subsoil
- Produce Loose Topsoil Well Mixed With Organics

Rotary Spading Machines

- Large Spaders Open Subsoils
  - Admit Air and Moisture
  - Increase Water Holding Capacity
  - Improve Soil Fertility
  - Enable Extensive Root System Development
- Penetrate Hard Soils
  - Work Well in Dry, Compacted Soils
  - Work Where Rototillers, Plows & Discs Ineffective

Other Incorporation Options

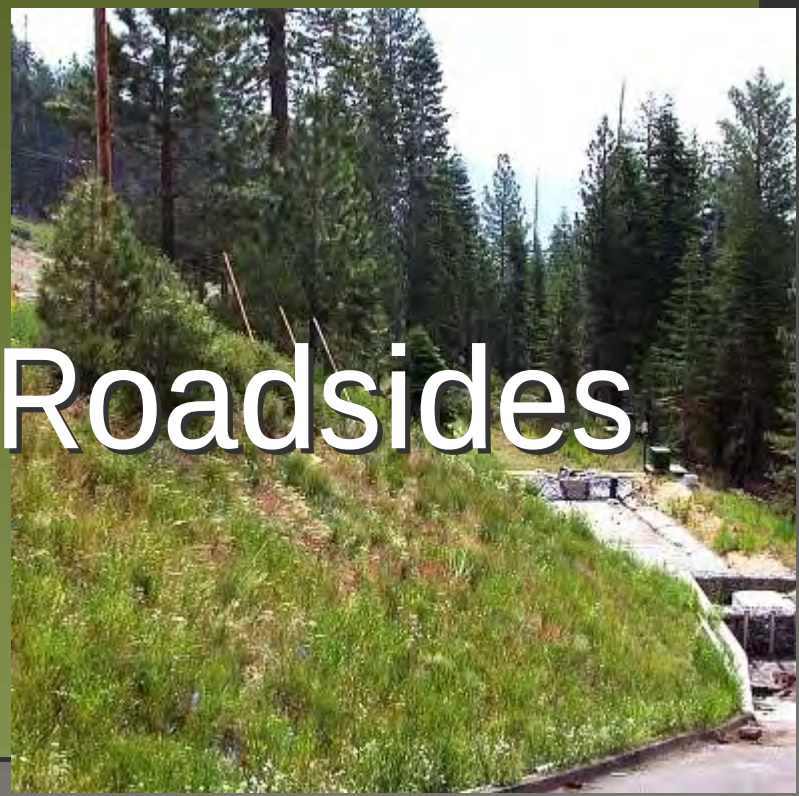
- Spider Excavator
- An Option for Steep Slopes?



Ideas Recap

RECAP

- New Ideas
- New Specs
- Sustainable Roadsides



New/Revised Specifications

The Specs

Spec Overview

- Planting Specifications
  - Mulch
  - Soil Amendment 

  - Planting
- Erosion Control Specifications
  - Erosion Control (Type C & Type D)
  - Erosion Control (Drill Seed)
  - Erosion Control (Compost Blanket) 

  - Erosion Control (Cultivate) 

New/Revised Specifications

Planting Specs

Planting Specifications

- Mulch
  - Revised Compost Definition
- Soil Amendment 

  - Replaces “Std Spec” Compost Definition
- Planting
  - Removed Std Spec Soil Amend Reference

Planting Specifications

- Mulch
- Soil Amendment

New/Revised Specifications

EC Specs

EC Specifications

- EC (Type C & Type D)
  - Updated Compost Definition
  - Removed Seed Inoculant Reqt.
  - Pay by Area
- EC Drill Seed
  - Added Compost Definition
- EC (Compost Blanket) NEW!
- EC (Cultivate) NEW!

Erosion Control (Type C/D)

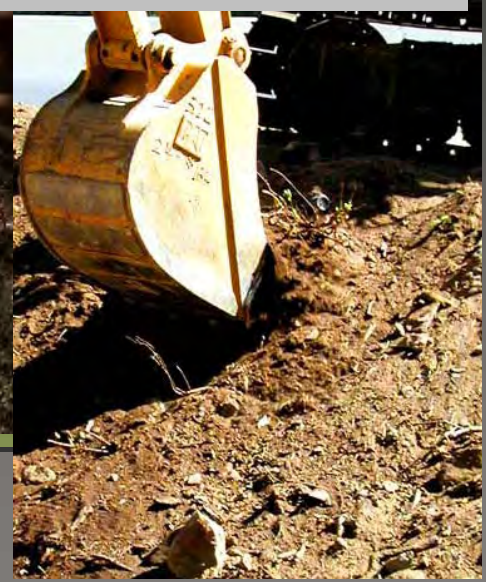
- Erosion Control (Type C)
- Erosion Control (Type D)

Erosion Control (Drill Seed)

- Erosion Control (Drill Seed)

EC (Compost Blanket & Cultivate)

- Erosion Control (Compost Blanket)
- Erosion Control (Cultivate)



New/Revised Specifications

All Specs

Compost – “Materials” Spec

Compost Shall Comply With the Following...

Producer Requirements

Compost Producer Shall be Fully Permitted Per:

- California Integrated Waste Management Board
- Local Enforcement Agencies
- Any Other State and Local Agencies That Regulate Solid Waste Facilities

Feedstock Options

- Green Material
  - Chipped, Shredded, or Ground Vegetation
  - Clean, Processed, Recycled Wood Products
- Biosolids
- Manure
- Mixed Food Waste

All Materials

- Shall be Composted to Reduce Weed Seed and Pathogens in Conformance with CA. Title 14, CCR, Div. 7, Ch. 3.1, Art. 7, Sec. 17868.3
  - Similar To US EPA Regulation 40 CFR, Part 503b

Compost Shall NOT

- Be Derived from Mixed Municipal Solid Waste.
- Contain Paint, Petroleum Products, Herbicides, Fungicides.
- Contain Chemicals Harmful to Animal or Plant Life.

Compost Shall NOT

- Possess Objectionable Odors
- Possess Metal Concentrations Exceeding Title 14, CCR, Div. 7, Ch. 3.1, Sect. 17868.2

Physical/Chemical Requirements

Property	Test Method	Backfill	Soil Prep (Cultivate)	Mulch	Drill Seed	Hydroseed EC (Type C/D)	Blanket (Vegetated Non-Inc)
pH	TMECC 04.11-A Electrometric pH 1:5 Slurry Method	6.0-8.5	6.0-8.5	6.0-8.5	6.0-8.5	6.0-8.5	6.0-8.5
Soluble Salts (Electrical Conductivity)	TMECC 04.10-A Electrical Conductivity 1:5 Slurry Method, Mass Basis	0-10.0 dS/m	0-10.0 dS/m	0-10.0 dS/m	0-10.0 dS/m	0-10.0 dS/m	0-10.0 dS/m
Moisture Content	TMECC 03.09-A Total Solids and Moisture at 70+/- 5 degrees C % Wet Weight Basis	30-60%	30-60%	N/A	30-60%	30-60%	30-60%
Organic Matter Content	TMECC 05.07-A "Loss-On-Ignition Organic Matter Method (LOI)" % Dry weight basis	30–65%	30–65%	30–100%	30–65%	30–65%	30–65%
Maturity (Bioassay)	TMECC 05.05-A "Germination and Vigor" Seed Emergence Seedling Vigor % Relative to positive control	80% or above 80% or above	80% or above 80% or above	N/A	80% or above 80% or above	80% or above 80% or above	80% or above 80% or above
Stability (Respirometry)	TMECC 05.08-B "Carbon Dioxide Evolution Rate" mg CO_2-C per g OM per day	8 or below	8 or below	N/A	8 or below	8 or below	8 or below
Particle Size	TMECC 02.02-B "Sample Sieving for Aggregate Size" % Dry Weight Basis	Inches % Pass 5/8 95% 3/8 70%	Inches % Pass 5/8 95% 3/8 70%	Inches % Pass 3" 99% 3/8 < 25% Max length 4"	Inches % Pass 5/8 95% 3/8 70%	Inches % Pass 5/8 95% 3/8 70%	Inches % Pass 3 100% 1 90-100% ¾ 65-100% 1/4 0-75% Max Length 6"
Pathogen (Fecal Coliform)	TMECC 07.01-B "Fecal Coliforms"	Pass <1000 MPN/gram	Pass <1000 MPN/gram	Pass <1000 MPN/gram	Pass <1000 MPN/gram	Pass <1000 MPN/gram	Pass <1000 MPN/gram
Pathogen (Salmonella)	TMECC 07.02 "Salmonella"	Pass <3 MPN/4 grams of TS	Pass <3 MPN/4 grams of TS	Pass <3 MPN/4 grams of TS	Pass <3 MPN/4 grams of TS	Pass <3 MPN/4 grams of TS	Pass <3 MPN/4 grams of TS
Physical Contaminants (Man-made inerts)	TMECC 02.02-C "Man Made Inert Removal and Classification" Plastic, Glass & Metals Sharps > 4 mm fraction	< 1% None Detected	< 1% None Detected	< 1% None Detected	< 1% None Detected	< 1% None Detected	< 1% None Detected

Submittal Requirements

- Compost Technical Data Sheet
- Copy of the Compost Producer's STA certification
- Certificate of Compliance (Per Caltrans Std Specs).

Submittal Requirements

Compost Technical Data Sheet

US COMPOSTING COUNCIL
Seal of Testing Assurance

#REF!
#REF!
#REF!
#REF!
#REF!

Product Identification: #REF!

Caltrans

Date Sampled/Received: #REF!

COMPOST TECHNICAL DATA SHEET for Caltrans

LABORATORY:

Compost Parameters	*Test Results*	*Reported as (units of measure)*	*TMECC Test Method*
Particle Size		% dry weight passing through	02.02-D Sample Sieving for Aggregate Size Classification
Heavy Metals Content	#DIV/0!	PASS/FAIL: Per US EPA Class A 40 CFR 503.13, tables 1 and 3	04.06 Heavy Metals standard and Hazardous Elements
Soluble Salts (electrical conductivity)	#DIV/0!	dS/m (mmhos/cm)	04.10-A 1:5 Slurry Method Mass Basis
pH	0.00	Units/us	04.11-A 1:5 Slurry pH
Maturity Indicator (bioassay) Percent Emergence Relative Seedling Vigor		average % of control average % of control	05.05-A Germination and vigor
Organic Matter Content	0.0	%, dry weight basis	05.07-A Loss-on-Ignition Organic Matter Method (LOI)
Stability Indicator	NA	mg CO2-C/g OM/day	05.08-B Carbon Dioxide Evolution Rate
Pathogens		PASS/FAIL: Per US EPA Class A standard, 40 CFR 503.32(a)	07.01-B Fecal coliforms and 07.02 Salmonella
Moisture content		%, dry weight basis	03.09-A - Total Solids and Moisture (at 70+/- 5C)
Physical Contaminants		%, dry weight basis	02.02-C - Man-Made Inerts Total content and Sharps content

Planting Specifications

http://pd.dot.ca.gov/design/landscape/nssp/planting.htm

Project Delivery — Design

Construction | Engineering Services | Environmental Analysis | Project Management | Right of Way

Onramp > Project Delivery > Design > Nonstandard Special Provisions

- Caltrans Internet
- Onramp
- Project Delivery Home
- Project Delivery Search
- Project Delivery Site Map
- LAP Intranet Home
- Nonstandard Spec Home
- Erosion Control
- Highway Planting
- Irrigation
- Roadside Mgmt

Planting NSSPs

These nonstandard special provisions are in "Final Draft" form and may be used in current projects provided only ***minor*** edits are made. Significant edits will trigger the nonstandard special provision review process - requiring submittal, review and concurrence by the Specification Owner. When in doubt - discuss the proposed edits with your HQ LAP Landscape Coordinator.

For more information regarding the use of these nonstandard specifications, please visit our FAQ page.

New?	Description	Blanket Concurrence	CAD Detail
Revised	Planting (English) Planting (Metric) Revised to reference the new Draft NSSP for Soil Amendment, rather than the Standard Specifications Section 20-2.03 Soil Amendment.	Not Available Contact Your District Landscape Coordinator	No Detail
New	Soil Amendment (English) Soil Amendment (Metric) Replaces the Standard Specification Section 20-2.03 "Soil Amendment." Includes updated Department definition of compost	Not Available Contact Your District Landscape Coordinator	No Detail
Revised	Mulch (English) Mulch (Metric) Revised to use updated Department definition of compost. Use the Standard BEEs item for Mulch.	Not Available Contact Your District Landscape Coordinator	No Detail

Erosion Control Specifications

http://pd.dot.ca.gov/design/landscape/nssp/ec.htm

Project Delivery — Design

Construction | Engineering Services | Environmental Analysis | Project Management | Right of Way

Caltrans Internet
Onramp
Project Delivery Home
Project Delivery Search
Project Delivery Site Map
LAP Intranet Home
Nonstandard Spec Home
- Erosion Control
- Highway Planting
- Irrigation
- Roadside Maint

Erosion Control NSSPs

These nonstandard special provisions are in "Final Draft" form and may be used in current projects provided only *minor* edits are made. Significant edits will trigger the nonstandard special provision review process - requiring submittal, review and concurrence by the Specification Owner. When in doubt - discuss the proposed edits with your HQ LAP Landscape Coordinator.

For more information regarding the use of these nonstandard specifications, please visit our FAQ page

New?	Description	Blanket Concurrence	CAD Detail
New	Erosion Control (Type C) English Erosion Control (Type C) Metric Supersedes the Erosion Control (Type C) SSP currently on the DES/OE Server.		No Detail
New	Erosion Control (Type D) English Erosion Control (Type D) Metric Supersedes the Erosion Control (Type D) SSP currently on the DES/OE Server.		No Detail
New	Erosion Control (Type M) English Erosion Control (Type M) Metric Compost Blanket NSSP. Covers installation of compost and seed, to form a fibrous blanket to help establish permanent roadside vegetation, minimize weed competition, minimize topsoil loss, retain soil moisture, improve soil structure and fertility.		No Detail
New	Erosion Control (Drill Seed) English Erosion Control (Drill Seed) Metric Covers drill seeding of areas to provide permanent erosion control. Use drill seeding to establish vegetation on slopes no greater than 4:1 (H:V) that are accessible from the roadway. Add a nonstandard item (measured by the square meter) for Erosion Control (Drill Seed) to the BEES/Engineer's Estimate. Use this specification together with other appropriate storm water BMPs.		No Detail

New/Revised Specifications

Recap

Recap

- Planting Specifications
  - Mulch
  - Soil Amendment NEW!
  - Planting
- Erosion Control Specifications
  - Erosion Control (Type C & Type D)
  - Erosion Control (Drill Seed)
  - Erosion Control (Compost Blanket) NEW!
  - Erosion Control (Cultivate) NEW!

Remember

Use the Specs


Using Compost to Improve Erosion Control and Highway Planting
Thank-You

The Laboratory

- Compost Filter Socks
  - Currently Under New Products Review Process