

Urban Roadways: A refreshing look at roadside projects



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Today

- General Consensus
- Case Studies
 - Program overview
 - Changed practice
 - Value
- Lessons learned

General Consensus

An aerial photograph of a road construction site in a rural area. A long, straight road is under construction, with a semi-trailer truck parked on the right side. The surrounding landscape is flat and open, with some trees and a small building visible in the distance. The sky is clear and blue.

- Road Projects are focused on:
 - The Performance of the road surface
 - Traffic volume and flow
 - Safety
 - Budget
- Groups wanting plantings don't always understand the constraints

How We Imagine **Existing** Trees in Construction Areas



SHADED PARKING

PACING

SPREADING FILL MATERIAL

SHADED PARKING

PACING - MOW

THIS AREA PLANNED TO
HAVE TREES INSTALLED



Texas DOT Roadside Forests

- Since 1998:
- 1,546,142 Trees
- 416,630 Shrubs
- 585,252 Vines/Groundcover
- 1,200+ ACRES Amended Soil

- TXDOT
- Zero maintenance of roadside forests
 - Establishment Contracted

Why Reforestation

- Main goals
 - AESTHETICS
 - Air Quality- harder to attain will smaller plantings
 - Work with all “tree” and Quality of life groups in the area. They see the value.
 - In turn they support DOT by contacting local elected officials at state and district levels .

And We Wonder Why Plants Struggle On Disturbed Sites?

INSTALLED 20 YEARS PRIOR TO PHOTO



How Do We Improve Conditions?

Life Cycle of
Construction
Soil

1964



2001



2004



2007



2009




- Post-construction “dirt”
 - has the most favorable engineering qualities



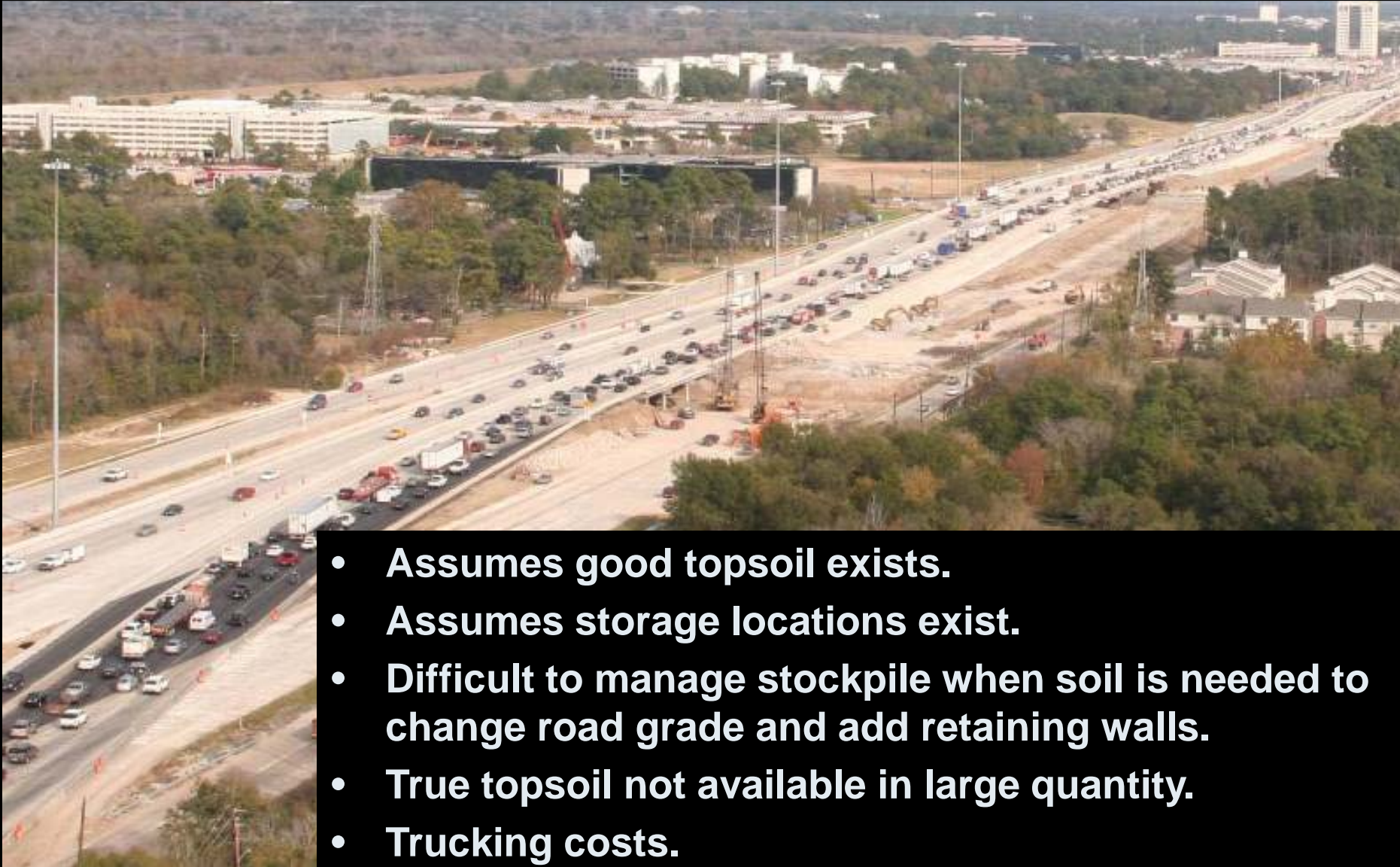
- Organic matter in soil
 - conflicts with the engineering properties necessary to support a road bed or embankment
 - as do the soil pore spaces, which contain air and water

Everything plants need to survive is bad.

Compare Soil/Dirt : Physical, Chemical and Biological Properties

Undisturbed Soil		Post-Construction Dirt
40-55%	Compaction ↑	95-98%
1.1-1.4 g/cc	Bulk Density ↑	1.5-2.0 g/cc
-	Aggregate Stability ↓	Decreases
-	Porosity ↓	Reduced
Adequate	Organic Matter ↓	Reduced or absent
Present and active	Micro-organisms ↓	Reduced
35%	Storm water Infiltration ↓	15%
15%	Storm water Runoff ↑	55-70%
-	Water-holding Capacity ↓	Reduced
-	Available Water ↓	Reduced
Yes	Available Nutrients ↓	Very reduced
-	pH	Altered
-	Electrical conductivity ↓	Reduced
-	Cation Exchange Capacity ↓	Reduced
-	Rooting Penetration	Resistant

What about salvaged/purchased topsoil?

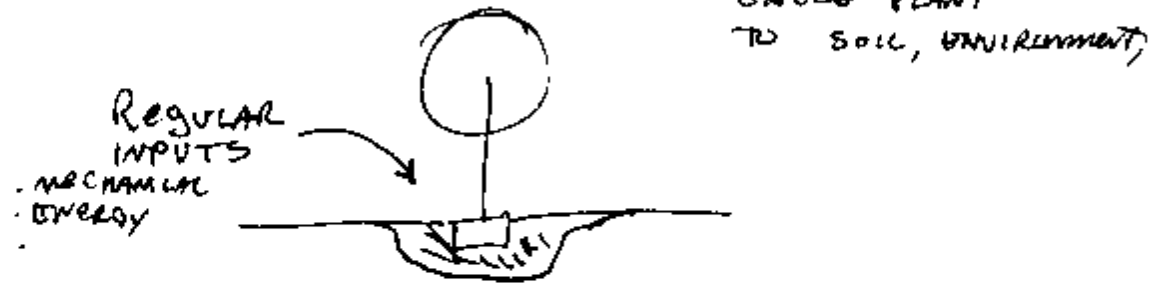


- **Assumes good topsoil exists.**
- **Assumes storage locations exist.**
- **Difficult to manage stockpile when soil is needed to change road grade and add retaining walls.**
- **True topsoil not available in large quantity.**
- **Trucking costs.**

Adjusted Approach to meet Goal

LANDSCAPE MODELS

OLD



New



How could TxDOT have a conversation regarding urban landscape soils?

1,200+ ACRES amended soil

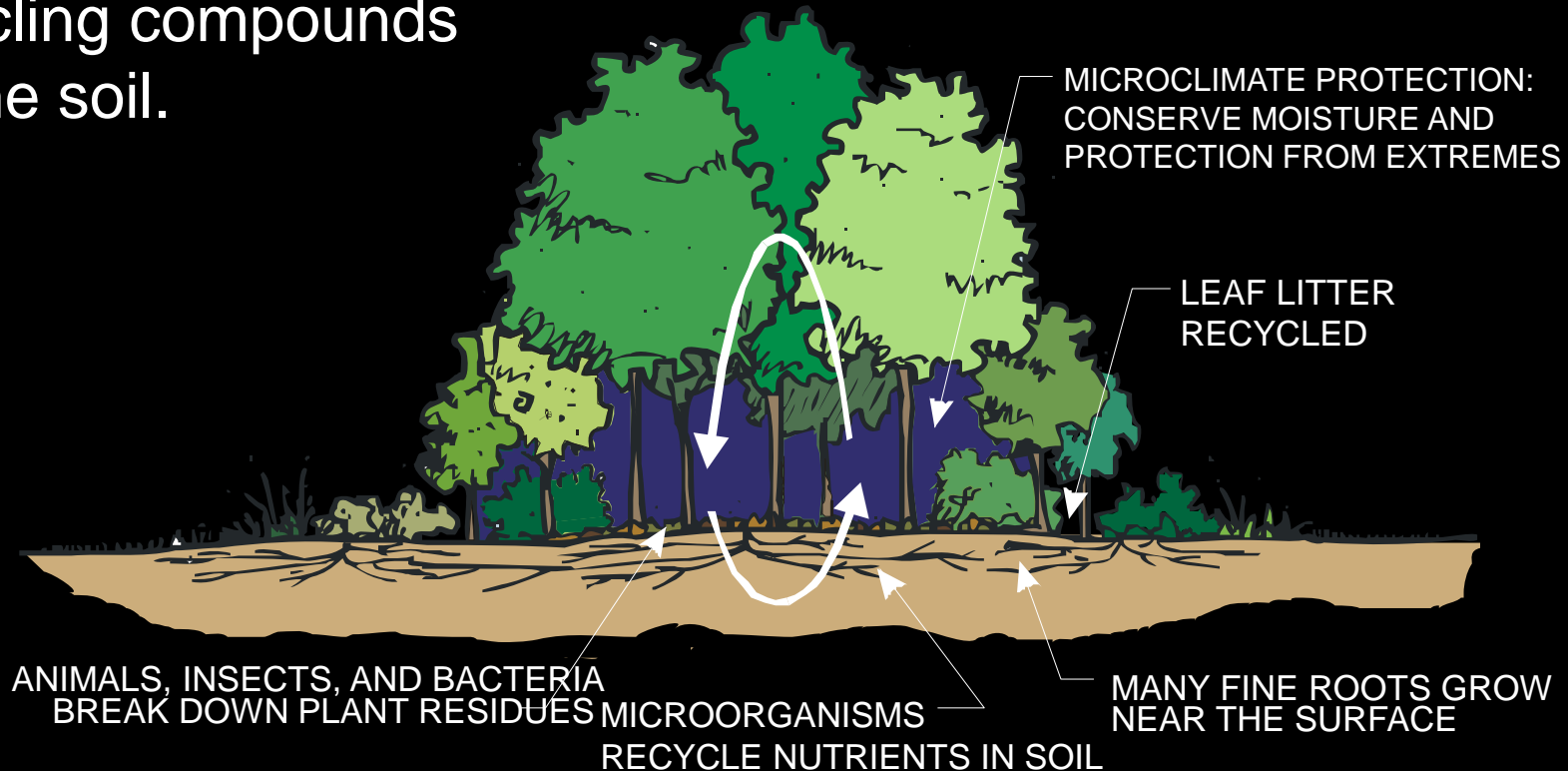
Tremendous opportunities:

- Explore methods and procedures
- Test materials
- Monitor growth and mortality
- Address long term management concerns
- Test designs in various site conditions
- Balance expectations with resources
- Manage partners and multi-disciplinary design teams

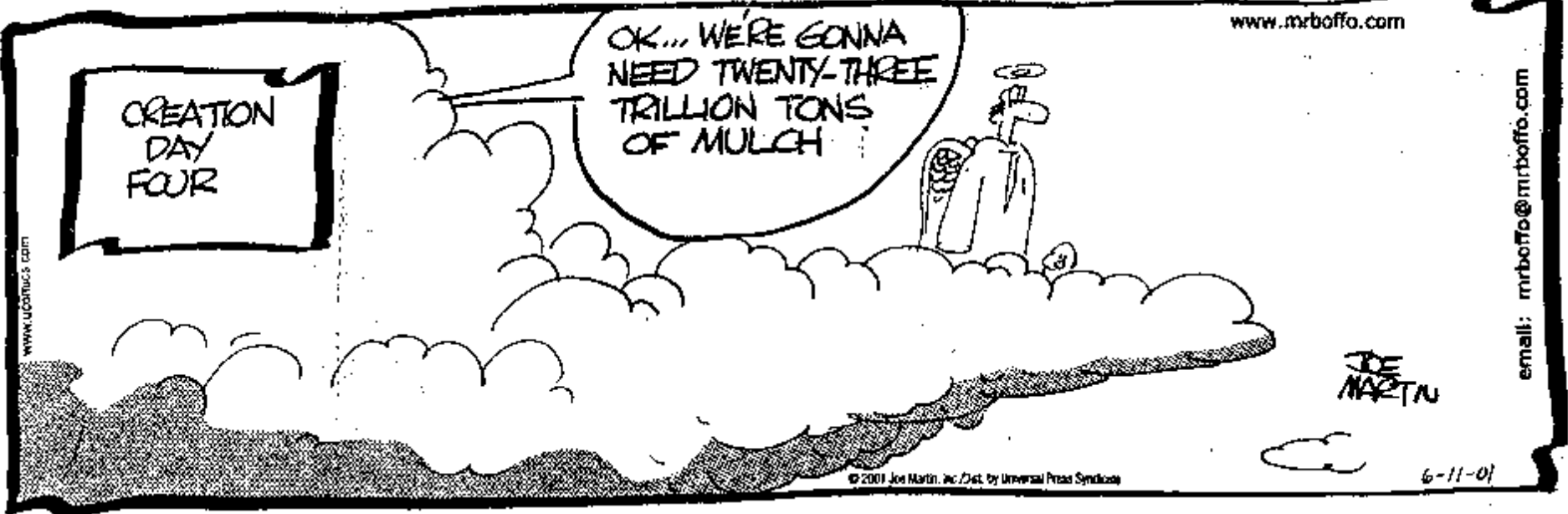
Why Does It Matter?

MATTER VS. MATERIAL

- Organic **material**: anything that was alive and is now in the soil (mulch, compost, leaves, etc.)
- Microorganisms convert organic **material** into **matter** by cycling compounds into the soil.



Mr. Boffo



It takes A LOT of organic material to increase organic matter content.

Adding compost: compensates for lack of nutrient cycling. Future leaf drop sustains nutrient cycling.



Concepts for Improving Dirt to Soil

- Managing soil.
- Natural organics feed soil.
- Synthetic fertilizers feed plant.
- Nutrient source: organic matter (leaves, fertilizer).
- Forest landscapes are self fertilized.
- Urban landscapes often don't receive leaf litter.
- Natural organics are like an insurance policy.
The soil biology and plant will perform necessary chemistry for plant nutrition.

AMENDED AREAS READY FOR PLANTING





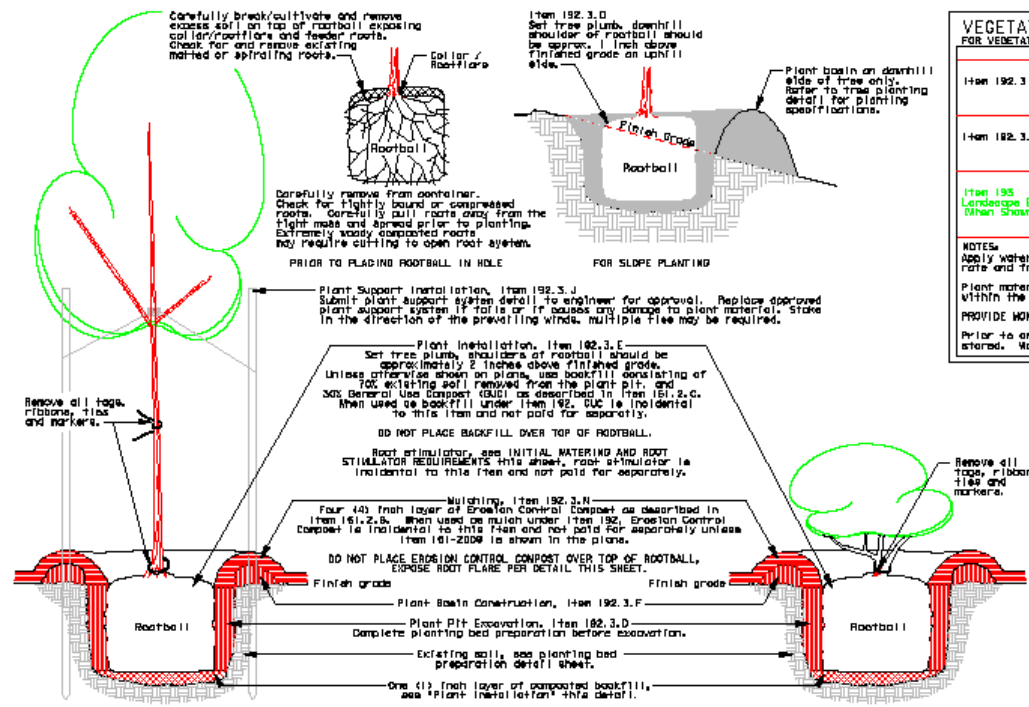
Over 12,000 trees at this interchange.

Spec it!

- All soil treatments installation and initial maintenance contracted
- All naturally-derived or certified organic (third party, OMRI, etc)

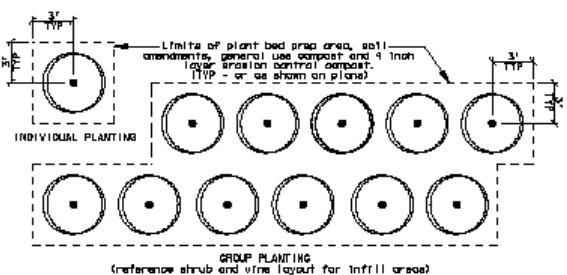
Fertilizers, amendments, compost/tea/extract

- **Inspection**/approval/quality
- Industry has grown



TREE PLANTING DETAIL

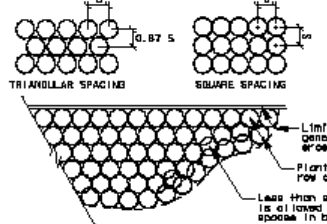
FOR PALM TREE PLANTING DETAIL SEE PLANTING AND ESTABLISHMENT SHEET 2 OF 5



TREE PLACEMENT WITHIN PLANTING BED PREP AREA, LAYOUT AND SPACING SHOWN ON PLANS

SHRUB AND VINE PLANTING DETAIL

5' Spacing as indicated on the plans. Square or triangular spacing will be shown by the placement of the plants on the drawing and/or be called out in the plant label.



SHRUB AND VINE PLACEMENT WITHIN PLANTING BED PREP AREA LAYOUT AND SPACING SHOWN ON PLANS

VEGETATIVE WATERING SCHEDULE FOR TREES, SHRUBS, VINES
FOR VEGETATIVE WATERING FOR PALMS ONLY SEE PLANTING AND ESTABLISHMENT SHEET 2 OF 5

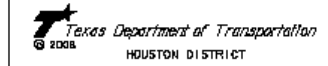
PHASE	ITEM DESCRIPTION	FREQUENCY	RATE / PLANT
Item 192.3 Construction	Item 192.3.G. Watering is incidental to Item 192 and is not paid for separately. See Initial Watering Note	Begin same day as planting with 3 times per week 1 day minimum between waterings	CNTR SIZE WATER DIV 30 GAL = 16 gallons 15 GAL = 10 gallons 5 GAL = 4 gallons 3 GAL = 2 gallons 1 GAL = 2 gallons
Item 192.3.0 Maintenance	Item 192.3.0.1. Watering is incidental to Item 192 and is not paid for separately.	See Initial Watering Note	1 1/2 X plant CNTR gallon size per gallon size per shown, or (1) gallon minimum
Item 195 Landscape Establishment (Main Shown in Plans)	Item 195.3.C. Watering is incidental to Item 195 and is not paid for separately.	2 times per week with 2 days minimum between waterings	See Initial Watering Note

NOTES:
Apply water over the rootball within the tree well only, unless otherwise shown on plans. Adjust rate and frequency to meet site conditions and weather as approved or directed by engineer.
Plant material in poor condition due to the failure to apply the specified amount of water within the time allowed or overwatering will be replaced at contractor's expense.
PROVIDE MONTHLY METER READINGS OF WATER APPLIED.
Prior to arrival at project or storage area, provide watering plan(s) of plants to be installed or stored. Watering plan(s) must be approved by engineer prior to delivery to project or storage area.

INITIAL WATERING AND ROOT STIMULATOR REQUIREMENTS

PHASE	ITEM DESCRIPTION
Item 192.3 Construction	Initial watering.
Item 192.3.5.5 Plant Installation	Plant stimulator material is incidental to Item 192 and is not paid for separately.
MATERIALS AND SOLUTION	Two (2) ounces of root stimulator concentrate per one (1) gallon water. Root stimulator must be commercially available and labeled as an oil soluble/non-directional liquid concentrate Bio-Stimulant and Root Stimulator. Use the following product or an approved equal: Super Seaweed, San Joaquin Environmental Supplies, 713-957-0509.
FREQUENCY AND RATE	At the time of planting, provide initial watering at rate shown in Vegetative Watering Schedule this sheet. Use root stimulator solution for initial watering.

- GENERAL NOTES:**
- Reference Item 192 of the Texas Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges 2004 for specifications, dimensions, values, and measurements not shown.
 - Verify that all planting marks the following clear zone minimum distance requirements from the edge of the travel lane: Trees 32' unless protected by a barrier, Shrubs 18' unless protected by a barrier, Groundcover and vines to minimum distance. Engineer has final authority over all clear zone related issues.
 - Locate and expose all underground conduits and utilities associated with but not limited to: CIMS, CIMS power supply, lighting, signal wires and detectors, gas, electric, telephone, fiber optics, etc.
 - Locate and strike existing ground boxes, inlets, culverts, manholes, etc. within the project area with a 4" wooden stake painted orange. Maintain the stakes in place for duration of the contract. Remove stakes when directed by engineer.
 - Reference Item 6.7 (protection) of the Texas Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges 2004. At any time during all phases of the contract, any materials or work performed not in accordance with the plans and specifications will be replaced and/or reworked until in accordance. Any delinquencies due to the failure to comply with plans and specifications shown will be at contractor's expense.



PLANTING AND ESTABLISHMENT
SHEET 1 of 8

Details not to scale

FLUP	TREE & SHRUB	
	NO	DATE
ORIGINAL	DATE	BY
	DATE	BY
	DATE	BY
	DATE	BY

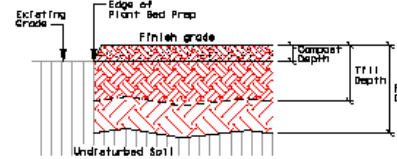
TYPE OF WORK

ITEMS AND REQUIREMENTS FOR EACH TYPE OF WORK

192-2063 PLANT BED PREP (TYPE I) SY	192-2064 PLANT BED PREP (TYPE II) SY	192-2065 PLANT BED PREP (TYPE III) SY	192-2066 PLANT BED PREP (TYPE IV) SY			
✓	✓	✓		161-2012 GENERAL USE COMPOST CY	APPLICATION RATE Item 161.2.C. General Use Compost. Apply 2 in. uniform layer over bed preparation area.	Item 161.2. Material. Compost producer's STA certification must be dated to meet STA requirements (certification must be within 30 or 90 days). Lab analysis performed by an STA-certified lab must be dated within 30 days before delivery of the compost.
✓	✓	✓	✓	1009-2002 LANDSCAPE SOIL AMENDMENT (TYPE I) SY	APPLICATION RATE Plant Bed Preparation areas - apply 0.30 lbs/SY	Use a non-chemical fertilizer with the following requirements: (1) Is OMRI Listed meeting USDA National Organic Program Rules, provide current certification. (2) Is registered with Texas State Chemist as a commercial fertilizer. (3) Meets USEPA guidelines for unrestricted use. (4) Derived from the following biological sources: processed poultry manure. (5) Contains 3.0% nitrogen and 2.2% of nitrogen is water insoluble, 4% phosphate, 3% soluble potash, 10% calcium. (6) Use the following product or an approved equal: Plant Vigor 3-4-3 Plus 10% Boron manufactured by Natural Resources Group, Inc., Tomball, Texas 800-279-8567.
✓	✓	✓	✓	1009-2006 LANDSCAPE SOIL AMENDMENT (TYPE V) SY	APPLICATION RATE - Install 1 cup per new plant in planting hole prior to planting. Limit/Measurement of Pay: 1 cup equals 1 SY	Use a non-chemical fertilizer with the following requirements: (1) Is OMRI Listed meeting USDA National Organic Program Rules, provide current certification. (2) Is registered with Texas State Chemist as a commercial fertilizer. (3) Meets USEPA guidelines for unrestricted use. (4) Derived from the following biological sources: worm castings. (5) Contains 0.02% humic acid derived from humate, 1.0% nitrogen and 0.3% of nitrogen is water insoluble, 0.85 phosphate, 0.2% soluble potash, 1.0% calcium, 0.02% iron (include the following product or an approved equal: Block Soil from manufacturer by Verml-Technology Unlimited available from Earth's Better 805-808-1139.
✓	✓	✓	✓	1009-2003 LANDSCAPE SOIL AMENDMENT (TYPE III) SY	APPLICATION RATE For new and existing Plant Bed Preparation Areas - apply 0.120 lbs/SY	Humate containing 2.25% iron in the raw material and greater than 45% humic acid, decrease 2.5% to 2% on weight basis. Pelletized humate without added binders and pass #18 mesh. Use the following product or an approved equal: Block Soil from manufacturer by San Jacinto Humate, San Jacinto Environmental Supplies, 713-857-0908.
✓	✓	✓	✓	1009-2004 LANDSCAPE SOIL AMENDMENT (TYPE III) SY	See PLANTING AND ESTABLISHMENT SHEET 5 of 8 For Requirements	
✓	✓	✓	✓	1009-2005 LANDSCAPE SOIL AMENDMENT (TYPE IV) SY	See PLANTING AND ESTABLISHMENT SHEET 5 of 8 For Requirements	
✓	✓	✓		RIPPING/TRENCHING Incidental to Item 192 Plant Bed Preparation.	RIP/TRENCH DEPTH Rip/Trench to a depth of 18 inches +/- 2%. Distance between each Rip/Trench is 24 inches.	
✓	✓	✓		ROTOR TILLING Incidental to Item 192 Plant Bed Preparation.	ROTOR TILL DEPTH After application of compost and amendments and Rip/Trench (when required), rotor till to a depth of 8 inches +/- 2%.	
✓	✓	✓	✓	HERBICIDE and MOWING Incidental to Item 192 Plant Bed Preparation. Solicit new 15 days after final herbicide treatment.	APPLICATION RATE Prior to all other work, apply two applications of an approved herbicide with 15 days between the applications. Apply herbicide during weather conditions and at a rate per manufacturer's recommendations.	

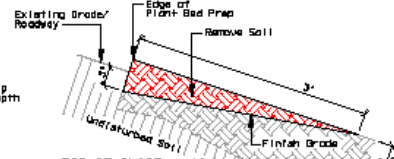
GENERAL BED PREPARATION NOTES:

- Reference Item 192 of the Texas Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges 2004 for specifications, dimensions, volumes and requirements not shown.
- Locate and strike all underground conduits and utilities associated with but not limited to: CTS, CTS power supply, lighting, signal wires and detectors, gas, electric, telephone, fiber optics, etc.
- Locate and strike existing ground bases, inlets, culverts, manholes, etc. within the project area with a 4" wooden stake painted orange. Maintain the stakes in place for duration of the project. Remove stakes upon direction by contractor.
- Repair any damage within right of way caused by contractor or to additional expense to the Department.
- Provide a 1800 SF "mock up" of soil amendment, general use compost, and bed preparation complete and in place within an approved area for approval by engineer.
- Pick-up litter prior to seed mix and bed preparation.
- All concrete, steel, earth, and other debris uncovered during bed preparation work which the engineer determines as detrimental to the project will become the responsibility of the contractor and disposed of in an approved manner. Debris removal will occur daily and will be incidental to bed preparation and will not be paid for separately.
- Reference Item 5.7 Inspection of the Texas Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges 2004. At any time during all phases of the contract, any materials or work performed not in accordance with the plans and specifications will be replaced and/or reworked until in compliance.
- Any adjustments due to the failure to comply with plans and specifications shown will be at contractor's expense.



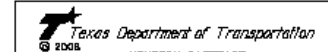
PLANTING BED PREPARATION SECTION

SEE ITEMS AND REQUIREMENTS THIS SHEET FOR DIMENSIONS, RATES, AND SPECIFICATIONS



TOP-OF-SLOPE and/or EDGE OF PAVEMENT TREATMENT OF BED PREPARATION AREA

Install at all areas with the following conditions:
Within the bed preparation areas or top-of-slope (adjacent to shoulder sections and areas with slight barrier/curb) and/or at edge of roadway, remove filled or unfilled (TYPE IV) soil to show evenly distribute removed soil in a thin layer over adjacent existing filled or unfilled (TYPE IV) soil being careful not to create a mound. This work is incidental to Item 192 Plant Bed Prep Preparation.



PLANTING AND ESTABLISHMENT

SHEET 4 of 8

Details not to scale BED PREPARATION

PROJECT	DIST	COUNTY	CENTRAL	SECT	JOB	NO	DATE
	10	DALLAS	0312	31	228	414	1/14

Specification focus changed to root zone.







Specification focus changed to root zone.



Minnesota DOT Landscape Partnership Program

- Evolved predominantly into a Community Entrance program
 - Design work by Dot or outside design approved by dot
 - Participation is first come first served
 - Reimbursement for plant material
 - labor and or equipment on city/org.
 - Cooperative agreement required

Goals

- (1) Roadside beautification
- (2) Community improvement
- (3) Environmental stewardship



Since Establishment

- 330 projects
- \$7 million in landscaping improvements
 - <1/3 in State Highway Funds
- Cost savings of nearly \$1.75 million in maintenance
- 60 national and state awards.



How its Funded

- Funding out of District maintenance budget
 - Districts set aside \$40,000 each.
 - Metro districts are investing \$150,000
 - Participation varies, usually in spurts.
 - Some years districts only spend \$10,000



The Average Project

- Community population: 300-5,000
- DOT completes or approves design
- Municipality does site prep work



- 2-3 hr volunteer event or contracted install
- Municipal or volunteer org follow-up to complete project/ begin maintenance
- Some communities participate multiple times 5-7 yrs in a row



Delaware DOT

Roadside Vegetation Concept and Planning Manual

- Highway enhancement program
- Legislation lead development
- Systematized approach
 - Site evaluation
 - Landscape investment prioritization
 - Planting design and vegetation guidelines

Objectives

- Document DeIDot **Policies** with respect to roadside vegetation modifications
- Define criteria to **guide judgments** in roadside design process
- Set forth the most current and effective design **techniques and procedures**
- Assure that **safety, economic, aesthetic, and environmental quality** factors are adequately considered in the design process

Safety



“Steep” slopes are considered for non turf vegetation to reduce maintenance and increase safety



Landscape Editing



Natural regrowth on this exit ramp slope appears random and disorganized to most passing motorists.

- Selective removal to develop “ordered appearance”
- No planting cost
- Native ecotypes are conserved and celebrated



The benefits of this process are that planting cost is eliminated and local species and ecotypes are conserved and celebrated in the managed roadside landscape.

Periodic and Strip mowing



Helps discourage
undesirable woody re-
growth

Mowing provides a clean
and “orderly” edge while
promoting diversity of
species.



Intersection design Requirements

Figure 1. Four corner intersection

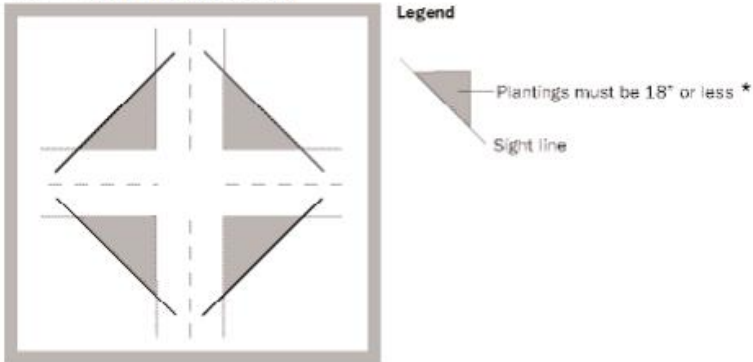


Figure 2. Intersection with channelization Islands

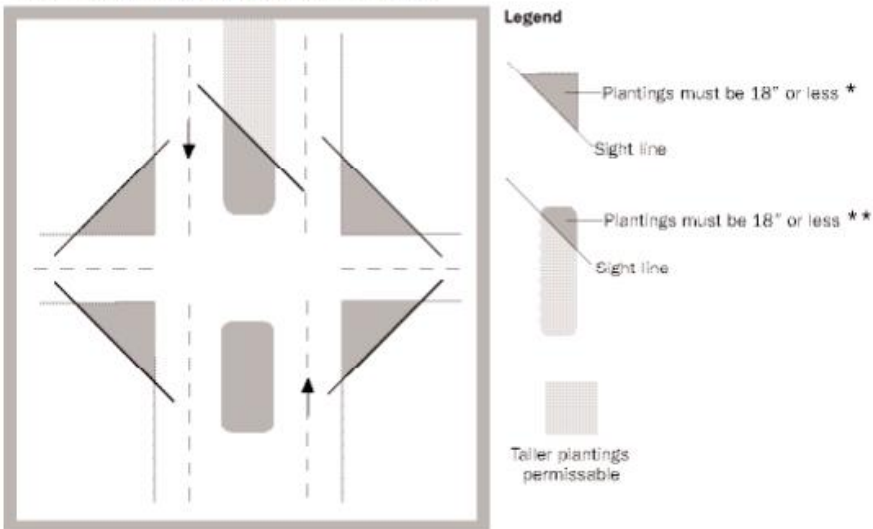
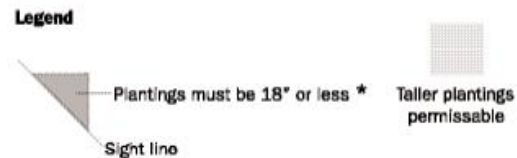
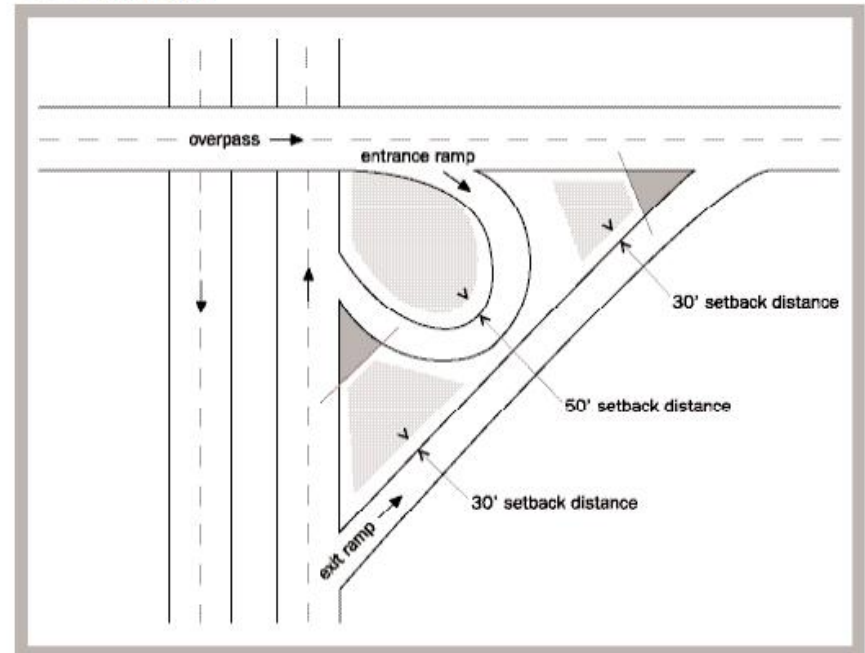


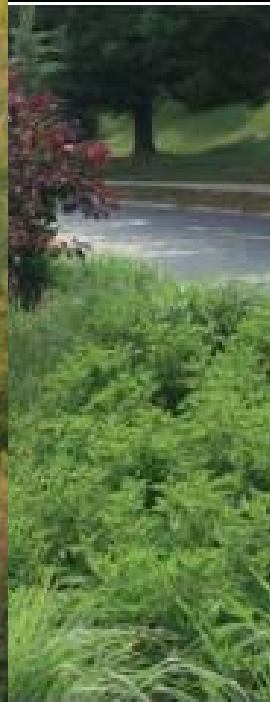
Figure 3. Ramp infield



* Designer should consider vertical roadway geometry at intersection to determine maximum acceptable height.

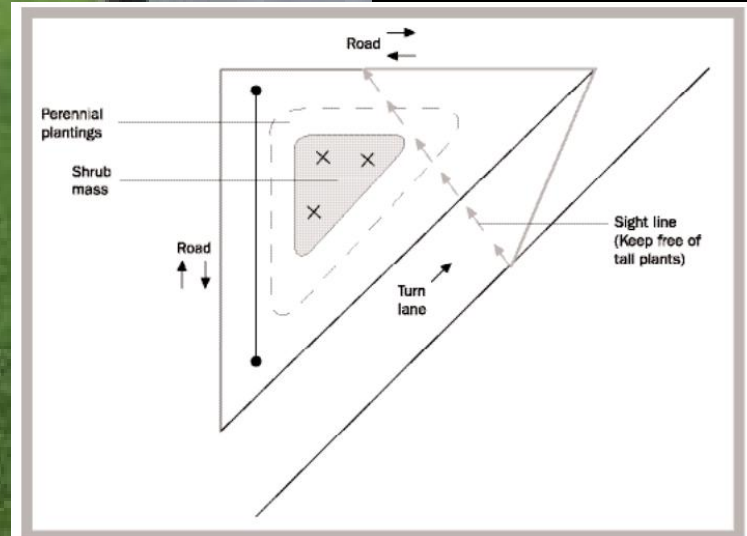
** Designer should consult with maintenance staff to determine logistics and safety of plant installation in median locations

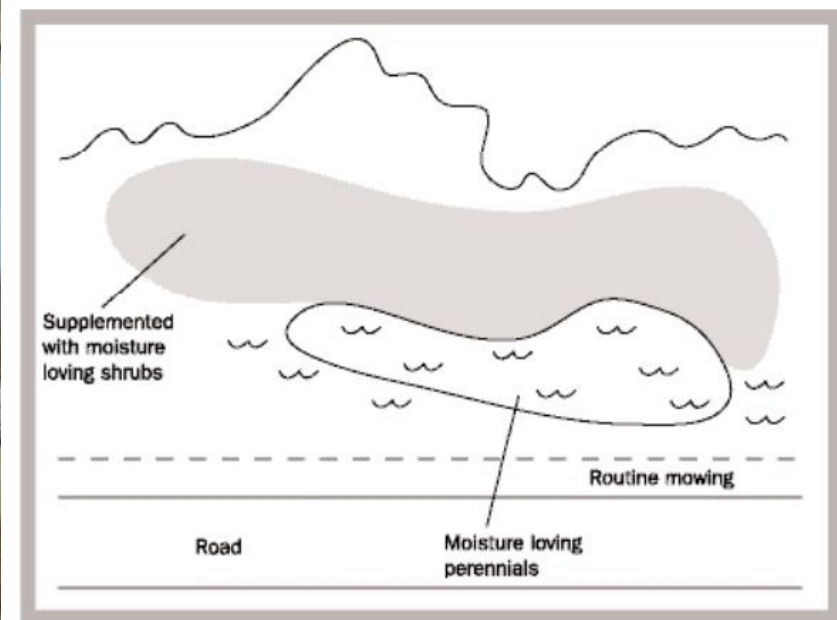
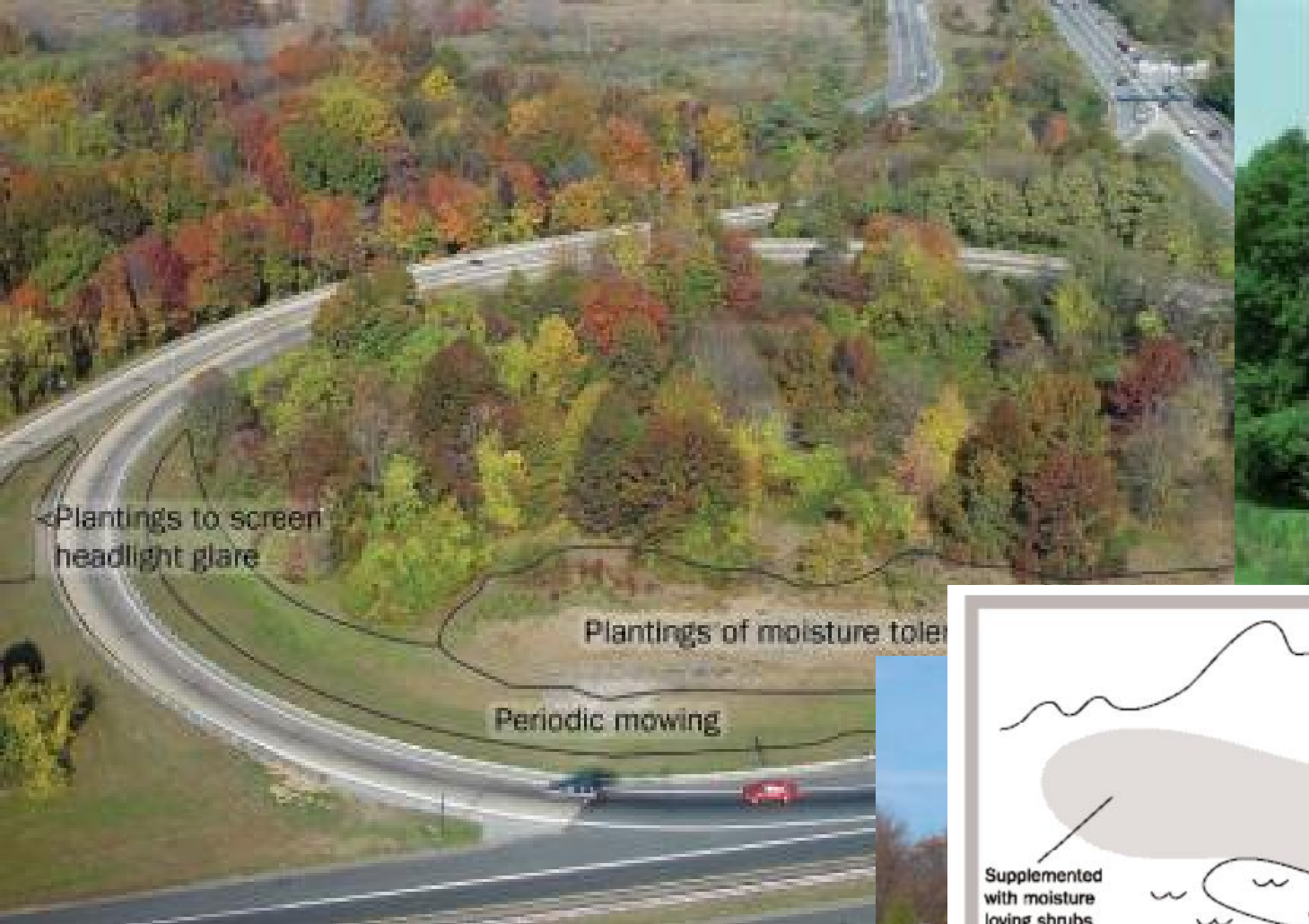
Landscape Matrix



Higher speeds of
65mph. The gre

Gateway Vegetation





- Legend**
- Woody plants
 - Routine mow line
 - Tree line
 - Wet area

My Lessons Learned

- Its all about Public Relations
 - Build better community relationships & partners
 - Be clear about expectations
 - Set an attainable example in your region
 - It has been done and can be replicated
 - Environmentally better.

- Projects hold value
 - Aesthetic improvement
 - Lower maintenance
 - Lower plant mortality
 - Increase safety
 - Projects provide ecosystem services



- Pick the low hanging fruit



- Work with partners who want to work with you
- Implement new projects where contractors, communities, engineers are willing to try something new.
- Try new ideas on non controversial projects first

Other consistencies

- Programs used containerized stock between 3 and 30 gal. Some used bare root stock
- All consider the site conditions ecological and cultural



Call for Change

- Consider the cost benefit of new practices.
- What proportion of your project is landscape cost?
- How can that best be used? Leveraged?
- Are we using the right tree(s) in the right locations?
- What can we do to improve Indiana's Communities, roadsides, landscape.