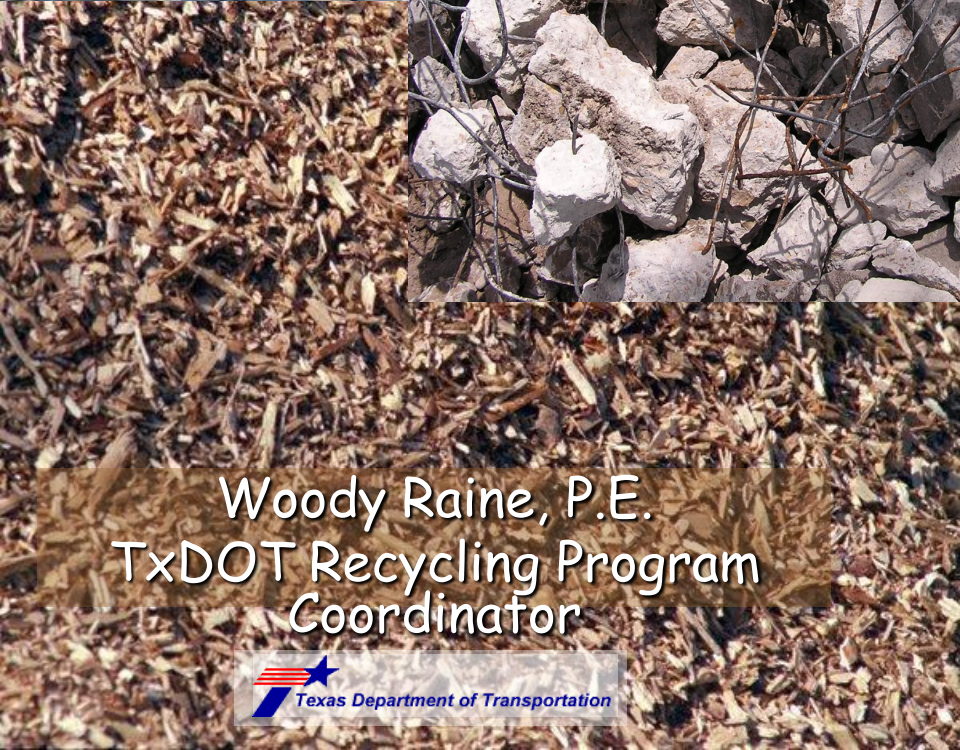


Roadway Use of Reclaimed Materials



Woody Raine, P.E.
TxDOT Recycling Program
Coordinator

Recovery & Reuse

lots of recycling opportunities at TxDOT

- 12,000 employees
- 525 TxDOT facilities
- 92 Rest Areas & TICs
- 16,000 fleet equipment
- 80,067 centerline miles of roads
- 2,750 structures with 8.6 million square feet
- 1.1 million acres of right of way (0.6% of Texas)



Each year, TxDOT uses:

Millions of tons of materials reclaimed from:

- Industry
- Roadways
- Municipalities
- Demolition sources



Roadway Reclaimed Materials & Products Placed, FY10

>2 million tons Reclaimed Asphalt Pavement

>700,000 tons Recycled Concrete Aggregate

200,000 cu yd Compost

143,000 tons Fly Ash

5,500 tons Crumb Rubber

2,200 tons Oil & Gas Well Drill Cuttings

2,200 tons Glass Traffic Beads

1,200 tons Cellulose Fiber Mulch



Purpose

- *Increase public and private use of reclaimed materials in roadways*
- *Greater use increases supply and competition which reduces costs*



Why Use Reclaimed Materials?



Environmental



Economic



Financial



Why Use Reclaimed Materials?

- *Conserve water*
 - *Conserve energy*
 - *Conserve landfill space*
 - *Conserve natural resources*
 - *Reduce air & water pollution*
- Environmental**
- Economic**
- Financial**





Climate Change - Waste



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You are here: [EPA Home](#) » [Climate Change](#) » [What You Can Do](#) » [Waste](#) » [Tools](#) » Waste Reduction Model (WARM)

[Tools](#) [ReCon](#) [WARM](#)

Waste Reduction Model (WARM)

NEW VERSION: Updated August 2010

EPA created the Waste Reduction Model (WARM) to help solid waste planners and organizations track and voluntarily report greenhouse gas (GHG) emissions reductions from several different waste management practices. WARM is available both as a [Web-based calculator](#) and as a [Microsoft Excel spreadsheet](#) (355K WinZip archive). The Excel-based version of WARM offers more functionality than the Web-based calculator.

WARM calculates and totals GHG emissions of baseline and alternative waste management practices—source reduction, recycling, combustion, composting, and landfilling. The model calculates emissions in metric tons of carbon equivalent (MTCE), metric tons of carbon dioxide equivalent (MTCO₂E), and energy units (million BTU) across a wide range of material types commonly found in municipal solid waste (MSW). For information on the data and methodologies behind the calculations, please see the [model documentation](#).

WARM is periodically updated as new information becomes available and new material types are added. Users may refer to the [model history](#) to better understand the differences among various versions of WARM. WARM was last updated August, 2010.

WARM now recognizes 40 material types, which are presented in the table below; their emission factors are available for viewing in units of [metric tons of carbon dioxide equivalent \(MTCO₂E\)](#) or [metric tons of carbon equivalent \(MTCE\)](#). Note that the emission factors represent the GHG emissions associated with managing 1 short ton of MSW in the manner indicated. GHG savings should be calculated by comparing the emissions associated with the alternative scenario with the emissions associated with the baseline scenario, as opposed to simply multiplying the quantity by an emission factor. For instance, the GHG savings of recycling 1 short ton of aluminum instead of landfilling it would be calculated as follows:

$$(1 \text{ short ton} \times -13.61 \text{ MTCO}_2\text{E/short ton}) - (1 \text{ short ton} \times 0.04 \text{ MTCO}_2\text{E/short ton}) = -13.65 \text{ MTCO}_2\text{E}$$

Frequent Questions

[Frequently Asked Questions about WARM](#)
[An Explanation of Life-Cycle GHG Accounting Versus GHG Emission Inventories](#)

Note

ReCon and WARM were developed for purchasers and waste managers, respectively. ReCon calculates the benefits of alternative recycled content purchasing decisions. WARM, on the other hand, calculates the benefits of alternative end-of-life waste management decisions. Both tools calculate the benefits of an alternative scenario versus a business-as-usual scenario.

The WARM and ReCon tools are based on a life-cycle approach, which reflects emissions and avoided emissions upstream and downstream from the point of use. As such, the emission factors provided in these tools provide an account of the net benefit of these actions to the environment. This life-cycle approach is not appropriate for use in inventories because of the diffuse nature of the emissions and emission reductions within a single emission factor.

Climate Change Home

What You Can Do Home

Waste Home

Basic Information

Publications

Tools

Stakeholder Success Stories

Steps 1 and 2. Baseline and Alternative Scenarios

Material	Baseline Scenario				Tons Generated	Alternative Scenario				
	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted		Tons Source Reduced	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted
Aluminum Cans	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A	0	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Steel Cans	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A	0	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Copper Wire	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A	0	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Glass	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A	0	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
HDPE	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A	0	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
LDPE	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A	0	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
PET	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A	0	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Corrugated Containers	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A	0	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Magazines / Third-class mail	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A	0	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Newspaper	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A	0	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Office Paper	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A	0	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Phonebooks	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A	0	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Textbooks	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A	0	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Dimensional Lumber	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A	0	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Medium-density Fiberboard	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A	0	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A

Mixed Plastics	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A	0	N/A	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Mixed Recyclables	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A	0	N/A	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Mixed Organics	N/A	<input type="text" value="100000"/>	<input type="text"/>	<input type="text"/>	100,000	N/A	N/A	<input type="text"/>	<input type="text"/>	<input type="text" value="100000"/>
Mixed MSW	N/A	<input type="text"/>	<input type="text"/>	N/A	0	N/A	N/A	<input type="text"/>	<input type="text"/>	N/A
Carpet	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A	0	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Personal Computers	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A	0	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A
Clay Bricks	N/A	<input type="text"/>	N/A	N/A	0	<input type="text"/>	N/A	<input type="text"/>	N/A	N/A
Concrete ¹	<input type="text"/>	<input type="text" value="250000"/>	N/A	N/A	250,000	N/A	<input type="text" value="250000"/>	<input type="text"/>	N/A	N/A
Fly Ash ²	<input type="text"/>	<input type="text" value="130000"/>	N/A	N/A	130,000	N/A	<input type="text" value="130000"/>	<input type="text"/>	N/A	N/A
Tires ³	<input type="text"/>	<input type="text" value="5500"/>	<input type="text"/>	N/A	5,500	<input type="text"/>	<input type="text" value="5500"/>	<input type="text"/>	<input type="text"/>	N/A
Asphalt Concrete	<input type="text"/>	<input type="text" value="2000000"/>	N/A	N/A	2,000,000	<input type="text"/>	<input type="text" value="2000000"/>	<input type="text"/>	N/A	N/A
Asphalt Shingles	<input type="text"/>	<input type="text" value="1000"/>	<input type="text"/>	N/A	1,000	<input type="text"/>	<input type="text" value="1000"/>	<input type="text"/>	<input type="text"/>	N/A
Drywall	<input type="text"/>	<input type="text"/>	N/A	N/A	0	<input type="text"/>	<input type="text"/>	<input type="text"/>	N/A	N/A
Fiberglass Insulation	N/A	<input type="text"/>	N/A	N/A	0	<input type="text"/>	N/A	<input type="text"/>	N/A	N/A
Vinyl Flooring	N/A	<input type="text"/>	<input type="text"/>	N/A	0	<input type="text"/>	N/A	<input type="text"/>	<input type="text"/>	N/A
Wood Flooring	N/A	<input type="text"/>	<input type="text"/>	N/A	0	<input type="text"/>	N/A	<input type="text"/>	<input type="text"/>	N/A

Please enter data in short tons (1 short ton = 2,000 lbs.)

Please refer to the User's Guide if you need assistance completing this table.

1 Recycled concrete used as aggregate in the production of new concrete

2 Recycled fly ash is utilized to displace Portland cement in concrete production.

3 Recycling tires is defined in this analysis as using tires for crumb rubber applications and tire-derived aggregate uses in civil engineering applications.

EPA's WARM model

Material	Tons	GHG Emissions (MTCO ₂ E*)		
		Disposal	Recycling or Composting	Difference
Organics	100,000	31,400	-19,800	-51,200
Concrete	250,000	9,700	-1,980	-11,680
Fly Ash	130,000	5,000	-113,000	-118,000
Tires	5,500	210	-2,160	-2,370
RAP	2,000,000	77,700	-164,000	-241,700

* MTCO₂E – metric tons of CO₂ equivalents



Environmental Reasons *better world for future Texans*



“TxDOT is a recycling leader, and takes great steps to reduce waste, improve air quality and protect our environment. We’ve made a commitment to improve the environment in Texas and reduce pollution's effect on public health and safety. For conservation efforts to work, however, we all must do our part. Our individual actions make a huge impact. Help us – help Texas. Let’s all be good stewards of our environment.

Happy Earth Day and safe travels!”

Amadeo Saenz, TxDOT Executive Director
Texas Transportation Forum, Earth Day, 2008



Why Use Reclaimed Materials?



Economic

"TxDOT adheres to values that have created an entire industry out of resource conservation."

"Indeed, it's good business to be good stewards of the environment."

Michael Behrens
former TxDOT Executive Director
Transportation News, September 2003



Why Use Reclaimed Materials?



Financial

- *Reduce construction costs*
- *Reduce maintenance costs*



Why Use Reclaimed Materials?



Financial

- *Relieve regional material shortages*
- *Conserve native materials*
- *Substitute less expensive material*
- *Reduce hauling costs*



Why Use Reclaimed Materials?



Financial

- *Support markets for scrap materials*
 - *Concrete*
 - *Asphalt Pavement*
 - *Tires*
- *Reduce disposal costs*



Why Use Reclaimed Materials?



Financial

In FY10, TxDOT generated:



3.34 million tons of
asphalt pavement

1.01 million tons
of concrete



Why Use Reclaimed Materials?



Financial

In FY10, TxDOT generated:



- 2,030 tons of scrap tires & rubber, or
- 203,000 scrap tire equivalents



Why Use Reclaimed Materials?



Financial

- *Meet environmental standards*
 - *Compost – water quality*
- *Improve performance*
 - *tire rubber - durability*
 - *fly ash - durability*





U.S. Department of Transportation
Federal Highway
Administration



Financial

Recycled Materials Policy

February 7, 2002

"Recycling highway construction materials can be a cost-saving measure, freeing funds for additional highway construction, rehabilitation, preservation or maintenance."





U.S. Department of Transportation
**Federal Highway
Administration**



Financial

Recycled Materials Policy

February 7, 2002

- *Give recycled materials first consideration*
- *Judge engineering & environmental suitability*
- *Assess financial benefits*
- *Remove non-technical restrictions*



Recycled Concrete Aggregate



973 Materials, Austin



Recycled Concrete Aggregate



- Cement Treated Base
- Flex Base



Recycled Concrete Aggregate



- Rigid Pavement



Recycled Concrete Aggregate



- Gabions



Recycled Concrete Aggregate



- Rock Filter Dam



Recycled Concrete Aggregate



- Dry Rip Rap



Recycled Concrete Aggregate



- Select Backfill for Retaining Walls
www.reinforcedearth.com





TECHNICAL ADVISORY

Published as needed by the Construction and Bridge Divisions - September 2008

Recycled Concrete Aggregates Make Cents

In today's environment of skyrocketing material and transportation costs encountered in road construction, recycled concrete aggregates (RCA) provide substantial savings to TxDOT and taxpayers. Natural resources are conserved, waste disposal is reduced, and air quality is improved due to reduced haul distances and reduced energy consumption. In many cases, allowing the use of RCA can be the most cost effective choice for an aggregate source. This is especially true for those districts that do not have good, native aggregate sources. Using RCA can reduce time and expense of importing aggregates from other parts of the state.

TxDOT has researched and used RCA with good success for about 15 years. In just the last two years alone, TxDOT saved approximately 1.8 million tons of virgin aggregates by incorporating RCA in cement treated base, flexible base, continuously reinforced concrete pavement (CRCP), filter dams, gabion walls, concrete traffic barriers, flowable fill and select backfill for mechanically stabilized earth walls. This equates to an estimated savings of \$12.6 million from reduced or eliminated landfill and virgin aggregate associated costs. Savings from using RCA has the potential to increase tenfold based on current availability of RCA.

➔ ENGINEERING PROPERTIES

Compared to virgin aggregates, RCA typically have a higher percentage of material passing the No. 200 sieve, lower specific gravity, higher water absorption, higher sulfate soundness loss and higher Los Angeles Abrasion loss. The minus No. 4 fraction typically has a low plasticity index and high alkalinity. Item 6, "Control of Materials," of the Department's 2004 Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges requires that it be certified as a nonhazardous recyclable material (NRM) in order to be used on TxDOT projects. The RCA producer must meet the requirements of departmental material specification DMS-11000, "Evaluating and Using Nonhazardous Recyclable Materials Guidelines."

➔ ITEM 247, FLEXIBLE BASE

RCA can be used on TxDOT projects when specified on the plans as Type D under Item 247, "Flexible Base," of the Department's 2004 Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges. In addition to the requirements specified in DMS-11000, Item 247 requires contractor-furnished RCA to be free from reinforcing steel and other objectionable material. It can have a maximum of 1.5% deleterious material and 3000 ppm of soluble sulfates. The Engineer may also require separate dedicated stockpiles. RCA typically increases the optimum moisture requirement when used as a flexible base. Because of its high absorption properties, it can potentially lose strength if not protected from moisture. When allowing Type D as an option, it is recommended that strength and wet ball mill requirements be specified (such as in Grade 1). An alternative is to specify Item 276, "Cement Treatment (Plant-Mixed)," to reduce or eliminate the potential for loss of strength and water absorption of RCA.

➔ ITEM 421, HYDRAULIC CEMENT CONCRETE

RCA can also be used as a coarse aggregate in Item 421, "Hydraulic Cement Concrete," as long as it meets the specification requirements. CRCP constructed with RCA has a long history of good performance. Positive effects for pavements are higher creep values and lower modulus of elasticity. Although RCA can cause the final concrete to have a higher coefficient of thermal expansion (CTE) due to the attached old mortar, experience has eliminated this as a concern and CTE requirements are waived when RCA

Recycled Concrete Makes Cents

December 10, 2010



Recycled Concrete Aggregate

Benefits

- Engineering
 - Better than native aggregates along coast
- Financial – e.g., Houston District:
 - \$2/ton less to deliver than limestone
 - \$5/ton disposal savings
- Environmental
 - Reduced CO₂ & NO_x emissions

www.hpprecycles.com/RiceAirPollutionStudy.pdf



Reclaimed Asphalt Pavement

Applications

- Flexible Pavement
- Flex Base
- Pavement Edges



Reclaimed Asphalt Pavement

Fractionating RAP into coarse & fine aggregates allows:

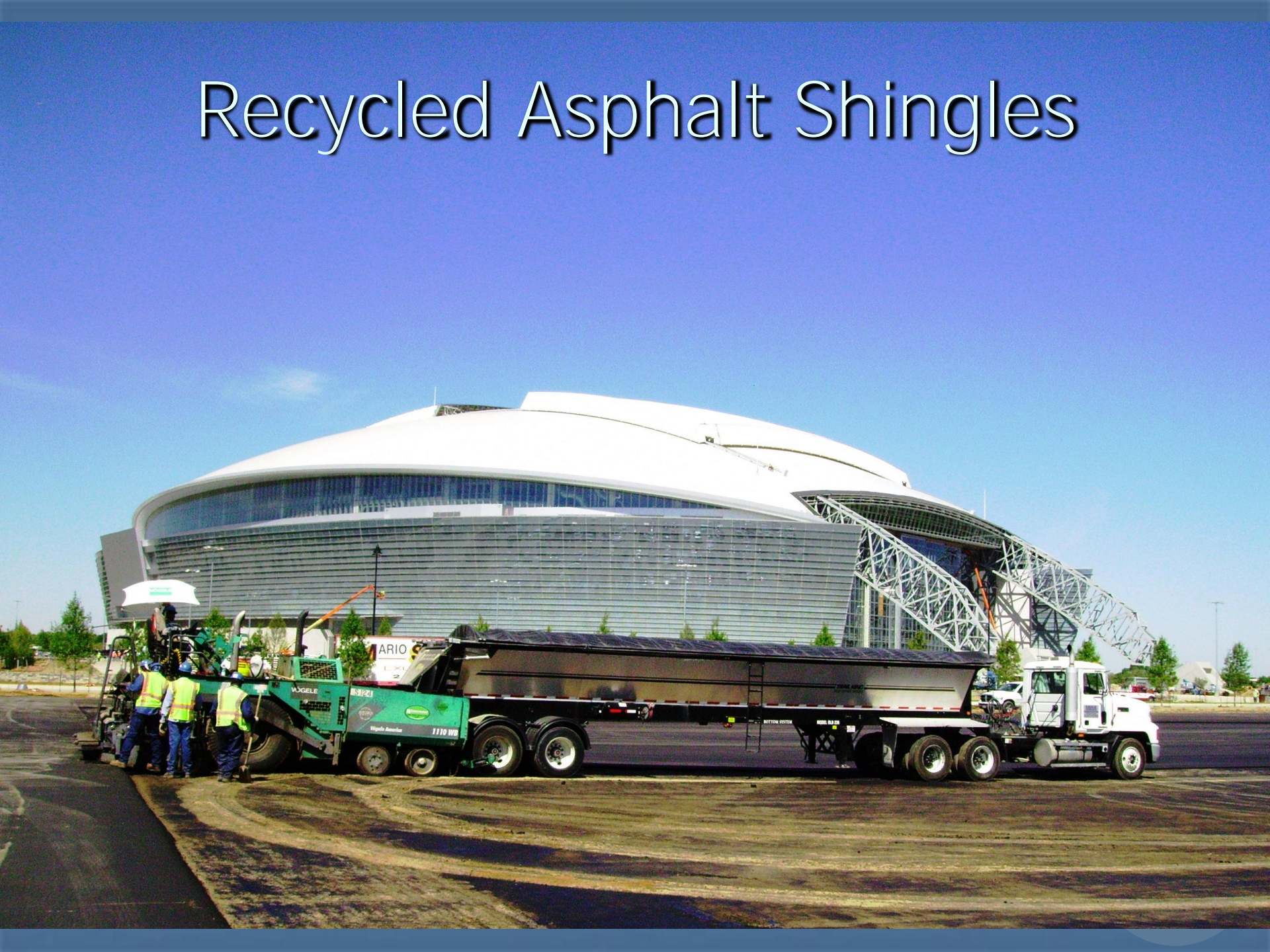
- More RAP
- Less asphalt binder
- More financial savings
- More environmental benefit



Recycled Asphalt Shingles



Recycled Asphalt Shingles



Scrap Tires & Rubber, FY10 Use

- 5,500 tons of crumb rubber, or
- 550,000 scrap tire equivalents



Scrap Tires & Rubber

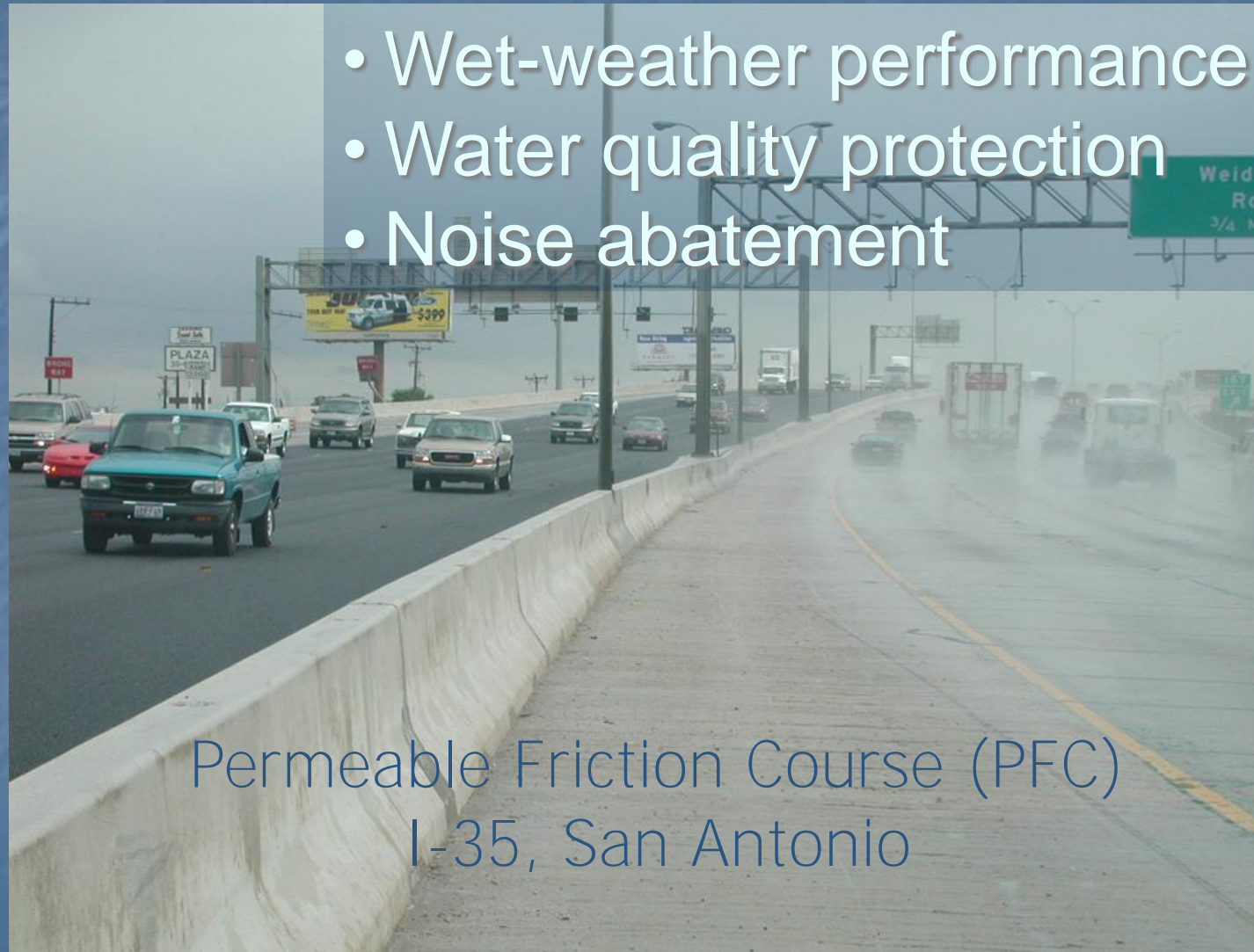
- *Surface Treatments
(Chip Seals, Seal Coats)*

- 5 to 15% rubber in asphalt binder
- Adds durability
- Holds aggregate



Scrap Tires & Rubber

- Wet-weather performance
- Water quality protection
- Noise abatement



Permeable Friction Course (PFC)
I-35, San Antonio



Scrap Tires & Rubber

Recycled Rubber Products

- Joint fillers
- Crack sealant
- Delineator posts
- Guard rail spacer blocks



Scrap Tires & Rubber

Recycled Rubber Products



Delineator Posts

SHUR-TITE on I 35



Scrap Tires & Rubber

Recycled Rubber Products



Guardrail Spacer Blocks



Scrap Tires & Rubber

Tire Bales

2-cubic yard,
1-ton bales
stacked like
bricks



December 10, 2010

Scrap Tires & Rubber

Tire Bales



Portable Tire Baler



Scrap Tires & Rubber *Tire Bales*

Slope Repair on I-30, Fort Worth



December 10, 2010



Scrap Tires & Rubber

Tire Bales

Slope Repair on I-30



~60,000 scrap
tires in 600 bales



Scrap Tires & Rubber

Tire Bales

Slope Repair on I-30



December 10, 2010

50



Scrap Tires & Rubber

Tire Bales (& compost)



Compost & Mulch



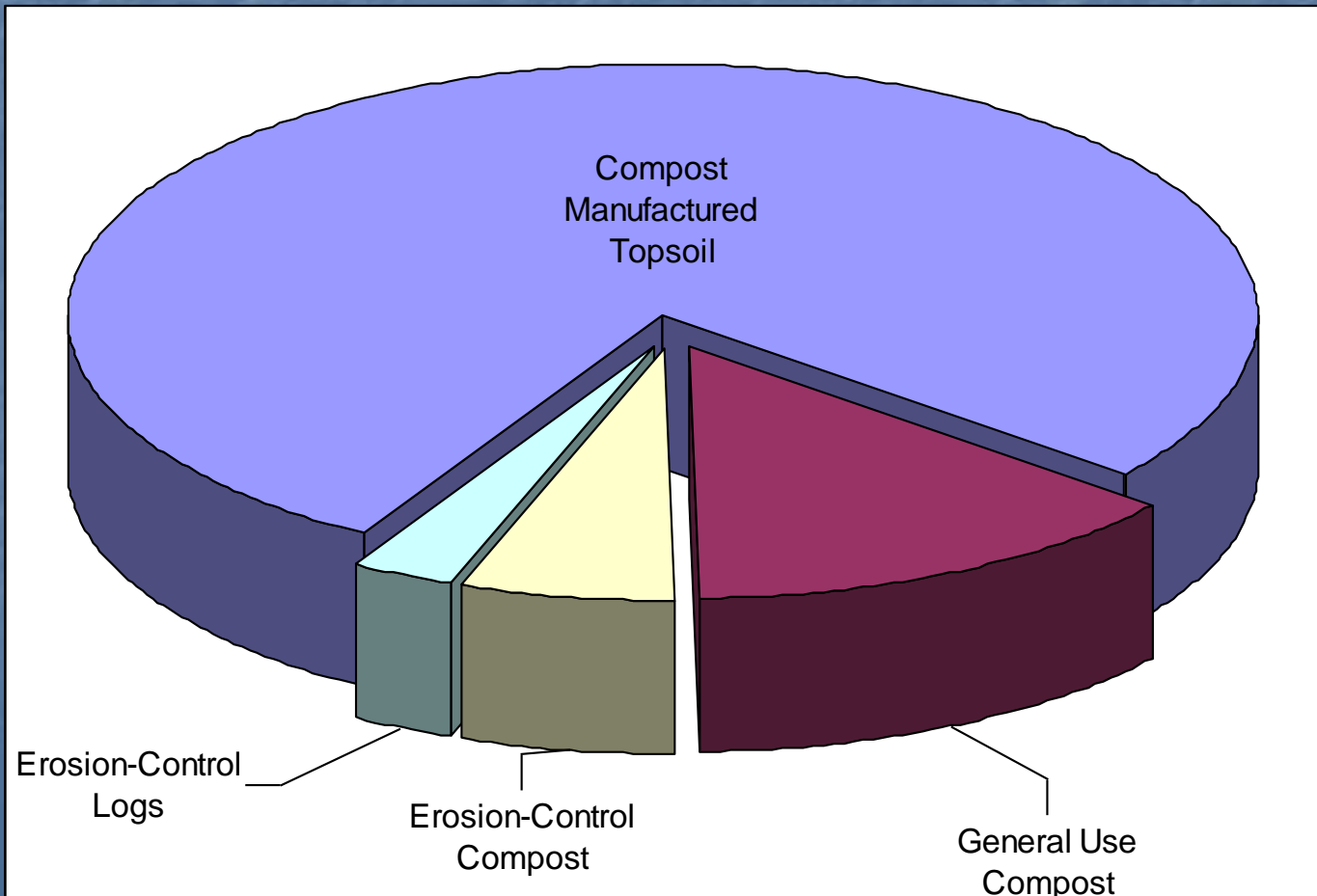
- *Benefits*

- Accelerates revegetation
- Reduces storm water runoff & erosion
- Protects water quality

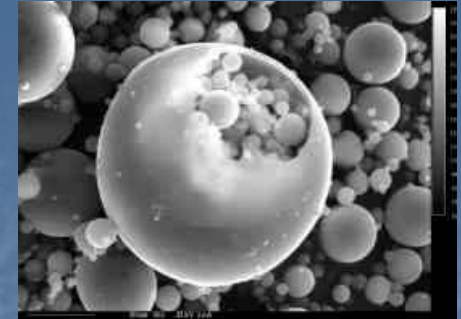


Compost & Mulch

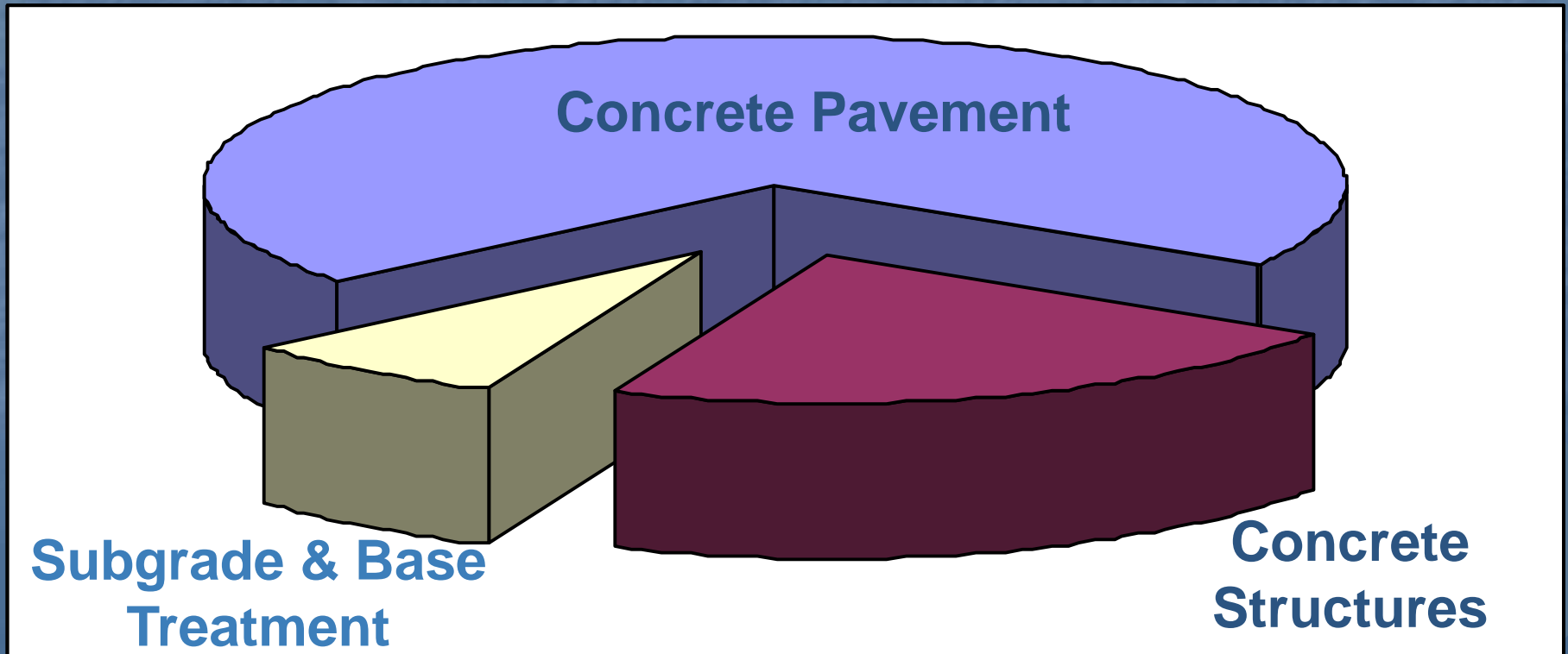
FY10 Usage - 200,000 cubic yards



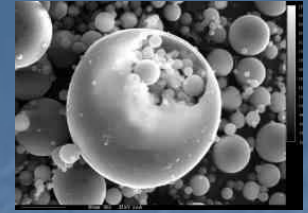
Fly Ash



FY10 Usage - 143,000 tons



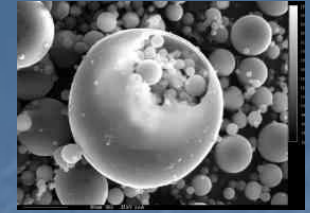
Fly Ash



- *Subbase and Base Courses – base material, stabilization*
 - Adds strength and durability
 - Adds resistance to sulfates



Fly Ash



- *Rigid Pavement or Structures (backfill, rip rap, concrete structures)*
 - Reduces cement up to 35%
 - Yields higher ultimate strengths, although initial strength gain is slower
 - Improves resistance to alkali-silica reactivity (ASR), sulfates, seawater
 - Improves workability, pumpability



Glass Cullet

Applications:

- Reflective Striping Beads
- Pipe bedding, other backfill
- Embankments
- Road base
- Paving



Road Base, Devine, Texas

More Municipal & Industrial Byproducts

- Sand blast material
- Foundry sand
- Drill cuttings
- Print toner
- Filter cake
- Toilets



DMS-11000

Guide to Using Nonhazardous Recycled Materials

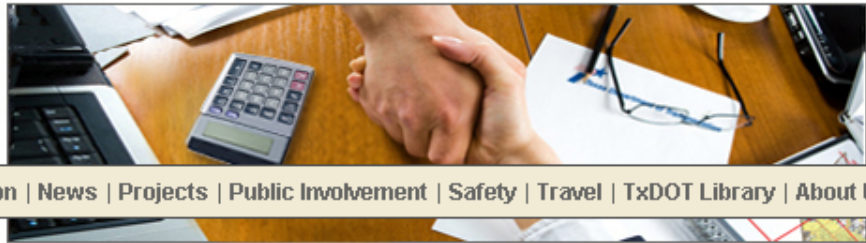
Eligible materials:

- *Have TxDOT History of Use*
- *Meet Environmental Risk Standards*
- *On Approved Products List*



Texas Department of Transportation

Providing safe, effective and efficient movement of people and goods.



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- Freight Transportation
- Other Maintenance Projects
- Professional Services Projects
- Right of Way Acquisition
- Scientific Services
- Toll Plaza Operations
- Contractors/Consultants
- Motor Carriers
- Motor Vehicle Dealers
- Lienholders

Recycling Information for Contractors

As our [Annual Recycling Summary](#) attests, TxDOT prevents waste through workplace recycling, environmentally preferable purchasing and the use of recycled products and materials in roadway construction. These materials include recycled concrete aggregate, reclaimed asphalt pavement, tire rubber, fly ash from coal-fired power plants and many others.

- Roadway Recycled Materials**
 - **Specifications**
 - [By Roadway Application](#)
 - [By Recycled Material](#)
 - [Environmental Guidelines](#)
 - **Materials Information**
 - [Material Summaries](#)
 - [Material Suppliers Map](#)
 - **Research and Demonstrations**
 - [Research Summaries](#)
 - [Road Base](#)
 - [Embankments](#)
 - [Vertical Moisture Barriers](#)

Recycled-content Products

- [Environmental Purchases](#)
- [Recycled Concrete Aggregate](#)
- [Roadway Products](#)
- [Recycled Glass](#)
- [Recycling Education Stop of Texas \(REST\)](#)

Recycling Service Specifications

- [Recycling Asphalt Millings](#)
- [Removing Scrap Rubber](#)

Other Resources

- [Links](#)

Construction Debris Recycling

- [Associated General Contractors](#)
- [Construction Materials Recycling Association](#)

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- Other Upcoming Projects**
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- Other Maintenance Projects
- Professional Services Projects
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- Scientific Services
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- Public-Private Partnerships
- Government
- Conferences & Meetings
- Training & Development

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Specifications Using Recycled Materials by Application

TxDOT has eliminated unnecessary requirements for virgin materials in its construction and maintenance specifications. Additionally, we have approved specifications that specifically call for or allow for the use of recycled materials. Some specifications require their use, while others allow their use if noted in the plans. Please note, this document is provided for information only and is not to be used for bidding or contract purposes.

[Specifications](#) using Recycled Materials can also be [viewed by Materials](#). All use 2004 Standard Specifications unless noted.

Acronyms

- **RAP** - Reclaimed Asphalt Pavement
- **SCM** - Supplementary Cementing Material

Earthwork

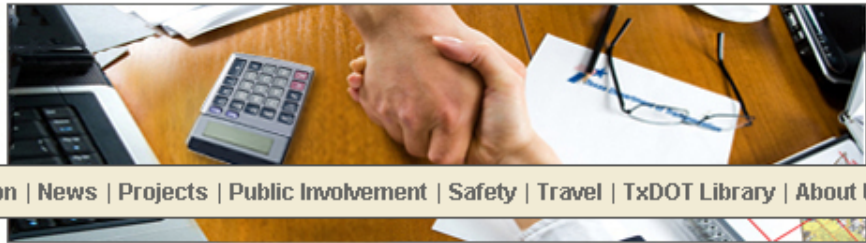
SPECIFICATION	RECYCLED MATERIALS	APPLICATIONS
Embankment	Granular materials (such as crushed concrete, glass cullet, RAP)	Form a stable embankment
Compost	Leaves, yard trimmings, biosolids, food scraps, food-processing residuals, manure or other agricultural residuals, forest residues, bark, and paper	Establish vegetation, control erosion (See compost producer list and DMS-6360 Compost)
Seeding For Erosion Control	Cellulose	Mulch
Landscape Establishment	Loose organic materials such as wood chips or shredded bark	Mulch

Sub-base and Base Courses

SPECIFICATION	RECYCLED MATERIALS	APPLICATIONS
Flexible Base	Crushed concrete, RAP, or other (such as glass cullet)	Coarse aggregate
Lime Treatment (Road-Mixed)		
Lime Treatment (Plant-Mixed)		
Fly Ash Or Lime-Fly Ash Treatment (Road-Mixed)	Fly ash	Subgrade or base stabilizer
Cement Treatment (Road-Mixed)	Crushed concrete, RAP, or other (such as glass cullet)	Coarse aggregate
Cement Treatment (Plant-Mixed)		
Asphalt Treatment (Plant-Mixed)		

Texas Department of Transportation

Providing safe, effective and efficient movement of people and goods.



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Roadway Recycled Materials Summaries

As part of our Road to Recycling initiative, a road construction industry panel identified 12 materials with great potential in road construction that are readily available in Texas in potentially large volumes, offer engineering benefits, cost-effective pricing and no increased environmental risks.

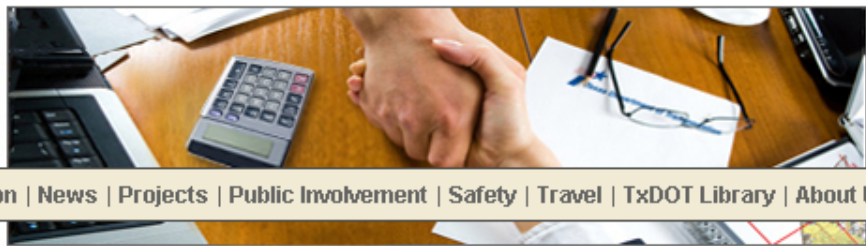
We have assembled packets of information for each of these materials. The packets include a material overview, research summaries, case studies, a list of current specifications, a list of material sources and a summary of experiences with the material.

Material Summaries

Title	Format
Asphalt Shingles	HTML
Coal combustion by-products, including fly ash, bottom ash, and hydrated fly ash	PDF
Compost and Mulch	HTML
Glass	HTML
Industrial sands	PDF
Metals, primarily steel and aluminum	PDF
Plastics	PDF
Reclaimed Asphalt Pavement (RAP)	HTML
Recycled Concrete Aggregate	HTML
Slags, including ground granulated blast furnace slag	PDF
Soils, including petroleum-containing soils	PDF
Tires and tire rubber	HTML

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Compost and Mulch

Texas generates about 4 million tons of yard trimmings (leaves, grass, weeds, and tree limbs) each year. Rather than dispose of these materials in landfills, many cities and private enterprises turn these materials into compost or mulch.

Compost is an effective soil amendment and erosion-control material. It retains water in sandy soil, maintains even moisture in clay soils, and adds nutrients to soil to be passed through plants. Similarly, shredded brush mulch is useful in controlling erosion. It retains moisture, reduces soil temperature, and prevents erosion during heavy rains.

Roadway Construction





TxDOT uses several hundred cubic yards of compost and mulch each year to establish vegetation and control erosion on highway roadsides. Using project-generated shredded brush mulch increases the benefits.

During the final phase of most roadway construction projects, the contractor blades topsoil over subgrade material, hydroseeds the area with grass seed, applies a mulch or erosion-control blanket over the seedbed, and irrigates the area to re-establish vegetation.

Importance







Establishing vegetation after roadway construction is completed is extremely critical. If grass fails to grow, soil washes away and erosion begins to threaten the paved surface of the roadway. The Environmental Protection Agency (EPA) mandates stiff penalties for noncompliance. Delays are expensive to the contractor and inconvenient for the traveling public.

Quality topsoil is essential to adequate grass cover. Unfortunately, soil is often void of the organic matter needed for proper grass establishment, whether stockpiled on site or obtained from other sources. Research found that adding compost improves topsoil quality.





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Consequently, TxDOT worked with the Texas Commission on Environmental Quality (TCEQ), the Texas Transportation Institute (TTI) and the compost industry to develop a specification for compost. This specification has enabled TxDOT to enhance the environmental sensitivity of its transportation system while providing a much-needed market for organic materials.


Research and Reports

Title	Format
Characteristics of Composts: Moisture Holding and Water Quality Improvement	
Comparison of Alternative Seed Mixes to Standard TxDOT Specifications	
Effects of Using Compost as a Preventive Measure to Mitigate Shoulder Cracking: Laboratory and Field Studies	
Evaluation of Highway Runoff Filtration Systems	
Research Summary: Use of Compost and Shredded Wood on ROWs	HTML
Use of Compost and Shredded Brush on Rights-of-Way for Erosion Control: Final Report	
Water Quality Characteristics and Performance of Compost Filter Berms	

Specifications

Title	Format
Item 161 Compost	
Item 161 Special Provisions	HTML
Special Specification 5049 Biodegradable Erosion Control Logs	
Erosion Control Log	
Sediment Traps	

Material Use and Availability

Title	Format
Compost Fact Sheet	
Material Supplier Mapping System	HTML
Seal of Testing Assurance, Texas Participants	HTML

More Information

- [Links](#)

2D 3D Road CYP Aerial Labels Print Latitude: 29.64091719 Longitude: -95.17112732 | Zoom Level: 11



Map Tools:

- Mapping Tools Menu

Processors of:

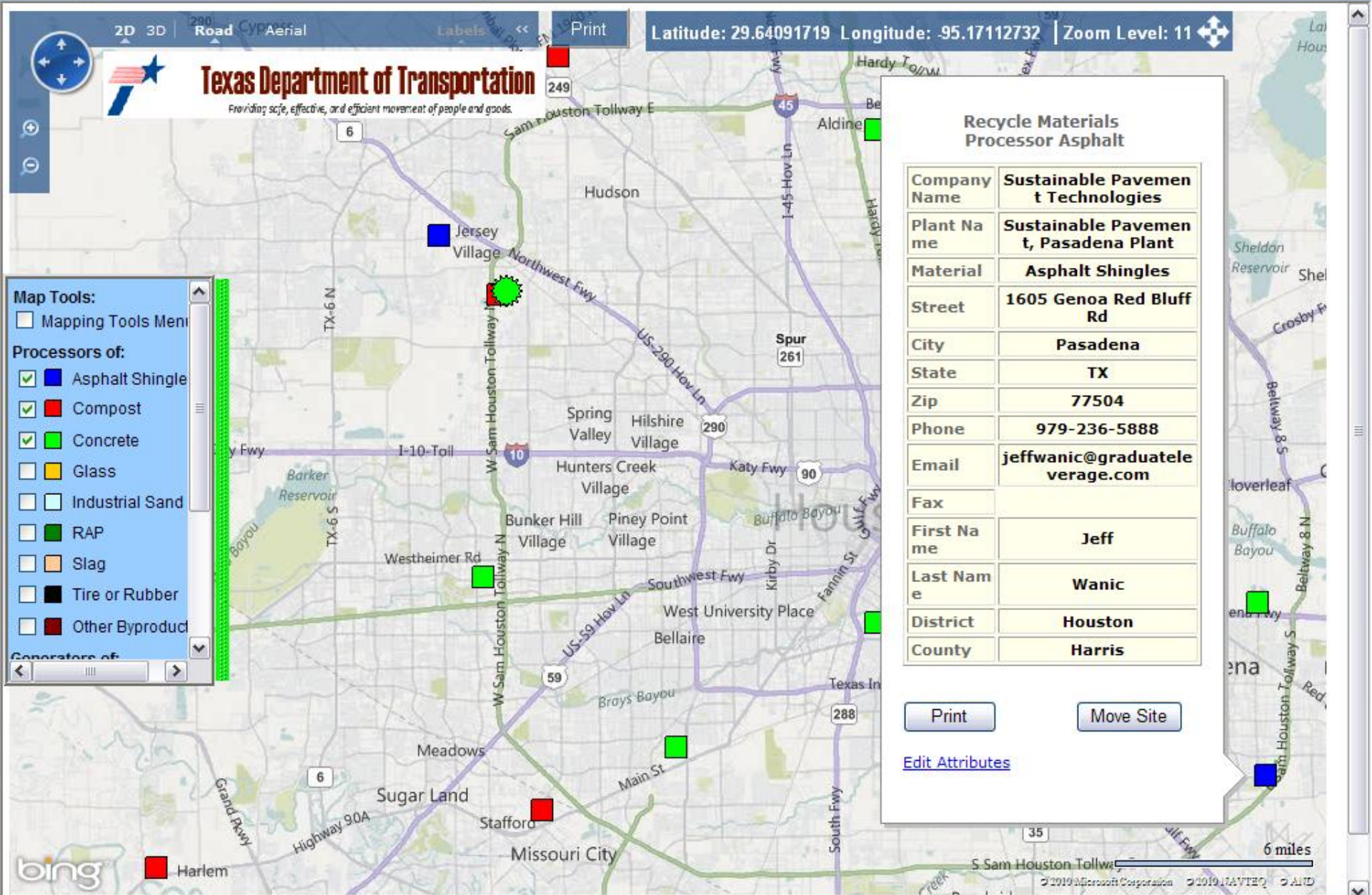
- Asphalt Shingle
- Compost
- Concrete
- Glass
- Industrial Sand
- RAP
- Slag
- Tire or Rubber
- Other Byproduct

Generators of:

Recycle Materials Processor Asphalt

Company Name	Sustainable Pavement Technologies
Plant Name	Sustainable Pavement, Pasadena Plant
Material	Asphalt Shingles
Street	1605 Genoa Red Bluff Rd
City	Pasadena
State	TX
Zip	77504
Phone	979-236-5888
Email	jeffwanic@graduatelevelverge.com
Fax	
First Name	Jeff
Last Name	Wanic
District	Houston
County	Harris

[Edit Attributes](#)



Public Education

Colorado County Safety Rest Area

RECYCLING ROADS TO MAKE NEW ROADS

Each year 500,000,000,000 tons of asphalt are used in U.S. roadwork. If not recycled, this ends up in landfills. TxDOT has been recycling asphalt since 1967.

Here's how:



Old worn roads are broken up and loaded into a "crusher" at the recycling plant.



Asphalt chunks are ground-up and mixed with recycling agent, new asphalt, and/or aggregate.



This new mix creates a stonger road that is more impervious to water and needs less maintenance.

Old asphalt from the I-10 access road was recycled in this manner to rebuild the roads here. This reduces use of natural resources, reduces landfill, reduces transportation costs, and preserves the environment.



IH-10 near Columbus



Web References

Highway & Environmental Groups



- Federal Highway Administration
www.fhwa.dot.gov/pavement/recycling
- Turner-Fairbanks Highway Research Center
www.tfhrc.gov/hnr20/recycle



- AASHTO Environmental Excellence Center
environment.transportation.org
- U.S. EPA Conservation Challenge
www.epa.gov/epaoswer/osw/conserve



- Recycled Materials Resource Center
www.rmrc.unh.edu
- U.S. Green Bldg Council
www.usgbc.org



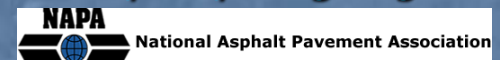
- Association of General Contractors (AGC)
www.agc.org
- Green Highways Partnership
greenhighways.org



Web References

Material Related Groups

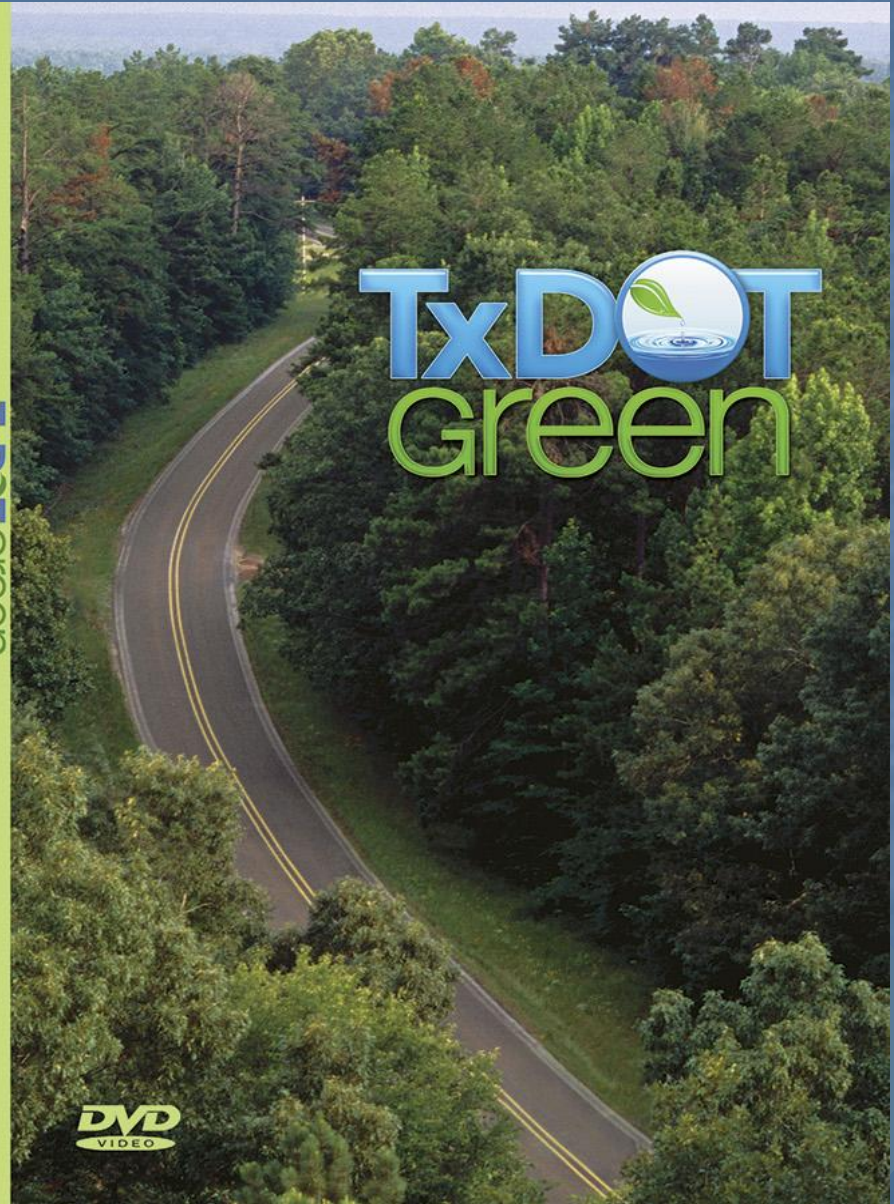
- American Coal Ash Association – www.acaa-usa.org
- American Foundry Society – www.afsinc.org/Env.htm
- Asphalt Shingles – www.shinglerecycling.org
- Asphalt Recycling & Reclamation Assn (ARRA) – www.arra.org
- Construction Materials Recycling Association – www.cdrecycling.org
- Foundry Industry Recycling Starts Today (FIRST) – www.foundryrecycling.org
- National Asphalt Paving Association – www.hotmix.org
- Nat'l Council for Air & Stream Improvement (paper & pulp) – www.ncasi.org
- National Slag Association – www.nationalslag.org
- Portland Cement Association
www.cement.org/tech/cct_aggregates_recycled.asp
- Rubber Manufacturers Association – www.rma.org
- Rubber Pavements Association – www.rubberpavements.org
- Silica Fume Association – www.silicafume.org
- Slag Cement Association – www.slagcement.org
- US Compost Council – www.compostingcouncil.org



Enjoy *TxDOT Green*, our environmental video, at
www.youtube.com/user/TxDOTpio - TxDOT Green Parts 1 & 2



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For more information
<http://crossroads.org/gsd/Recycling/>



Ready to go?



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512-302-2422

