New York State
Department of Transportation
Solid and Hazardous Waste
Reduction Policy

August 1999
1. Objective:

This policy formally states the intentions and describes the actions of the New York State Department of Transportation (DOT) to reduce the amount of solid and hazardous wastes generated. This document provides a framework to continue our efforts to comply with federal and state laws, regulations, and policy requirements to reduce wastes and prevent pollution.

2. Policy:

DOT is firmly committed to environmental excellence and strives to continually improve and enhance environmental protection through procedures that reduce waste and prevent pollution. Part of this commitment involves reducing the volume and toxicity of hazardous and nonhazardous solid wastes, and minimizing emissions to the air and water. DOT seeks to identify opportunities that increase waste management options, to analyze current processes and procedures, and identify gaps and measure our progress in achieving these goals. The scope of DOT’s efforts will focus upon the following objectives:

- Source Reduction - Reducing or eliminating the volume and toxicity of wastes generated.
- Reuse and Recycling - Reusing material for its original purpose or recycling waste materials that cannot be reused.
- Recycled Products - Considering acceptable materials and products that contain recycled content in all DOT operations and construction projects; helping to contribute to the market development of recycled products where reasonable and feasible.
- Implementing a preferred management hierarchy for waste disposal.

3. Background:

It is the mission of DOT to ensure our customers -- those who live, work, and travel in New York State -- have a safe, efficient, balanced and environmentally sound transportation system. DOT must perform many, varied operations to construct and maintain our transportation systems; these include designing and building safer highways and bridges, replacing and rebuilding utilities, paving, excavating, painting, removing snow and ice, managing vehicles and equipment, removing lead-based paint from bridges and viaducts, clearing drainage and rights-of-way, managing roadside vegetation and planning today for tomorrow’s sound and viable transportation systems. The environmental impacts and potential wastes generated by these activities must be considered and minimized wherever feasible.

Both hazardous and non-hazardous wastes can be generated or encountered during these activities. Properly managing and minimizing these wastes lowers the cost of waste disposal, minimizes DOT’s need for expensive remediation at both State properties and external disposal
facilities, complies with regulations, and ensures that DOT's activities do not degrade the environment.

As a user of goods and services, DOT also has the opportunity to consider the use of recycled/recovered materials, or materials that would otherwise be wastes, in the projects we design and build and the products we purchase. By using materials with recycled/recovered content or innovatively using materials that would otherwise be wasted, DOT can assist in fostering feasible uses for such materials and ensuring a market for recovered material products in the future.

4. General Techniques:

A. Source Reduction - Techniques that prevent waste from being generated in the first place or which reduce the quantity and toxicity of the waste include:

- Good Operating Practices - Maintaining good inventory control does not allow expired or excess material to accumulate. Periodic “spring cleaning days” remove materials or products that are no longer needed. Managing spill or leak detection systems also prevents releases in the first place and avoids disposing of contaminated cleanup materials.

- Product Substitution - Substituting a less hazardous or toxic product lowers the hazards and/or volume of the waste generated. Substituting an "environmentally friendly" product can sometimes avoid generating a hazardous waste, eliminate the need for regulatory reporting, and reduce or eliminate concerns about accidental employee exposure.

- Procedure Substitution - Modifying procedures may help reduce the volumes and toxicities of the waste generated.

B. Reuse and Recycling - Recycling and reusing materials by DOT staff or contractors either on or off site that would otherwise be managed and disposed as wastes.

C. Using Recycled Products - Using materials that have been recycled or are composed of recycled materials at least in part, and beneficially reusing materials that would otherwise be solid wastes, by either DOT staff or contractors. Examples include using recycled paper, recycled antifreeze, retread tires, using tire shreds for lightweight fill in embankments, recycled asphalt pavement, building noise walls from plastic lumber, and adding microsilica and fly ash to Portland cement concrete.

D. Disposal Hierarchy - This hierarchy of preferred waste management methods is critical to preventing pollution and minimizing the environmental impacts of waste management. The hierarchy is:
1. Source Reduction - Prevent the waste from being generated in the first place (or reduce the volume and toxicity of the wastes generated)
2. Recycling - Reuse or recycle the material for other useful purposes
3. Energy Recovery - Recover the energy content (burn) the waste if possible
4. Treatment - Treat the waste to make it less hazardous or toxic before disposal
5. Disposal - Select the disposal method that minimizes future pollution and liability from the disposal.

**5. Benefits:**

DOT benefits from reducing waste by:

- Reduced Disposal Costs - Disposal of smaller quantities or less hazardous wastes can lower both handling and disposal costs. Eliminating outdated or unnecessary materials avoids the initial purchase costs as well as disposal costs later.

- Reduced Operational Costs by Use of Less Hazardous Materials - Using less hazardous or toxic products may be less expensive and lower the handling and compliance costs associated with environmental and employee safety requirements.

- Reduced Operational Costs Associated with Recycled/Recovered Materials - Recycling and reusing materials can reduce the quantity of new products that must be purchased and presents an avoided disposal fee. Using materials that would otherwise be wastes in lieu of new products can also lower the purchase price.

- Reduced Exposure to Future Liability - Smaller quantities and reduced toxicity will help limit potential future liability from disposal.

- Supporting DOT’s Environmental Ethic - Reducing the generated wastes and preventing pollution goes to the heart of DOT’s environmental initiative to minimize the impact of DOT’s activities and enhance or improve environmental protection.

**6. Laws and Regulations:**

Since hazardous waste laws and regulations were formalized and disposal capacity problems developed during the recent past, many legislative and regulatory bodies have sought to prevent pollution, reduce waste and encourage reuse. The primary requirements that affect DOT’s activities are summarized below:

**Federal:**

- Resource Conservation and Recovery Act (RCRA) of 1976 established "cradle-to-grave" responsibilities for hazardous waste generators and assigned liability for improper disposal to the generator. The RCRA Amendments of 1984 restricted future land
disposal of untreated hazardous wastes, and required generators to develop programs that minimize the volume and toxicity of the hazardous wastes they generate.

- The Pollution Prevention Act of 1990 established a national policy that pollution should be prevented or reduced at the source wherever feasible.

- RCRA Section 6002 and Executive Order 12873 issued by the United States on October 20, 1993 require federal and state agencies that use appropriated Federal funds for procurement to adopt recommended recovered content levels in some products if more than $10,000 is paid for that product. Recommended recovered content levels have been issued for paper and paper products, vehicle products (lubrication oil, retread tires, engine coolants); construction products (building insulation, structural fiberboard and laminated paperboard, cement and concrete, carpet, floor tiles and patio block, shower and restroom dividers, latex paint for specified uses); transportation products (temporary traffic control devices, parking stops, channelizers, delineators, and flexible delineators), park and recreation products (playground surfaces, running tracks, and plastic fencing for specified uses); landscaping products (hydraulic mulch, yard trimmings compost, garden and soaker hoses, and lawn and garden edging) non-paper office products (office recycling containers and office waste receptacles, plastic desktop accessories, toner cartridges, binders, plastic trash bags, printer ribbons and plastic envelopes; and miscellaneous products (pallets). Although the requirements do not directly apply for many DOT uses of these products, the recommendations’ intent should be considered during DOT operations.

State:
- Article 27 of the Environmental Conservation Law (ECL 27-0106) requires that each state agency identify and encourage the implementation of effective waste reduction techniques.

- Sections 163 and 165 of Article 11 of the State Finance law allow increased discretionary buying thresholds for recycled or remanufactured products and a 10 - 15% cost premium for products with recycled content, respectively. Section 165 also requires state agencies to source separate wastes.

- Executive Order No. 142, issued January 16, 1991 requires that all State agencies participate in a program to reduce waste generation, source separate recyclable materials from the workplace mainstream, and maximize procurement of recycled products.

7. DOT Waste Management Initiatives:

A. Source Reduction:
DOT considers using products and methods that reduce the quantity of wastes, their toxicity, or
other emissions and environmental impact resulting from activities.

**Current Initiative Examples:**

- Environmentally-friendly solvents for cleaning pavement-marking painting equipment - Substituting a less hazardous, non-chlorinated solvent for methylene chloride to clean epoxy paint from equipment creates a waste that is no longer classified as hazardous. This also reduces the costs and liability of hazardous waste disposal and the potential for employee exposure.

- Degreasing solvents and equipment - Changing the solvents used to degrease vehicle parts reduces the quantity and hazards of the resulting wastes. Although the spent solvents are still ultimately recycled off-site, hazardous chlorinated solvents have been eliminated.

- Traffic marking paints - DOT began using new pavement-marking paints starting in 1990 and fully implemented the program statewide by 1996. These new paints significantly reduce the volatile organic compounds (VOCs) released to the air when they dry. Using these new "waterborne paints" decreased the total VOCs released by more than 80%, and decreased the quantity of reportable toxic chemical releases by more than 75%. In addition, the 1997 Pavement Marking Plan adopted the use of more durable pavement markings on roadways with higher traffic volumes to reduce the frequency of painting. Using epoxy-type paints, for example, further reduces the release of VOCs and requires repainting at only half to a third as often as conventional paints.

- Bridge Paints - DOT stopped using lead-based paint on bridges in 1989. New bridge paints also have the lowest achievable VOC content and reduce the VOC emissions when they dry. In addition, DOT is experimenting with new methods to lengthen the traditional twelve-year repainting cycle of state bridges.

- Removing lead-based paint from bridges - DOT has experimented with several new methods to reduce (concentrate) the volume of lead-based paint removed prior to repainting that must be handled as a hazardous waste. Using steel shot to "sandblast" the old paint and then magnetically separating the paint waste from the reusable shot can greatly reduce the volume of hazardous waste generated by a typical bridge project. DOT is also pilot-testing two methods of using high pressure water jets (hydroblasting) and chemical strippers to remove lead-based paint.

- Herbicide use reduction - Better mixing procedures and improved application equipment eliminates excess mixed herbicides and reduces product "drift" onto nontarget areas during application. Under a vegetative management plan, DOT currently uses herbicides in areas where mowing is not practical such as under guiderails and to remove noxious
vegetation such as poison ivy. DOT currently uses less than 3000 gallons and less than 500 lbs of lower toxicity herbicides annually to maintain rights-of-way throughout the state. DOT is also researching an “alternatives to herbicides” program in coordination with several environmental groups, trying to identify promising new methods of vegetative management without using any chemical herbicides.

- Mulching vegetation during construction and maintenance operations - Woody vegetation is chipped and converted to mulch and used to amend soil at construction sites and along highway rights-of-way rather than disposing of the vegetation as a waste material offsite.

- Reduced salt use - Highway agency studies have shown that preventing snow and ice from forming a bond with the pavement surface is more important to keeping roadways passable during winter than liberally scattering road salt. DOT is using these improved practices to pre-wet the pavement with calcium chloride or magnesium chloride before a winter storm begins. Prewetting helps salt cling to the road instead of bouncing off or being swept aside by traffic, requiring less salt to be used. In addition, salt requires moisture to be effective, and helps dissolve the salt to melt ice and snow and break the pavement-ice bond. Prewetting can help reduce salt use by 25% to 65% over a given time period. In addition, DOT is experimenting with low salt and non-salt deicing agents, including one that is a byproduct from commercial grain processing being used under a Beneficial Use Determination (BUD) from the New York State Department of Environmental Conservation (NYSDEC).

Future Initiatives:

- Degreasing Solvents - DOT has pilot-tested using different solvents and equipment that filter the spent solvents for washing engine parts to further reduce the quantity of solvents that must be transported for disposal or recycled off-site. These "environmentally friendlier" solvents are not flammable or otherwise hazardous after use so the spent solutions do not have to be managed and disposed as hazardous wastes.

- Bridge Paint Removal Debris - DOT has begun to revise specifications to allow lead paint and abrasive blasting debris to be recycled. This will encourage the use of new technologies to reduce the quantity of wastes generated when each year we repaint some of the 13,000 bridges and spans in New York that still contain lead-based paint.

B. Reuse and Recycling:

Current Initiatives:
DOT allows some wastes and recycled materials to be reused or recycled for DOT projects and activities. The March 10, 1998 Policy for the Use of Recycled Materials in Construction (copy attached) describes the following recycled materials as possibly suitable for DOT projects:
- Blast furnace slag as an aggregate material in subbase;
- Recycled Portland cement concrete aggregate as a subbase;
- Reclaimed asphalt pavement in hot mix or cold mix asphalt or as subbase;
- Recycled glass in hot mix asphalt and subbase and earthwork items;
- Flyash in concrete;
- Silica fume and rice hull ash in concrete;
- Recycled plastic in noise barriers; and
- Ground recycled tire rubber in sealants

Other recycled or reused materials are acceptable if they are granted a Beneficial Use Determination (BUD) from the NYSDEC. BUDs can be used for materials that are processed continuously such as an asphalt drum mix plant that accepts petroleum-contaminated soil, or for a specific, single use. A case-specific BUD allowed DOT to use off-specification ceramic cores for catalytic converters from a manufacturer in Corning, NY as subbase during construction of the Corning Bypass (State Route 17).

The NYSDEC has granted statewide BUDS for some materials that are commonly used commercially and have a low potential to pollute the environment. These materials are generally not considered nor regulated as wastes, and are listed in New York’s solid waste management regulations. These materials include: wood or wood chips (mulch) from land-clearing operations; uncontaminated soil, rock, concrete and concrete products, asphalt pavement, brick and glass that are used as substitutes for conventional aggregate; coal ash; and nonhazardous, petroleum contaminated soil excavated as part of a routine construction project that is used to backfill the same excavation or excavations that contain similar contaminants at the same site.

DOT attempts to offer financial incentives that will encourage recycling and reuse during demolition activities as well. DOT contracts make the bidder responsible for disposing of potentially marketable wastes such as old road signs and scrap steel from bridges.

New York State agencies also try to encourage the use of products with recycled content that are available through Office of General Services (OGS) standard contracts. These products are typically used by DOT’s maintenance and equipment management units when feasible, and include the following products:

- Antifreeze;
- Recapped tires;
- Lubricating Oil;
- Recycled paper and other office supplies with recycled content;
- Recycled content plastic cones; and
- Recycled lead acid batteries

DOT has investigated whether roadside litter and trash can be separated into recyclable glass, metal, and paper that could be reused or composted. It was hoped that roadside trash collected
by DOT staff and volunteer Adopt-a-Highway workers could reduce the volume of contaminated materials that are not suitable for recycling or reuse. Results to date have not been encouraging because most of the collected materials were too soiled, weathered, or contaminated to be suitably recovered or reused.

Future Initiatives:

DOT will evaluate proposals to use recycled materials as they become feasible and available. One initiative involves using shredded pieces of waste tires as lightweight embankment fill. A pilot project along Route 17 near Binghamton will be built in 1999. DOT will follow the Federal Highway Administration interim design guidelines dated July 23, 1997 developed by an industry-led civil engineering committee to study the problems associated with tire shred fills. This particular pilot project will use the equivalent of 450,000 waste tires and be closely monitored for stability and impact on the environment. If successful, using tire shreds as lightweight embankment fill someday help to reduce the waste tire piles that threaten New York’s environment.

C. Disposal Methods:

Current Initiatives:

DOT policy focuses on using landfiling and waste-to-energy as the least desirable options, or when waste reduction, reuse or recycling are not possible or feasible. DOT uses permitted municipal or commercial disposal / incineration facilities for waste disposal and is not pursuing siting, designing, constructing or operating its own permitted disposal facility.

New York's solid waste regulations allow DOT to dispose of some waste materials on rights-of-way or on land under the State's ownership and control under certain conditions. This practice of "spoilng materials on site" is exempt from permitting or registration requirements when the waste consists of recognizable uncontaminated concrete and concrete products, asphalt pavement, brick, glass, soil and rock or trees, stumps and wood waste. These small fills are common along the state's highway network. Nonexempt wastes are disposed at municipal or commercial disposal / incineration facilities both within and outside New York.

Some DOT disposal problems are unique. Highway work crews routinely encounter road-killed animals that, if left unattended, can pose health problems for nearby residents and animals. A specific provision in the State's solid waste management regulations allows up to ten road-killed animals to be buried on highway rights-of-way if some criteria are met. Mass burial of road-killed animals is not exempt and animal carcasses that are known to
have infectious agents such as rabies must be disposed at a landfill or a rendering facility.

Some DOT wastes are sent to energy recovery facilities. Used motor oil is drained into special waste oil tanks and removed periodically by oil recyclers who collect it, treat it, and burn it for energy recovery. In some communities with municipal solid waste incinerators such as those on Long Island, DOT’s nonhazardous solid wastes are also incinerated rather than landfilled.

Future Initiatives:

Some currently marketable wastes such as scrap steel from bent guiderail is presently separated and sold to recyclers. DOT is also evaluating whether additional source separation of wastes such as paper, plastic and other types of metals is feasible.

8. Summary:

DOT is committed to developing procedures that reduce the volume and toxicity of our wastes and identifying new waste management options that further reduce emissions to the air or water. As part of the environmental initiative program, DOT will extend the scope of this effort beyond the program level and develop those steps that can be implemented on individual projects and routine operations.

TO: Bureau Directors

FROM: P. J. Mack, Director, Technical Services Division

SUBJECT: POLICY FOR THE USE OF RECYCLED MATERIALS IN CONSTRUCTION

DATE: March 10, 1998

Purpose: This document establishes policy for the use of recycled materials in construction. It also documents the use of recycled materials to date.

Background: In 1986, the Technical Services Division first documented a statement of Division policy for the use of recycled (waste) materials in construction. While this policy was not formally adopted by the Department, it provided guidance that has gained general acceptance.

On a national level, more stringent solid waste regulations are forcing the closing of existing landfills. According to a study conducted in 1996, the number of landfills in the United States decreased by 49% between 1991 and 1995. Only 38 states have greater than 10 years capacity (at current rates) remaining. Ten states have between five and ten years capacity remaining, and two states have less than five years capacity remaining (Massachusetts and New Jersey). Clearly, a solution must be found.

As a responsible State agency it is incumbent on the Department to thoughtfully consider the use of waste materials in its construction program when appropriate. When waste materials can be used for Civil Engineering purposes we need to be committed to doing our share in reducing the waste stream.

It is critical that this Division, and the Department, have a policy in place that permits the evaluation and use of these waste materials in a controlled manner. The use must not compromise the basic function and longevity of the infrastructure, and be able to be implemented without incurring additional costs or hardship on the taxpayers. It is important to realize that although the Department uses millions of tons of material in its projects annually, it is not feasible to totally replace virgin materials with recycled materials.

The Department currently uses some recycled waste material for their improved engineering properties or cost. There are currently studies being conducted by NCHRP and the FHWA, as well as other State Transportation Departments investigating the use of waste and recycled materials.
Bureau Directors
March 10, 1998

There is another, perhaps less well-publicized reason to use recycled materials. That reason is to conserve our dwindling natural resources. Many previous sources of engineering material have either been used, are buried under new construction, or are simply too expensive to obtain.

Policy Statement

The policy statement for Technical Services Division’s use of recycled materials is as follows:

To be considered suitable for highway use, a waste material must exhibit the proper engineering characteristics, consistently satisfy specification requirements, provide an acceptable level of performance, and be economically competitive with available construction materials without harming the environment.

Policy Statement Characteristics

A. **The Technical Services Division is open to evaluation of any waste material for use on Departmental projects.** The Division will approach each evaluation objectively, and will perform the evaluation in accordance with the objectives and intent stated in this document.

B. **Waste or recycled materials used by the Department should be “sound” engineering materials, and when used alone or in conjunction with other materials should provide durable, predictable performance results.** These materials must satisfy specification requirements, exhibit proper engineering characteristics, provide an acceptable level of performance, and be economically competitive with naturally occurring construction materials.

C. **The continued successful use of any recycled material must be market-driven.** It will not be the Division’s policy to fund the utilization of recycled materials, except in the special case of a pilot or demonstration project.

D. **The proper evaluation and eventual acceptance of the use of any material is a gradual process.** Eventual and continued acceptance will be based on evaluation of long term performance of the facility in which the material is used.

E. **Proposed and actual use of waste or recycled materials must meet FHWA, EPA and NYSDEC regulations.** For some materials, this means getting a Beneficial Use Determination (BUD) from the DEC.
F. **The use of recycled materials should be “environmentally clean”, and may not pose an additional hazard to the taxpayers.** It is possible that such use may potentially pose a hazard or danger to workers and/or equipment during construction. The eventual approval of each specific use will depend on the successful implementation of safety procedures that minimize additional hazards to health, safety, and equipment.

G. **Evaluation of each use of recycled materials will be based on existing quality and performance standards.** However, evaluation techniques may and should be altered on a case-by-case when appropriate. Current standards are written for natural materials that are appropriate for a wide range of applications. In order to properly and fairly evaluate recycled materials, a change in thinking is necessary. Many times, a recycled material will perform in a similar or even superior manner to its naturally occurring counterpart, but in a more limited number of applications.

H. **Life cycle costs should be equivalent or less than those from the use of standard construction materials.** Cost analyses should take into account first costs, maintenance costs, expected service life, and quantifiable performance characteristics.

I. **It is not acceptable to blend in minor amounts of unsound or deleterious materials in products, pavements, or structures when such practice may adversely affect performance or lower current quality standards.**

J. **Suitable quality assurance/quality control (QC/QA) procedures should be included in all specifications using recycled materials.**

**Current Accepted Use of Recycled Materials in NYSDOT Projects**

Many waste materials have been used or tried by the Department in the past. This document will not provide a history of such past uses, but instead will catalogue and provide a brief description of current recycled material uses and ongoing evaluations.

The descriptions below are not intended to contain all information available for each material. The intent is to provide a general description of the source and nature of the material, and to identify how quality is assured.

**Blast Furnace Slag**

Blast furnace slag (not steel slag) has been used by the Department as an aggregate material for over 45 years. Slag is durable and lighter in weight than stone, and has an excellent track record. Although it is no longer used as an aggregate in asphalt and concrete, it is still used in
subbase, particularly in Region 5. It’s performance is superior to a gravel subbase, and performs more like a stone subbase in that it “hardens” up quicker, and ruts less during placement and compaction. The only caution is to not use it adjacent to steel pipe, due to increased corrosion potential.

Recycled Portland Cement Concrete Aggregate (RPCCA)

As the name implies, RPCCA is an aggregate comprised of crushed Portland Cement Concrete (PCC). It is used as a subbase material, either alone or mixed with sand, gravel, or blast furnace slag. Because RPCCA can contain sand, slag, and gravel, it is not appropriate for use as an aggregate in PCC or ACC.

RPCCA must contain 95% PCC by weight, and be essentially free of metal (old rebar), wood, or other deleterious material. This means that RPCCA, by itself, can contain up to 5% of sand, asphalt or gravel.

The quality of this material is assured through the application of the Geotechnical Engineering Bureau’s manual entitled “Procedure For The Control Of Granular Materials”, currently designated GCP-17.

RPCCA is used extensively in Regions 5, 11, and especially 10. Use in other Regions is minimal due to lack of sources, and greater availability of natural materials.

Reclaimed Asphalt Pavement (RAP)

RAP consists of milled asphalt. This material can be used as an unbound subbase material, but the more common use is as an aggregate in Hot Mix Asphalt (HMA) or Cold Mix Asphalt (CMA). RAP has proven to be a valuable component to these mixes.

Recycled Glass

Recycled glass consists of crushed glass cullett. The crushed glass must have a maximum particle size of 10 mm, and must not contain more than five percent, by volume, of deleterious material (typically paper and plastic).

Currently, a special note is included in contract proposals for all hot mix asphalt (HMA) paving projects which allows the Contractor to include 3% to 6% crushed glass, as a fine aggregate, in HMA supplied to Department projects.
Recycled glass is used as an additive in subbase and earthwork items. The resulting mixture cannot contain more than 30% crushed glass by weight. Performance of material containing glass to date has been very favorable.

There are a few drawbacks to this material. First, limiting deleterious material to the amount specified is difficult for the producer, requiring vigilance on the Department’s part to assure quality. Second, the producers have complained that meeting the 10 mm top size criteria means the glass has to be run through the crusher more than once, which slows and complicates their operation. Third, the glass content in the material poses safety risks for the workers that have to handle it. Last, there are only small quantities of glass available for recycling, relative to the volumes necessary in our construction.

Flyash

Flyash is a by-product of coal combustion. It is the fine ash that rises up the flue.

Flyash is a pozzolanic material that is used as an admixture in concrete for bridge decks, in grout for bored-in piles, and controlled low strength material. Research and experience had shown that flyash improves flowability and freeze-thaw resistance.

Despite previous attempts, flyash is not used as embankment fill due to its high heavy metal content and its poor public image.

Tire Shreds

Tire shreds is a material made from shredded tires between 50 mm and 300 mm in size. Among their favorable engineering properties are the fact that they are lightweight, free draining, they impose lower lateral pressures than conventional backfill, and they are in ready supply.

Great care must be taken, however, to avoid some of the potential dangers with using tire shreds, not the least of which includes combustion. Research and experience indicates that tire shred embankments can be safely constructed by imposing strict design criteria and using good field inspection to assure quality and conformance with the specifications.

In an effort to give tire shreds a fair trial, tire shreds will be used in a pilot project in Region 9 to be let in 1998. The fills will be constructed according to specifications and plans developed by the Geotechnical Engineering Bureau.
Microsilica

The term "Microsilica" is used to describe several types of materials that, like flyash, are pozzolanic in nature and used as concentrate admixtures. Of these, silica fume and rice hull ash are recycled products, while metakaolin is not.

Silica fume is a waste product from the silicon and ferrosilicon manufacturing processes. Rice hull ash is a refined waste product from the burning of rice hulls (a by-product of the rice industry). Both silica fume and rice hull ash contain high percentages of reactive silica that, when properly proportioned in a concrete mix, provide increased strength, density, sulfate resistance, and durability.

Waste Stream Plastics

Blends of plastic products found in the waste stream may be heated and formed to desired shapes using one or more processes. Sometimes chemical additives are used in the formation of the new products to improve appearance or incorporate a resistance to ultra violet degradation.

Although complex shapes may be produced using recycled plastics, the most practical shapes produced for use in construction are standard lumber sizes. Typically, recycled plastic lumber is somewhat higher in cost than pressure treated lumber, and has structural drawbacks such as lower strength than a similar-sized piece of lumber, and the tendency to deflect more than a similar-sized piece of lumber under the same load (lower modulus of elasticity.)

The Department has developed a noise barrier design method which incorporates recycled plastic lumber. The first noise barrier designed using this method will be constructed in Region 10 in 1998. Currently, a second research effort is underway to develop construction specifications which will incorporate recycled plastic lumber in structural and non structural applications.

ASTM D3405 Crack and Joint Sealant

Ground recycled tire rubber is used in some ASTM D3405 sealants. These sealants are used to seal cracks and joints in hot mix asphalt pavements. Sealants with or without recycled materials are tested to ensure that they meet the physical requirements given in ASTM D3405. Those meeting the requirements are placed on the Materials Bureau Approved List and are considered equal.

Summary

The Department is of the opinion that recycling is a progressive way to efficiently use materials that already exist, saving landfill specifications, reducing costs, and conserving our natural resources.