

# Transportation: Leading in Recycling

## Did you know?

Highways are a leading recycler—with more asphalt pavement recycled than any other product in America.

Few people realize that highways are among the nation's top recyclers—with some 80 percent of asphalt pavement being reused in the highway environment, compared with only 28 percent of recycled post-consumer goods in the municipal solid waste stream. Concrete also is routinely being recycled as a base material for U.S. roadways.

At the same time, huge quantities of industrial byproducts and other materials are put to constructive re-use in construction and maintenance of America's roadways each year. Some of these materials include:

- ▶ blast furnace slag;
- ▶ coal bottom ash and boiler slag;
- ▶ coal fly ash;
- ▶ mineral waste;
- ▶ non-ferrous slags;
- ▶ steel slag;
- ▶ tires and tire rubber;
- ▶ recycled glass;
- ▶ reclaimed Portland Cement concrete; and
- ▶ compost.

For transportation, recycling is a win-win-win proposition. It provides good stewardship of valuable resources while maintaining the high quality of America's roadways and saving taxpayer dollars.

### Asphalt Pavement: A Recycling Leader

According to industry experts, the asphalt pavement industry is the nation's leader in recycling. Each year, 73 million tons of reclaimed asphalt pavement is reused—almost twice as much as paper, glass, plastic, and aluminum combined—saving taxpayers almost \$300 million annually. The volume of recycled asphalt pavement is 13 times greater than recycling of newsprint, 27 times greater than recycling of glass bottles, 89 times greater than recycling of aluminum cans, and 267 times greater than recycling of plastic containers.<sup>4</sup>

Recycled asphalt is used not only for new roads, but also for roadbeds, shoulders and embankments. A variety of other products are recycled to



State transportation departments' recycling programs focus not only on recycling materials for use in roadway construction, but also on recycling in everyday activities of the agencies—including recycling of office paper, motor lubricant, antifreeze, fluorescent lamps, aluminum cans, scrap metal, use of mulch in landscaping, and more.

Opposite and above –  
In 2002, TxDOT paid \$500,000 to process nearly one million tires worth of rubber into fuel, crumb rubber, or other rubber products, and used more than 1.6 million tires worth of crumb rubber in various paving designs and road maintenance.

Photos courtesy of TxDOT

make asphalt pavement—including old tires, slag aggregate, roofing shingles, glass, and foundry sand.

Recycling is increasingly important in the transportation sector. The Federal Highway Administration has a leadership team focused on promoting use of recycled materials, and a number of state transportation agencies have recycling coordinator positions focused on new technologies, research, and getting the word out.

States with exemplary recycling programs include California, Massachusetts, North Carolina, Pennsylvania, and Texas.<sup>5</sup> These programs focus not only on recycling materials for use in roadway construction, but also on recycling in everyday activities of the agencies—including recycling of office paper, motor lubricant, antifreeze, fluorescent lamps, aluminum cans, scrap metal, use of mulch in landscaping, and more.

### **Texas Department of Transportation's Road to Recycling Initiative**

Since the launch of its recycling program in 1994, TxDOT has spent more than \$506 million on “green products” and diverted more than 13 million tons of materials from landfills.

The agency also has coordinated over \$1 million in research to investigate the use of recycled materials in road construction—including glass cullet, scrap tires, fly and bottom ash, crushed porcelain toilets, shredded brush, compost, roofing shingles, plastics, recycled asphalt pavement, crushed concrete, and industrial wastes. Researchers are finding a variety of uses for these materials, including road signs, roadway safety devices, embankments, asphalt and concrete pavements, soil erosion control, drainage, vertical moisture barriers, and road bases.

### **Strategic Recycling in Pennsylvania**

PennDOT's Strategic Recycling Program is a comprehensive effort to systematically identify, evaluate, and implement recycling opportunities throughout Pennsylvania.

PennDOT and the state Department of Environmental Protection are working together to reduce waste materials from transportation operations and to encourage use of recycled materials throughout transportation applications in the state.

The objective of the program is to realize economic savings and environmental enhancement to PennDOT and the entire state through the continued development of pollution prevention, recycling, energy efficiency, and sound environmental management practices. The program provides major benefits to society by reducing the amount of materials going into landfills and developing new business opportunities within the state.

### **MassHighway's Recycling Program: Closing the Loop**

The Massachusetts state transportation agency, MassHighway, takes recycling seriously and boasts impressive numbers—including a 76 percent recycling rate in 2000—more than double the state's municipal solid waste recycling rate of approximately 36 percent. Waste materials recycled



Photo courtesy of TxDOT

Road maintenance making use of recycled products.

include antifreeze, construction and demolition debris, street sweepings, and tires.<sup>6</sup>

In 2000, MassHighway reported the following impressive statistics:

- ▶ More than 15,000 tons of waste was recycled.
- ▶ More than 111,000 tons of recycled materials were used in construction projects.
- ▶ Overall, nearly \$27 million was spent on recycled-content and environmentally preferable materials and products.

The Massachusetts highway agency uses the following recycled materials in road construction:

- ▶ Blast furnace slag—for use in cement concrete;
- ▶ Compost—for use in amended loam;
- ▶ Fly ash—for use in cement concrete and controlled density fill;
- ▶ Pavement millings—for use in mulch under guardrail;
- ▶ Processed glass aggregate—for use in bituminous concrete, borrow, and sub-base course;
- ▶ Reclaimed asphalt pavement—for use in bituminous concrete;
- ▶ Reclaimed pavement borrow material—for use in base and sub-base courses;
- ▶ Recycled plastic offset blocks—for use in guardrail construction.
- ▶ Rubberized asphalt—for use in hot-poured joint sealers and stress-absorbing membrane interlayers (SAMIs); and
- ▶ Silica fume—for use in cement concrete.

### **Recycling at California's Highway Agency**

The California Department of Transportation (Caltrans) is partnering with other state agencies to minimize materials going into landfills, and the promotion and development of new business opportunities within the state of California to the benefit of all.

Caltrans recycles asphalt and concrete pavement by converting it into base and sub-base under the new road surface—and at the same time the agency is looking for new ways to use recycled materials in road surfaces.

Other Caltrans recycling activities include:

- ▶ Employee recycling of office paper waste—diverting over 360 tons per year.
- ▶ Use of safety vests that contain poly fiber made from 100 percent recycled plastic soda bottles (over 133,000 two liter bottles).
- ▶ Annual use and recycling of 122,000 gallons of re-refined motor lubricants, 14,250 gallons of re-refined anti-freeze, 4,900 remanufactured automotive batteries, and 1,800 remanufactured tires.
- ▶ Annual recycling of 5,800 fluorescent lamps, 81 tons of glass, and 69 tons of aluminum cans.
- ▶ Use of mulch (green waste) within landscaped areas, also saving water.
- ▶ Where feasible, recycling of scrap metal.
- ▶ Recycling of state surplus furniture and equipment.

# Transportation: On the Road to Cleaner Air



Opposite and above – State transportation officials are urging commuters to use mass transit, carpool, ride a bike, or to telecommute, in a campaign to help communities get cleaner air. Cities are also turning to alternative fueled vehicles as means of transportation.

## Did you know?

Air pollution has decreased significantly over the past 30 years—with the greatest success coming from on-road vehicles.

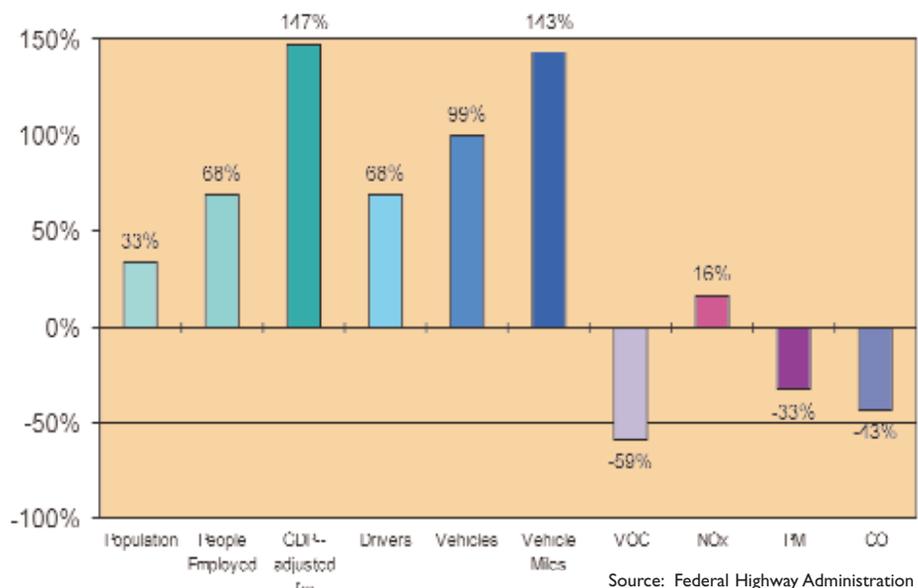
While more Americans are driving more miles than ever before, few realize that the transportation sector has contributed to a significant reduction in air pollution over the past 30 years.

The transportation sector has achieved a 77 percent drop in on-road motor vehicle emissions of so-called “criteria” pollutants, while at the same time ensuring the safety and mobility needs of a growing population.<sup>7</sup>

Thirty-eight percent more people—and 68 percent more drivers—clocked 143 percent more miles on their vehicles from 1970 to 1999. At the same time, cleaner vehicles, clearing of traffic-congestion bottlenecks, and strong emissions inspection and enforcement—often administered through state DOTs—have had a positive impact.

From 1970 to 1999, over 80 percent of the drop in emissions of the six major pollutants was attributed to cars and other on-road vehicles, according to U.S. Environmental Protection Agency data. Motor vehicles

**Percentage of Change in Motor Vehicle Emissions, Demographics, and Travel from 1970–1999**



emissions of carbon monoxide were reduced by 43 percent, particulate matter emissions were down 33 percent, and volatile organic chemical emissions dropped 59 percent. And, while nitrogen oxide (NOx) emissions have increased, NOx emissions from automobiles actually decreased by 31 percent.

And engines and fuel are expected to become even cleaner under recent EPA-issued emissions standards and cleaner fuel requirements. These new standards require all passenger vehicles sold after the 2004–2007 period to be 77 to 95 percent cleaner than those on the road today. Standards that will begin to take effect in model year 2007 will require each new truck and bus to be more than 90 percent cleaner than current models.<sup>8</sup>

The steep decline in NOx and VOC emissions suggests that the impact of vehicle travel on emissions is substantially less than it was in the 1970s through the 1990s.<sup>9</sup>

### **Billions in Funding Targeted to Transportation Projects That Reduce Emissions**

Transportation programs are funneling billions of dollars into efforts to clean up the nation's most polluted areas.

From 1998 through 2003, over \$8.1 billion was targeted for transportation-related projects that will reduce pollutant emissions in areas not meeting air quality standards for ozone, carbon monoxide and particulate matter. These funds—provided through the Congestion Mitigation and Air Quality Improvement (CMAQ) Program—allow state transportation agencies and local governments to fund innovative strategies to clean up the air.<sup>10</sup>

Communities in so-called “non-attainment areas” have been able to increase public awareness concerning the links between transportation choices and air pollution, provide technological applications to improve transportation system efficiency, increase transit services, or implement ozone action programs.

Clean-air benefits from CMAQ transportation funding include transit and traffic flow improvements, shared-ride programs, demand management, automobile inspection and maintenance programs, and bicycle and pedestrian improvements.

These transportation funds also are being used for programs to retrofit heavy-duty diesel engines to reduce emissions from trucks or buses as well as for a variety of freight projects—such as truck stop electrification equipment to reduce idling.

### **Alternatives to Driving**

Many transportation agencies are supporting alternatives to driving—including telecommuting, parking buy-out, and commuter choice programs—as a way to demonstrate emissions reductions. To ensure that transportation activities do not worsen air quality, federal law requires that all transportation plans and programs in areas that are out of compliance

Right – The New York Department of Transportation (NYSDOT) has been promoting an Ozone Action Day Program for several years, working with the state’s air quality agency, which provides air-quality forecasts. In larger the urban areas of New York City, Buffalo, Rochester, and Syracuse, NYSDOT has partnered with local and regional transportation agencies to get the message out to the public. The program utilizes outreach to employers, use of variable message signs and other ITS technology, and public visibility.



with air quality standards conform to the state’s air quality plan. Programs that encourage alternatives to driving are helping agencies achieve “transportation conformity.”

Highway programs also are important supporters of transit, providing the needed infrastructure for expansion of commuter bus service and other public transportation options that reduce auto emissions.

The American Public Transportation Association reports that through 2001, over \$1.2 billion of flexible highway funding has been transferred to public transportation.<sup>11</sup>

Highway investments that benefit air quality can be seen around the country in construction of park-and-ride facilities for buses and carpools; funding of carpool programs; building high-occupancy vehicle lanes; providing rail transit in the highway median in areas including Virginia, Baltimore, and Chicago; and highway/transit interchanges that provide freeway access to transit stations.

### **Ozone Action Days: Transportation Doing Its Share**

An effective and visible way for transportation to do its share to clean up the air is to participate and lead Ozone Action Day Programs.

These programs alert the public when ozone levels are expected to be unhealthy and seek their cooperation to change their travel and other behaviors to reduce emissions on those days. Messages are broadcast by media, through employer organizations, and by roadside variable message signs.

Actions the public can take to reduce emissions include:

- ▶ Carpooling, biking, walking, or taking transit to work;
- ▶ Trip chaining (combining trips and errands into one trip so the catalytic converter does not cool off);
- ▶ Avoiding drive-through lanes, and excessive idling;
- ▶ Re-fueling after 6:00 p.m., and not topping off when fueling;
- ▶ Mowing the lawn in the evening; and
- ▶ Allowing employees to telecommute or use flex time.



A clean air hybrid-electric bus operating in New York City is part of a larger effort to improve air quality within the state of New York. Many transportation agencies are supporting alternative fueled vehicles (AFVs) and the infrastructure associated with them.

Photos courtesy of New York State DOT

## Alternative Fueled Vehicles: Independence and Clean Air

The transportation sector is finding innovative ways to advance new vehicle technologies to benefit air quality. Many transportation agencies are supporting alternative-fueled vehicles (AFVs) and the technology and infrastructure associated with them.

Applicable not only to light-duty vehicles—such as fleet vehicles—but also to transit buses, school buses, delivery vehicles, and station/commuter cars, AFVs are leading to improved energy efficiency and air quality and less reliance on imported energy.

New York has been a leader in adopting AFV vehicles and technologies in a wide variety of applications:

- ▶ The state has committed to alternative-fueled vehicles and technology in its own fleet of vehicles. As of July 1, 2001, New York has acquired over 1,400 AFVs. Since 1998, New York has exceeded its vehicle acquisition requirements under the federal Energy Policy Act.
- ▶ New York is installing compressed natural gas (CNG) fueling stations across the state at locations owned and operated by various state agencies including DOT. Low-volume sites are available to state vehicles only; fast-fill sites are commercially operated and are open to the public. A number of electric vehicle charging stations also have been installed.
- ▶ In the New York City metropolitan area, a Clean Commute commuter station car program has been launched. The public is offered an opportunity to lease a small electric vehicle for the commute between their homes and the rail station. Charging stations are provided at the rail stations. To date, over 100 vehicles have been leased with plans to expand the program to 400 vehicles.
- ▶ The New York City Transit Authority has made a significant commitment to using hybrid-electric buses. It has steadily increased alternative-fueled buses into its fleet, with over 2,300 programmed by 2004. All of its standard size bus purchases after 2004 will be of buses as clean as AFVs. In addition, bus depots are being converted to facilities that can store and refuel these buses.

New York is committed to investigating and testing the economic, energy, and environmental factors for all emerging alternative-fueled technologies, and to advance the most appropriate technologies—or combination of technologies—that address and support the state's needs.

## **Public Education: *It All Adds Up to Cleaner Air***

A key to continued progress in cleaning the nation's air is public education. Transportation and environmental officials are partners in an ongoing program dubbed, *It All Adds Up to Cleaner Air*. Officials are working to educate the public on causes of transportation related air pollution and simple steps the average citizen can take to improve air quality.<sup>12</sup>

Through these public education efforts, transportation officials are urging commuters to use mass transit, carpool, ride a bike, or telecommute—and are encouraging common-sense strategies, like regular auto maintenance and filling up the gas tank on cool days. The program provides a range of advertising spots, check lists, marketing kits, television and radio spots, and other tools to help communities get out the word on cleaner air.

At the beginning of the 1999 ozone season, *It All Adds Up to Cleaner Air* was introduced in 14 demonstration communities across the country. Those areas are sharing their lessons with communities that face similar air quality and congestion issues and demographics.

The Georgia Department of Transportation conducted a statewide kickoff of the media campaign to increase awareness of HOV lanes under construction in Gwinnett County, and to increase use of the existing HOV lanes and metro rail. The event attracted significant media coverage, including three Atlanta television stations. They also ran radio ads on several stations throughout the year. To draw attention to the campaign, GDOT is using the HOV BUG, a 1999 Volkswagen Beetle that was donated. The BUG travels the Atlanta metro area highlighting the need for and benefits of carpooling.

## **Intelligent Transportation Systems: A Smart Way to Keep Traffic Moving**

Development of new transportation technologies holds significant promise for future improvements in air quality. Intelligent Transportation Systems (ITS) is a national program aimed at using modern computers and communications to make travel smarter, faster, safer, and more convenient.

According to federal highway officials, over the past 11 years, the federal government has invested over \$2 billion on ITS research, development, testing, and demonstrations, as well as other activities designed to accelerate the adoption and commercialization of ITS applications.

Promising technologies offer many benefits:

- ▶ Intelligent traffic control systems reduce the time spent stopped at red lights or waiting on freeways when an accident occurs.
- ▶ Automatic toll collection moves vehicles more quickly through tollbooths, reducing congestion, and pollution.
- ▶ Traveler information systems provide current, multi-modal information on travel conditions allowing citizens to make smarter choices about how, when, and where to travel.
- ▶ In-vehicle systems will provide in-vehicle maps and improve safety by automatically notifying emergency services when a serious accident occurs and exactly where the accident is located.
- ▶ Advanced transit systems help transit agencies operate more efficiently and provide travelers with real-time information that makes using transit easier and more attractive.
- ▶ Intelligent commercial vehicle systems will help commercial vehicle operators process the paperwork associated with moving goods. These systems also will help public agencies improve safety by inspecting the vehicles that need it the most.<sup>13</sup>