

The Problem

Air Pollution and Traffic Congestion

Since the 1950s, we have known that vehicle exhaust fumes play a major role in the deterioration of air quality in urban areas. This knowledge led to widespread State and Federal regulatory activity, which eventually resulted in the passage of the modern Clean Air Act (CAA) in 1970.

The CAA gives the U.S. Environmental Protection Agency (EPA) the responsibility and legal authority to control air pollution by setting limits on pollution from stationary, area, and mobile sources of emissions. Federal standards, known as National Ambient Air Quality Standards (NAAQS), are required to be set at levels that protect human health. There are currently NAAQS for six pollutants. Those for which transportation sources are significant include carbon monoxide, particulate matter, and ozone. The most persistent pollution problem is ground level ozone, which is not emitted directly but is produced in the air during a complex photochemical reaction involving volatile organic compounds (VOCs) and oxides of nitrogen (NOx) contained in automobile exhaust emissions and other similar gasses.

Figure 1. Comparison of Growth Areas and Emission Trends

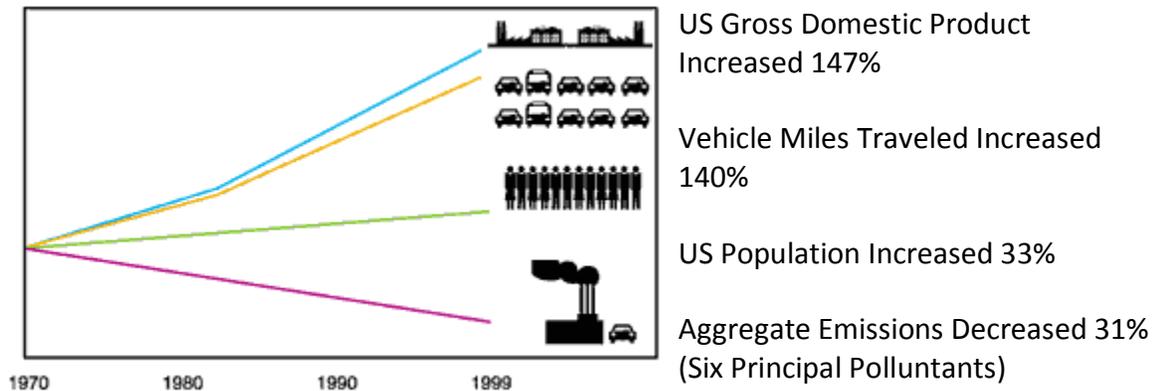


Figure 2. Decrease in National Concentrations and National On-Road Mobile Source Emissions

	Percent Decrease in Concentrations (1989-1998)	Percent Decrease in Emissions (1989-1998)
CO	-39	-24

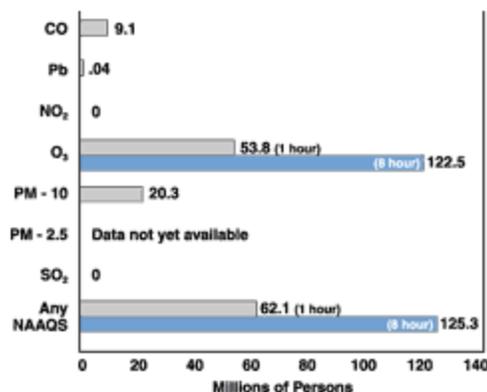
O₃	-4 (1 hour)	-26 (VOC) +1 (NOx)
PM₁₀	-25	-30

The air is much cleaner than it was in 1970 even though further progress is necessary. For example, the EPA estimates that from 1989-1998 national emissions from mobile sources for carbon monoxide (CO) decreased 24 percent, 26 percent for VOCs and 30 percent for particulate matter (PM) less than 10 microns in size. These dramatic emission reductions occurred simultaneously with significant increases in economic growth and population.

Despite substantial progress in reducing emissions, the impact of mobile source air pollution continues to be large. EPA estimates that over 5,000 tons of VOCs from transportation sources were emitted in 1999 and that approximately 62 million people were living in areas that do not meet the health-based standards.

Fine particulate matter, or PM_{2.5}, is defined as particles less than 2.5 microns in size. This pollutant causes adverse health effects by depositing in the lungs where it interferes with the respiratory process. The health risk from an inhaled dose of PM may depend on the size, composition, and concentration of the particulate. Combustion sources, including on-road vehicles, are thought to be significant to overall pollution levels of PM 2.5.

Figure 3. Number of People Living in Counties with Air Quality Concentrations Above the Level of the NAAQS in 1999



Large and densely populated metropolitan areas experience increased traffic congestion problems. The cost of traffic congestion to travelers is measured in hours of delay and wasted fuel. Travelers in the nation's 68 largest metropolitan areas spent over \$72 billion in hours of lost time and wasted fuel in 1999. Between 1982 to 1997 the annual hours of delay per driver in the country's largest metropolitan areas increased by 125 percent, and in the small urban areas, the average increase was 400 percent.

The Response

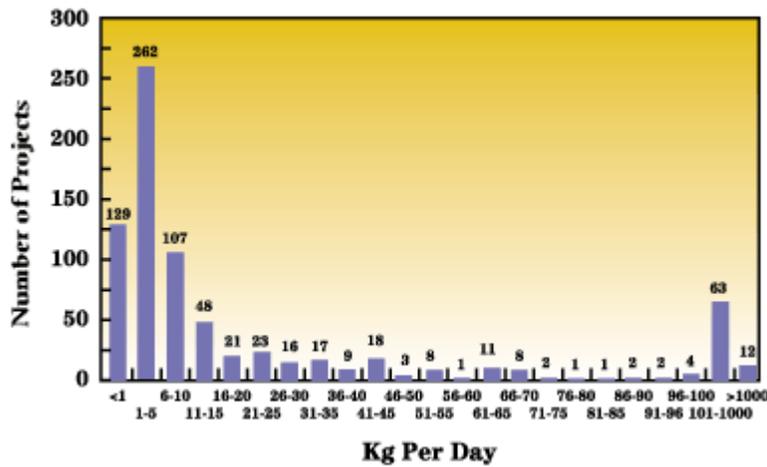
The Congestion Mitigation and Air Quality Improvement Program

In 1990, Congress amended the Clean Air Act to accelerate America's efforts to attain the NAAQS. The amendments required further reductions in the amount of permissible tailpipe emissions, initiated more stringent control measures in areas that still failed to attain the NAAQS (nonattainment areas), and provided for a stronger, more rigorous linkage between transportation and air quality planning. The following year, Congress adopted the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. This law authorized the Congestion Mitigation and Air Quality Improvement Program (CMAQ) to provide funding for surface transportation and other related projects that contribute to air quality improvements and congestion mitigation. The CAA amendments, ISTEA and the CMAQ program together were intended to realign the focus of transportation planning toward a more inclusive, environmentally-sensitive, and multimodal approach to addressing transportation problems.

CMAQ and Air Quality

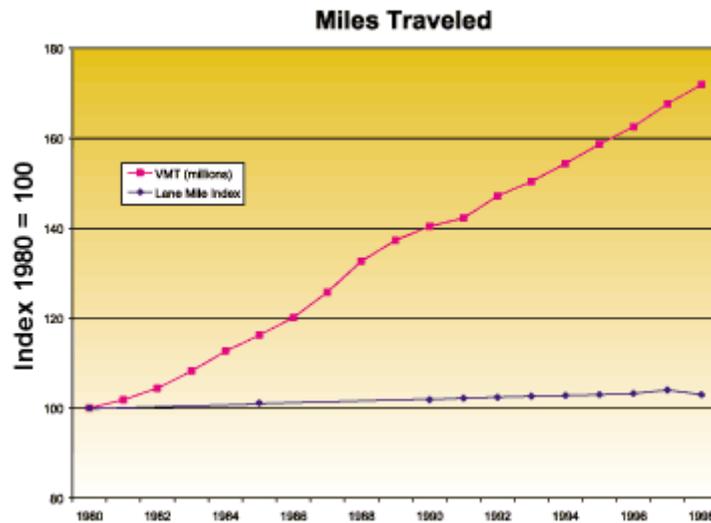
The main goal of the CMAQ Program is to fund transportation projects that reduce emissions in nonattainment and maintenance areas. Using State Departments of Transportation (State DOTs) estimates in 1997, total emissions reductions nationwide for CMAQ-funded projects were 170 tons per day for VOC and 430 tons per day for CO. While small in comparison to the reductions needed to attain the NAAQS, CMAQ funding has been proven to assist State DOTs and MPOs to meet their emission reduction requirements. Typically, under ISTEA, 89 percent of CMAQ-funded activities result in an estimated benefit of fewer than 100 kg/day or less while a much smaller percentage show significantly greater benefits. Figure 5 shows the distribution of expected VOC reductions for CMAQ-funded projects nationwide for FY 1997.

Figure 5. Expected Emission Reductions (VOC) FY 1997



Emissions reductions are provided without comment to their accuracy.

Figure 6⁴. VMT Versus Lane Mileage



The most effective CMAQ-funded projects tend to be large in scope and those that directly affect vehicle emissions, for example, Inspection and Maintenance VOC reductions range from 2 to 17 tons per day.³

CMAQ and Congestion Relief

Congestion mitigation is also a goal of the CMAQ Program. Congestion relief can contribute to improvements in air quality by reducing travel delays, engine idle time and unproductive fuel consumption. And while emissions are generally being reduced

nationally, most metropolitan areas are experiencing increases in congestion. Over the past twenty-five years, vehicle miles traveled (VMT) have more than doubled, while lane miles have increased slightly. (See Figure 6). This means that people are driving more and over a relatively static surface transportation system which is causing increased congestion.

Reductions in traffic congestion may decrease mobile source emissions as well as improve local economic competitiveness and productivity. However, given our current investment patterns, increasing levels of congestion are likely in the coming years. Our current course of runaway congestion is ---less and less--- a publicly acceptable option. In addition to the \$72 billion in lost time and wasted fuel, businesses located in areas with major travel delays face added costs associated with production delays, delivery difficulties, and diminished access to clients. While one alternative is to fund additional road construction to keep pace with traffic growth, this requires large capital expenditures, as well as other social and environmental costs that many communities are increasingly unwilling to accept.

Furthermore, there just may not be enough land where the need is greatest in dense urban cores. Part of the solution for these areas is to greatly improve the efficiency of the entire transportation network by increasing vehicle occupancy through better transit services, ridesharing and other demand management strategies; and managing our road systems better through Intelligent Transportation Systems and other traffic flow improvements. These improvements offer the mobility choices to reduce congestion and emissions, and CMAQ funding can help make these a reality.⁵

The CMAQ program is targeted at the areas of the country with the most severe air quality problems, which unsurprisingly represent the nation's largest metropolitan areas. These areas are of tremendous importance. They account for 34 percent of the population, 45 percent of the national Gross Domestic Product, 34 percent of the employment, and comprise just 3 percent of the land area. If CMAQ funding were sub-allocated to these areas according to the federal apportionment formula applied to the States, they would receive more than 57 percent of all CMAQ funds nationally (see Table 1).

Metropolitan Area Name	Total CMAQ Funds for Metro Area
New York City (tri-State area)	\$ 182.5 M
Los Angeles	\$ 158.7 M
Chicago	\$ 68.7 M
San Francisco	\$ 34.0 M
Philadelphia (tri-State area)	\$ 56.2 M
Detroit	\$ 24.5 M
Boston	\$ 50.0 M
Washington DC (tri-State area)	\$ 59.7 M
Dallas - Ft. Worth	\$ 31.3 M
Houston	\$ 35.6 M
Miami	\$ 23.0 M
Atlanta	\$ 24.8 M
Total	\$ 749.2 M
Percent of Total Apportionment	57.2%

*If suballocated according to the Federal apportionment formula

CMAQ and Livability

Smog-free urban areas with good mobility underpin sustainable development goals, and a key benefit of CMAQ-funded projects is improved livability in an urban area. Areas with significant traffic congestion and bad air pollution are consistently rated poorly by the affected populations. Congestion is cited as the cause of "road rage" and other anti-social behavior. By addressing these key needs, CMAQ funding can help an area achieve a more livable environment for its inhabitants. Other quality of life benefits can also result from CMAQ funded projects. Bicycle and pedestrian improvements can make urban life much more enjoyable.

In addition to these benefits, the CMAQ Program has many indirect benefits such as including new stakeholders in transportation decisions, fostering project innovation, enhancing intermodal planning, and promoting savings in infrastructure investment. The

future success of the CMAQ Program relies upon the continued participation of a diverse group of stakeholders. This diversity results in positive benefits for communities throughout the United States, because air quality decisions are subjected to a wider variety of input from representatives throughout communities and the public

The Scale of CMAQ Projects

CMAQ funding will not "solve" an area's air quality or congestion problems. Nor can it alleviate a great many urban problems, and dramatically improve an area's livability. It is one piece of a larger mosaic that can help in specific transportation corridors. For example, about \$109 billion was spent by all levels of government on highway and transit programs in 1995. CMAQ funding available to the States in that year was only about \$1 billion, or just 0.9 percent. Even single, albeit major, transportation infrastructure projects can cost in the billions of dollars, far exceeding total CMAQ funding.

As instructive as this comparison is to give a relative sense of scale, the proper comparison is not to the amount spent each year to maintain and improve the transportation network but to the total value of the network. While reliable estimates are not available, that figure is generally estimated to be in the trillions of dollars. When viewed in this context, CMAQ funding can only be viewed as providing incremental improvements to such a vast network. The appropriate way to view the potential of the CMAQ program is at the project or corridor level where the benefits of a single project can make a difference.

Project Eligibility

Because CMAQ funds are intended to improve air quality, funds must be spent in nonattainment or maintenance areas. A nonattainment area is an area formally designated (in the Code of Federal Regulations) by EPA as not meeting the NAAQS. A maintenance area is an area that was nonattainment but has subsequently attained the NAAQS and was officially redesignated to attainment by EPA.

The CMAQ program strives to reduce transportation-related emissions by providing State DOTs and local governments options to fund different emission reduction strategies. For example, the CMAQ Program enables communities to increase public awareness concerning the links between transportation choices and air pollutions; provide technological applications to improve transportation system efficiency; increase transit services; or implement "Ozone Action" programs. Many of these activities could be Transportation Control Measures (TCMs). Most of the eligible categories of CMAQ projects are TCM-type activities and include a wide variety of measures to decrease vehicle emissions, primarily by reducing the total amount of vehicle miles traveled (VMT) in an area. Certain projects are ineligible for CMAQ funds. Legislative prohibitions exclude vehicle retirement programs and highway capacity expansion projects. Policy

considerations exclude highway maintenance and reconstruction projects because these activities preserve existing levels of service and are unlikely to contribute to further improvements in air quality.

Transit and Public Transportation Programs

CMAQ funds may be used to support the use of public transportation. There are three broad categories of transit projects or programs that are eligible for funding: service or system expansion; provision of new transit service; and financial incentives to use existing transit services. Service expansion strives to attract new users, typically by providing new transit facilities or additional transit vehicles. Improving intermodal connections in the major urban areas has been a focus since ISTEA and these projects are generally eligible for CMAQ funding.

The start-up of new transit service (e.g., new express bus routes or new shuttle service linking major activity centers) is supported under the CMAQ program in an effort to tap new markets for transit. While CMAQ cannot be a permanent source of funding for transit service, the goal is to encourage experimentation to determine whether new types of services are viable.

Financial incentive strategies attempt to encourage transit use, and include innovative fare policies as part of an overall effort to reduce exceedances of the air quality standards. Under specific conditions, CMAQ may be used to offset the cost of offering reduced or free transit fares. This can be done when the subsidized fare is an element of an overall, area wide strategy for reducing emissions during peak periods of ozone pollution.

Traffic Flow Improvements

This strategy reduces emissions by promoting efficient traffic movement, thereby reducing unproductive travel delays and emissions resulting from engine idling. There are many ways to reduce and improve air quality by improving traffic flow. These include: traffic signal synchronization, channelization (to separate turning movements, for example), high occupancy vehicle lanes, and transportation management improvements. Of particular note are Intelligent Transportation Systems (ITS). The ITS efforts, using the very latest technologies, may be among the most innovative traffic flow improvement activities that are funded by CMAQ. In Fiscal Year (FY) 1997 the majority of CMAQ funds went to traffic flow improvements for the first time in program history, and much of this growth can be attributed to increased interest in ITS activities. FY 1996 and FY 1997 CMAQ funds were used for ITS projects that range from the ITS Early Deployment Plan in New York or the Traffic Operations Centers in New Jersey, Georgia and California to placing fiber optic cables in Texas and Kentucky's deployment of the Interstate Traffic Management Program.

Travel Demand Management Strategies

The demand for transportation can be moderated by adopting policy incentives that minimize the aggregate number of single occupancy vehicle trips and miles traveled. These strategies have grown substantially over the years and many metropolitan areas employ them to good advantage. Guaranteed Ride Home programs, employer outreach, public education, telecommuting, transportation management organizations, and other alternatives are also used to encourage trip reduction.

Ride Sharing Programs

Ride sharing programs are designed to increase vehicle occupancy in an attempt to reduce emissions. This can be achieved by minimizing the total number of vehicles on the road and these programs are most effective for commuting purposes. Ride sharing programs tend to be most effective when participants save time or money by ridesharing, for example when high occupancy vehicle lanes are available that reward those traveling with 2 persons or more in a vehicle through reduced travel times.

Pedestrian and Bicycle Programs

No mobile source emissions are produced by travelers using bicycles or walking, therefore, programs that promote these options are eligible for CMAQ funds. The substitution of bicycling and walking for relatively short trips is especially beneficial, because brief automobile trips result in disproportionately large emissions caused by cold engine starts and fuel evaporation after the conclusion of the trip.

Bicycle programs may include the creation of trails, storage facilities, and marketing efforts designed to support bicycles as a form of transportation. The bicycle, as a viable transportation mode, has spurred many communities to incorporate bicycling facilities into urban plans, stimulating the reduction of motor vehicle emissions in some areas.

One such example is the Long Beach Bikestation in California which provides a convenient transfer point for riders on the adjacent light rail line. In addition, the Bikestation includes mechanics on site and provides secure bike lockers and rental bicycles. The Long Beach Bikestation has become a community hub for bicycle advocacy, transit information and community events.

Education and Outreach

CMAQ funding may be used to increase public knowledge of transportation-related emissions and opportunities to reduce them through mitigation strategies and improved transportation choices.

Successful education and outreach projects have included metropolitan public awareness campaigns, such as "Ozone Action" day programs that inform citizens about the causes of rising ozone levels during the day. Other activities have included public-private projects. One project in Houston-Galveston, Texas, assessed public resistance to transit and led to the development of compelling marketing materials, reduced fares and the targeted promotion of transit services and resulted in a significant increase in transit ridership.

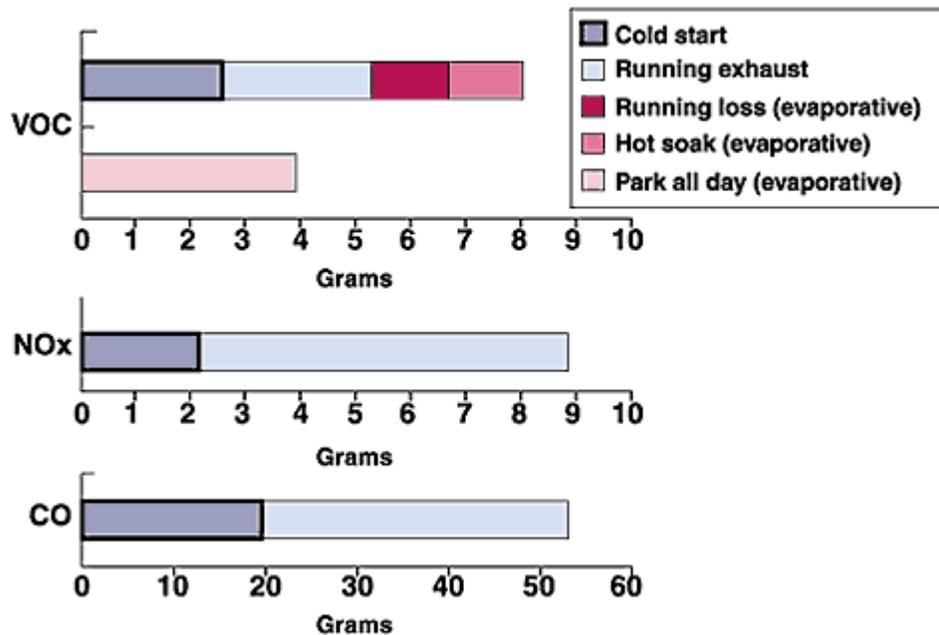
Inspection and Maintenance Programs

Poor engine maintenance and malfunctioning of pollution control equipment can significantly increase the amount of emissions released per vehicle. According to EPA analysis, only 10 percent of the vehicles on the road produce 50 percent of the pollution. Consequently, CMAQ funds may be used to introduce, conduct and provide start-up costs for automobile inspection and maintenance programs.

Extreme Cold Start Programs

Several physical factors impact engine performance and increase emissions. Cold temperatures, and cold engine starts increase emissions because specialized exhaust equipment, such as catalytic converters, take time to warm up to the optimum operating temperature. While an important phenomenon everywhere, it is particularly crucial in cold-weather climates. CMAQ funds may be directed towards the development and implementation of programs that are designed to reduce or mitigate excessive cold start emissions. It is estimated that for a five mile trip, the cold car generates about 30 percent more NO_x and 60 percent more carbon monoxide than starting the car when it is warm.

Figure 8⁹. Trip Emissions
Emissions of a Typical Car on the Road in 1997, for a 5-Mile Trip



Alternative "Clean" Fuels

Alternative or clean fuels are defined somewhat differently in the Clean Air Act and Energy Policy Act. But for CMAQ purposes an "alternative" fuel must reduce emissions to be eligible. These fuels can include natural gas, ethanol, methanol, electricity and liquefied propane gas. While a great many transit providers have used CMAQ funds for switching to alternative fuels, eligibility also extends to the purchase of vehicles and refueling equipment for other public agencies as well. And under TEA-21, eligibility can even extend to private companies (see Figure 8).

Public/Private Partnerships

Partnerships between public and private enterprises can leverage scarce funding resources by allowing private firms to own or operate a service developed with public funds. Often, public support is vital for projects that are not yet commercially viable because they lack markets sufficiently developed to stimulate private sector investment. TEA-21 eliminates some of the restrictions that previously limited private participation in emission reduction projects.

Some partnerships are ineligible for public funding because the private participation is mandated by law. CMAQ funds can not be used to help a private entity come into

compliance with specific legal requirements, such as Clean Air Act or Energy Policy Act mandates. However, if the private entity clearly goes beyond the requirements, CMAQ funds may be used if the eligibility provisions are met. Furthermore, without public sponsorship or a contractual arrangement between a public agency and a private firm, CMAQ funds cannot be directed to the private sector.

Public agencies interested in a partnership project need to consider several institutional and administrative issues. Federal regulations are often a major challenge to people unfamiliar with the process. Local match provisions, reimbursement conditions, environmental clearances, and other requirements apply regardless of whether a project is implemented by a public or private entity. Public partners need to consider contract administration issues, including the length of a contract, and legal recourse in the event of contract performance deficiencies.

Private corporations interested in partnership arrangements need to be aware of program funding characteristics. Potential funding changes include annual appropriation levels or program cancellation. Private partnerships may need to produce satisfactory financial returns for shareholders, but these returns may be set by regulatory authorities in noncompetitive or monopoly market environments.

Experimental Pilot Projects

The CMAQ Program has proved overall to be a highly successful experiment in Federal transportation funding. However, there are many possible ways to use CMAQ funds in which Federal, State and local authorities may have little experience. Experimental pilot projects are innovative initiatives that are designed to provide a funding mechanism for well thought out strategies that extend beyond current experience and are not explicitly eligible under the law. Before and after evaluations are required to see if the experimental project has produced air quality benefits, and States may not use more than 25 percent of their annual

CMAQ apportionment. Pilot projects are usually unique, with few precedents to guide the proposal and development process, but technical assistance is available from Federal agencies, including FHWA and FTA. Experimental pilots must meet all legal requirements -- they must be reasonably classified as transportation projects; they must show potential to reduce emissions; and they cannot violate any legal restrictions.

Recipient Responsibilities

The project sponsor is usually responsible for assembling the proper documentation for CMAQ proposals. The requirements to apply for CMAQ funds vary by metropolitan area and State. Interested parties should contact their State DOT or MPO to find out the requirements for their nonattainment or maintenance area. Once the project is found

eligible by FHWA or FTA, the recipient must follow through by supplying information necessary for the State DOT to adequately develop the required annual report. Every effort should be made by the project sponsors to quantify, or qualitatively assess, (if quantification is impossible), the proposal's benefits.

Reporting Requirements

The CMAQ Guidance requires State DOTs to provide FHWA with annual reports detailing their CMAQ projects. The report should list the CMAQ projects by category, and include information about emission reduction estimates and project costs. Generally, these reports are prepared on a Federal fiscal year basis.

Looking to the Future

Highways and transportation facilities have significant effects on the natural environment and on the quality of life in communities. Through Federal-aid programs such as CMAQ, we work with our partners to ensure that highway and transit facilities enhance the natural environment.

The CMAQ program can aid communities in improving the quality of the natural environment by reducing transportation-related pollution. The FHWA and FTA partner with States and MPOs to strengthen the links between transportation investments and communities by supporting and promoting increased transportation options and programs and projects to reduce environmental impacts.

The country's transportation system faces many special challenges. Lane mileage has increased slowly, while highway travel has increased rapidly. Increased congestion is a result of this disparity. The implementation of an integrated ITS infrastructure system with CMAQ funds is just one of the underlying strategies and initiatives associated with achieving the strategic objective of reduced congestion by improving the operations and efficiency of our surface transportation system.

Other challenges include the growth in the demand for travel, which serves to partially counteract the emissions benefits of cleaner cars and cleaner fuels. In addition, as the new NAAQS for ozone and fine particulate matter begin to phase in, States will face new challenges in meeting the air quality targets. In nonattainment and maintenance areas, the impending impacts of potentially stricter NAAQS are expected to increase the challenge of meeting the transportation conformity requirements. FHWA and FTA aim to reduce mobile source emissions by encouraging the use of less polluting transportation options and supporting the deployment of fuel- and emission- efficient vehicles. Many of these activities are eligible for CMAQ funds.

While the FHWA and FTA are proud of the contribution the CMAQ Program has made to reductions in mobile source emissions and congestion, the CMAQ Program's emissions impacts must be recognized as one relatively small part of the solution to a large and complex problem.

Over the first 9 years CMAQ has opened up the project selection process, helped reduce mobile source emissions and helped slow the rate of growth of congestion in some of the nation's largest cities. The goals of improved mobility and environmental protection are a delicate balancing act repeated throughout the country every day.