

Transportation Conformity: A Basic Guide for State & Local Officials

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Executive Summary

Overview

The concept of transportation conformity was introduced in the Clean Air Act (CAA) of 1977 which included a provision to ensure that transportation investments conform to a state's air quality plan for meeting the Federal air quality standards. Conformity requirements were made substantially more rigorous in the CAA Amendments of 1990. The transportation conformity regulations¹ that detail implementation of the new requirements were first issued in November 1993, and have been revised numerous times since. The regulations detail the process for transportation agencies to demonstrate and ensure that air pollutant emissions from transportation sources are consistent with air quality goals. This document was prepared for State and local officials who are involved in decision making on transportation investments.

What is Transportation Conformity?

Transportation conformity is a way to ensure that Federal funding and approval goes to those transportation activities that are consistent with the air quality goals: to eliminate violations, reduce the frequency and severity of violations and reach attainment in a timely manner.

What Actions are Subject to Conformity?

Conformity applies to long-range transportation plans, shorter-term transportation improvement programs (TIPs) and transportation projects funded or approved by the Federal Highway Administration (FHWA) or the Federal Transit Administration (FTA). Conformity requirements apply in areas that either do not meet or previously have not met certain air quality standards.

What is a Conformity Determination?

A conformity determination is a demonstration that the emissions from travel on an area's transportation system are consistent with goals for

air quality found in the State Implementation Plan (SIP).

Who is Responsible for Making a Conformity Determination?

Metropolitan Planning Organization (MPO) policy boards make initial conformity determinations in metropolitan areas, while State Departments of Transportation (DOTs) usually do so in areas outside of metropolitan areas. Conformity determinations must also be made at the Federal level by FHWA/FTA. A formal interagency consultation process is required for developing SIPs, transportation plans, TIPs, and making conformity determinations, and includes the Environmental Protection Agency (EPA), FHWA, FTA, and State and local transportation and air quality agencies.

How Frequently are Conformity Determinations Required?

Conformity determinations must be made at least every three years, or when transportation plans or TIPs are updated. Also, conformity determinations must be made within 18 months of certain actions on the state's air quality plan. In addition, conformity determinations must be made within 12-months of an area being designated by EPA as nonattainment for ozone (O₃), carbon monoxide (CO), particulate matter (PM-10 and PM-2.5), or nitrogen dioxide (NO₂), the pollutants for which conformity is required.

How do we Involve the Public?

A conformity analysis is made available to the public as part of the MPO and/or State DOT transportation planning process. MPOs are required to make transportation plans, TIPs, and conformity determinations available to the public, to accept and respond to public comment, and to provide adequate notice of relevant public meetings. Project sponsors must also include appropriate public involvement during project development.

¹Title 40 C.F.R., Parts 51 and 93.

How do we Determine Conformity?

Regional emissions are estimated based on projected motor vehicle travel on existing and planned highway and transit facilities consistent with an area's transportation plan and TIP. The projected emissions must not exceed the emissions limits ("motor vehicle emissions budgets") established by the SIP. Also, the MPO is required to demonstrate that Transportation Control Measures (TCMs) in EPA-approved SIPs are implemented in a timely fashion.

What are Emissions Budgets?

The state air quality plan assigns emission reductions for each pollutant or precursor for each source type (on-road motor vehicles, non-road equipment and vehicles, stationary and area sources). The level of emissions for on-road motor vehicles, such as cars, trucks, and buses, is called a "motor vehicle emissions budget". For conformity, projected emissions from highway and transit use must be less than or equal to the budget. Budgets are developed as part of the air quality planning process by State air quality or environmental agencies, and approved by EPA. Transportation agencies participate in this process in accordance with required interagency consultation procedures.

What are Transportation Control Measures (TCMs)?

TCMs are specific projects or programs designed to reduce emissions from transportation sources by reducing vehicle use, changing traffic flow or congestion conditions. Examples include programs for improving public transit, developing high occupancy vehicle (HOV) facilities, and ordinances to promote non-motorized vehicle travel. Areas can include TCMs in their SIPs.

What is Project-level Conformity?

In nonattainment and maintenance areas, projects must come from a currently conforming transportation plan and TIP that have undergone a conformity determination which has been approved by FHWA and FTA. In carbon monoxide and particulate matter nonattainment and maintenance areas, additional analysis may be necessary for Federally funded or approved

projects, to determine if a project has localized or micro-scale air quality impacts as part of project-level conformity. This analysis is sometimes referred to as "hot-spot" analysis.

What Happens if an MPO Cannot Make a Conformity Determination?

When a conformity determination is not made by one of the deadlines described above, there is a conformity lapse and the use of Federal transportation funds is restricted. Exceptions include: safety projects, TCMs in EPA-approved SIPs, and project phases that are already authorized by the FHWA/FTA.

What Options do States and MPOs have to Reduce Emissions?

A variety of projects and programs can be implemented to reduce emissions. Options include traditional investments like transit, high-occupancy vehicle (HOV) lanes, and signal timing, and technology-based measures such as retrofitting, repowering, and/or replacing heavy-duty diesel trucks or implementing idling reduction programs.

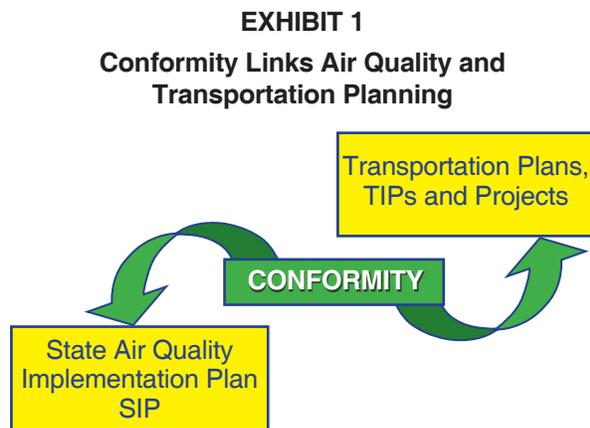
Purpose of this Guide

This Guide was prepared to help State and local officials understand transportation conformity and how conformity requirements relate to transportation investments in their communities. Specifically, we discuss the implications of conformity on transportation plans, transportation improvement programs (TIPs), and transportation projects. The Guide provides overview information on the major elements of the conformity process and provides answers to basic questions². Several exhibits are included in the Guide to illustrate key elements of the conformity process. Appendices are also included that discuss the health effects of pollutants, options to reduce on-road mobile source emissions, and resource agency contacts. A glossary is also included.

²Many additional documents and training materials are available at: <http://www.fhwa.dot.gov/environment/conform.htm> that address the technical requirements of transportation conformity.

Introduction

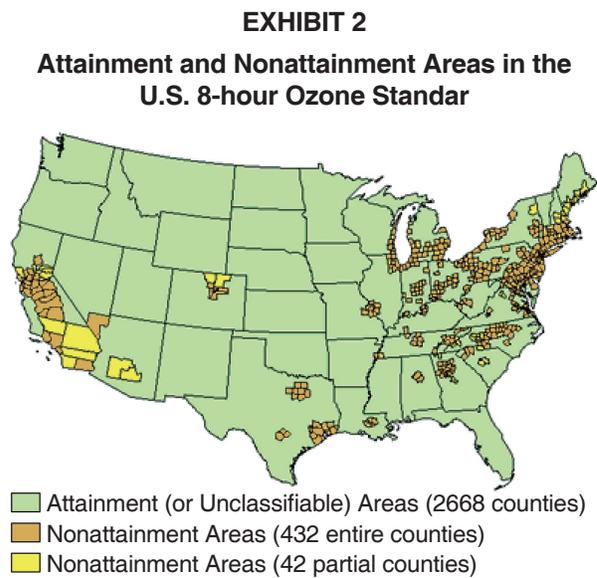
The air quality provisions of the Clean Air Act (CAA) and the transportation planning provisions of Title 23 and Title 49 of the United States Code³ require a planning process that integrates air quality and transportation planning such that transportation investments support clean air goals. This process is known as transportation conformity and is carried out in accordance with 40 CFR Part 93⁴, U.S. Environmental Protection Agency’s (EPA) conformity rule. Exhibit 1 below illustrates how conformity plays a central role as the link between transportation and air quality planning.



Transportation Conformity and Actions Subject to Conformity

Transportation conformity (“conformity”) is a way to ensure that Federal transportation funding and approvals go only to transportation activities that are consistent with Federal clean air goals. Conformity applies to metropolitan transportation

plans, metropolitan TIPs, and projects that are funded or approved by the Federal Highway Administration (FHWA) or Federal Transit Administration (FTA). Conformity requirements apply to areas that do not meet or previously have not met the air quality standards for ozone (O₃), carbon monoxide (CO), particulate matter (PM-10 and PM-2.5) or nitrogen dioxide (NO₂). These areas are known as nonattainment or maintenance areas, respectively. Exhibit 2 below shows all of the areas in the country that are nonattainment for the 8-hour ozone standard. Exhibit 3 shows all of the areas that are nonattainment for PM-2.5. For nonattainment and maintenance areas for these and other pollutants see 40 CFR Part 81 or <http://www.epa.gov/oar/oaqps/greenbk/>.

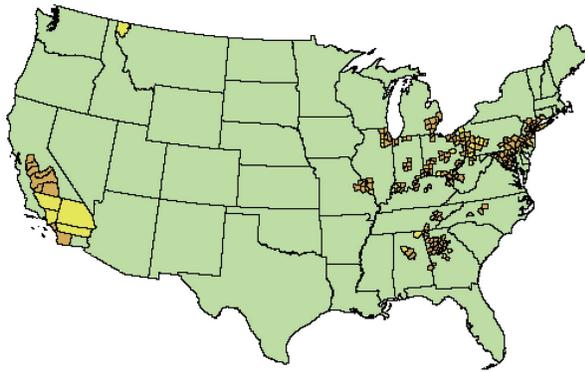


³Title 23 and Title 49 of the United States Code (U.S.C.) codify various transportation laws including the Transportation Equity Act for the 21st Century (TEA-21). These include transportation planning provisions that govern the programs of the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA).

⁴The transportation conformity rule, as amended, is available at <http://www.fhwa.dot.gov/environment/conform>.

EXHIBIT 3

Attainment and Nonattainment Areas in the U.S. PM2.5 Standards



- Attainment (or Unclassifiable) Areas (2916 counties)
- Nonattainment Areas (191 entire counties)
- Nonattainment Areas (34 partial counties)

Pollutants that Come from On-road Vehicles (e.g., cars, trucks, buses)

Transportation sources contribute to four of the six criteria pollutants for which EPA has established standards to protect public health and/or safety. The pollutants are: ozone (O₃), carbon monoxide (CO), particulate matter (PM-10 and PM-2.5), and nitrogen dioxide (NO₂). EPA recently began implementing new standards for PM-2.5 and O₃. Appendix A provides basic facts about health impacts of these pollutants. Exhibit 4 shows the on-road percentage of total emissions by pollutant in 2002. Exhibit 5 shows the proportion of volatile organic compounds (VOCs), CO, NO_x, PM-10, and PM-2.5 emissions from the various sources of pollution.

Description of a Conformity Determination

A conformity determination demonstrates that the total emissions projected for a plan or TIP are within the emissions limits (“budgets”) established by the State Implementation Plan (SIP), and that transportation control measures (TCMs) in EPA-approved SIPs are implemented in a timely

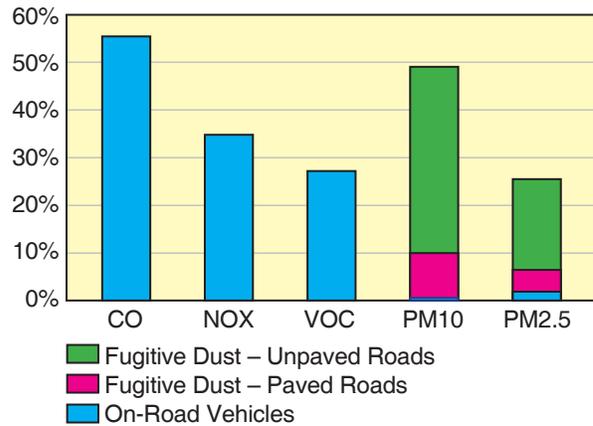
fashion. In certain cases, conformity may be demonstrated using other EPA-approved tests such as before a state has approved or found a motor vehicle emissions budget adequate for conformity purposes.

Responsibility for Making a Conformity Determination

The policy board of a Metropolitan Planning Organization (MPO) must formally make a conformity determination on its transportation plans and TIPs prior to submitting them to FHWA/FTA for an independent review and conformity determination. The conformity process is done in accordance with the required interagency consultation process described below. For individual projects including those in rural areas, the State Department of Transportation (DOT) or project sponsor usually prepares the conformity analysis. FHWA or FTA must make a project-level conformity determination prior to project approval and/or funding. Exhibit 6 shows the typical roles and responsibilities of the various involved agencies.

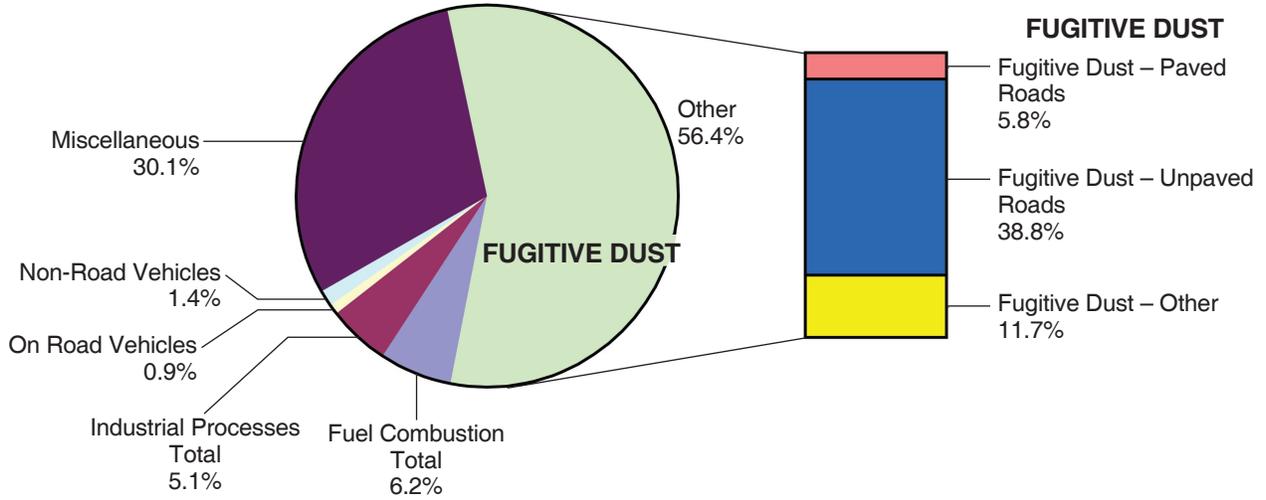
EXHIBIT 4

Emissions from On-Road Vehicles & Fugitive Dust as % of All Emissions 2002

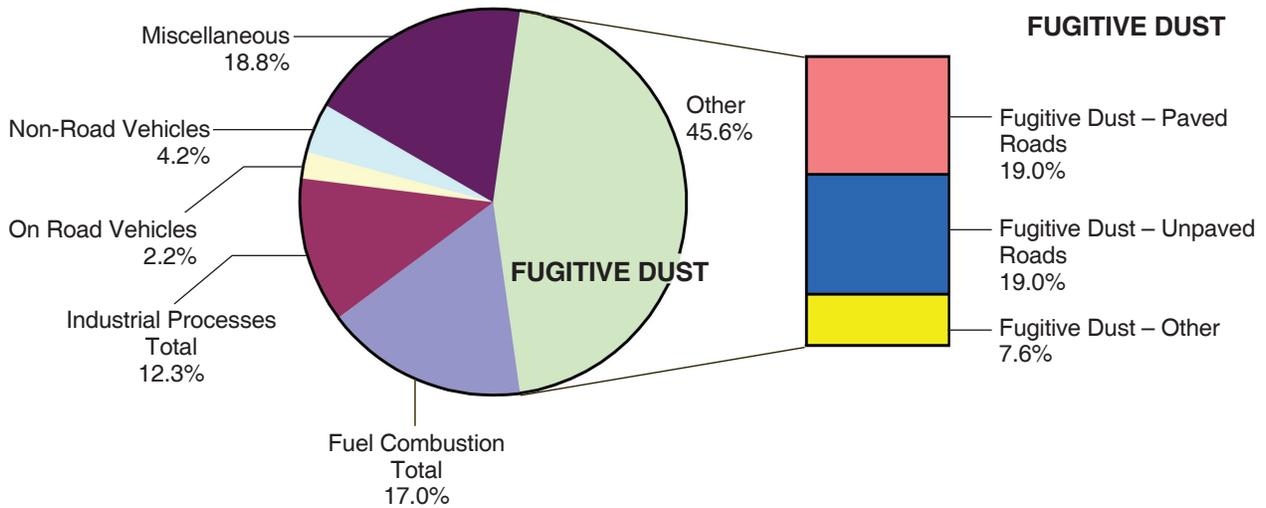


Source: U. S. EPA Emission Trends Report, 2002.

EXHIBIT 5
National Emissions Trends
PM10 Emissions
2002

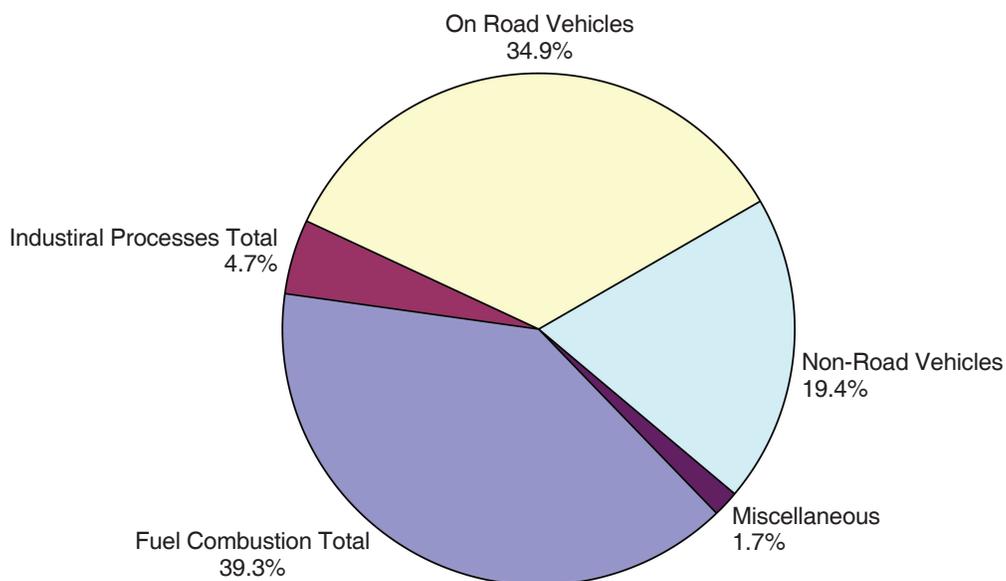


National Emissions Trends
PM2.5 Emissions
2002

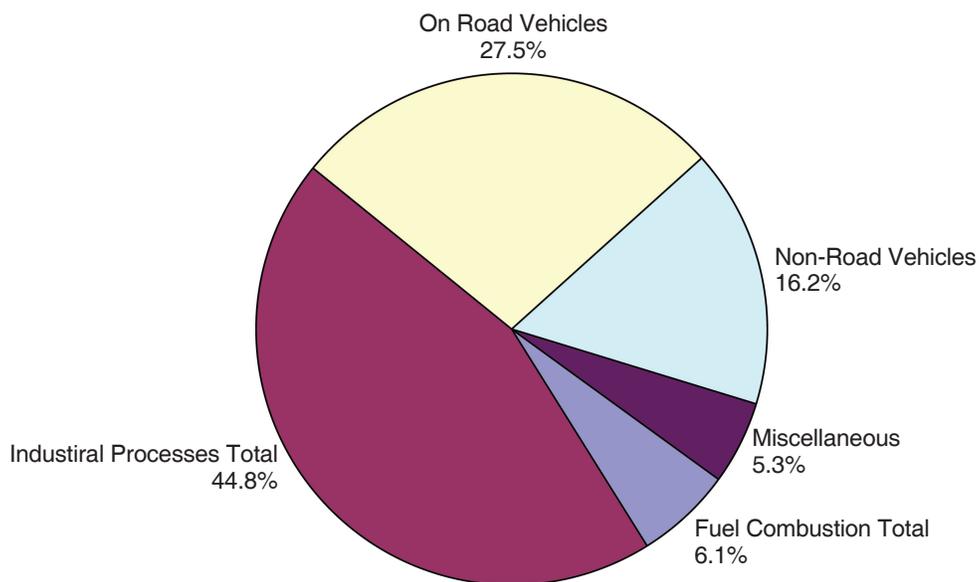


Source: U.S. EPA Emission Trends Report, 2002.

EXHIBIT 5 (cont'd)
National Emissions Trends
Nitrogen Oxide (NOX) Emissions
2002

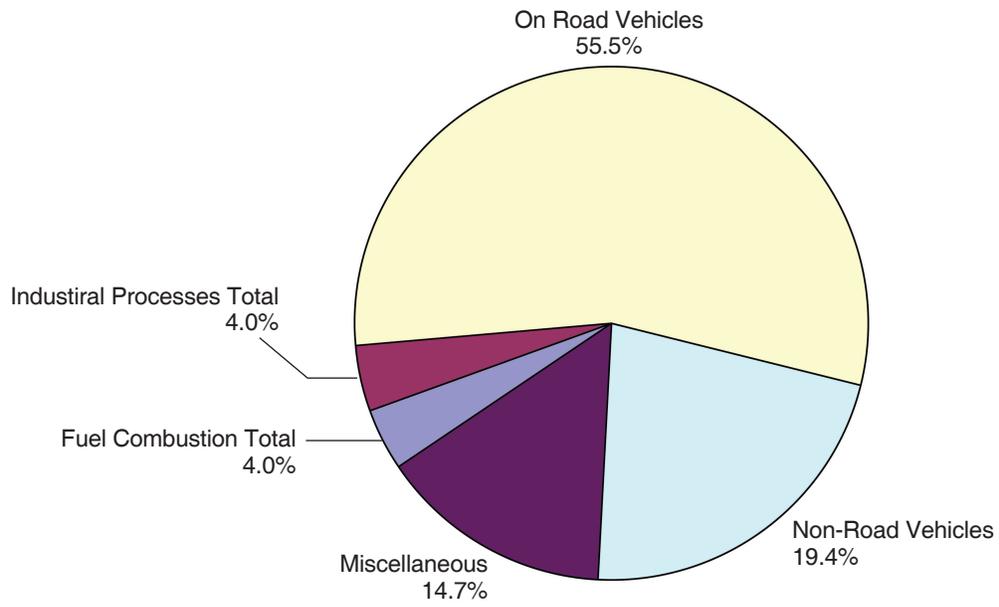


National Emissions Trends
Volatile Organic Compound (VOC) Emissions
2002



Source: U.S. EPA Emission Trends Report, 2002.

EXHIBIT 5 (cont'd)
National Emissions Trends
Carbon Monoxide (CO) Emissions
2002



Source: U.S. EPA Emission Trends Report, 2002.

EXHIBIT 6

Roles and Responsibilities of Federal, State, and Local Transportation and Air Quality Agencies in Transportation Conformity and SIP Development Process*

(*Specific States and metropolitan areas may have negotiated different assignments of responsibility tailored to local conditions.)

Agencies	Action Required	When
MPO	<ul style="list-style-type: none"> • Conduct analysis on regional plan/TIP and projects • Incorporate latest emissions factors, planning assumptions, and emissions models • Circulate draft plan/TIP for interagency and public comment • Ensure public involvement procedures are followed • Ensure timely implementation of TCMs • Respond to significant comments on TIP/plan conformity documents • In CO and PM₁₀ nonattainment areas, conduct “hot-spot” analysis as part of the NEPA process • Consult with agencies throughout the conformity determination process • Consult on the development of the SIP and motor vehicle emissions budgets 	<ul style="list-style-type: none"> • At least every 3 years, when a new plan, TIP or amendments to a plan/ TIP are proposed, or as needed based on SIP submittal
State Transportation Agency	<ul style="list-style-type: none"> • Consult with agencies throughout the conformity determination process • Conduct regional conformity analysis on projects not in metropolitan areas, based on interagency consultation • In CO and PM₁₀ nonattainment areas, conduct “hot-spot” analysis as part of the NEPA process • Provide for public involvement/respond to significant comments • Ensure timely implementation of TCMs • Review and approve staff regional and hot-spot analysis • Consult on the development of the SIP and motor vehicle emissions budget 	<ul style="list-style-type: none"> • As needed
State Air Quality/ Environmental Agency	<ul style="list-style-type: none"> • Prepare SIP for each relevant pollutant • Ensure interagency involvement during SIP development (including the state DOT and MPO(s)) • Hold public hearings prior to SIP adoption • Ensure SIPs are complete and control measures are enforceable under the 1990 CAA, prior to board approval action • Ensure latest emissions factors and planning assumptions are used for SIP development • Review and approve staff recommendation, forward to EPA for Federal approval • Participate in the interagency consultation process for plan/TIP development and conformity determinations 	<ul style="list-style-type: none"> • As needed
State Legislature	<ul style="list-style-type: none"> • Adopt State legislation to develop and enforce applicable CAA provisions • Ensure funding available for implementation of programs and projects 	<ul style="list-style-type: none"> • As needed
U.S. DOT-FHWA/FTA	<ul style="list-style-type: none"> • Make joint conformity determinations on MPO plans/TIPs amendments and projects • Participate in the interagency consultation process for plan/TIP development and conformity determinations • Ensure timely implementation of TCMs • Ensure adequate public involvement as part of the metropolitan planning process • Ensure that all other conformity and transportation planning requirements are met 	<ul style="list-style-type: none"> • At least every 3 years for each conformity determination or as needed • For each plan/ TIP or plan/TIP amendment conformity determination • As needed

Agencies	Action Required	When
	<ul style="list-style-type: none"> • Develop technical guidance on traffic demand and forecasting, and Federal aid program guidance • Consult on the development of the SIP and motor vehicle emissions budgets 	
EPA	<ul style="list-style-type: none"> • Consult on the development of the SIP and motor vehicle emissions budgets • Review submitted budgets for adequacy and implement adequacy process • Provide technical guidance on TCMs and SIP development • Review and comment on draft and submitted control strategy and maintenance SIPs • Review, comment, and approve SIPs • Participate in the interagency consultation process for plan/TIP development and conformity determinations • Review and comment on proposed conformity determinations • Designate approved emissions models for use in SIP development and conformity determinations 	<ul style="list-style-type: none"> • As needed

Frequency Requirements for Transportation Conformity

Conformity determinations must be made at least once every three years, or when a transportation plan or TIP is updated or amended. In addition, certain SIP actions relating to motor vehicle emissions budgets may also require an updated conformity determination within 18 months. Also, conformity must be demonstrated within 12-months of EPA’s designation of an area as nonattainment for any criteria pollutant.

Conformity in New 8-Hour Ozone and PM-2.5 Areas

Most metropolitan areas that were designated as nonattainment of the 8-hour ozone standard must have an approved conformity determination under that standard by June 15, 2005⁵. Newly designated PM-2.5 areas will have to demonstrate conformity within 12-months of the effective date of designations, or by April 5, 2006. Table 1 shows the classifications and attainment dates for the 8-hour ozone nonattainment areas.

TABLE 1
Classifications and Attainment Dates
8-Hour Ozone Nonattainment Areas

Classification	Years to Attain	Attainment Date
Marginal	3 years	2007
Moderate	6 years	2010
Serious	9 years	2013
Severe 1	15 years	2019
Severe 2	17 years	2021
Subpart 1 (“Basic” areas)	5 years	2009

⁵Note, EPA has provisionally deferred into the future the effective date of 8-hour ozone nonattainment designations for areas participating in an Early Action Compact (EAC). Conformity for the 8-hour ozone standard does not apply in areas with an EAC unless an area fails to meet all the terms and milestones of its compact and the nonattainment designation becomes effective.

Key Elements of a Conformity Determination

One way to understand transportation conformity is to know the key requirements and how they interact. The major components of a conformity determination include:

- Interagency Consultation and Public Involvement
- Latest Planning Assumptions and Emissions Model
- Regional Emissions Analysis
 - Motor Vehicle Emissions Budget
- Timely Implementation of TCMs
- Fiscal Constraint

Interagency Consultation and Public Involvement

Experience has shown that ongoing coordination and communication between Federal, State and local transportation and air quality agencies is vital to a smoothly running conformity process. In addition, a clear understanding of roles and responsibilities of participating agencies is essential.

The conformity rule requires that Federal, State and local transportation and air quality agencies establish formal procedures to ensure interagency coordination on critical issues. Typical participants in interagency consultation include FHWA, FTA, EPA, state DOTs, state and regional air quality agencies, and MPOs. In addition, transit operators are often active participants in interagency consultation. Interagency consultation is a forum for discussing key assumptions to be used in conformity analyses, strategies to reduce mobile source emissions, specific impacts of major projects, issues associated with travel demand and emissions modeling, and the development of motor vehicle emissions budgets. The specific process that will be followed in each area must be adopted as part of the SIP and must be used to develop transportation plans, TIPs and the SIP. These adopted interagency consultation procedures are referred to as the “conformity SIP”.

Public Involvement

Good public involvement processes are proactive, easily accessible to the public and keep the public informed on an ongoing basis.

MPOs are required to make transportation plans, TIPs and conformity determinations available for public review. MPOs must also respond to public comment and provide adequate notice of relevant meetings. Project sponsors must also allow for public involvement during project development. The public involvement requirements for transportation planning must be met; there are no additional public involvement requirements for conformity.

Latest Planning Assumptions and Emissions Model

Conformity requires that latest planning assumptions and EPA-approved emissions models be used each time a regional emissions analysis is conducted. This requirement ensures that the latest planning, travel, vehicle age and fleet mix, demographic, and economic assumptions are reflected in conformity determinations.

Transportation agencies must make assumptions about the future in their regional plans. These assumptions include population, employment, travel needs, vehicle fleet composition (proportions of types of vehicles), land use, and economic development. The conformity rule requires that when plans and TIPs are developed or updated, the assumptions used to forecast future conditions must be based on the latest available information. Current motor vehicle fleet information is essential to good planning and forecasting and is one of the key planning assumptions in conformity. Likewise, the latest EPA-approved emissions models must be used that reflect the latest science and policies regarding motor vehicle emissions and the emissions benefits of cleaner engine and fuel standards.

Regional Emissions Analysis

Regional emissions analysis is the key analytical component of a conformity

determination. It demonstrates that transportation investments are consistent with air quality goals.

Estimating regional emissions from on-road mobile sources traveling on the planned transportation system is essential to a conformity determination. The conformity rule requires that future emissions estimates include the entire horizon of the transportation plan (at least 20 years) for the region. The regional emissions that are forecast through models are compared to the motor vehicle emissions budget (“budget”) from the SIP that sets a limit on emissions from on-road sources. This budget cannot be exceeded in order for an area to make a conformity determination. In the absence of an approved or adequate budget, areas must pass interim tests that basically compare emissions associated with the proposed transportation network (“build” scenario) with a status-quo-type situation (“no-build” or “baseline”). The regional emissions analysis is based on motor vehicle travel across the entire current and planned transportation system and reflects the investments detailed in the transportation plan and TIP.

Motor Vehicle Emissions Budget

The State air quality agency is responsible for the development of the entire SIP. The air quality agency identifies how pollution from all sources will be reduced sufficiently to meet the federal air quality standards. As part of this process, the motor vehicle emissions budget is developed. Transportation agencies, including state DOTs and MPOs, should consult with the air quality agency on the development of the SIP and motor vehicle emissions budget.

The SIP accounts for emissions of each pollutant for each source type. There are three types of sources: mobile (on-road and non-road), stationary (i.e., refineries), and area sources (i.e., dry cleaners). Required emission reductions are calculated and control measures are adopted to achieve needed reductions. This reduced level of emissions is used to set a limit for motor vehicle emissions, which are called “budgets”.

Timely Implementation of TCMs

When an EPA-approved SIP includes TCMs, each time a conformity determination is made the MPO must demonstrate that these measures are being implemented on schedule as called for in the SIP.

Transportation Control Measures, or TCMs, are measures that are included in the SIP to help reduce emissions from on-road mobile sources. Section 93.101 of the conformity regulations contains a definition of TCMs for conformity purposes. Some of these measures are specifically listed in the CAA⁶ and transportation and air quality agencies often consider whether such measures are beneficial and needed to meet air quality requirements. TCMs are designed to reduce emissions from motor vehicles by reducing vehicle use, changing traffic flow, or relieving congestion at bottlenecks. Examples include high-occupancy vehicle (HOV) lanes, improving public transit, and vanpooling programs. If an EPA-approved SIP includes any of these measures, the MPO must show, as part of the conformity determination, that the measures are being implemented on schedule and given priority for Federal funding. Not all

areas have these measures in their approved SIPs, nevertheless these types of measures are often routinely implemented through the transportation plan and TIP (i.e., transit services, telecommuting programs).

Fiscal Constraint

Plans and TIPs in nonattainment or maintenance areas must be shown to meet the FHWA/FTA fiscal constraint requirements.

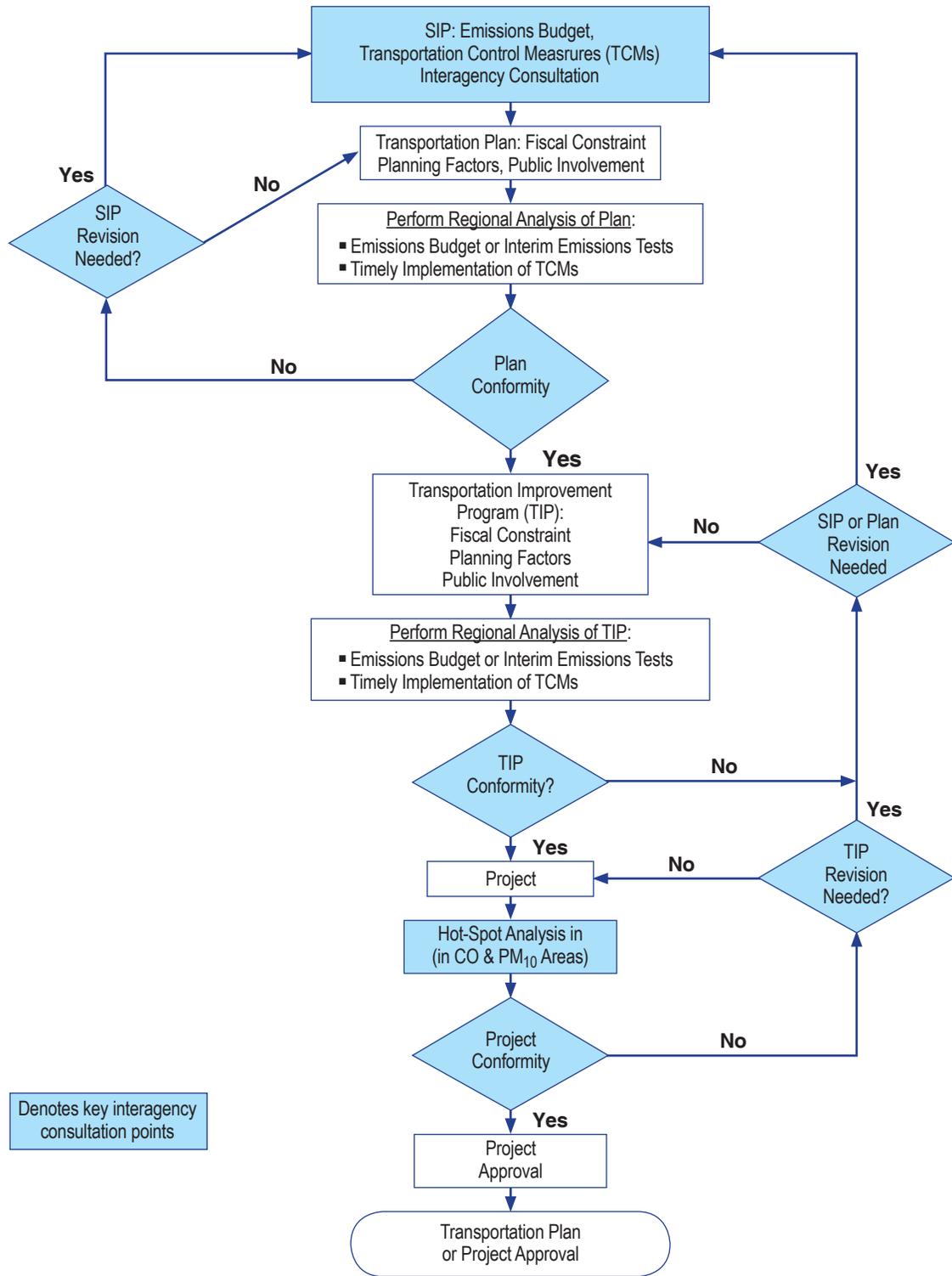
The FHWA/FTA⁷ metropolitan planning regulations require that transportation plans and TIPs be based upon reasonable estimates about future revenues. In addition, in the first two years of the TIP, projects must be limited to those for which funds are known to be available and committed. This is known as fiscal constraint. The conformity rule requires that the fiscal constraint requirements of the planning regulations be met prior to determining conformity on a plan or TIP.

Exhibit 7 shows the conformity process and how the elements of a conformity determination interact.

⁶CAA Section 108(f)(1)(A).

⁷23 USC Section 134.

**EXHIBIT 7
Transportation Conformity Process**



Source: Federal Highway Administration

Project Level Conformity and Hot-spot Analysis

Project-level conformity determinations must also be made for Federal highway and transit projects to demonstrate that the project is reflected in a conforming transportation plan and TIP. Additionally, as part of these project level determinations, in carbon monoxide and particulate matter nonattainment and maintenance areas, localized analysis is required for Federally-funded or approved projects. This analysis is called “hot-spot” analysis.

Conformity Lapse

If a conformity determination is not made according to the required frequency, a conformity lapse occurs. In the case of a conformity lapse, the use of Federal transportation funds is restricted to certain kinds of projects. These include “exempt projects” such as safety projects and certain mass transportation projects, TCMs from an approved SIP, and project phases that were authorized by the FHWA/FTA prior to the lapse. The FHWA and FTA do not reduce the amount of funding a State receives if there is a lapse; however, as noted above, use of Federal funds is restricted during the lapse.

Options to Resolve a Conformity Lapse

There are two options to resolving a conformity lapse if emissions estimates exceed the motor vehicle emissions budget: change the projects in the transportation plan or TIP (either the mix or timing of projects), and/or revise the motor vehicle emissions budget. In order to revise a motor vehicle emissions budget, a SIP revision is required which can be time consuming. Also, in order to revise a budget, the State air quality agency may need to identify additional control measures from on-road or other sources of pollution in order to increase the budget for on-road emissions. Often times, however, a lapse may occur due to a missed deadline such as an expired plan, TIP, or conformity determination. In this case, the lapse may be resolved by completing the necessary steps to fulfill transportation or air quality planning requirements.

Options for MPOs to Reduce Emissions

The MPO can adopt projects in the transportation plan and TIP that help to reduce emissions. Examples include: HOV lanes, transit investments, signal timing, bicycle lanes and coordinating land use planning with transportation planning. Other projects that can be implemented including retrofitting, repowering, or scrapping old trucks, supporting idling reduction at truck stops, or encouraging accelerated use of cleaner fuels, especially low sulfur diesel fuel. Appendix B includes a discussion of options to reduce emissions from on-road motor vehicles.

Appendix A: Health Effects of Pollutants

EPA has established standards⁸ for four transportation-related pollutants:

- ground level ozone formed by volatile organic compounds [VOCs] and oxides of nitrogen [NOx], the primary ingredients of smog;
- carbon monoxide [CO];
- particulate matter (less than 10 microns [PM10] and less than 2.5 microns [PM2.5]; and,
- nitrogen dioxide.

The standards are based upon EPA's assessment of the health risks associated with each of the pollutants on at-risk populations. These assessments are based upon short and long-term scientific studies by noted health professionals and medical research institutions. At-risk groups include children, the elderly, persons with respiratory illnesses, and even healthy people who exercise outdoors. The 8-hour ozone standard and PM-2.5 standard were established in 1997 based upon an assessment of the health-risks associated with exposure to these pollutants. The effective date of the 8-hour ozone standard also coincides with the revocation of the 1-hour ozone standard such that only one ground-level ozone standard is in effect at a given time.

Air pollution often involves a complex set of chemical reactions including combinations of pollutants and other factors such as weather and geography. Each pollutant plays a different role in the overall air quality in any given geographic area. Below is a brief overview of the key transportation-related pollutants.

Ozone: Ozone often irritates the eyes, impairs the lungs, and aggravates respiratory problems. Ozone can cause chest pain, coughing, nausea, pulmonary congestion, and possible long-term lung damage. Nitrogen oxides (NOx) and volatile organic compounds (VOCs) are precursors to ozone formation.

• **Volatile Organic Compounds (VOCs):**

VOCs come from vehicle exhaust, paint thinners, solvents and other petroleum-based products. VOCs and nitrogen oxides react in the presence of sunlight to form ozone. A number of exhaust VOCs are also toxic, with the potential to cause cancer.

• **Nitrogen Oxides (NOx):** Under the high pressure and temperature conditions in an engine, nitrogen and oxygen atoms in the air react to form various nitrogen oxides, collectively known as NOx. NOx, like hydrocarbons, is a precursor to the formation of ozone and also contributes to the formation of acid rain. NOx impacts the respiratory system, causing a high incidence of acute respiratory diseases. Pre-school children are especially at risk. NOx also degrades visibility due to its brownish color and the conversion to nitrate particles.

Carbon Monoxide (CO): Carbon monoxide is a product of incomplete combustion and occurs when carbon in the fuel is partially oxidized rather than fully oxidized to carbon dioxide (CO₂). Carbon monoxide reduces the flow of oxygen in the bloodstream and is particularly dangerous to persons with heart disease. Exposure to carbon monoxide can impair visual perception, manual dexterity, learning ability, and performance of complex tasks.

Particulates (PM): These are tiny particles that can cause irritation and damage to the respiratory system which can result in difficulty breathing, induce bronchitis and aggravate existing respiratory disease. Exposure to particles may more dramatically impact individuals with chronic pulmonary or cardiovascular disease, people with influenza or asthma, and children and elderly persons. Particles may aggravate breathing difficulties, damage lung tissue, alter the body's defense against foreign materials, and can lead to premature mortality. There are two PM standards: PM-10 and PM-2.5. PM-10 refers to particles with a diameter of 10 microns (µm) or less, and PM-2.5 refers to particles with a diameter of 2.5 microns or less. As a comparison, an average grain of table salt is 100 µm in diameter.

⁸National Ambient Air Quality Standards (NAAQS).

Appendix B: Options to Reduce Emissions from On-Road Motor Vehicles

The CAA identifies actions that may be taken to reduce emissions from mobile sources. While some of the measures are not the responsibility of State and local transportation officials, it is beneficial for officials to be familiar with on-road motor vehicle control programs implemented by other public agencies (e.g., motor vehicle departments, environmental agencies), automobile manufacturers and fuel suppliers. It is also important to understand the trade-offs between those measures others implement and the transportation strategies and TCMs that MPOs might include in their transportation plans and TIPs. Having an understanding of the costs and benefits of all available options to achieve emission reductions is also useful to officials in advance of being asked to make decisions on specific strategies for implementation.

Vehicle controls and fuel-based standards

Emission reductions resulting from the implementation of nationwide vehicle emission control strategies and fuel standards have been the most substantial to date in efforts to reduce mobile source emissions. Nevertheless, due to expected growth in vehicular travel, tailpipe emission standards for cars and light-duty trucks were tightened in the CAA and, as of 1996, applied to all new vehicles sold nationwide. In addition, heavy-duty trucks had to meet new NO_x emission standards after 1998. Urban transit buses also have to meet tighter emissions standards under the CAA.

EPA adopted the Tier II Vehicle & Gasoline Sulfur program that took effect in January 2004. This rule affects every new passenger vehicle and every gallon of gasoline in the U.S. For the first time SUVs, pickups, vans, and even the largest passenger vehicles are subject to the same, more stringent, national emission standards as cars. New emission standards apply to all passenger vehicles, regardless of fuel type (gasoline, diesel or alternative fuels). Vehicles meeting the Tier II standards are 77 to 95 percent cleaner, depending

on the size of the vehicle, compared to model year 2003 and earlier vehicles. The new standards reduce the sulfur content of gasoline by up to 90 percent. Heavy-duty gasoline engines are also required to meet new, more stringent standards starting with model year 2005.

In July 2000, EPA finalized a two-phased rule for heavy-duty diesel trucks and buses. In the first phase, new diesel engine standards apply beginning in 2004 for all diesel vehicles over 8,500 pounds. Additional diesel standards and test procedures will begin in 2007. The new standards require diesel trucks to be more than 40 percent cleaner than in 2000. The second phase of the program requires cleaner diesel fuels and even cleaner engines starting with model year 2007 trucks, and will reduce air pollution from diesel trucks and buses by another 90 percent. Starting in June 2006, the sulfur content of highway diesel fuel will be reduced from its current level of 500 parts per million to 15 parts per million, a 97 percent reduction in sulfur content.

The CAA included a clean fuel fleet program for serious ozone nonattainment areas with a population of more than 250,000. These areas were required to adopt a clean-fuel vehicle program for centrally fueled fleets of 10 or more vehicles by May 15, 1994. By requiring fleet owners (public and private) to convert to clean-fueled vehicles, it was hoped that the market for such vehicles will increase and broad-based public acceptance of clean-fueled vehicles will increase. However, it should be noted that existing nonattainment and maintenance areas can opt out of this program and no new 8-hour ozone areas meet the criteria for this program.

In addition to vehicle-related measures, stricter fuel volatility requirements (the rate at which fuel evaporates) may be required in some areas and can be useful in others. The use of reformulated gasoline (or RFG; fuel containing a different mix of ingredients than conventional gasoline) is mandated in the Nation's most serious ozone areas.

EPA now allows areas that voluntarily opted into the RFG program to “opt out” of the requirements under certain conditions. In addition, no new 8-hour ozone areas are required to implement RFG. However, this is a measure that officials may want to consider because it is possible that all light-duty vehicles operating in the nonattainment or maintenance area could be using cleaner fuels, whereas certain other strategies such as TCMs apply only to limited numbers of vehicles and trips (e.g., commute trips). Oxygenated gasoline is also required during the winter months in areas with serious carbon monoxide pollution, and where low-sulfur content diesel fuel was required beginning in 1993.

An intermediate measure between mobile source controls and stationary source controls is to reduce VOC emissions by mechanical means, rather than by reducing the volatility of the fuel. In many areas, emissions from tanker truck delivery of fuel to gasoline stations are already controlled by what is known as “Stage I” vapor recovery. This can be taken a step farther with “Stage II” vapor recovery nozzles, which reduce VOC emissions from fueling individual vehicles by capturing them at the pump. Automobile manufacturers will soon begin incorporating on-board vapor recovery controls into new vehicles, but the Stage II controls could provide benefits until these on-board controls are fully integrated into the vehicle fleet, which will be in about 25 years.

Inspection and Maintenance Programs

The CAA requires inspection and maintenance programs to be adopted in certain ozone (O₃) and carbon monoxide (CO) nonattainment areas. The requirements of the program vary depending upon the severity of pollution in the nonattainment areas in each State. The emission reduction potential of inspection and maintenance programs is substantial and is critical to many areas achieving the short-term emission reductions required from mobile sources.

Transportation Control Measures (TCMs)

Another set of options to control and reduce emissions from motor vehicles comes

under the category of TCMs. Implementation of these measures is typically within the purview of transportation agencies, and TCMs are usually funded with FHWA/FTA or State and local transportation funds. The emission reduction potential of conventional TCMs, such as ridesharing and bicycling programs, is not likely to be as substantial as the technology-based transportation measures discussed above. Nevertheless, TCMs can be useful in reducing congestion and may be needed in some areas in order to demonstrate attainment of the NAAQS. TCMs such as expanded transit services can also provide and enhance travel options and increase travel choices.

The CAA requires that in ozone nonattainment areas classified as severe or extreme, the State must identify and adopt specific transportation control strategies and TCMs to offset any projected growth in emissions from growth in vehicle miles traveled. States and MPOs should consider the CAA list of TCMs (Section 108(f)(1)(A) for strategies they might include in the SIP. These 16 TCMs (with the exception of programs to encourage the removal of pre-1980 vehicles) are eligible for Congestion Mitigation and Air Quality Improvement Program (CMAQ) funding. Below is the list of TCMs included in the CAA. There is overlap between some of the measures and the descriptions listed illustrate types of projects that might be considered in nonattainment areas to reduce mobile source emissions or to increase overall vehicle occupancy.

CAA Section 108(f)(1)(A) Transportation Control Measures

- (i) programs for improved public transit;
- (ii) restriction of certain roads or lanes to, or construction of such roads or lanes for use by, passenger buses or high-occupancy vehicles (HOV);
- (iii) employer-based transportation management plans, including incentives;
- (iv) trip-reduction ordinances;
- (v) traffic flow improvement programs that achieve emissions reductions;
- (vi) fringe and transportation corridor parking

- facilities serving multiple-occupancy vehicle programs or transit service;
- (vii) programs to limit or restrict vehicle use in downtown areas or other areas of emission concentration particularly during periods of peak use;
- (viii) programs for the provision of all forms of high-occupancy, shared-ride services;
- (ix) programs to limit portions of road surfaces or certain sections of the metropolitan area to the use of non-motorized vehicles or pedestrian use, both as to time and place;
- (x) programs for secure bicycle storage facilities and other facilities, including bicycle lanes, for the convenience and protection of bicyclists, in both public and private areas;
- (xi) programs to control extended idling of vehicles;
- (xii) reducing emissions from extreme cold-start conditions;
- (xiii) employer-sponsored programs to permit flexible work schedules;
- (xiv) programs and ordinances to facilitate non-automobile travel, provision and utilization of mass transit, and to generally reduce the need for need for single-occupant vehicle travel, as part of transportation planning and development efforts of a locality, including programs and ordinances applicable to new shopping centers, special events, and other centers of vehicle activity;
- (xv) programs for new construction and major reconstruction of paths, tracks, or areas solely for use by pedestrian or other non-motorized means of transportation when

economically feasible and in the public interest. For purposes of this clause, the Administrator shall also consult with the Secretary of the Interior;

- (xvi) programs to encourage removal of pre-1980 vehicles.

Market-Based Transportation Control Measures

In addition to conventional TCMs, work is underway in nonattainment areas to explore options to reduce mobile source emissions using market-based TCMs such as road pricing, congestion pricing, vehicle miles of travel (VMT) fees, and parking pricing. These mechanisms can be relatively cost-effective and can be designed to impact vehicles at either certain times of the day (e.g., peak-period pricing), or at all times. In addition, these measures in combination with traditional TCMs have the potential to address other public policy objectives such as congestion reduction and energy conservation.

In many areas public acceptance of market-based TCMs has been slow due to practical and political considerations. For example, implementation of market-based measures may require State legislation (e.g., congestion pricing) or a voter referendum. Therefore, regardless of the potential merits and cost-effectiveness of these measures, the implementation of market-based TCMs is likely to occur gradually. While it is too soon to predict whether widespread use of market-based measures will occur in the future, experts generally agree that this is one option available to make substantial reductions in emissions from on-road mobile sources.

Appendix C: Resource Agencies and Other Helpful Contacts

Below is a list of resource agencies and other helpful organizations.

State Departments of Transportation

American Association of State Highway Transportation Officials –
<http://www.transportation.org/aashto/home.nsf/FrontPage>.

Metropolitan Planning Organizations or Councils of Government

Association of Metropolitan Planning Organizations – <http://www.ampo.org/>.

National Association of Regional Councils – <http://www.narc.org/>.

Transit Agencies

American Public Transportation Association – <http://www.apta.com/>.

State or Local Air Agencies

State and Territorial Air Pollution Program Administrators/Association of
Local Air Pollution Control Officials – <http://www.cleanairworld.org/>.

Federal Highway Administration

Office of Natural and Human Environment

http://www.fhwa.dot.gov/environment/conformity/con_cont.htm.

Division Offices

<http://www.fhwa.dot.gov/field.html#fieldsites>.

Resource Center

<http://www.fhwa.dot.gov/resourcecenter/teamairq.cfm>.

Federal Transit Administration

Regional Offices

http://www.fta.dot.gov/about/offices/4978_ENG_HTML.htm.

Environmental Protection Agency

EPA Office of Transportation and Air Quality (OTAQ)

<http://www.epa.gov/otaq/transp.htm>.

Regional Offices

<http://www.epa.gov/otaq/transp/conform/contacts.htm>.

GLOSSARY

1-Hour Ozone NAAQS	The 1-hour ozone national ambient air quality standard codified at 40 CFR 50.9.
8-Hour Ozone NAAQS	The 8-hour ozone national ambient air quality standard codified at 40 CFR 50.10.
Area source	Small stationary and non-transportation pollution sources that are too small and/or numerous to be included as point sources but may collectively contribute significantly to air pollution (i.e. dry cleaners).
Attainment area	An area considered to have air quality that meets or exceeds the U.S. Environmental Protection Agency (EPA) health standards used in the Clean Air Act. An area may be an attainment area for one pollutant and a nonattainment area for others. Nonattainment areas are areas considered not to have met these standards for designated pollutants.
Carbon monoxide (CO)	A colorless, odorless, tasteless gas formed in large part by incomplete combustion of fuel. Human activities (i.e. transportation or industrial processes) are largely the source for CO contamination in ambient air.
Conformity	Process to assess the compliance of any transportation plan, program, or project with air quality implementation plans. The conformity process is defined by the Clean Air Act and regulated by the conformity rule.
Congestion Management and Air Quality Improvement Program (CMAQ)	A categorical funding program under the Federal-aid Highway Program. Directs funding to projects that contribute to meeting or maintaining National air quality standards in nonattainment and maintenance areas. CMAQ funds generally may not be used for projects that result in the construction of new capacity available to SOVs (single-occupant vehicles).
Emissions inventory	A complete list of sources and amounts of pollutant emissions within a specific area and time interval.
Environmental Protection Agency (EPA)	EPA is the Federal regulatory agency responsible for administering and the enforcement of Federal environmental laws including the Clean Air Act, the Clean Water Act, the Endangered Species Act, and others.
Federal Highway Administration (FHWA)	An agency of the U.S. Department of Transportation that funds highway planning and programs.
Federal Transit Administration (FTA)	An agency of the U.S. Department of Transportation that funds transit planning and programs.

High Occupancy Vehicles (HOVs)	Generally applied to vehicles carrying three or more people; freeways, expressways and other large volume roads may have lanes designated for use by carpools, vanpools, and buses. The term HOV is also sometimes used to refer to high-occupancy vehicle lanes themselves.
Highway	Term applies to roads, streets, and parkways, and also includes rights-of-way, bridges, railroad crossings, tunnels, drainage structures, signs, guardrails, and protective structures in connection with highways.
Hydrocarbons (HC)	Colorless gaseous compounds originating from evaporation and the incomplete combustion of fossil fuels.
Inspection and Maintenance Program (I/M)	An emissions testing and inspection program implemented to ensure that the catalytic or other emissions control devices on in-use vehicles are properly maintained over time.
Land use	Refers to the manner in which portions of land or the structures on them are used (i.e., commercial, residential, retail, industrial, etc.).
Maintenance area	Means any geographic region of the United States previously designated nonattainment pursuant to the CAA Amendments of 1990 and subsequently redesignated to attainment subject to the requirement to develop a maintenance plan under section 175A of the CAA, as amended.
Metropolitan Planning Organization (MPO)	The organizational entity designated by law with lead responsibility for developing transportation plans and programs for urbanized areas of 50,000 or more in population. MPOs are established by agreement of the Governor and units of general-purpose local government, which together represent 75 percent of the affected population of an urbanized area.
Mobile sources	Mobile sources include motor vehicles, aircraft, seagoing vessels, and other transportation modes. The mobile source related pollutants are carbon monoxide (CO), hydrocarbons (HC) or volatile organic compounds (VOCs), nitrogen oxides (NO _x), and small particulate matter (PM-10).
Mode	A form of transportation such as an automobile, bus or bicycle.
Motor Vehicle Emissions Budget	is that portion of the total allowable emissions defined in the submitted or approved control strategy implementation plan revision or maintenance plan for a certain date for the purpose of meeting reasonable further progress milestones or demonstrating attainment or maintenance of the NAAQS, for any criteria pollutant or its precursors, allocated to highway and transit vehicle use and emissions.
National Ambient Air Quality Standards (NAAQS)	Federal standards that set allowable concentrations and exposure limits for various pollutants. The EPA develops the standards in response to a requirement of the CAA.
National Environmental Policy Act (NEPA)	The National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.). It is the major legislation that requires federal actions to address potential environmental impacts.

Nitrogen Oxides (NOx)	A group of highly reactive gases that contain nitrogen and oxygen in varying amounts. Many of the nitrogen oxides are colorless and odorless. NOx is formed when the oxygen and nitrogen in the air react with each other during combustion. The primary sources of nitrogen oxides are motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels.
Nonattainment area	A geographic region of the United States that the EPA has designated as not meeting the NAAQS.
Oxygenated gasoline	Gasoline enriched with oxygen bearing liquids to reduce CO production by permitting more complete combustion.
Ozone (O3)	Ozone is a colorless gas with a sweet odor. Ozone is not a direct emission from transportation sources. It is a secondary pollutant formed when HC and NOx combine in the presence of sunlight. Ozone is associated with smog or haze conditions. Although the ozone in the upper atmosphere protects us from harmful ultraviolet rays, ground-level ozone produces an unhealthy environment in which to live. Ozone is created by human and natural sources.
Particulate Matter (PM), (PM-10), (PM-2.5)	Any material that exists as solid or liquid in the atmosphere. Particulate matter may be in the form of y ash, soot, dust, fog, fumes, etc. Small particulate matter is too small to be filtered by the nose and lungs. PM-10, is particulate matter that is less than 10 microns in size. PM-2.5 is particulate matter that is less than 2.5 microns in size. A micron is one millionth of a meter.
Parts per million (ppm)	A measure of air pollutant concentrations.
Public participation	The active and meaningful involvement of the public in the development of transportation plans and programs.
Reformulated gasoline (RFG) State Implementation Plan (SIP)	Gasoline specifically developed to reduce undesirable combustion products. A plan mandated by the CAA and developed by the State that contains procedures to monitor, control, maintain, and enforce compliance with the NAAQS.
Stationary source	Relatively large, fixed sources of emissions (i.e. chemical process industries, petroleum refining and petrochemical operations, or wood processing).
Telecommuting	The substitution, either partially or completely, or transportation to a conventional office through the use of computer and telecommunications technologies (e.g., telephones, personal computers, modems, facsimile machines, electronic mail).
Transit	Generally refers to passenger service provided to the general public along established routes with fixed or variable schedules at published fares. Related terms include: public transit, mass transit, public transportation, urban transit and paratransit.

Transportation Control Measures (TCMs)	Any measure that is specifically identified and committed to in the applicable implementation plan that is either one of the types listed in section 108 of the CAA, or any other measure for the purpose of reducing emissions or concentrations of air pollutants from transportation sources by reducing vehicle use or changing traffic flow or congestion conditions. Notwithstanding the first sentence of this definition, vehicle technology-based, fuel-based, and maintenance-based measures which control the emissions from vehicles under fixed traffic conditions are not TCMs for the purposes of transportation conformity.
Transportation Improvement Program (TIP)	Also known as a transportation program, a TIP is a program of transportation projects drawn from, or consistent with, the transportation plan and developed pursuant to Title 23, U.S.C. (United States Code) and the Federal Transit Act. This document is prepared by metropolitan planning organizations listing projects to be funded with FHWA/FTA funds for the next one- to three-year period.
Transportation plan	This is a long-range plan that identifies facilities that should function as an integrated transportation system, and developed pursuant to Title 23, U.S.C. (United States Code) and the Federal Transit Act. It gives emphasis to those facilities that serve important national and regional transportation functions, and includes a financial plan that demonstrates how the long-range plan can be implemented.
U.S. Department of Transportation (DOT)	The principal, direct, Federal-funding agency for transportation facilities and programs. Includes the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), the Federal Railroad Administration (FRA), and others.
Vehicle Miles Traveled (VMT)	The sum of distances traveled by all motor vehicles in a specified region.
Volatile Organic Compounds (VOCs)	VOCs come from vehicle exhaust, paint thinners, solvents, and other petroleum-based products. A number of exhaust VOCs are also toxic, with the potential to cause cancer.