

ENVIRONMENTAL PROTECTION AGENCY

[AMS-FRL-4115-8]

VMT Forecasting and Tracking -- Notice of Availability

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of Availability of Section 187 VMT Forecasting and Tracking Guidance.

SUMMARY: Today's action provides notice of available guidance on how to forecast and track vehicle miles traveled (VMT) in Moderate and Serious carbon monoxide (CO) non-attainment areas with design values greater than 12.7 ppm at the time of classification. This guidance is required by Section 187(a) of the Clean Air Act Amendments of 1990 (CAAA).

The guidance states that estimates of actual annual VMT in areas subject to the Section 187 requirements should be obtained from the Highway Performance Monitoring System (HPMS). A state containing such an area should commit in its State Implementation Plan (SIP) to follow the Department of Transportation, Federal Highway Administration guidance in sampling for HPMS, with separate urbanized area sampling for the affected areas in 1993 and later calendar years. The HPMS VMT estimates will be used to track actual VMT.

The guidance also states that VMT forecasts should be based on a validated network-based travel demand modeling process meeting certain requirements, except that in Moderate areas without a currently validated travel demand model that meets these requirements, VMT forecasts may be based on the HPMS.

Further, the guidance discusses the criteria for determining whether actual VMT or an updated forecast is greater than a prior forecast.

Finally, the guidance discusses the linkage between forecasted VMT and the several CO emission inventories required by the Amendments.

As required by Section 187 of the CAAA, the guidance was developed in consultation with the U.S. Department of Transportation.

**TO OBTAIN A COPY OF THE GUIDANCE:** Please send requests by FAX or by mail to Natalie Dobie. FAX: (313) 668-4368 or FTS 374-8368. Mailing address: Test and Evaluation Branch, U.S. EPA Motor Vehicle Emission Laboratory, 2565 Plymouth Road, Ann Arbor, MI 48105.

**FOR FURTHER INFORMATION CONTACT:** Natalie Dobie or Mark A. Wolcott, Test and Evaluation Branch, U.S. EPA Motor Vehicle Emission Laboratory, 2565 Plymouth Road, Ann Arbor, MI 48105. Telephone: (313) 741-7812 or (313) 668-4219, FTS 374-8812 or 374-8219.

**SUPPLEMENTARY INFORMATION:** Section 187(a)(2)(A) of the CAAA requires that states containing a Moderate and/or Serious CO non-attainment area with a design value greater than 12.7 ppm at the time of classification must forecast vehicle miles traveled in the

non-attainment area for each year before the attainment year. The first forecast is due no later than November 15, 1992. The VMT forecast for the attainment year is the basis for the area's attainment demonstration. The intermediate forecasts act as milestones for progress towards attainment.

Annual updates of the annual VMT forecasts must be submitted to EPA along with annual reports regarding the extent to which such forecasts have proven to be accurate. These reports must contain estimates of actual vehicle miles traveled in each year for which the forecast was required.

Although the Section 187 VMT Forecasting and Tracking Guidance does not identify the required contingency measures to be implemented if a VMT forecast is exceeded by either actual VMT or an updated forecast nor does it discuss the process for their implementation, the contingency measures and the implementation process will be discussed in future EPA guidance.

Dated: March 12, 1992

(signed)  
William K. Reilly  
Administrator



U.S. Department of  
Transportation

Office of the Secretary  
of Transportation

Office of Assistant Secretary

400 Seventh St., S.W.  
Washington, D.C. 20590

DEC 23 1991

Refer to: HEP-22

Mr. Richard D. Wilson  
Director, Office of Mobile Sources  
US Environmental Protection Agency  
Washington, D.C. 20460

Dear Mr. Wilson:

I am writing in response to your October 30, 1991, letter transmitting the VMT Forecasting and Tracking Guidance required by Section 187 of the Clean Air Act Amendments of 1990. This letter is our formal acknowledgement that the consultation required under the Clean Air Act in the preparation of this guidance has indeed taken place.

As you know, EPA and DOT have been working diligently in the preparation of this guidance since March 1991. This effort has resulted in a product that we believe addresses the Section 187 requirement and represents good planning practice. The "Final Draft" dated November 1991 (with subsequent modifications to provide for (1) a phase-in for improved VMT estimation over time and (2) alternative approaches to estimating transit travel), represents EPA/DOT agreement on appropriate methods for VMT estimating and forecasting.

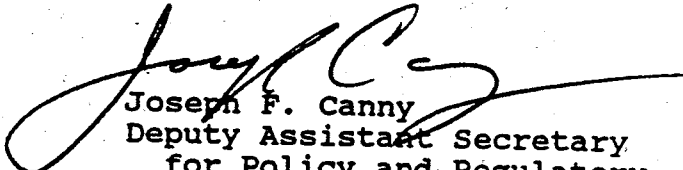
From the outset, both EPA and DOT have been concerned that the methods and procedures contained in the guidance appropriately consider the analytical and resource capabilities of States and MPOs, and the state-of-the-practice. This is of particular concern since these methods for estimating VMT will be applicable to both serious and above Ozone nonattainment areas as well as the CO nonattainment areas specified in the guidance. In addition, we wanted to make the best use of data collection and analyses already in place to keep additional costs for States and MPOs to a minimum. We also wanted to use a methodology which provided consistent validity across the country. The use of the Highway Performance Monitoring System (HPMS) as a base achieves these objectives in most cases.

While DOT believes that the methods in the Guidance represent "best practice," not all States and MPOs are currently up to this level of application. Some areas will require some flexibility and time to upgrade to existing procedures. For

example, several States and MPOs have voiced concern over the current adequacy of local traffic counting programs and HPMS as a basis for the nonattainment area VMT estimates, as well as the precision level assumed in this data by the guidance. In response to these concerns, we fully support the "phasing-in" of required precision levels for estimated VMT for 1993, 1994, and 1995. This "phase-in" recognizes that initially there will be significant unknowns, but that data collection and analytical processes will be improved over time. While we cannot be certain that a 3 percent variance in the HPMS-based VMT estimate is achievable by 1995 due to uncertainties involved in the precision of the data, DOT does support the 3 percent limit as a goal. The new requirements in the Intermodal Surface Transportation Efficiency Act and the Clean Air Act Amendments will push us towards this goal.

We look forward to a continued close association with EPA in the implementation of these and other initiatives related to the Clean Air Act Amendments. EPA has indicated that additional, more in-depth guidance will be developed to assist States and MPOs in using the VMT guidance. We offer our support and would appreciate being involved in this effort.

Sincerely,



Joseph F. Canny  
Deputy Assistant Secretary  
for Policy and Regulatory  
Affairs



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## 1.0 PURPOSE, BACKGROUND, AND GENERAL APPROACH

### 1.1 Purpose

This guidance is required by Section 187(a) of the Clean Air Act Amendments of 1990 (CAAA). It offers the Environmental Protection Agency's (EPA's) recommendations on how to forecast and track vehicle miles traveled (VMT) in Moderate and Serious carbon monoxide (CO) non-attainment areas with design values greater than 12.7 ppm at the time of classification.

The purpose of this guidance is to help states prepare State Implementation Plan (SIP) revisions that EPA can readily propose to approve as meeting the requirements of the CAAA. If a state adheres to the guidance, EPA will propose approval of its SIP. A state intending to depart from the guidance, however, should show that the alternative approach it proposes is technically sound and adequate to meet the requirements of the CAAA. EPA will review SIP submittals from such states on a case-by-case basis to determine whether they do in fact comply with the CAAA requirements. States are encouraged to obtain EPA approval before using methods other than those specified in this guidance, in order to avoid later problems.

Each state may assign its responsibilities, as specified in this guidance, to various state organizations as it sees fit. EPA will coordinate its responsibilities under the guidance with the Federal Highway Administration.

This guidance does not establish or affect legal rights or obligations. It does not establish a binding norm, and it is not finally determinative of the issues addressed. Agency decisions in any particular case will be made by applying the applicable law and regulations to the specific facts of that case. In any proceeding in which the policy articulated in this guidance may be applied, the Agency will thoroughly consider the policy's applicability to the facts, the underlying validity of the policy, and whether changes should be made in the policy based on submissions made by any person.

### 1.2 Overview of Carbon Monoxide Air Quality Planning Requirements of the Clean Air Act Amendments of 1990

Under the Clean Air Act Amendments of 1990 states have the responsibility to inventory emissions contributing to violations of the National Ambient Air Quality Standards (NAAQS), to track these emissions over time, and to ensure the implementation of control strategies that reduce emissions and move areas toward attainment.

The CAAA establish non-attainment area classifications and control program requirements ranked according to the severity of a carbon monoxide non-attainment area's air pollution problem.

There are two CO non-attainment classifications: Moderate and Serious. In addition, for the purposes of Section 187(a)(2)(A), "Vehicle Miles Traveled," the subject of this guidance, the Moderate classification is divided into two sub-classifications on the basis of design value: 12.7 ppm and lower, and greater than 12.7 ppm. This guidance applies to CO non-attainment areas with design values greater than 12.7 ppm.<sup>1</sup>

<sup>1</sup> The areas currently affected are the following. (For a complete listing of non-attainment area classifications and designations, see the Federal Register Notice "Designation of Areas for Air Quality Planning Purposes" published on November 6, 1991.)<sup>a</sup>

Area Name	Design Value (ppm)	Classification
Anchorage, AK	13.1	Moderate
Denver-Boulder, CO	16.2	Moderate
Fresno, CA	13.0	Moderate
Las Vegas, NV	14.4	Moderate
Los Angeles South Coast Air Basin, CA	23.4	Serious
New York-N. New Jersey-Long Island, NY-NJ-CT	13.5	Moderate
Provo, UT <sup>b</sup>	15.8	Moderate
Seattle-Tacoma, WA	13.4	Moderate
Spokane, WA	13.8	Moderate

<sup>a</sup> The attainment designation for the area encompassed by Jefferson County, OH, Brooke County, WV, and Hancock County, WV is not final. At the date of enactment of the CAAA, the area was designated unclassifiable/attainment, but

Section 187(a) requires Moderate CO non-attainment areas to submit a comprehensive, accurate, current inventory of actual emissions from all sources, as described in Section 172(c)(3). The inventory is defined as the base year inventory and is for the calendar year 1990. EPA has instructed states to submit draft base year inventories between January and March of 1992. The inventory must report actual CO emissions during the peak CO season for the non-attainment area.<sup>2</sup> All stationary point and area sources and all highway/non-highway mobile sources<sup>3</sup> must be included in the inventory.

Section 187(a)(2)(A) requires that states containing a Moderate and/or Serious CO non-attainment area with a design value greater than 12.7 ppm at the time of classification must forecast vehicle miles traveled in the non-attainment area for each year before the attainment year. The first forecast is due no later than November 15, 1992. The VMT forecast for the attainment year is the basis for the area's attainment demonstration. The intermediate forecasts act as milestones for progress towards attainment.

Annual updates of the annual VMT forecasts must be submitted to EPA along with annual reports regarding the extent to which such forecasts have proven to be accurate. These reports shall contain estimates of actual vehicle miles traveled in each year for which the forecast was required.

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these states and EPA are reviewing whether to confirm or reverse this designation and will publish a separate notice to that effect. (Federal Register, Vol. 56, No. 215, November 6, 1991.)

<sup>b</sup> Only the city of Provo was designated non-attainment by operation of law under Section 107(d)(1)(C) of the CAAA, and the rest of Utah County remained unclassifiable/attainment. However, the state and EPA are reviewing whether to confirm or reverse that designation under the process set out under Section 107(d)(4)(A) and will publish a separate notice to that effect. (Federal Register, Vol. 56, No. 215, November 6, 1991.)

<sup>2</sup> For most CO non-attainment areas, this will be the winter months of November, December, 1990 and January, 1991.

<sup>3</sup> All states except California should use an updated version of the mobile source emission factor model (MOBILE4.1) to estimate mobile source emissions. The updated model replaces MOBILE4 and should be used in the development of all 1990 base year inventories.

The statutory requirement for annual VMT reports suggests that Congress intended the reports, and any action that they indicate is necessary, to be completed reasonably soon after the close of the reporting period. This guidance, therefore, specifies that annual reports on actual VMT and subsequent forecasts should be submitted annually no later than each September 30. Most states now submit their HPMS data reports to FHWA around June 30, and the additional three months will allow states to respond to FHWA data validity questions and to prepare updated projections, projected-versus-actual comparisons, and other elements of the report for EPA. The first forecast includes the years 1993 and each year prior to the year of attainment. Annual reports must contain estimates of actual VMT in the non-attainment area in each year for which a forecast is required.

Section 187(a)(3) requires that a state subject to the VMT forecasting/tracking provision must provide in its SIP for the implementation of contingency measures if the annual estimate of actual VMT or a subsequent VMT forecast exceeds the most recent prior forecast of VMT or if the area fails to attain the CO NAAQS by the attainment date. These contingency measures must be adopted and enforceable in the SIP and must take effect immediately, without further action by the State or the Administrator, following such an event.

Section 187(a)(4) is a savings provision for existing vehicle inspection/maintenance (I/M) programs.

Section 187(a)(5) requires Moderate CO non-attainment areas to submit periodic (historical) inventories. The first periodic inventory is due no later than September 30, 1995; subsequent inventories are due every three years thereafter until the non-attainment area is redesignated to attainment. The periodic inventory must meet the same requirements as those that apply to the base year inventory.

Section 187(a)(6) requires Moderate CO non-attainment areas with a design value greater than 12.7 ppm to implement an enhanced I/M program in an urbanized area with a 1980 population of 200,000 or more.

Section 187(a)(7) requires that a state containing a Moderate non-attainment area with a design value greater than 12.7 ppm demonstrate that the area will comply with the NAAQS by December 31, 1995. The demonstration must include specific annual emission reductions necessary to achieve attainment by that date.

Section 187(b)(1) requires a state containing a Serious CO non-attainment area to make the same submissions as a state containing a Moderate non-attainment area.

Sections 187(a)(2)(B) and 187(b)(2) require Serious CO non-attainment areas and Denver, Colorado to adopt and implement enforceable transportation control measures (TCMs) to offset any growth in emissions from growth in vehicle miles traveled and numbers of vehicle trips, and to achieve reductions in mobile source emissions as are necessary in conjunction with other control measures to comply with the periodic emission reduction requirements of the CAAA. Section 187(b)(2) also requires Serious CO areas only to adopt an employer-based trip reduction program.

Section 187(c)(2) allows the Administrator to waive any requirements that pertain to transportation controls for CO non-attainment areas in which mobile sources do not contribute significantly to CO levels in the area.

Section 187(d) requires Serious CO non-attainment areas to submit to EPA by March 31, 1996 a demonstration that the emission reductions anticipated to occur by December 31, 1995 as specified in the 1992 State Implementation Plan revision have, indeed, occurred. Serious CO non-attainment areas that miss this milestone must submit to EPA a SIP revision to implement an economic incentive and transportation control program sufficient to achieve the annual emission reductions specified in the SIP by the attainment date. This SIP revision is due within nine months of a failure to make the demonstration or of EPA's notification of an inadequate demonstration.

Sections 187(b)(3) and 211(m) together require that a state containing a CO non-attainment area with a design value above 9.5 ppm based on 1988 and 1989 data must require that, by November 15, 1992, fuel sold or supplied or offered for sale or supply within the larger of either the Consolidated Metropolitan Statistical Area (CMSA) or Metropolitan Statistical Area (MSA) in which the non-attainment area is located contain 2.7 percent oxygen by weight during the period of high CO concentrations, as determined by the Administrator.

Section 246(a)(2)(B) requires all CO non-attainment areas with a 1980 population of 250,000 or more and a design value of 16.0 ppm or greater to provide for clean-fuel vehicle fleet programs no later than May 15, 1994. The programs must require a specified percentage of fleet vehicles in model year 1998 and thereafter to be clean-fuel vehicles and use clean alternative fuels when operating in the non-attainment area.

### 1.3 General Approach

Air quality forecasting and attainment planning require an estimate of emissions in a certain geographic area in a past period with a known air quality, and forecasts of future emissions under various alternative strategies designed to reduce emissions. Motor vehicles are the dominant source of CO in most non-attainment areas. CO emissions from highway motor vehicles are a

product of gram per mile emission factors (reflecting periods of both travel and parking) and the number of miles driven. The emission factors in turn are a function of trip length and traffic flow, with average traffic speed being the most common indicator of flow.

While trip length and traffic flow characteristics also influence emissions and are to some extent sensitive to influence by clean air programs, the more VMT growth there is in an area, the more effort is required to reduce both per vehicle and stationary source emissions to attain the ambient CO standard by the required deadlines. Consequently, the CO attainment plan is built largely around forecasted VMT in the attainment year.

However, future VMT is dependent on trends in regional population and economic growth, on land and transportation system development patterns, and on the effectiveness of measures to foster the use of alternative modes of transportation. Forecasting VMT is therefore subject to uncertainty.

A feature of the Clean Air Act Amendments of 1990 is annual VMT tracking in CO areas in the period prior to the target attainment date. This is intended to spot situations in which the actual VMT growth occurring in the non-attainment area is higher than the forecasted VMT growth used in the attainment demonstration. Such a situation may arise from higher than expected population or economic growth, or lower than expected success at promoting alternative modes of travel. Under these circumstances, attainment is in jeopardy, and action beyond that originally contemplated in the demonstration might be necessary. Such actions include further reducing VMT growth and per mile vehicle emissions, as well as further controlling stationary emissions sources.

Because of the safety-net role played under the CAAA by a good tracking system and contingency measures, uncertainty in the initial VMT forecast is of somewhat less concern than it otherwise might be, since deviations from the forecast can be detected and mid-course corrections can be made to preserve the attainment date. This guidance, therefore, places as much emphasis on a well-defined and quality-assured tracking method as it does on valid forecasting methods. In particular, the guidance specifies the use of systematic traffic ground counts as the underlying data for estimates in the future of actual VMT, at least in the urbanized area. This method is considered by EPA to be superior in terms of both practicality and effectiveness to other methods such as driver surveys, odometer data, registration counts, fuel sales, annually validated network models, etc.

In preparing this guidance, EPA encountered two views among interested parties regarding how ground counts should be used to estimate actual travel in a year just completed. One view supported the approach that has already been institutionalized in the Federal Highway Administration's Highway Performance Monitoring System. In this approach, traffic counts taken at various points on an urban area's road network are directly expanded into an estimate of area-wide VMT using statistics on the number of roadway miles associated with each sampling point.

The other view supported the use of network-based transportation models, which theoretically provide more detail on the location, sources, and purposes of travel. While network-based models begin with only indirect indications of VMT (for example, number of households, household locations, and household trips per day by purpose), their final results are generally validated via comparison to actual ground counts at selected sites, usually sites on major traffic corridors. However, annual updates of household and other input data and annual validation against traffic counts would be too resource intensive to be practical. Therefore, EPA has chosen to specify the use of the HPMS approach in this guidance for purposes of tracking 1993 and later VMT.

Estimating 1990 VMT is a different issue because some areas did not make as full a set of HPMS ground counts as they will be able to in 1993 given this guidance as advance notice, and because validating a network-based model for one historical year is a practical possibility. EPA therefore considered including as an option in the guidance the use of network models to define 1990 VMT, provided that demographic inputs are properly updated to 1990 and the model is validated against 1990 ground counts. However, this method was not considered to be viable for most areas due to the general disrepair of a large number of network models. Areas should use this method only if their network model is particularly strong and their 1990 HPMS data are particularly weak, and only after consulting with EPA.

Since HPMS will be used to track VMT after 1990, areas using a network model to estimate 1990 VMT must accept the risk entailed in comparing data derived from two different estimation methods. If the 1990 VMT estimate from the model is not consistent with later HPMS data, the discrepancy may not be discovered until the later HPMS data are reported, and adjustments will have to be made.

For forecasting VMT, network models were chosen as the best method. Though these models are not considered to be a superior source of historical area-wide VMT, if they are well validated and if they use an equilibrium approach to allocating trips, they are considered to be the best predictor of growth factors for VMT forecasts.

For all areas, estimates of actual 1993 and later vehicle miles traveled should be derived from traffic ground counts consistent with the existing Highway Performance Monitoring System. Since participation in this system is already a requirement of the Federal Highway Administration (FHWA), this approach will involve minor costs above those imposed in the same time period by the FHWA requirement.<sup>4</sup>

Moderate areas, which need to forecast VMT only through 1995, may use a simple, historically based extrapolation method, if a better method is not locally available. The detailed guidance statement that follows provides flexibility for cases in which the accuracy of the historical data is suspect or there are other factors that would discredit this extrapolation method. Serious areas that have not obtained an exemption under Section 187(c)(2) based on stationary source emissions, a group that probably will comprise only the South Coast Air Basin of California, should use a demographically based transportation demand model to forecast VMT growth factors through 2000.

A state may adjust its VMT forecast upward without limit, if it considers a higher forecast more accurate than that developed under this guidance. Also, if a state adopts new or strengthens existing transportation control measures, it may adjust its VMT forecast downward to the degree that the proposed TCMs will change VMT, provided that the effect of such measures is based on sound analytical techniques and is clearly documented in the SIP. EPA will disseminate information on the VMT reduction benefits of TCMs as it is developed by EPA and other organizations active in the area.

The CAAA also require updated forecasts each year. EPA interprets this to be a Congressional desire to make sure that the State Implementation Plan is based on the best VMT information available.

In general, economic factors should inform long-term VMT forecasts when an area uses land use and transportation network travel demand models to forecast VMT.<sup>5</sup> This guidance allows such an approach.

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<sup>4</sup> FHWA is implementing improvements that will add to the reliability of the ground count method in the period in question. States are free to exceed the FHWA requirements.

<sup>5</sup> Metropolitan Washington, D.C., metropolitan Chicago, IL, and the South Coast Air Quality Management District around Los Angeles, CA currently rely upon large forecasting models that explicitly use economic variables.



This guidance only addresses VMT forecasts in CO non-attainment areas with design values greater than 12.7 ppm. CO areas with design values at or below 12.7 ppm are not required to forecast VMT or demonstrate attainment. This guidance does not address requirements for VMT forecasts and tracking in ozone non-attainment areas. Nor does it address VMT forecasts made under the conformity provisions of the CAAA. Also, this guidance does not address issues of speed and other vehicle operating parameters. These topics will be addressed in other guidance documents and/or other Federal Register notices and/or rules.

## 2.0 SUMMARY OF GUIDANCE

### 2.1 Actual Annual Vehicle Miles Traveled

A state containing a Moderate and/or Serious CO non-attainment area with a design value greater than 12.7 ppm at the time of classification should commit in its State Implementation Plan to sample each Highway Performance Monitoring System facility class/volume group separately for each such CO non-attainment area, starting no later than January 1, 1993. This sampling is to be done in accordance with the Department of Transportation, Federal Highway Administration's HPMS guidance, as described in:

U.S.D.O.T.Code	Title
M 5600.1A	Highway Performance Monitoring System (HPMS) Field Manual
M 5600.1A, Chg. 1	Highway Performance Monitoring System (HPMS) Field Manual Updates
M 5600.1A, Chg. 2 (Deleted by Chg. 3)	Highway Performance Monitoring System (HPMS) Field Manual
M 5600.1A, Chg. 3	Highway Performance Monitoring System (HPMS) Field Manual

and the traffic monitoring guidance described in:

the Traffic Monitoring Guide, June, 1985, U.S. Department of Transportation, Federal Highway Administration, Office of Highway Planning,

for the purposes of:

1. estimating 1990 actual area-wide VMT in the designated VMT Tracking Area. Methods other than HPMS may be used to estimate that portion of 1990 VMT that occurs outside of the Federal Aid Urbanized Area (FAUA).<sup>6</sup> (A state that does not sample each FAUA separately and cannot supplement its HPMS data with other counts not reported to HPMS but has a well-maintained network model that is validated with 1990 ground counts will have the flexibility to use the network model rather than HPMS to estimate 1990 VMT.)
2. estimating 1993 and later calendar years' actual area-wide VMT in the designated VMT Tracking Area. These estimates of actual area-wide VMT will be used in tracking both actual VMT and calculated emission inventories. Methods other than HPMS may be used to estimate that portion of 1993 and later VMT that occurs outside of the FAUA.

Under certain conditions, a state with a localized CO non-attainment problem may use an alternative to HPMS for estimating VMT, if the alternative is documented and justified in the SIP.

## 2.2 Forecasted Vehicle Miles Traveled

All states containing Moderate and/or Serious CO non-attainment areas with design values greater than 12.7 ppm at the time of classification must forecast annual VMT for each year from 1993 until the year in which the SIP forecasts attainment.

### 2.2.1 Serious Areas

All states containing a Serious CO non-attainment area<sup>7</sup> should forecast VMT in the VMT Tracking Area by applying growth factors based on a validated network-based travel demand modeling process (the "Network Travel Demand Model Method") to the actual annual 1990 VMT described in Section 3.0, "1990 VMT Estimation and VMT Tracking." Details of this application are described in Section 4.2, "Network-Based Travel Demand Modeling Process Methodology."

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<sup>6</sup> The Federal Aid Urbanized Area is the area within the boundary jointly developed by state and local officials and approved by the Department of Transportation Federal Highway Administration to serve the federal aid highway program needs and requirements. Boundary maps are available from state Departments of Transportation and FHWA Division offices.

<sup>7</sup> Only the Los Angeles South Coast Air Basin non-attainment area is so designated.

### 2.2.2 Moderate Areas

All states containing a Moderate CO non-attainment area with a design value greater than 12.7 ppm at the time of classification should forecast VMT in the VMT Tracking Area by the method just described for Serious CO areas if validated travel demand models are currently available or if such models could be made available in time to allow the required SIP revisions and submissions.

If the lead planning agency for a Moderate CO area, in consultation with appropriate other state and local organizations, determines that a validated travel demand model is currently unavailable and that such a model cannot be made available in time to allow the required SIP revisions and submissions, then the state may submit a request to the EPA Regional Administrator for an EPA commitment to propose approval of a SIP based on the Historical VMT Method, discussed in Section 4.3, "Historical Area-Wide VMT Method." The EPA Regional Administrator will review the request in consultation with the Federal Highway Administration Regional Office and will attempt to respond to the request within 30 days.

A state that uses an alternative to HPMS to estimate and track VMT may base its VMT forecasts on growth factors derived from the historical data collected for the alternative program.

### 2.3 Determining Whether a Forecast Has Been Exceeded

EPA has determined, in consultation with the Department of Transportation, that there is a statistical variability in the estimates of actual annual VMT generated through HPMS. Since forecasts of future VMT are based upon past VMT levels also generated from HPMS, using the "Historical Area-Wide VMT Method," this statistical variability similarly applies to VMT forecasts. Given the statistical variability in these numbers, EPA believes that it is appropriate to conclude that an estimate of actual annual VMT or a subsequent forecast of future VMT has exceeded the most recent prior forecast of VMT in any year only if the difference between the two numbers exceeds the statistical variability in the accuracy of the numbers themselves. Although EPA is confident that this statistical variability exists and always will, EPA is not certain of the exact magnitude of the variability. Presently, EPA's best estimate of the variability of HPMS estimates and forecasts based on recent traffic counts is five percent. However, since EPA expects states to improve their HPMS programs over the next few years in response to FHWA guidance and this EPA guidance, EPA anticipates that the variability will be reduced to three percent.

Thus, EPA believes it is appropriate to allow a margin of error of 5.0 percent for VMT comparisons made in 1994 based on HPMS data collected for 1993, a margin of 4.0 percent for VMT comparisons made in 1995 based on HPMS data collected for 1994, and a margin of 3.0 percent for VMT comparisons made in 1996 and thereafter based on HPMS data collected for 1995 and later years.

So, in 1994, the estimate of actual VMT for 1993 will be considered to exceed the most recent prior forecast, if the estimate of actual VMT is more than 5.0 percent greater than the prior forecast of 1993 VMT submitted by November 15, 1992. In 1995, the estimate of actual 1994 VMT will be considered to exceed the most recent prior forecast, if the estimate of actual VMT is more than 4.0 percent greater than the prior forecast of 1994 VMT reported in 1994. In 1996 and later years, an estimate of actual VMT will be considered to exceed the most recent prior forecast if the estimate of actual VMT exceeds by more than 3.0 percent the most recent prior forecast for the same year.

The same margin of error applies in each year for comparisons of an updated forecast to the most recent prior forecast. For example, in a Moderate area that forecasts VMT through 1995, a prior forecast will be considered to be exceeded in 1994, if either the 1994 or 1995 updated VMT forecast is more than 5.0 percent greater than the previous forecast for the corresponding year, submitted by November 15, 1992. For a Moderate area making comparisons in 1995, its updated VMT forecast for 1995 will be considered to exceed the prior forecast for that year, if the updated forecast is more than 4.0 percent above the prior forecast.

However, it is possible that both the estimate of actual VMT and the updated VMT forecast could routinely exceed the most recent prior VMT forecast. Since each such revised forecast becomes the VMT baseline for triggering contingency measures, the application of a margin of error every year could allow the forecasts to increase without bound, without ever triggering contingencies.

In light of EPA's uncertainty as to the exact magnitude of the statistical variability in VMT calculations, and EPA's concern about the implications for SIP planning presented by the potentially uncontrolled VMT growth that can result from the application of a statistical error band every year, EPA believes that a cap must be imposed to prevent VMT estimates and forecasts from exceeding a defined margin above the VMT forecast relied upon as the basis of the approved attainment demonstration for a non-attainment area. Thus, while EPA believes that it is appropriate to allow areas the benefit of the 5.0, 4.0, or 3.0 percent variability, EPA believes that it is

appropriate only as long as, cumulatively, estimates of actual VMT or VMT forecasts never exceed by more than 5.0 percent the VMT forecast relied upon in the area's attainment demonstration.

In practice, then, there are two ways in which an estimate of actual VMT or an updated forecast can be found to exceed a prior forecast. Individual yearly comparisons can result in an exceedance of the prior forecast by more than the prescribed percentage for that year, and exceedances can accumulate so that, cumulatively, they exceed the 5.0 percent "exceedance budget", which is based on the attainment demonstration forecast. So, even though actual VMT or an updated forecast remains within the error band around the most recent prior forecast for a particular year, the individual exceedance for that year plus the exceedances accumulated over previous years could amount to more than 5.0 percent above the forecast used in the attainment demonstration, thus triggering the automatic contingency measures.

### 3.0 1990 VMT ESTIMATION AND VMT TRACKING

#### 3.1 Period and Geographic Coverage

EPA has based the implementation of Section 187(a)(2)(A) on annual VMT, since this is most in keeping with current practice. VMT estimates for other spatial and temporal resolutions are needed for inventories and will be calculated from the annual VMT by the use of adjustment factors.

The geographic boundaries of the CO non-attainment areas affected by this guidance, along with a complete listing of non-attainment area designations and classifications, were published in the Federal Register on November 6, 1991. The designated area might, in some cases, be smaller than the urbanized area. In other cases the non-attainment area may extend out to the limits of the MSA.

Since the HPMS system cannot spatially resolve VMT within the boundaries of the FHWA-defined Federal Aid Urbanized Area and since the Federal Aid Urbanized Area, in turn, may not fully encompass the non-attainment area and generally does not follow political subdivisions, states should identify a "VMT Tracking Area" for purposes of VMT forecasting and tracking.

The boundaries of the VMT Tracking Area should be consistent with those of the several CO inventories required of CO non-attainment areas to the extent that VMT in the areas can be logically related. In addition, the boundaries generally should be not smaller than the FAUA that contains or overlays the designated non-attainment area since HPMS produces a statistically valid sample only for the FAUA as a whole. However, a Tracking Area smaller than the FAUA may be appropriate if it encompasses all vehicle travel contributing to the non-attainment situation and if the state or another designated entity operates a VMT tracking system equivalent in performance to HPMS for that area. The VMT Tracking Area need not exceed the limits of the MSA (unless adjacent areas are involved in the non-attainment area).

The MSA itself may be the most convenient choice for the VMT Tracking Area. The estimated VMT would, in that case, include the VMT within the FAUA, estimated directly from HPMS, plus the VMT in the remainder of the VMT Tracking Area, estimated by a method selected by the state after consultation with the lead planning agency for the area.

### 3.2 Highway Performance Monitoring System

All states containing a Moderate and/or Serious CO non-attainment area with a design value greater than 12.7 ppm at the time of classification should estimate actual annual VMT using the Department of Transportation, Federal Highway Administration's Highway Performance Monitoring System, according to guidance listed in Section 2.1. Actual annual VMT should be derived from estimates of VMT on all functional systems within the corresponding Federal Aid Urbanized Area.<sup>8</sup>

All states, except for the states of California, Connecticut, Florida, Hawaii, Maine, Michigan, Missouri, North Carolina, New York, Ohio, Oregon, South Carolina and Washington, should base their 1990 estimates of actual annual VMT on unique sample panels for each Federal

<sup>8</sup> States may obtain prior approval from the EPA Regional Administrator to supplement the 1990 HPMS counts with counts not submitted to HPMS, if the collection of those individual non-HPMS counts equals or exceeds in reliability the specifications for such counts listed in the the Department of Transportation's publications, as described in Section 2.1.

Aid Urbanized Area within the state, since sampling has already occurred at that level of geographic detail.<sup>9</sup>

The excepted states have three options:

1. An excepted state may allocate its state-wide HPMS estimate of 1990 VMT in all Federal Aid Urbanized Areas to the given Federal Aid Urbanized Area on the basis of the population aged 16 years and older within the associated Federal Aid Urbanized Area in comparison to the population aged 16 years and older within all Federal Aid Urbanized Areas within the state. This allocation should be done separately for rural, small urban, and urban areas.
2. An excepted state may also request approval from the EPA Regional Administrator to supplement any available 1990 HPMS counts for the affected area with sufficient non-HPMS counts to allow an area-specific VMT estimate. Non-HPMS counts should be used only if the collection of those individual counts equals or exceeds in reliability the specifications for such counts listed in the the Department of Transportation's publications, as described in Section 2.1.
3. Finally, an excepted state may use a method of its own choosing, provided the method is well documented and justified in the SIP, to estimate 1990 VMT in each urban area on the basis of the area-wide VMT submitted to the FHWA under HPMS.<sup>10</sup>

All states subject to the VMT forecasting/tracking provision should base their 1993 and later calendar year's estimates of actual annual VMT on separate Federal Aid Urbanized Area sampling. All counts used in the VMT estimates should also be submitted as HPMS counts, so that they meet the HPMS quality assurance guidance and are subject to FHWA review.

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<sup>9</sup> The states of California, Florida, Hawaii, Maine, Michigan, Missouri, North Carolina, Oregon, South Carolina and Washington base HPMS VMT estimates on one or more collective sample panels while the states of Connecticut, New York and Ohio base HPMS VMT estimates on a combination of individual and collective sample panels.

<sup>10</sup> These estimates are considered by FHWA to be of less uniformly certain reliability than the area-specific estimates from states that complete full HPMS ground counts in each urban area, but in individual cases they may be of equal reliability depending on the method used by the state.

Three additional options for estimating 1990 VMT in unusual circumstances are described below in the sections titled "HPMS-Like Alternative," "Areas Using Network-Based Models to Estimate 1990," and "VMT Estimates for Localized Non-Attainment Problem."

### 3.3 Local Functional System VMT Estimates

While HPMS includes state-provided estimates of VMT on the local functional system, these estimates are not generally based on current ground counts at statistically representative sites. Instead the estimates are based on a method chosen by the state in light of its own circumstances. States may continue to use the same methodology to estimate actual 1990, 1993, 1994 and 1995 VMT on the local functional system within the VMT Tracking Area.<sup>11</sup>

If, after a state submits its VMT forecast and attainment demonstration, it wishes to change the methodology it uses to estimate actual VMT on the local functional system within the Federal Aid Urbanized Area, it should re-estimate, or re-forecast, as appropriate, 1990, 1993, 1994, and 1995 VMT on that system using the same alternative methodology for each year.

Proper estimation of actual travel on the local functional system is most important for areas subject to the highest ambient CO concentrations but will require some lead time. Therefore, states containing areas designated as Serious CO non-attainment areas at the time of classification should, by June 30, 1994, propose to and obtain approval from the EPA Regional Administrator for a method to estimate VMT on the local functional system within the Federal Aid Urbanized Area by a count-based methodology equivalent to that described in Section 2.1, to take effect no later than January 1, 1995. The EPA Regional Administrator will consult with FHWA when considering the proposed count-based methodology.

### 3.4 VMT Estimates Outside of the Federal Aid Urbanized Area

States may use any reasonable methodology to estimate 1990, 1993, 1994, and 1995 VMT on the separate functional systems within the VMT Tracking Area but outside of the associated Federal Aid Urbanized Area.

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<sup>11</sup> A state may substitute, for the 1990 estimate of actual VMT accumulated on the local functional system, a methodology superior to that used in the past, provided that the substitution is reflected in both its VMT forecast and its attainment demonstration.



If, after a state submits its VMT forecast and attainment demonstration, it wishes to change the methodology it uses to estimate actual VMT on the separate functional systems within the VMT Tracking Area but outside of the associated Federal Aid Urbanized Area, the same procedures apply as given above for changes in the method used to estimate VMT on the local functional system within the FAUA.

As with count-based estimates of travel on the local functional system within the FAUA, EPA believes that accurate estimates of VMT outside of the FAUA are necessary in those areas subject to the highest CO concentrations. Therefore, states containing areas designated as Serious CO non-attainment areas at the time of classification should, by June 30, 1994, propose to and obtain approval from the EPA Regional Administrator for a method to estimate VMT on the separate functional systems within the VMT Tracking Area but outside of the associated Federal Aid Urbanized Area by a count-based methodology equivalent to that described in Section 2.1, to take effect no later than January 1, 1995. The EPA Regional Administrator will consult with FHWA when considering the proposed count-based methodology.

### 3.5 HPMS-Like Alternative

Under certain conditions, a state may use an alternative to HPMS to estimate actual VMT. If a state or other entity operates an HPMS-like system to track VMT within an area that encompasses all vehicle travel contributing to the non-attainment situation and this alternative system is equivalent to HPMS in terms of providing a reliable and accurate VMT estimate for the area and if it conforms to Federal Highway Administration guidance, the state can use this alternative system to estimate actual VMT. In order for this method to be used, adequate data for making forecasts for this area should also be available. (See Section 4.3, "Historical Area-Wide VMT Method," below). The area and the alternative system should be well documented and justified in the SIP, and the SIP should demonstrate that the conditions of this paragraph have been met. In this case, the area covered by the alternative system would be the VMT Tracking Area.

### 3.6 Areas Using Network-Based Models to Estimate 1990 VMT

Since 1990 ground counts submitted to HPMS may not be as comprehensive as ground counts submitted for 1993 and later and since it may be possible for network-based travel demand models to be validated for 1990, this guidance allows for the use of travel demand models to estimate 1990 VMT under certain circumstances.

An affected area with a strong network-based travel demand model that is based on reasonably recent demographic trip-making data may use its model to estimate 1990 VMT after consultation with EPA and under the following conditions:

1. Urban areas within the state were not sampled separately under HPMS in 1990;
2. The state cannot supplement the available HPMS data with non-HPMS counts;
3. The model is validated with 1990 counts;
4. The model uses demographic inputs properly updated to 1990.

An area using this method should make sure that all VMT in the entire VMT Tracking Area is included in the estimate. Most network-based models normally do not account for intra-zonal trips or trips on functional classes outside of the modeling area. States may use any reasonable method to estimate VMT on those functional classes that are within the VMT Tracking Area but that are not included in the model.

### 3.7 VMT Estimation for Localized Non-Attainment Problem

If a state containing a Moderate CO non-attainment area covered under this guidance receives prior approval for an attainment demonstration that addresses only locally generated vehicle emissions in a finite number of specific intersections or other localized areas of high CO concentrations (such that virtually all trips in each area originate or terminate outside it), the state, with prior approval from the EPA Regional Administrator, may estimate and track the traffic across the boundaries of each of the specified areas, rather than VMT over a wider area. Monitoring should include all approaches to the area, meet FHWA guidance, and occur during the CO season on those days of the week and times of day when CO exceedances occur. Base-year counts should be taken within the 1987-92 period and should be adjusted for area-wide growth to 1990.

## 4.0 VMT FORECASTING FOR 1992 SIP SUBMITTAL

### 4.1 Forecasting Years

By November 15, 1992, affected states must forecast VMT in the VMT Tracking Area, for 1993 and each subsequent year until the year in which the SIP forecasts the primary National Ambient Air Quality Standard for carbon monoxide will be attained.

Since Moderate non-attainment areas must attain the primary National Ambient Air Quality Standard for carbon monoxide by December 31, 1995, an affected state must, by November 15, 1992, forecast 1993, 1994, and 1995 VMT unless the SIP demonstrates that the area will reach attainment prior to 1995, in which case the state only needs to forecast VMT through the year of attainment.

Since Serious non-attainment areas must attain the primary National Ambient Air Quality Standard for carbon monoxide by December 31, 2000, a state containing an area designated as a Serious non-attainment area at the time of classification must, by November 15, 1992, forecast 1993, 1994, 1995, 1996, 1997, 1998, 1999, and 2000 VMT, unless the SIP demonstrates that the area will reach attainment prior to 2000, in which case no forecast is required for years after the attainment date.

#### 4.2 Network-Based Travel Demand Modeling Process Methodology

The network-based travel demand modeling process brings together an area's highway and transit network, demographic information, land-use forecasts, and trip characteristics to project travel volumes and patterns. An area is represented by zones of activity, which are further defined and connected by links of the roadway system. Through a series of steps, including trip generation, trip distribution, mode choice, and trip assignment, the travel demand modeling process allocates travel on the network.

Due to the range of inputs used, the travel demand modeling process provides more complete information from which to determine VMT than other forecasting methods. Network-based travel demand forecasting models are available for use on microcomputers.

It is not necessary for regional transportation models to treat the transit network in as sophisticated a manner as the highway network is treated in all cities for purposes of accounting for the effect of transit on regionwide VMT. There are alternative approaches that can be used to estimate the effects of transit travel on regionwide VMT. In most areas these alternatives can be employed at significantly lower cost without sacrificing accuracy.

Where local planners do not envision a significant systemwide change in the transit network through investment in new transit infrastructure or a significant increase in highway congestion that would make transit more attractive as an alternative, transit travel may usually be taken into account simply by subtracting flat percentages of Central Business District (CBD)-bound and non-CBD-bound trips prior to traffic assignment. Reasonable adjustments in these flat

percentages will account for the effect on transit ridership of TCMs other than major transit system changes. Appropriate logit-based or elasticity techniques for making these minor adjustments exist.

All states containing a Serious CO non-attainment area should forecast VMT by applying growth factors based on a validated network-based travel demand modeling process to the 1990 actual annual VMT estimate derived by the methodology described in Section 3.0, "1990 VMT Estimation and VMT Tracking."

All states containing a Moderate CO non-attainment area with a design value greater than 12.7 ppm at the time of classification should forecast VMT in the non-attainment area by this same method, if such a model is currently available or if such a model could be made available in time to allow the required SIP revisions and submissions.

States using the Network Travel Demand Model method should forecast VMT for the travel demand model domain, based on equation (1).

$$(1) \quad \text{Forecasted VMT}_{(\text{future}_i)} = \text{Actual VMT}_{(1990)} \cdot (\text{Travel Demand Model VMT}_{(\text{future}_i)} / \text{Travel Demand Model VMT}_{(1990)})$$

where  $i = 1993, 1994, \text{ or } 1995\text{-}2000$

Since travel demand model output will be unavailable for some of the required VMT forecasting years because the state will not have prepared separate demographic, land-use, and transportation system projections for all years, the state should linearly interpolate between chronologically adjacent travel demand model scenario years to calculate the values of both "Travel Demand Model VMT(1990)" and "Travel Demand Model VMT<sub>(future<sub>i</sub>)</sub>" used in equation (1).

States using a network-based modeling process to forecast VMT growth should validate their models against 1985 or more recent ground counts. In addition, the models should use a constrained equilibrium approach to allocating trips among links; no link should be loaded beyond its reasonable capacity; a distinction should be made between peak versus off-peak travel demand and travel times; zone-to-zone travel times should be recycled as inputs until a self-consistent equilibrium trip assignment among zones is achieved; and, if transit trips make up a significant portion of historical or anticipated future travel on the network, zone-to-zone highway and transit travel times should be recycled as inputs until a self-consistent equilibrium trip assignment is

achieved among modes as well. The demographic land-use assumptions for future years may be judgmental but should be reasonable in light of the planned highway and transit network, local land-use policy, and other relevant influences on public and private development and location decisions.

States using a network-based model to forecast VMT growth should construct demographic land-use scenarios for enough future years so that there is not more than five years between a year for which a VMT forecast is required and the nearest base year or future year scenario. In addition, the last scenario year for which land-use and other assumptions are made should be no earlier than the final forecast year. For example, a Serious area using a model last validated with 1985 ground counts should develop future land-use, employment, and other demographic forecasts for at least 1995 and 2005, in order to forecast VMT for 1993 through 2000.

A state may propose to and obtain approval from the EPA Regional Administrator to forecast VMT based on equation (1) for travel within the area and road types covered by the modeled network and to use any other reasonable method to develop growth factors for VMT on the local functional system excluded from the network model and in the remainder of the VMT Tracking Area. The state should consult with the lead planning agency for the area before proposing a method to the EPA Regional Administrator, who will consult with FHWA when considering approval.

If a state in its SIP adopts new or strengthens existing transportation control measures effective after 1990 but prior to a forecast year, it may adjust the VMT forecast calculated in equation (1) to the degree that the proposed TCMs will change VMT in that year beyond the change already captured in the network model, provided that the effect of such measures is based on sound analytical techniques and is clearly documented in the SIP.

#### **4.3 Historical Area-Wide VMT Method**

If the lead planning agency for a Moderate CO area, in consultation with appropriate other state and local organizations, determines that a validated travel demand model is currently unavailable and that such a model cannot be made available in time to allow the required SIP revisions and submissions, then the state may submit a request to the EPA Regional Administrator for an EPA commitment to propose approval of a SIP based on historical area-wide VMT. The EPA Regional Administrator will review the request in consultation with the Federal Highway Administration Regional Office and will attempt to respond to the request within 30 days.

Once the EPA Regional Administrator agrees to a state's use of historical area-wide VMT, the state should base its VMT forecasts on growth factors derived from an ordinary least squares linear regression extrapolation of that state's 1985-1990 HPMS reports for the Federal Aid Urbanized Area, according to equation (2).

$$(2) \quad \text{Forecasted VMT}_{(\text{future}_i)} = \text{Actual VMT}_{(1990)} \cdot (\text{Forecasted HPMS VMT}_{(\text{future}_i)} / \text{HPMS VMT}_{(1990)})$$

where  $i = 1993, 1994, \text{ or } 1995$

States may use any reasonable methodology to forecast VMT on the separate functional systems within the VMT Tracking Area but outside of the associated Federal Aid Urbanized Area.

Affected states that receive approval for an attainment demonstration addressing only locally generated vehicle emissions in a finite number of localized areas and that estimate and track traffic across the boundaries of each of the specified areas should also base their VMT forecasts on growth factors derived from an ordinary least squares linear regression extrapolation of 1985-1990 traffic estimates across these same boundaries, or some other reliable indicator of traffic growth in that period, if traffic counts were not conducted.

Affected states that track actual VMT using an HPMS-like alternative for a VMT Tracking Area less than the full urbanized area, and do not use the network model method for forecasting, should use historical data from the alternative counting program to forecast growth, if data were collected in the 1985-1990 period. If not, the state should justify some other forecasting method as being reliable, or forego use of the alternative HPMS-like method.

If a state in its SIP adopts new or strengthens existing transportation control measures effective after 1990 but prior to a forecast year, it may adjust the VMT forecast calculated in equation (2) to the degree that the proposed TCMs will change VMT in that year, provided that the effect of such measures is based on sound analytical techniques and is clearly documented in the SIP.

#### 4.4 Safety Margin

If a state wants to reduce the likelihood of a later finding that actual annual VMT is greater than forecasted annual VMT, that state may explicitly identify a safety margin for the non-attainment area forecasted VMT, provided that the state also bases its SIP emission inventory and

attainment demonstration on both the same higher level of VMT and the associated lower level of vehicle speeds on the expected highway network.

## 5.0 REVISING A FORECAST

### 5.1 Network-Based Travel Demand Modeling Process Methodology

A state forecasting VMT using a network-based travel demand modeling process should annually revise its forecast of VMT by applying equation (1), substituting for "Actual VMT<sub>(1990)</sub>" and "Travel Demand Model VMT<sub>(1990)</sub>" the actual and model-forecasted VMT in the year prior to the year the annual report is required for the Federal Aid Urbanized Area.

A state may, as part of its revised forecast, update its network-based travel demand model with new demographic and other input data and new base and forecast years, provided that the state supplies all of the information described in Section 7.4, "Report Content," for the updated model. The future highway and transit network for such a revised model is defined as the current highway network plus the modifications of that network on which the SIP attainment demonstration is based, unless the future network was modified since SIP approval by a conforming transportation plan and transportation improvement program, in which case the future network is that modified network. The state may include a safety margin in its revised forecast.

### 5.2 Highway Performance Monitoring System

A state using the "Historical Area-Wide VMT Method" should revise its forecast of VMT within the Federal Aid Urbanized Area using the ordinary least squares linear regression technique applied to that state's HPMS reports for the six-year period through the last year for which the HPMS data are reported, according to equation (2). For example, the revised forecast of 1994 VMT prepared during 1993 should use 1987 through 1992 historical data. States with Federal Aid Urbanized Area boundaries that have been re-defined during the six-year period may use any reasonable method to make adjustments to the re-defined geographic base.

States may use any reasonable methodology to re-forecast VMT on the separate functional systems within the VMT Tracking Area but outside of the associated Federal Aid Urbanized Area, subject to the provisions of Section 3.3, "Local Functional System VMT Estimates," and Section 3.4, "VMT Estimates Outside of the Federal Aid Urbanized Area." The state may include a safety margin in its revised forecast.

## 6.0 CONTINGENCY MEASURES

By November 15, 1992, a state containing a Moderate and/or a Serious CO non-attainment area with a design value greater than 12.7 ppm at the time of classification must commit in its SIP to implement specific measures if any estimate of VMT traveled in the area or a subsequent VMT forecast exceeds the number predicted in the most recent prior forecast or if the area fails to attain the CO National Ambient Air Quality Standard. These measures shall be included in the plan revision as contingency measures to take effect without further action by the State or the Administrator if the prior forecast has been exceeded by an updated forecast or estimate of actual VMT or if the primary national standard is not attained by the applicable attainment date. This is a statutory requirement. The statute does not further describe or specify the contingency measures that must be adopted.

The provision that contingency measures be triggered whenever a new forecast exceeds an old forecast, even if the actual VMT has not yet exceeded any forecast, appears to be intended to address as early as possible any situation in which a trend towards higher than expected VMT has been detected, since such a trend may affect the forecasted attainment date.

The need to preserve the integrity of the attainment demonstration and to react to unexpected VMT growth must be balanced against the desirability of preventing a false trigger of the contingency measures caused by the uncertainty in the VMT estimation and re-forecasting processes. This uncertainty can result in a merely transitory appearance in one year that actual or newly re-forecasted VMT exceeds the original VMT forecast, with the situation reversing in the next year or the year thereafter.

The sampling and non-sampling error inherent in HPMS points to a practical and theoretical need for a margin of error around VMT estimates and forecasts so that contingencies are not triggered for small and possibly random deviations from forecasted VMT. At the same time, actual annual VMT cannot be allowed to creep above the original attainment-producing forecast without limit. Though successively higher forecasts may remain within the established margin of error compared to the previous forecasts, they could, in fact, be drifting further and further from the original forecast.

In order for a margin of error to serve the purpose of preventing a false trigger of contingency measures without allowing unchecked VMT growth, actual annual VMT and later forecasts should never be allowed to be more than the defined margin above the forecast that is the



basis for an approved attainment demonstration. The use of an attainment-producing forecast as the base for measuring deviations ensures that growth in VMT remains consistent with the attainment demonstration, except for a de minimis deviation, or, if it does not, that contingency measures are triggered.

Consequently, as previously explained in Section 2.3, contingency measures will be triggered in any case where an estimate of actual annual VMT or an updated VMT forecast exceeds the most recent prior VMT forecast by more than 5.0 percent in 1994, 4.0 percent in 1995, and 3.0 percent thereafter. Contingency measures will also be triggered even though the margin of error is less than the specified percentage for that year if, cumulatively, estimates of actual VMT or VMT forecasts exceed the VMT forecast relied upon in the attainment demonstration for the area by more than 5.0 percent.

As explained in Section 4.4, a state has the option of adding a safety margin to its VMT forecasts for purposes of both the annual reporting requirement and its attainment demonstration, if it wants to reduce the likelihood that actual annual VMT or a later forecast will exceed an earlier forecast and trigger contingency measures.

This guidance does not identify the required contingency measures or the process for their implementation.

## **7.0 ANNUAL REPORTING PROCEDURES**

### **7.1 Requirement**

All states containing Moderate and/or Serious CO non-attainment areas with design values greater than 12.7 ppm at the time of classification must submit to the EPA Regional Administrator annual updates of the annual VMT forecasts along with annual reports regarding the extent to which such forecasts proved to be accurate. These reports shall contain estimates of actual vehicle miles traveled in each year for which the forecast was required. These reports should be submitted to EPA by September 30 of the year following the year for which the VMT estimate is made.

In accordance with Section 187(d)(1), states containing Serious CO non-attainment areas also must submit by March 31, 1996 a demonstration that emission reductions achieved by December 31, 1995 were as expected in the SIP. Data to estimate actual 1995 VMT may not be available this early, in which case the most recent forecast of 1995 VMT may be used.

## 7.2 Responsibility

The state should, in its SIP, identify the organization responsible for submitting these reports by the required due date.

## 7.3 Process

Pursuant to Section 121, the state must, in its SIP, also provide for consultation among all affected agencies, including, but not limited to, the state department of transportation, local metropolitan planning organizations, the state department of environment (or the equivalent), local air agencies, and local councils of governments.

## 7.4 Report Content

### 7.4.1 General Content

Each annual report should provide a comprehensive history of VMT forecasts and estimates of actual VMT. For example, the report due on September 30, 1994 by a state containing a Moderate non-attainment area should contain the estimate of actual 1993 VMT. That report should also contain the original 1993, 1994, and 1995 VMT forecasts as well as updated forecasts of 1994 and 1995 VMT. The report should further show both the comparison of the estimate of actual 1993 VMT and the previously forecasted 1993 VMT and the comparison of the previously forecasted 1994 and 1995 VMT submitted by November 15, 1992 and the revised forecasts of 1994 and 1995 VMT. The next annual report would repeat this information and add the 1994 actual VMT and the updated forecast of 1995 VMT.

Changes in urbanized area boundaries based on the 1990 census and improvements to HPMS over time should be explained and accounted for in the annual reports but will not alter the annual report requirement itself. For example, an expanded FAUA would mean that the state continues to use HPMS to estimate VMT in the FAUA, but only a smaller non-FAUA area requires VMT estimates using the state selected method.

### 7.4.2 Highway Performance Monitoring System-1990 Base and Tracking VMT

All states containing Moderate and/or Serious CO non-attainment areas with design values greater than 12.7 ppm at the time of classification should document within the required annual reports the following information:

a. Statistical Precision<sup>12</sup>

- (i) Actual ground counts for each HPMS sample segment, the date(s) those counts were completed and the number of hours over which those counts were made.
- (ii) Actual number of ground count sample segments required to achieve the FHWA-prescribed confidence intervals for each HPMS facility class/volume group estimate of average daily traffic volume.
- (iii) For each HPMS facility class/volume group, the actual number of HPMS sample segments counted.

b. Adjustments and Expansions<sup>13</sup>

- (i) The number of road miles within the Federal Aid Urbanized Area by facility class/volume group.
- (ii) The facility class/volume group factor(s) used to expand the HPMS segment data into Federal Aid Urbanized Area VMT estimates.
- (iii) The methods, data sources, and specific factors used to adjust counts on sample segments for month, day-of-week and/or hour-of-day.
- (iv) The methods and specific factors used to adjust counts on sample segments for those segments not actually counted in a given year.

c. VMT Accumulated on Each Volume Group Within Each Functional System Except the Local Functional System

The resulting estimates of annual VMT accumulated on each volume group within each functional system, except the local functional system, within the Federal Aid Urbanized Area.

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<sup>12</sup> Alternatively, the report may reference other specific reports, internal agency records, and/or FHWA data bases for this information.

<sup>13</sup> Ibid.

d. VMT Accumulated on the Local Functional System

The specific methodology and calculations<sup>14</sup> used to estimate VMT accumulated on the local functional system within the Federal Aid Urbanized Area.

e. VMT Accumulated Outside of the Federal Aid Urbanized Area

The specific methodology and calculations<sup>15</sup> used to estimate VMT accumulated on functional systems within the VMT Tracking Area but outside of the associated Federal Aid Urbanized Area.

7.4.3 Network-Based Travel Demand Modeling Process Methodology

All states using a network-based travel demand modeling process under Section 4.2 should document the following information within the SIP, and subsequent changes should be documented in the required annual reports.

a. Model Accuracy and Confidence

- (i) That the travel demand forecasting model used is validated with 1985 or more recent calendar year ground counts according to generally accepted modeling procedures;
- (ii) The methods and measures used to validate the model and the results of that validation;
- (iii) The extent to which the traffic assignment matched the base year ground count for groups of links ranked by average daily traffic volume;
- (iv) That the travel demand forecasting model method uses a constrained equilibrium approach to allocating trips among links;

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<sup>14</sup> Calculations may be referenced.

<sup>15</sup> Ibid.

- (v) That a distinction is made between peak versus off-peak trip volumes and travel times;
- (vi) That model outputs on zone-to-zone travel times are recycled as inputs until a self-consistent equilibrium trip assignment among zones is achieved and that this recycling is done until a self-consistent equilibrium trip assignment is achieved among modes as well, if transit trips make up a significant portion of historical or expected future travel on the network;
- (vii) That no link is loaded beyond its reasonable capacity;
- (viii) That the travel demand forecasting model forecasts of future year VMT are based upon the future demographic and land-use assumptions of the agency responsible for making such forecasts for transportation planning purposes and upon the future highway and transit network, and that the demographic land-use assumptions for future years are reasonable in light of the planned highway and transit network, local land-use policy, and other relevant influences on public and private development and location decisions.
- (ix) That the highway and transit network assumptions are consistent with the attainment strategy and demonstration through the attainment date, and (if a model scenario year falls after the attainment date) that beyond the attainment date the network assumptions are based on reasonable expectations.

**b. Model Definition and Inputs**

**(i) Geographic Domain**

The geographic domain to which all of the model inputs and VMT forecasts refer.

**(ii) Socio-Economic Data<sup>16</sup>**

Socio-economic data associated with each year for which VMT is forecasted, including, but not limited to, the following:

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<sup>16</sup> Alternatively, the report may reference other specific reports, internal agency records, and/or FHWA data bases for this information.

- (A) Population;
  - (B) Number of households;
  - (C) Employment.
- (iii) Network

A general description of the network and a reference to complete documentation of network parameters.

c. Model Outputs<sup>17</sup>

(i) Trip Distribution Output

Person-trip lengths in minutes by trip purpose.

(ii) Trip Generation Output

- (A) Person trips by purpose for internal trips;
- (B) External-internal vehicle trips;
- (C) External-external vehicle trips.

(iii) Mode Split

- (A) Transit person-trips;
- (B) Auto person-trips;
- (C) Auto driver person-trips.

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<sup>17</sup> Ibid.

(iv) **Traffic Assignment**

- (A) The constrained equilibrium speed versus volume-to-capacity equations used by functional class;
- (B) Average speed;
- (C) VMT by functional class;
- (D) VMT by geographic area; e.g., ring/sector;

d. **Growth in VMT Accumulated on the Local Functional System**

The specific methodology and calculations<sup>18</sup> used to forecast growth in VMT accumulated on the local functional system within the Federal Aid Urbanized Area.

e. **Growth in VMT Accumulated Outside of the Geographic Domain of the Network But Within the Federal Aid Urbanized Area**

The specific methodology and calculations<sup>19</sup> used to forecast growth in VMT accumulated on functional systems within the associated Federal Aid Urbanized Area but outside of the geographic domain of the network-based travel demand modeling process.

f. **Growth in VMT Accumulated Outside of the Federal Aid Urbanized Area**

The specific methodology and calculations<sup>20</sup> used to forecast growth in VMT accumulated on functional systems within the VMT Tracking Area but outside of the associated Federal Aid Urbanized Area.

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<sup>18</sup> Calculations may be referenced.

<sup>19</sup> Ibid.

<sup>20</sup> Ibid.

#### 7.4.4 Highway Performance Monitoring System-Based Forecasts

##### a. Historical Data and Regression Equation

For all states that are permitted, under Section 4.3, "Historical Area-Wide VMT," to use the Highway Performance Monitoring System to forecast Federal Aid Urbanized Area VMT in the VMT Tracking Area, the historical data and regression equation used to forecast that VMT.

##### b. VMT Accumulated on the Local Functional System

The specific methodology and calculations<sup>21</sup> used to forecast VMT accumulated on the local functional system within the Federal Aid Urbanized Area.

##### c. VMT Accumulated Outside of the Federal Aid Urbanized Area

The specific methodology and calculations<sup>22</sup> used to forecast VMT accumulated on functional systems within the VMT Tracking Area but outside of the associated Federal Aid Urbanized Area.

#### 7.4.5 Record Keeping Requirements

Each state containing a Moderate or a Serious CO non-attainment area with a design value greater than 12.7 ppm at the time of classification should commit in its SIP to keeping all information supporting the annual reports referred to in this section for three years and should commit in its SIP to allowing EPA staff and/or private persons under contract to EPA to audit that supporting information. This audit will be conducted in consultation with FHWA.

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<sup>21</sup> Ibid.

<sup>22</sup> Ibid.



## 8.0 AREAS RECEIVING EXTENSIONS UNDER SECTION 186(a)(4)

The CAAA specify that, upon application by any state, the Administrator may extend for one additional year the attainment deadline provided that the state has complied with all requirements and commitments pertaining to the area in the applicable implementation plan and no more than one exceedance of the National Ambient Air Quality Standard for carbon monoxide has occurred in the area in the year preceding the extension year.

No more than two one-year extensions may be issued for a single non-attainment area.

Under this guidance, all of the reporting requirements specified in Section 7.0, "Annual Reporting Procedures," apply during the extension period.

## 9.0 RECLASSIFICATION OF MODERATE AREAS UPON FAILURE TO ATTAIN

According to Section 186(b)(2), within six months of the applicable attainment date<sup>23</sup> for a carbon monoxide Moderate non-attainment area, the Administrator will determine, based on a Moderate area's design value as of the attainment date, whether that area has attained the primary National Ambient Air Quality Standard for carbon monoxide by that date. Any Moderate area that the Administrator finds has not attained the standard by that date will be reclassified as a Serious area.

For Moderate areas reclassified as Serious, EPA will issue new SIP guidance pertaining to implementation of the Section 187 VMT forecasting and tracking provisions at the time of reclassification.

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<sup>23</sup> The applicable attainment date for a carbon monoxide Moderate non-attainment area is December 31, 1995 unless an extension has been granted by the EPA Administrator. If the first one-year extension has been granted, the applicable attainment date is December 31, 1996. If the second one-year extension has been granted, the applicable attainment date is December 31, 1997.

## 10.0 INVENTORIES

### 10.1 Guidance Applicable to Specific Non-Attainment Area Inventories

#### 10.1.1 1990 Inventory [187(a)(1)]

All states containing Moderate and/or Serious CO non-attainment areas with design values greater than 12.7 ppm at the time of classification should use the annual VMT estimates developed in accordance with Section 2.1, "Actual Annual Vehicle Miles Traveled," as the starting point for the 1990 inventory [187(a)(1)].

#### 10.1.2 "Periodic Inventories" [187(a)(5)]

All states containing Moderate and/or Serious CO non-attainment areas with design values greater than 12.7 ppm at the time of classification should use the annual VMT estimates developed in accordance with Section 2.1, "Actual Annual Vehicle Miles Traveled," as the starting point for the "Periodic Inventories" [187(a)(5)].

#### 10.1.3 "Specific Annual Emission Reductions" [187(a)(7)]

All states containing Moderate and/or Serious CO non-attainment areas with design values greater than 12.7 ppm at the time of classification should use the annual VMT forecasts developed in accordance with Section 4.0, "VMT Forecasting for 1992 SIP Submittal," as the starting point for the "Specific Annual Emission Reductions" [187(a)(7)] inventory.

#### 10.1.4 Attainment Demonstration Inventory

All states containing Moderate and/or Serious CO non-attainment areas with design values greater than 12.7 ppm at the time of classification should use the annual VMT forecasts developed in accordance with Section 4.0, "VMT Forecasting for 1992 SIP Submittal," as the starting point for the Attainment Demonstration inventory.

#### 10.1.5 Severe Area Milestone [187(d)(1)]

All states containing Serious CO non-attainment areas should use the annual VMT forecasts developed in accordance with Section 4.0, "VMT Forecasting for 1992 SIP Submittal," as the starting point for the Severe Area Milestone [187(d)(1)] inventory.

10.2 Guidance Applicable to All Inventories in CO Non-Attainment Areas with Design Values Greater than 12.7 ppm

The following guidance applies to all of the emission inventories listed in Subsection 10.1 above.

1. CO emissions estimates generally are the product of a VMT estimate and an emission factor that depends upon the average speed at which that VMT occurred. Since CO emission factors are not linear with speed, total CO emissions should be estimated making use of the available information regarding the distribution of VMT among roadways of different speeds and other characteristics that affect mobile source emission factors. All non-attainment area emission inventories should at a minimum be derived from a breakdown of total historical or forecasted VMT into functional system-specific VMT estimates (or a similar disaggregation of VMT among road and/or geographic categories). Forecasted total VMT, excluding that on the local functional system, should be disaggregated into functional system-specific VMT in the same proportion as the most recent HPMS-derived estimates of VMT by system, unless a validated network-based travel demand model is used to forecast VMT, in which case forecasted total VMT should be disaggregated as indicated by the model. Travel demand models that do not meet the performance and validation requirements for use in forecasting VMT growth may nevertheless be suitable for deriving speed estimates. Emission factors applied to the VMT on each functional system or roadway should reflect the estimated speeds for that system or roadway by peak and off-peak trip volumes.
2. VMT estimates prepared under this guidance are for annual VMT, while inventories will require VMT estimates for a shorter period or periods. All adjustments to the functional system-specific annual VMT estimates, including, but not limited to, adjustments by month, day-of-week, and hour-of-day, should be fully consistent with the method used to adjust count-day ground counts to annual average daily counts for HPMS sample segments.
3. While HPMS is to be in all cases the measure of true 1993 and later VMT for non-local roads in the FAUA and will usually be the measure of 1990 VMT, network models and other sources of information will be important to inventories. Network models, as noted above, can be used to estimate link-specific speeds as well as to provide spatial and temporal VMT distributions, once system-wide VMT has been adjusted to match HPMS, e.g., by adjusting the VMT on each link proportionally. If such an adjustment is needed to match HPMS-based VMT and if the network model forecast of the number of trips also enters the inventory calculation, the number of trips should be adjusted also.

## 11.0 AUTHORITY

Authority for this guidance is granted to EPA by Section 187(a)(2)(A), "Vehicle Miles Traveled," of the Clean Air Act Amendments of 1990.

## 12.0 TIMELINE

The following table provides information and dates relevant to CAAA requirements for CO non-attainment areas.

January-March, 1992	Draft base year CO inventories submitted.
November 15, 1992	<p>The first forecast of VMT for each year before the attainment year is due from states with CO non-attainment areas that have design values greater than 12.7 ppm. Subsequent yearly forecasts and reports are due on September 30. (For Serious CO areas, the report due in 1996 should be submitted by March 31, 1996.)</p> <p>SIPs from states with Moderate and/or Serious CO non-attainment areas that have design values greater than 12.7 ppm must contain contingency measures to take effect if the prior VMT forecast has been exceeded by an updated forecast or estimate of actual VMT or if the primary national standard is not attained by the attainment deadline.</p> <p>CO non-attainment areas with a design value of 9.5 ppm or above are required to mandate that fuel sold during the period of high CO concentrations contain 2.7 percent oxygen by weight.</p>
January 1, 1993	A state with Moderate and/or Serious CO non-attainment area that has a design value greater than 12.7 ppm should begin sampling each HPMS facility class/volume group separately for each non-attainment area, as stated in its SIP.

May 15, 1994	Deadline for CO non-attainment areas with a 1980 population of 250,000 or more and a design value of 16.0 ppm or greater to provide for a clean-fuel vehicle fleet program.
June 30, 1994	<p>Deadline for states with Serious CO non-attainment areas to obtain approval from the appropriate EPA Regional Office for a count-based method to estimate VMT on separate functional systems within the VMT Tracking Area but outside of the Federal Aid Urbanized Area. The approved method is to take effect by January 1, 1995.</p> <p>Deadline for states with Serious CO non-attainment areas to obtain approval from the appropriate EPA Regional Office for a count-based method to estimate VMT on the local functional system within the Federal Aid Urbanized Area. The approved method is to take effect by January 1, 1995.</p>
September 30, 1995	First periodic inventory is due. Subsequent inventories are due every three years thereafter until attainment.
December 31, 1995	Moderate CO non-attainment areas are required to attain the National Ambient Air Quality Standard for CO.
March 31, 1996	<p>Serious CO non-attainment areas must submit a demonstration that the emission reduction specified in the 1992 SIP revision has occurred by December 31, 1995.</p> <p>If the specified reduction has not occurred, a SIP revision with economic incentives and a transportation control measures program is due within nine months of failure to make the demonstration or of EPA's notification of an inadequate demonstration.</p>
December 31, 2000	Serious CO non-attainment areas are required to attain the National Ambient Air Quality Standard for CO.

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