APPENDIX F

TRAFFIC MONITORING PROCEDURES FOR THE HPMS

INTRODUCTION

High quality traffic data are critical to the many uses of the HPMS data set:

- Traffic derived travel data from the HPMS are used in the Federal-aid Highway fund apportionment formulae;
- Traffic data are critical to the analyses that support the Condition and Performance Reports to Congress which are subsequently used for national highway budgeting purposes;
- HPMS derived travel data are required to meet Clean Air Act requirements; and
- Travel data are central to estimating several of the Department's performance indicators such as vehicle crash and fatality rates and delay.

Traffic monitoring is also a key activity in the development and maintenance of the HPMS data set. Traffic data drives the HPMS sample stratification and selection process; the validity of the entire HPMS sample expansion procedure depends on the maintenance of adequate traffic monitoring programs.

GENERAL

State maintenance of an adequate traffic counting program is a primary HPMS concern. A State's count program should cover all Interstate, principal arterial, other NHS, and HPMS sample sections on a 3-year maximum cycle. It should cover all roads, not just State-owned roads, and should include counts on those systems made on the State's behalf by MPOs, cities, or counties. The program should provide for a sufficient number of automatic traffic recorder (ATR) stations and classification count stations to permit factoring of 48-hour tube-type counts to estimates of annual average daily traffic (AADT). The State should also have an underlying short count program that assures that traffic counts on all roads on all systems are obtained over a longer term (6-year maximum) cycle for basic traffic monitoring purposes. For further details, see the discussion of Data Obsolesce Counts in Chapter 2 of the *AASHTO Guidelines for Traffic Data Programs*. The information provided by the State's overall count program should be of sufficient detail to permit the State to develop and maintain comprehensive traffic flow maps in rural and urban/urbanized areas.

Traffic information in a comprehensive count program may be available from several monitoring sources including State, MPO, city, or county. Automatic traffic recorders provide continuous monitoring of existing traffic conditions around the State. Vehicles on freeways/expressways and other important multi-lane facilities can be monitored by route under a multi-year statewide or MPO count plan that includes input from real-time intelligent transportation system (ITS) deployments. Other highway functional systems, both State and off-State, can be monitored by geographic area, such as by county or highway district.

A schedule should be developed for the State's comprehensive count program. Areas of the State selected for counting in a program year should be selected on a random basis. Areas of high growth should be counted more often than those with low growth; although all areas should be comprehensively

counted at least every 6 years. To make the most of available resources, an area traffic count plan should consider using cluster count techniques. Counts scheduled and obtained under other programs should be incorporated into the count plan to avoid duplication of monitoring sites. Coordination and cooperation with local governments to implement a shared data, comprehensive count program is highly desirable; however, the State ultimately maintains responsibility for ensuring that these data meet minimum collection and quality requirements. To meet these responsibilities, the State should have a comprehensive quality assurance program that includes data collection, the conversion of traffic counts into AADT values, and equipment testing provisions.

Information collected from all monitoring programs should be maintained in a computerized database, preferably in a geographic information system. If several years of data are maintained, traffic growth by location will be more readily available for developing trends, determining changes to volume group breakpoints, scheduling of future monitoring, and other uses. Note that although some planning and design activities, such as urban planning models, may make use of average weekday traffic (AWT) estimates, the HPMS makes use of AADT estimates.

VOLUME GROUP ASSIGNMENTS

The State's comprehensive traffic count program can be used to develop traffic volume group assignments for all road sections if the program has been formulated to adequately monitor both high and low volume roads, including those off the State system. To facilitate this process, count station locations should be selected to represent expected AADT volume group breakpoints for the volume ranges of both the standard and nonattainment area samples. This may require locating count stations at one per 5 to 10 miles in rural areas and more closely in urban areas; for homogeneous traffic sections, more than one section may be represented by a single traffic count station. Selection of count station locations should be based on previous count experience, recent land developments, and the existence of uncounted sections along the routes.

Generally, traffic counts in addition to those taken for the HPMS are needed to establish the assignment of road sections to their respective volume groups in both rural and urban areas. A well-designed comprehensive count program that includes off-State system roads should provide the needed additional counts. Traffic mapping techniques also can be applied to maximize the use of HPMS universe and sample counts, other coverage counts, and counts taken for project planning or operational purposes in assigning road sections to volume groups.

TRAFFIC MONITORING GUIDE

A detailed discussion of recommended procedures for developing reliable estimates of travel characteristics, including AADT, is contained in the *Traffic Monitoring Guide* (TMG). However, a general discussion of some elements of a typical traffic volume count program and their applicability to the HPMS follow.

Continuous ATRs

Automatic Traffic Recorders (ATRs) are used to provide continuous traffic count coverage at selected locations. ATR data are also used to develop seasonal or monthly, day-of-week, and growth factors which are then used to adjust short coverage counts to AADT. Analytical procedures to determine the appropriate level of effort and to develop the needed traffic estimates are described in the TMG.

Continuous count data are essential for converting coverage counts to AADT. The State's documentation of its continuous count program should discretely identify the number of continuous counters on the rural and urban portions of the PAS/NHS system. Whenever possible, the State should have at least one continuous counter on each major PAS/NHS highway route. At a minimum, each continuous counter should have at least two full days of data for each day of the week for each month.

Short Counts

Although short counts can cover lesser periods, the TMG recommends using 48-hour counts (two full 24-hour days) for all HPMS universe, standard sample, and donut area sample sections whether on or off the State-owned highway system. Short counts should be randomly scheduled geographically throughout the State and temporally throughout the calendar year to ensure adequate representation and to minimize bias. Where axle correction factors are needed to adjust raw counts, they should be derived from facility specific vehicle classification data obtained on the same route or on a similar route with similar traffic in the same area. Factors that purport to account for suspected machine error in high traffic volume situations should not be applied to HPMS traffic counts or traffic count programs used for HPMS purposes, such as volume group assignment. In high volume situations, such as controlled access facilities, it is more appropriate to use ramp counts in conjunction with strategic mainline counting, or other appropriate technology, than to use short counts and adjustment factors.

Vehicle Classification Data Collection

Data reported in the HPMS should reflect the use of statistically valid data collection procedures employing automatic vehicle classification equipment. Summary vehicle classification data reporting requirements are outlined in Chapter III; percent trucks data are reported in Items 81-84 for each HPMS standard sample section (see Chapter IV). Axle corrections based on vehicle classification data should be applied to all counts where the counting device uses axle sensors. State documentation of the vehicle classification activity should illustrate that:

a. Classification data are representative of specific functional systems.
b. Each season of the year is represented in the development of axle correction factors.
c. Classification sessions are long enough to account for the changes in vehicle mix from day to day. The TMG recommends that vehicle classification sessions be at least 48-hours. Data for less than 24 continuous hours is not appropriate.
d. The total volume of vehicles observed is at least equal to that for an average day.
e. Classification counts are well distributed among rural and urban locations.
f. Classification counts are collected, at a minimum, over a 3-year cycle, one-third of the counts per year.
g. There are sufficient classification categories to represent vehicles with two to seven axles.

APPLICATION OF TRAFFIC COUNT PROCEDURES TO HPMS

Traffic count data reported for all Interstate, other principal arterial, and other NHS sections provide most of the travel data used for apportionment and other purposes (see Chapter 1, Table I-2). The HPMS standard sample design provides an appropriate statistical base for the development of traffic estimates for each sampled section and of systemwide travel for the sampled systems. By incorporating vehicle classification and truck weight information, the TMG structure provides the capability of estimating classified VMT and Equivalent Single Axle Loads (ESALs) from the HPMS data.

One-third of the Interstate, other principal arterial, and NHS road sections should be counted each year. In addition, one-third of the HPMS standard sample sections on each functional system should be counted each year. The sections to be counted should be randomly selected. Samples should be selected from each sample stratum (volume group), although minor adjustments may be necessary for strata with numbers of sections not divisible by three or having less than three samples. A single count may be used for several sections between adjacent interchanges on controlled access facilities.

The development of section AADT estimates from count data must include the use of short count and other appropriate adjustment factors. AADTs reported to the HPMS for standard sample and non-sample PAS/NHS sections not counted during the current year must be updated to current AADT estimates by use of appropriate growth factors.

Estimates of Daily Vehicle-Miles of Travel (DVMT) can be developed by direct computation for the Interstate, other principal arterials, and other NHS sections and by expansion of the HPMS standard sample on a functional system basis for other systems. This is done by multiplying the standard sample section AADT by the section length and by the standard sample expansion factor and summing the result to the HPMS stratification level desired (functional system, total rural, etc.); the HPMS software will perform these calculations by functional system. Since HPMS standard sample expansion procedures are based on the ratio of universe to sample mileage, mileage totals at any stratification level should be exact. A comprehensive count program, good count practices, a well-distributed HPMS standard sample, and appropriate AADT estimation techniques will result in highly reliable DVMT estimates.

The same procedures can be used in preparing and reporting count based AADT data for donut area sample sections; a unique expansion factor for each applicable NAAQS nonattainment area is used to prepare DVMT estimates.