

State Practices Used to Report Local Area Travel

The objective of this report to disseminate information on promising and innovative State practices used to estimate local area vehicle miles traveled (VMT).

States are required to report annually to the Federal Highway Administration (FHWA) aggregate estimates of VMT on the rural minor collector and local functional systems in rural, small urban, and urbanized areas. In 2001, travel on these local area systems totaled over 15 percent of highway VMT in the United States. The current practices used by the States to prepare these local area estimates vary significantly and often are not thoroughly documented. To gain an understanding of the various practices in use, FHWA conducted a survey of the States in April 2002 through its field division offices; the information from 50 States, the District of Columbia, and the Commonwealth of Puerto Rico are summarized below. The first section describes the most noteworthy State activities; the second section summarizes the State practices.

Section 1: Most noteworthy State activities:

Georgia – The State uses a stratified random sample for all road sections on the non-Federal-aid Highways to collect traffic data annually. The initial scheme used 4 population groups: urbanized areas over 100,000 persons, other urbanized areas, small urban areas of 20,000 to 49,999 persons, and areas under 20,000 persons and 4 road surface type groups: urban paved, urban unpaved, rural paved, and rural unpaved. The initial analysis of 2,500 counts revealed that while the precision of the individual VMT estimates for the 16 population/road surface groups varied widely, all were 25% or better at a 90% confidence level (except for the urban unpaved categories which contain very little mileage). A statistical test of the initial results for the estimate statewide is a precision of 9% at a 90% confidence level. After 1991, the State modified the panel strata and applied seasonal factors based on collector system data to enhance the precision of the local road VMT estimates. The strata and number of samples sites in each are as follows: Atlanta area (1,617), Non-Atlanta Urbanized Areas (590), Small Urban Areas (808), Rural Local (1,417), and Rural Minor Collectors (213). The VMT for local roads and /or rural minor collectors, by geographical area or statewide, can then be obtained in the same way as VMT is obtained on all other road classifications. For more information, contact Mr. David Spillman, Georgia DOT, at (770) 986-1364.

Kansas – State statute requires that a portion of the state motor fuel tax be transferred to the cities and counties; the proportion of each county's allocation is based on total road mileage in the county, average daily vehicle miles traveled, excluding Interstate travel, and motor vehicle registration fees. Traffic count data are collected on rural minor collectors on a six-year cycle; approximately 500 24-hour counts are taken each year. A 10% sample of rural local roads is counted on a nine-year cycle; approximately 500 24-hour counts are taken each year. A 10%

sample of urban locals in 40 urban areas is counted on a nine-year cycle; approximately 400 counts are taken each year. For more information, contact Mr. Alan Spicer, Kansas DOT at (785) 296-3470.

Kentucky – The State developed a factor curve relationship between the local functional system annual average daily traffic (AADT) and (minor) collector AADT averages by county, allowing local VMTs to be generated by county for air quality purposes as well as statewide for HPMS. The relationship of average local ADT to average (minor) collector ADT was determined from coverage counts taken on the rural minor collectors and urban collectors and a one-time count on a random sample of rural and urban local road sites. The panel was comprised of 28 out of 120 counties randomly selected from rural and urban pools for each Highway District to assure both socioeconomic and geographic distribution and totaled over 4,000 randomly selected count locations using a 0.2 mile grid laid over a map of local roads. Prior to using this analysis scheme, the counts were annually factored from the original HPMS local sample. For more information, contact Mr. Peter Rogers, or Mr. Dan Inabnitt, Kentucky Transportation Cabinet, at (502) 564-7183.

New York – The State has proposed a sample-based count program for the local-owned, non-Federal-aid Highways based on guidance given in Appendix D of the HPMS Field Manual. The two approaches identified in the analysis are based on constructing sampling procedures for the collection of a limited number of traffic counts to estimate travel. The first option consists of establishing 6 sampling domains, which are based on roadway functional classification categories and the type of area the segments are located within. This option identified a need to take traffic counts on 1,721 roadway segments each year to obtain an accurate representation of travel levels. This option allows greater freedom in choosing roads to sample because no prior knowledge of the roadway is needed. The second option divides the two rural roadway systems that were investigated into four volume groups and divides both the small urban and the large urban local roadway systems into three volume groups each for a total of 14 domains. Pursuing this approach, only 437 traffic counts would be needed each year to obtain an accurate representation of these roadways. The volume groups cause a lower variability of annual average daily traffic (AADT) values included within each of the domains producing a lower required sample size.

The choice of 437 traffic counts is a feasible number of additional traffic counts to be taken and guarantees an 80-10 precision level for the AADT values on the local roadway networks. It is noted that it is difficult to predetermine volume groups. On the other hand, the collection of volume data on 1,721 roadway segments each year provides an estimate based on empirical data, removing the need for additional assumptions or extrapolations of the data, and will also provide an 80-10 precision level for the AADT. This larger number of traffic counts would create an additional data burden to the State that may not be accommodated on an annual basis using currently available resources. The State

chose a compromise: the sample size, to obtain a 90-10 precision level for AADT/daily VMT and to adequately address volume groupings, is approximately 2,700 segments. The State prefers to implement this sample count program over a 3-year collection period in combination with the local bridge count program (9,500 bridges over a 10-year period), railroad crossing count program (2,625 local roads over a 5-year period), and county counter initiative (over 40% of the State's 62 counties currently participate in a program that provides count equipment to the counties and traffic count data to the State). State regional count crews will assure that proper locations are counted and counts are properly factored. The panel selected represents geographic distribution, functional classification and volume group; the first year's selection is scheduled for 2003. Because of resource limitations, the State can further modify the sampling as well as each domain as the data are analyzed from 2 or 3 years and change the amount of points needed to be monitored especially where the variance may be less than expected. For further information, contact Mr. Michael Fay, or Mr. Todd Westhuis, New York DOT, at (518) 457-7203.

Texas – The State is developing an improved local VMT methodology for traffic counting in counties that have air quality conformity issues. The approach uses a random selection process when performing counts on local streets in order to estimate VMT. This recommendation is supported by the statistical analysis of counts performed in various urban areas that shows the entire local street network is better represented through randomly selected count locations than the historical station locations the State traditionally used. The historical count locations include bias since they were not originally selected to provide statistically representative traffic volume data. Furthermore, in order to obtain a truly random sample of data each time, new traffic count stations should be randomly selected each time the counts are performed. This element of the process will ensure that any new streets since the last counts have an opportunity to be included in the randomly selected sites.

The initial plan consisted of scheduling counts within highway districts subdivided into rural (under 5,000 persons), small urban (5,000 to 49,999), small urbanized (50,000 – 199,999) and large urbanized (200,000+) area types. The minimum average counts generally range from about 40 sites in rural, 40 in small urban, 65 in small urbanized, and 175 in large urbanized, but will vary depending on actual size of street networks in individual areas. In developing the district count schedule, the State chose to conduct 24-hour tube saturation counts to be taken during the non-summer month weekdays instead of randomly throughout the year.

Comparisons of count volumes from historical State station locations were made with count volumes from randomly selected sites within the same area for several areas around the State. The median values of volumes from randomly selected sites were consistently significantly lower than those of historical counts in the same area. The volumes at randomly selected sites are lower than volumes at

historical station locations primarily because the historical sites are typically located on local streets at or near intersections with collector or arterial streets, where volumes tend to be higher. Historical count sites are not usually found deep in neighborhoods, away from major streets. The randomly selected sites are located on all types of local streets, including cul-de-sacs, and better represent the variety of local streets on the roadway networks. It is important to note that the new count volumes are numbers of axles, divided by two, without any adjustment factors. In addition, some of the streets were found to carry extremely high volumes of traffic, well beyond what would be expected on a functionally classified local street. This issue will be addressed during reclassification activities.

The estimated VMT is computed based on the median daily traffic count by strata (such as county, etc.) times the applicable mileage. An analysis of the data determined that the median value adequately represents the entire data set. Based on further experiences in 2003 and 2004, the State's approach is expected to be further refined. For more information, contact Mr. William E. Frawley, Texas Transportation Institute, at (817) 462-0533 or Mr. Mark S. Hodges, Texas DOT, at (512) 486-5122.

Section II: Summary of survey results:

A. Please describe the practices used in your State to determine local area VMT reported in Highway Performance Monitoring System (HPMS) on the rural minor collector and rural and urban local functional systems. If the methodology differs for rural, small urban, and urbanized areas, please describe each separately. If a city or Metropolitan Planning Organization (MPO) determines its own estimate that is subsequently reported in HPMS, please describe the city or MPO practices separately.

About four out of five States maintained a traffic count-based method, or equivalent, on the rural minor collectors especially on State jurisdiction or State-Aid roads. For local roads, a variety of methods were employed. The most used methods include a multi-year cycle traffic sample, the application of traffic growth rates such as determined at the automatic traffic recorders, or the application of average traffic growth at a statewide level or on the minor arterial and major collector systems to the previous year's estimate. Less used methods include an annual stratified random traffic sample, assignment of average daily traffic (ADT) levels based on earlier studies by size of area population, assignment of a fixed percentage of total area VMT, or application of area population growth rates to a base value.

States use a variety of procedures to directly estimate the amount of highway VMT on rural and urban systems as shown in Table 1. In some urbanized areas, the metropolitan planning organization's reported count-based VMT on the higher systems and modeled VMT for the lower systems are used. In serious air quality non-attainment areas, the local system VMT is often traffic count-based using a small sample.

B. If the State obtains the local VMT for HPMS as a residual, please fully describe the statewide model, assumptions, and updates of factors involved in the model used to determine total statewide travel. How does the State determine the amount of upper system VMT that is subtracted from the total statewide amount? How is the residual VMT sub-allocated to rural, small urban, and urbanized area(s)? Please describe the practices used.

At least 10 of the reporting States use an indirect method to determine a total statewide travel estimate. The difference between the higher functional system estimates based on traffic monitoring and the statewide total is assigned to the local systems as a residual.

Table 1 -- State Practices Used to Report VMT

State	Rural Minor Collectors	Locals	State	Rural Minor Collectors	Locals
Alabama	G	G; T (UZA)	Montana	M	M
Alaska	M	M	Nebraska	R	R
Arizona	T	T	Nevada	M	M
Arkansas	M	Z; M (UZA)	New Hampshire	G	M
California	R	R	New Jersey	M	M
Colorado	X	X	New Mexico	G	T
Connecticut	M	A	New York	R	R
Delaware	M	A	North Carolina	R	R
Dist. of Columbia	--	A	North Dakota	Z	Z; M (UZA)
Florida	M	A	Ohio	A	A
Georgia	M	M	Oklahoma	M	M
Hawaii	R	R	Oregon	R	R
Idaho	M	R	Pennsylvania	M	M
Illinois	M	Z; T (UZA)	Rhode Island	A	A
Indiana	M	M	South Carolina	M	A
Iowa	M	M	South Dakota	M	M
Kansas	M	M	Tennessee	A	A
Kentucky	M	A	Texas	M	M
Louisiana	M	M	Utah	A	A
Maine	M	M	Vermont	A	A
Maryland	M	G; T (UZA)	Virginia	M	M
Massachusetts	A	A; M (UZA)	Washington	M	X
Michigan	T	T	West Virginia	M	A
Minnesota	C	R	Wisconsin	R	R
Mississippi	M	M	Wyoming	M	M; T (UZA)
Missouri	M	R	Puerto Rico	T	T

A - Assign areawide average daily traffic based on some criteria

G - Apply the current traffic growth rate on collectors or higher systems

M - Use a limited sample of short-term traffic counts or a combination of sample counts
and estimated average daily traffic

R - Assign the residual of the statewide total VMT minus the higher systems VMT

- T - Apply a statewide growth trend based on a factor(s) such as traffic, highway fuel, vehicle registrations, population, etc.
- X - Assign a fixed percentage of total area VMT
- Z - Assume a zero traffic growth
- UZA - Urbanized areas

Specific information about State procedures used to estimate highway travel on local systems is provided in Appendix A.

Estimates of the statewide total may involve several factors that account for current economics and social changes such as sales of vehicles by make and model, fuel taxes (gas and diesel), vehicle registrations, vehicle scrappage, population changes, and other inputs from selected use sector activities, to supplement statewide traffic counts. Normally a State will compute the VMT for its upper systems based on a traffic assignment process and subtract it from the total statewide estimate to create an estimate of the lower systems VMT called the residual. The residual is distributed in various ways. Generally, estimated growth rates are applied to the historical amounts of lower system VMT by local rural, small urban, and urbanized areas and minor collector rural, if applicable, until the computed VMT equals the estimated residual for the State.

C. Please describe each primary factor (i.e., traffic volumes, population, fuel consumed, motor vehicle registrations, employment, income, land use characteristics, etc.) used in the estimate. What practices are used to assure that these factors are reasonably correct? If a nationwide, or statewide, factor is utilized, how are local regional differences accounted for? Over the last 5 years, how often has each primary factor been updated?

Very little documentation of the primary factors was provided; little is known in terms of the quality of factor updates and their application. It appears that many methods lack validated results. Some States continue to apply a growth rate to a VMT base developed many years ago; the source and reliability of the base are mostly unknown.

D. Please describe weaknesses and strengths of the State's practices used to determine local area VMT. In your judgment, is the estimated statistical precision level of these VMT estimates within plus and minus 10 percent? 20 percent? 50 percent? 100 percent?

About half of the States indicated that they had no idea or way to determine how accurate their estimates were. Of the other half, most (76%) believed that their estimates were within 20 percent of the actual value.

E. Does the State have a policy regarding traffic monitoring on low-volume roads (i.e., <50, <500, <2000 vehicles daily) in rural or urban areas? Does the State collect traffic counts on local area systems? At what level of traffic is monitoring undertaken and on what time interval?

States normally monitor traffic on the State highways but do not monitor off-State highways on the rural minor collector or local functional systems. Any counting bias is usually towards those paved segments with higher volumes near or adjacent to intersections with the State system.

F. Do local planning agencies collect traffic data on local area systems that are not used by the State in preparing the HPMS summaries?

Many local planning agencies collect some traffic monitoring information that is not normally used by the States in reporting HPMS. Some States have attempted to work with local agencies to set up reporting formats and rules for traffic factor adjustments; only a few States actively involve the local governments in traffic monitoring for HPMS purposes.

G. For data used in reporting local area VMT in HPMS, about what percent of the road miles of each of the 4 local area functional systems (rural minor collector, rural local, small urban local, and urbanized area local) have been monitored in the last 5 years?

Over half of the States had traffic monitoring plans for the State highway system routes on the rural minor collectors that ranged from 100 percent coverage to a minimum level sampling plan. Traffic coverage on the local systems in rural and small urban areas appear to be almost nil; in selected urbanized areas, some traffic samples on the local systems may be collected for use in reporting HPMS VMT estimates.

H. We are interested in exploring options for improving procedures for estimating local area VMT. To that end,

(1) Does the State maintain a current inventory of paved vs. unpaved public roads by area? Who collects the information? How often is the information that is reported in HPMS updated? How is the information verified?

(2) How often is traffic monitored on local bridges (20 or more feet in length) and railroad crossings? Who collects the information? Is it currently used in estimating local area VMT?

Every State maintains surface type in their inventory of State highway agency owned roads. Nearly all States have a surface-type reporting requirement for county and local city inventories, which may be spot-checked. Most States have paved at least the highest traffic volume routes; in most parts of the United States many low volume roads remain unpaved except in Delaware, Maryland, New Jersey, and Rhode Island and District of Columbia where almost all roads are paved.

Few States have a regular program to specifically monitor structures or railroad crossings on the higher systems throughout the State. Instead, traffic counts are taken from

adjacent road sections that are periodically monitored. For the lower systems, traffic monitoring is normally done on a special request basis only.

I. Please describe any related research activities underway.

Several States have done or are doing some extensive research into development of procedures involving direct traffic monitoring; these States include those mentioned in the first section (Georgia, Kansas, Kentucky, New York, and Texas) as well as Missouri (metropolitan areas) and Vermont (New England Traffic Monitoring Study). North Carolina, North Dakota, Ohio, Pennsylvania, South Carolina, South Dakota, and Tennessee are looking into proposals for future local roads VMT research and data linkages.

J. Does the State have any suggestions or recommendations they would like to make concerning estimates of local area VMT?

A few suggestions were reported. One would have FHWA provide acceptable practices for traffic data collection and insist on adherence to them; others would have FHWA provide consistent procedures or provide financial incentives; some States expressed interest in learning what others are doing.

Appendix A

State Procedures Used to Estimate Highway Travel on Local Systems

In 2002, FHWA surveyed the States eliciting information about procedures used to estimate highway travel reported to HPMS for rural minor collector and rural and urban local functional systems. In general, the States prepare vehicle miles traveled (VMT) estimates for the entire State unless otherwise noted below. Also, for the most part, only State collected traffic counts are used for making these estimates, although the use of any supplemental counts from selected local governments is also noted below. In the following discussion, “RMC” refers to rural minor collector functional system, “locals” refer to rural, small urban, and urbanized area local functional systems, and “ADT” means average daily traffic. Please note when using this information that a few States have or are in the process of revising their travel estimating procedures.

Alabama

RMC – The same traffic growth as on the major collectors is assumed for the RMC. Counts were taken on RMC years ago; annual growth factors based on the rural major collectors have been applied to the VMT since then.

Locals – About 300 counts were taken 15 years ago on rural and small urban roads; count-based growth factors from the collector systems have been applied since. In urbanized areas, VMT is based on the modeling process updated every 3 to 5 years and growth trends applied annually.

Alaska

RMC & locals – The State uses a combination of sample counts and estimated ADT to prepare an estimate of VMT. It is computed based on the product of ADT by route times route length and summed. The growth of traffic on the collectors is applied to the local system older counts. In recent years, the State has been collecting additional local counts to update regional plans.

Arizona

RMC & locals – The State years ago established an estimate of travel for these systems; travel is adjusted annually based on population growth. Travel in Non-Metropolitan Planning Organization (MPO) areas are grown based on annual statewide growth in population for rural and small urban areas; travel in MPO areas are grown based on population growth within their respective areas.

Arkansas

RMC – The State’s VMT estimate is either updated with new count estimates or factored based on automatic traffic recorder information.

Locals – ADT for locals were inputted in 1981 and have not been updated since, except in 6 urbanized areas where some locations are periodically updated using new count estimates.

California

RMC & locals – The amount of local system VMT is dependent on the **residual** of subtracting the higher system VMT from the Statewide VMT based on a fuel consumption model. The Motor Vehicle Stock and Fuel Forecasting process involves detailed data breakdowns for motor vehicle stock, fuel consumption, fuel economy, socio-economic factors, vehicle registrations, scrappage, as well as inputs from automatic traffic recorders, toll bridge, transit usage, and other multi-modal trends. An estimate of VMT by functional system and jurisdiction is prepared annually based on assumed annual average daily traffic times the mileage. The amount of VMT is adjusted by trial and error until the total equals the residual from the statewide model and the distribution process built by jurisdiction and functional system splits out the appropriate values by rural and small urban statewide, and each urbanized area.

Colorado

RMC – The State assigns about 5 percent of the total rural VMT to this system. This portion is based on statistics developed in the 1980's.

Locals – The State assigns 10 percent of the total rural, small urban area, and urbanized area travel as the local functional system VMT share. This percentage falls within the guidance on the extent of rural and urban functional systems cited in “Highway Functional Classification, Concepts, Criteria and Procedures,” FHWA, revised March 1989.

Connecticut

RMC – The State enters the ADT collected (or estimated) into the State/Town-maintained road files. The ADT times applicable route mileage equals estimated VMT.

Locals – VMT for rural, small urban and urbanized area local functional system is estimated based on the average of traffic volume from pre-selected random samples times the applicable mileage.

Delaware

RMC & locals – Those facilities that are on the State system may be counted over a period of years. Non-counted segments are assigned pre-selected AADT values from a table setup for municipal streets by urbanized area and urban area and for non-municipal areas by county. Values were derived about 10 years ago and not factored up since. VMT by area type is developed as the product of applicable AADT values times the applicable mileage and summed.

District of Columbia

Local – An average traffic factor of 2,000 AADT is assigned to all local functional streets. (RMC is not applicable.)

Florida

RMC – System VMT is calculated by multiplying the section length times the traffic-based section AADT; the sum of the products is the system total. The method of traffic collection and factoring was not discussed.

Locals – Based on a revised method, the State assigns an AADT value for the largest urbanized areas, smaller urbanized areas, small urban areas, and rural areas based on a lookup analysis. VMT is the product of the AADT value and grouped mileage for each area type. The method assumes that the percentages of miles and of VMT by functional system shown in the “Highway Functional Classification, Concepts, Criteria and Procedures,” FHWA, revised March 1989 are applicable. Those areas grossly out-of-range were adjusted to fall within the expected range specified by functional system.

Georgia

RMC & locals – The State’s estimated VMT is computed based on a stratified random sample stratified for (1) Atlanta area, (2) non-Atlanta urbanized areas, (3) small urban areas, (4) rural local, and (5) rural minor collectors. The average AADT within each stratum times the applicable mileage yields the amount of VMT. Over 4,000 annual traffic counts area are taken for this program statewide.

Hawaii

RMC & locals – Total VMT for each of the four counties (separate islands) is based on the weighted annual average VMT per type of vehicle by county of vehicle inspection and current vehicle registration stock. Estimates of VMT on State facilities are prepared based on the ADT times the length of the route segment; their sum represents the VMT on all State facilities. The **residual** non-State facilities’ VMT is the total VMT for the county (island) minus the State system. The county non-State system VMT is distributed to the various area types (rural, small urban, and urbanized areas) based on a percentage basis of local road miles assigned to each area type.

Idaho

RMC – The State has traffic counts on about 88 percent of these facilities. VMT is computed based on the product of ADT times length basis and summed.

Locals – The State uses a statewide VMT based on the gallons of highway fuel sold in the State multiplied times an assumed miles per gallon value (Table VM-1 values used as default). Count-based VMT are calculated for the non-local functional systems, and VMT for the non-local routes is subtracted from the statewide VMT to get **residual** VMT for the locals. The sub-allocation of the residual VMT among the rural, small urban areas, and urbanized areas is based on the proportion of VMT in those areas on the higher functional classification roadways.

Illinois

RMC & locals – These systems are included in the county traffic surveys conducted on a 5-year cycle. A sample of segments is used to create average ADT for

computing the product of ADT that are then applied to the area amount of mileage within the RMC and Locals. Growth rates on the local systems, for the most part, are negligible.

Indiana

RMC and locals -- These systems are included in a 3-year coverage count program (about 5 to 25 counts per county depending on size) taken on paved roads throughout the State. In small urban, the State tries to collect 1 to 5 counts per area; and in at least two urbanized areas, the local government collects and processes the counts. The amount of VMT on the RMC and locals is computed as the average ADT times the length by functional system at a statewide level.

Iowa

RMC and locals – The State counts these systems with an annual ADT of 50 or more vehicles per day on a 4-year cycle. Those with less are sampled on an 8-year cycle. During each cycle, counting is done at some of the same locations and at new locations particularly those segments that have not been counted during the last 2 cycles. Every section of public road is represented in inventory files with an assigned annual ADT that has been count derived. Growth factors are not assigned to non-counted rural segments; however, automatic traffic recorder growth factors are applied to the old counts on municipal streets. Annual functional system VMT is computed as the sum of the product of section annual ADT and length.

Kansas

RMC – Traffic count data is collected on a 6-year cycle. About 500 24-hour counts are taken each year and the data are adjusted for season and axle and then matched to road section to estimate daily VMT by section. Growth factors and ADT are generated by county and applied to the uncounted sections.

Rural locals – 10 percent sample traffic count plans are applied to the rural and small communities by population groups on a 9-year cycle. ADT value by strata are formed and applied to all sections within the strata to compute daily VMT. ADT is updated every 3 years.

Urban/urbanized areas locals – A 10 percent sample of local streets in 40 urban areas is counted on a 9-year cycle. About 400 counts are taken annually. The counts are averaged and then multiplied by the local mileage reported.

Kentucky

RMC – The State takes coverage counts by county on a 3-year cycle. VMT is based on link ADT times RMC mileage and the products summed.

Locals – The relationship of average local ADT to average RMC ADT by selected county (and average urban local to urban collector) was determined from normal coverage counts for the collectors and a one-time count on a random sample of local road sites. One curve of local sample ADT plotted versus collector ADT was drawn based on the 28 counties selected out of 120. The averages for the non-sample county areas would

be developed based on the relationship established and the average collector ADT for rural, small urban, and urbanized areas. Local VMT by county and area type is the average ADT times the applicable mileage.

Louisiana

RMC – State monitors at least 88 percent of the segments on the RMC. Travel is computed directly from the traffic log, i.e., segment ADT times segment length and the products summed.

Locals – Streets and roads on the local functional systems are discretely monitored for traffic. Travel for the rural segments is based on estimated traffic while urban systems use a sample of counts to estimate the average ADT. The survey results were unclear as to how the State's travel estimate for the local functional systems is generated without any recent counts.

Maine

RMC & locals – The State populates its 100 percent inventory of roads open to public travel with an ADT from many sources. The ADT may come from actual counts, turning movements counts, or estimates, etc. To estimate VMT on these systems, the State multiplies the ADT times the length of link and sums the result. To keep the ADT estimates current, the State factors based on automatic traffic recorders and other coverage counts taken in the vicinity.

Maryland

RMC – State collects a sample of counts and expands the sample for reporting of VMT.

Locals – State uses the growth rate from the higher functionally classified count volumes statewide to apply to volumes on these roads. The survey results were not clear how the initial volumes database was established. In FY 2004, the Baltimore Metropolitan Council plans to begin a process of counting county urban local streets and county rural local streets.

Massachusetts

Urbanized area locals – An estimated VMT based on an expanded sample method is used by the State for urbanized area local travel. Traffic counts were taken for over 500 hand-selected samples. An expansion factor was created for each urbanized area by the ratio of the total local mileage to the sample mileage. VMT equals the ADT times the sample section length times the expansion factor, summed for a given area.

Michigan

RMC & locals – In 1983, a needs study included reporting of ADT on every road link. A growth factor assigned to each record is used to adjust traffic volumes to present day levels. Traffic on links is updated sporadically based on MPO and county road commissions collected data.

Minnesota

RMC – Most of the minor collectors are “county state-aid” and county roads that are counted and traffic volumes adjusted for day and week and month of year on a 4- or 2-year cycle. Those links uncounted are estimated using growth factors derived from similar system counts.

Locals – VMT from the upper systems is subtracted from a statewide projected total and the **residual** divided between the local systems according to the growth of related or “feeder” systems. These roads are primarily made up of township and undesignated municipal roads. The rate of growth applied to these types of roadways is the same as the rate for counted county roads since the township and municipal roads are local feeders to the higher volume county and municipal state-aid systems.

Mississippi

RMC and locals – The State triennially collects a local VMT sample; the last sample was 2001. Several years ago, the State overhauled its traffic counting program to update the factors/formulas used internally to estimate traffic on uncounted roads.

Missouri

RMC – 100 percent of the RMC are on the State system and are counted under the regular program. VMT is the sum of the product of link volume times the link length.

Locals – The **residual** from the total state VMT minus the State Systems is distributed among the local rural, small urban, and urbanized areas. Total State VMT is statistically generated through a historical process and growth factors are applied annually. The method of distribution of the residual VMT to the rural and other urbanized/small areas local functional systems was not explained. In recent years, the State completed the collection of 1,000 counts in St. Louis and 800 counts in Kansas City for all non-State functionally classified roadways.

Montana

RMC & rural local – About 62 sites are monitored. VMT is computed by functional system based on (averaged) traffic data collected.

Small urban/urbanized areas locals – About 82 locations are traffic monitored on these systems in conjunction with local governments whenever possible. VMT is calculated by functional class group mileage times the (averaged) traffic data collected and adjusted for season and axles.

Nebraska

RMC & locals – The **residual** of VMT derived from the total State VMT (based on a fuel consumption model) minus the VMT on the traffic counted State systems is distributed to the local systems. In 1977 (one-time basis), the entire RMC was counted.

Currently, the State does not collect traffic data on the non-State parts of the RMC and locals systems. For RMC routes on the State highway system and where new counts were made, the actual VMT is used. Estimates are distributed among the rural, small urban, and urbanized areas initially based on growth rates of the next higher system. Since the method is approximate, another iteration may be needed to adjust the initial total until it equals the residual.

Nevada

RMC – The State road inventory creates system links at all major “traffic breaks.” Each major segment is reviewed annually for count sample adequacy. Segment ADT times segment length equals the segment VMT; sum of the products is the total RMC VMT.

Rural locals – About 5 count locations are taken per county. Counting is taken on a need basis. Roadways are aggregated by ownership. The average ADT from all counts within each aggregate grouping is applied to the appropriate ownership mileage.

Urban/urbanized areas locals – Roads are aggregated by government ownership and 5-digit City FIPS codes. The average ADT from all counts within each aggregate grouping are applied to the appropriate mileage records. In addition, a random sample of 75 count locations each for the “Large Urban” portions of Clark and Washoe Counties was taken.

New Hampshire

RMC & locals – The growth rate of the statewide non-local traffic counts is applied to the previous year’s local system’s VMT estimate. The original estimates of local system VMT were developed about 10 years ago using fuel consumption, motor vehicle registration, and licensed driver data and have not been updated since then.

New Jersey

RMC and locals – The methodology for developing VMT for all the lower functional class levels is the same. Within each of these systems, local traffic counts are distributed into appropriate volume groups. The VMT is generated as a sum of the product of the average count within the volume group times the applicable volume group mileage. All volume groups are summed within a specific system and area to obtain the total for the area. The method appears to be getting better as more data is added to the State’s traffic volumes database.

New Mexico

RMC – The growth rate at the automatic traffic recorders located on these systems is applied to the previous year’s VMT to provide a current estimate. The survey results did not explain how the State initially estimated the RMC VMT.

Locals – A representative growth rate determined as the change in area population the last few years has been applied to update the previous year’s VMT estimate. Again, the survey results were unclear how the initial local VMT was generated.

New York

RMC and locals – A **residual** VMT based on the Total State Estimate minus the ground counted upper systems VMT is distributed to the RMC and locals. The State is looking into ways to re-validate the VMT estimate produced by doing a major count effort statewide on the lowest systems through implementation of a sample-based stratified approach. The present statewide model incorporates several travel related inputs including traffic trends, gross domestic product, personal income, vehicle registrations, drivers registrations, etc., and requires several iterative calculations before the policy group settles on the results. The allocation of the residual travel estimate statewide to the rural minor collectors, rural locals, and small urban locals and each urbanized area is based on a combination of steps. The first step uses the initial growth factors used in the model supplemented with any ground counts. The second step involves use of growth rates from the appropriate middle systems in rural and urban areas to adjust or temper the modeled rates.

North Carolina

RMC and locals – VMT for the RMC and locals is a **residual** from the total estimated VMT for the State minus the VMT from the traffic counted upper functional systems. The statewide VMT is determined by calculating VMT for all functional systems using the mileage and AADT in the mileage file for those sections having an AADT. The raw VMT, separately for the rural and urban and each urbanized area, is compared to the prior year's raw VMT and a factor of change is determined. These factors are applied to the previous year's area statewide VMT to determine the new totals for the subject year. The State counts most of the Secondary paved (odd years) and unpaved (even years) roads and develops AADT estimates on a 2-year basis. The State also counts some on State local urban, however, the bulk of the streets are municipal owned and the State does not use any local government counts in the VMT process since many municipalities stopped collecting data for traffic monitoring. All urban stations have data collected and AADT estimated on a 2-year cycle; 9 areas are done in odd years and 8 in even years.

North Dakota

Locals (State reclassified all RMC to locals) – Most of these facilities have very low traffic volumes. The State uses historical traffic volumes that are 10-years old to populate the annual VMT estimating process. Due to the rural nature of the State and low economic activity in most areas, there has not been a significant increase in local traffic in rural areas. The State simply uses a flat straight-line projection. In the three major urban areas, adjustments are made for mileage changes in the fringe areas.

Ohio

RMC & locals – The State's Rail Commission collects counts at at-grade rail crossings statewide and this information is available in a database. No non-state routes are counted by the State, except for 6 automatic traffic recorder sites. In addition, any

available county and township counts are incorporated. In developing an estimate of VMT, the known counts are expanded across all road inventory sections that have similar highway, area, and population features. Any remaining unpopulated segments are assigned appropriate traffic volumes based on higher or lower known functional class sections having similar features containing an AADT. This estimated traffic volumes base is then adjusted each year taking into consideration an annual growth adjustment derived from data gathered thru traffic counting program and current year population estimates for rural and small urban areas. The state's inventory of non-State roads depends on the road mileage information supplied by the appropriate agency.

Oklahoma

RMC – Traffic volumes by county are collected on a 2-year cycle. VMT is computed on a basis of link traffic volume times link length.

Locals – In 1993, estimated local road VMT was distributed to each rural, small urban and urbanized area, by using the population and road mileage for each county. These estimates were converted to ADT per mile by county and area type and have not been updated since 1993. The area type ADT times the current area type mileage for each county summed for the State equals the current statewide VMT for a particular system. In 2002, the State started collecting traffic volumes in towns and unincorporated places under 5,000 persons to improve the information in the local road database file.

Oregon

RMC & locals – The State uses a fuel-based method to estimate overall statewide VMT; the State subtracts the HPMS counted traffic estimates on the higher functional systems to arrive at the **residual** VMT for the lower functional classes. The residual VMT is allocated to the RMC, rural local, small urban, and urbanized area classes using percentage splits derived from moving averages of the counted systems. The State is currently reviewing an option to compute the VMT for the lower classes based on 500 traffic counts over a 3-year update cycle. The averages of these counts would be used with the mileage of the lower functional systems to calculate VMT.

Pennsylvania

The practices used to determine VMT on the RMC and locals varies by Government Ownership as follows:

State Highway Agency – These segments are counted on a 5-year cycle. During the 5-year cycle highway segments not counted in the current year are converted to current year counts using growth factors calculated as outlined in the Traffic Monitoring Guide (TMG).

Municipal Highway Agency – RMC highway segments are counted on a 5-year cycle. During the 5-year cycle, highway segments not counted in the current year are converted to current year counts using growth factors calculated as outlined in the TMG. Rural local and urban local VMT is calculated each year by applying the known State Highway Agency growth rate to the previous years Municipal Highway Agency local VMT by county, rural/urban code, and urbanized area distribution. The data is then reported in HPMS as a grouped record for each distribution.

Other State agency & Federal agency – The State and Federal agencies included in this category are queried periodically to update the traffic count data on public roads in their facilities. The data received is often incomplete or reported to the State in an unusable format. In these cases an estimated AADT is used. This VMT represents 1.5 percent of the State's total reported VMT.

Puerto Rico

RMC – The Commonwealth groups the public roads by county, area, governmental ownership and type of facility. The survey results were unclear if the Commonwealth collects traffic counts on the RMC and the method of computing the VMT.

Locals – The Commonwealth's methodology used to obtain the local VMT does not differ for rural, small urban, and urbanized area local functional systems. Growth factors in the central business districts and adjacent built-up areas are computed based on screen-line stations placed on the area's traffic flow maps. Traffic outside of the areas covered by traffic flow maps but inside the urban boundaries is estimated by formula using the changing in housing units and an assumed trip generation rate taken from the local urbanized area transportation plan. For the rural areas, a trip generation rate of 2 auto driver trips per dwelling unit is assumed.

Rhode Island

RMC – VMT is a product of assigned link AADT and road link lengths for the grouped HPMS records on the RMC system.

Locals – Group records for the rural local systems carry an annual ADT of 50 or 100 and records for the urban local systems carry an annual ADT of 100 or 200. A cursory review of these assigned counts suggests that the annual ADT carried in the State's database may be low.

South Carolina

RMC & locals – The State counts some of the RMC facilities and estimates a representative count for the others. Estimated counts are prepared for low volume non-count sections based on factors developed in the early 1990's. ADT assigned times section length yields the VMT; sum of all section VMT is the total for a given functional system and area.

South Dakota

RMC & locals – All VMT is calculated from counts, by multiplying the section length by annual ADT and summing for the rural systems and urban and urbanized area systems. Some counts at established coverage count locations are counted on a 2-year cycle; however, the bulk of the counts have not been updated in years. Many of these roads are of low volume and experience very little change over time.

Tennessee

RMC – Years ago the State collected counts on all rural minor collectors; however, in recent years cut backs have been made to traffic count affecting the lower volume routes. The State now develops its travel estimates by county using a formula based on bridge counts, system AADT, and system mileage.

Locals – Bridge and railroad crossing counts have been infrequently taken. In years past, a 3 percent growth factor was applied to the historical base. Beginning in 2001, the State worked with the University of TN and devised a formula to develop travel estimates by county based on system AADT rural and urban, bridge counts, and system mileage rural and urban.

Texas

RMC & locals – The State uses the same process for all area types. Roads are divided into groups within each county by city and pavement type, and mileage summations for each type are developed. Average ADT are established for each stratum. The strata ADT are multiplied by the mileage summations for each corresponding county (stratified by city and pavement type). All of the resulting products are then summed to yield a statewide total. In the past the default value of the samples ADT became the default value for the strata for the entire State. Currently the State is transitioning to a process that randomly selects traffic counts in each county. Thru this process, the median ADT values for each stratum within county become the default values by strata within county.

Utah

RMC & locals – The State has divided the State areas into zones with similar traffic. Within each zone, annual ADT values have been assigned for the rural minor collector, rural local, and urban/urbanized local. Population change is the primary factor used for adjusting the annual ADT values annually. Zones with higher population density and closer to major cities have higher base level annual ADT values assigned. Functional system miles for each zone are kept current. VMT by zone and system is developed as the product of applicable annual ADT values times the applicable mileage and summed.

Vermont

RMC & locals – The statewide VMT for these local systems are determined by averaging VMT per mile calculated for each county by functional system. VMT per mile (ADT per mile) for each functional system is calculated for each county based on random traffic counts and applicable mileage. If a particular county did not have any traffic counts for a functional system, than values from comparable counties are used. The weakness is a lack of representative traffic data, since the only real source is project counts or special requests. Functional system miles by county are kept current.

Virginia

RMC and locals – Traditionally the State has had a very extensive traffic-monitoring program on State and non-State maintained facilities. Averages of counts are

determined by functional system by county and city/town and directly applied to the applicable public roadways within the area to populate the VMT. Prior to 1985, the State had sufficient counts to cover nearly every link with 50 or more annual ADT. Between 1985 and 2000 scheduled counting was severely pruned on the lower systems. Beginning in 2000 the State's traffic count program was expanded again to include non-State public maintained roads. Updated counts were again available to populate the averages for each county, city and/or municipality on a scheduled basis. The State maintains traffic records over time and is able to estimate values for a particular area when insufficient information exists.

Washington

RMC -- The local Governments contribute information to the statewide county inventory database including traffic counts. It is possible to produce some type of traffic generated VMT using this database. The survey results were unclear how the State procedure computes the VMT.

Locals – The State assigns 7 percent of total rural VMT to the rural local functional system and 11 percent of total small urban/urbanized areas VMT to the urban local functional system.

West Virginia

RMC & locals – The State's inventory log includes an ADT for each road segment based on actual or count-based estimates. The State does collect traffic counts on the State system segments and uses representative data to populate the non-counted segments. Typically the State does not collect data on routes with less than 100 annual ADT. Estimates for low volume routes are made on an individual route basis and are based on culture along the road such as number of dwelling units, businesses, etc. To calculate statewide VMT, the route segment lengths are multiplied by their respective ADT and the resulting VMT summed for the individual functional classifications by area.

Wisconsin

RMC & locals – State determines the local area VMT reported in HPMS on these systems as a **residual** from the total statewide estimated VMT. In other words, the State arrives at a statewide control total for VMT, subtracts out the HPMS traffic count generated VMT estimates, and the remainder (or **residual**) gets allocated to the local systems. The statewide VMT is based on a combination of three methods: (1) fuel based approach, (2) automatic traffic recorders, and (3) VMT on the State system highways. The final statewide estimate (a percent change applied to the previous year's estimate) usually, but not always, is derived by weighting the three approaches equally. Distribution of the residual to the local systems by area basically is done proportionally to the previous year's VMT share. Some adjustments may be made for each area to account for what happened on the other functional systems in the area.

Wyoming

RMC – New traffic counts are done every 2nd year on the State system and the off-system roads intersecting with the State system routes. Off-system roads not intersecting State system routes are only counted as scheduled for special or coverage counts taken on an as-needed basis. The State uses a regression analysis or a trend analysis to determine the VMT.

Rural local – This system has had about 5 percent of its segments counted on a sample basis over the last 5 years; since most roads have extremely low volumes, the VMT is generated through an trend analysis approach.

Small urban/urbanized area locals – Coverage counts are taken on a 3-year cycle plus any from on –State system roads every other year. In addition, both Cheyenne and Casper collect counts each year to review growth issues and traffic problems and these are made available to the State for analysis. The VMT is generated based on modeling and trend analysis.