

How the United States Estimates Travel at the National Level

Transmitted by the Federal Highway Administration,
US Department of Transportation

Introduction

Estimating travel at the national level is a joint effort between the States and the Federal Government. The United State's Congress has assigned the Federal Highway Administration (FHWA) the responsibility of collecting, analyzing, and reporting all data associated with the Nation's highways. These data are collected and reported to FHWA annually by all 50 States plus the District of Columbia (DC) and the Commonwealth of Puerto Rico. States are responsible for incorporating and reporting data collected by their counties, cities, and local agencies. The cities are the focal point of urban area travel, with the larger ones usually being designated as Urbanized Areas by the U.S. Census. Each Urbanized Area is required by law to be represented by a regional planning agency referred to as a Metropolitan Planning Organizations (MPOs). MPOs are defined as a regional policy body, required in urbanized areas with populations over 50,000, and designated by local officials and the governor of the state. At last count there are 3,141 counties and 384 MPOs nationwide.

In 2004, the 50 States, DC, and Puerto Rico reported a total of 6.433 million kilometers (3.997 million miles) of public roads. The travel on all public roads was estimated at approximately 4.799 trillion annual vehicle-kilometers (2.982 trillion annual vehicle-miles). Passenger cars and other 2-axle 4-tire vehicles accounted for approximately 92% of all travel, with most of the remaining 8% being attributed to single-unit and combination trucks.¹

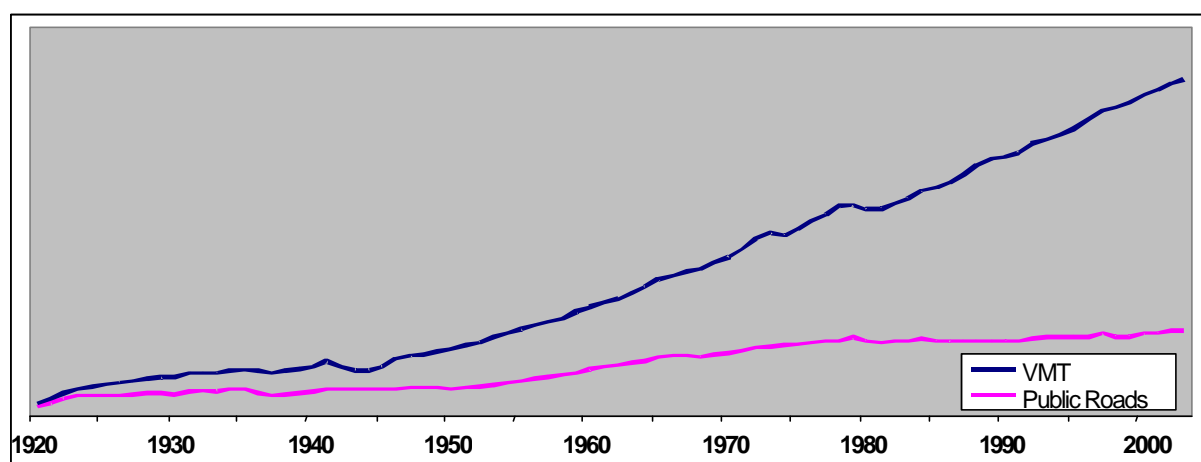


Figure 1. Vehicle-miles traveled and total public road mileage (1920 - 2004)

¹ 2004 Highway Statistics, U.S. Department of Transportation, Federal Highway Administration, November 2005.

The primary source of these traffic data within FHWA is the Highway Performance Monitoring System (HPMS), which contains data on the inventory, use, condition, and performance of all public roads. The HPMS is a national data program for each State, which is required by Federal regulations and funded with Federal aid planning funds made available annually to each State for data collection, analysis, and reporting of these data. There are more than 1.2 million HPMS sections nationwide.

On a more limited basis, States also collect voluntary monthly continuous automatic traffic recorder (ATR) and weigh-in-motion (WIM) data from approximately 5,000 sites. The installation and maintenance of traffic monitoring equipment at these sites is also funded with Federal aid funds (planning and construction). The continuous ATR and WIM data are used for validating the annual HPMS traffic estimates and for making monthly estimates of travel, usually within 60 days after data collection. Within FHWA, the Office of Highway Policy Information maintains the three previously mentioned data programs, along with the finance, motor fuel, motor vehicle, truck travel and use, and personal travel survey data.

The HPMS sampling schema is stratified by State, functional classification, and traffic volume group. The current functional classification system, procedures, and criteria are the result of two national studies that were conducted in the late 1960's and early 1970's.² These studies designated all public roads as either urban (having a population of 5,000 or more) or rural, depending on whether they are within or outside a populated urban area, respectively. Roads were further broken down by their function, ranging from the arterial system that provides a high degree of mobility with limited access to the local system that provides limited mobility with full access. There are a total 12 functional categories of public roads, all of which are represented in the HPMS.

The primary HPMS dataset consists of universe and sample records. The universe records contain limited information on only the higher functional systems, while the sample records contain more detailed information on a smaller portion of the functional systems. The 2004 data contains over 1.1 million universe records and a little over 113,000 sample records. The lowest functional systems are represented, along with the other systems, in an areawide summary table submitted by each State. This table contains information on the percent of travel by vehicle type by functional system on all public roads. Total national travel estimates are derived from reported universe, expanded sample, and summary travel data as submitted by the States. Table 1 lists the 12 functional classification categories and the type of data records reported by States for each category. The areawide summary, sample, and universe records are represented in the table by the columns labeled A, S, and U, respectively.

Rural				Urban			
A	S	U	Functional Classification	A	S	U	Functional Classification
X	X	X	Interstate	X	X	X	Interstate
X	X	X	Other Principal Arterial	X	X	X	Other Freeways & Expressways
X	X		Minor Arterial	X	X	X	Other Principal Arterial
X	X		Major Collector	X	X		Minor Arterial
X			Minor Collector	X	X		Collector
X			Local	X			Local

² Highway Functional Classification: Concepts, Criteria, and Procedures, U.S. Department of Transportation, Federal Highway Administration, revised March 1989.

Table 1. Functional Classification Categories

In order to ensure consistency of the data reported in the HPMS, FHWA has developed procedures for the States to follow. The *HPMS Field Manual* is the formal document that describes how States are expected to collect and code the universe, sample, and summary data that together comprise the annual HPMS submittal.³ Furthermore, there are FHWA Division Offices in each State, which are responsible for reviewing not only the State's HPMS data, but also the procedures that are used for collecting, developing, and reporting these data. Every year, each Division Office submits a written review of State's data and procedures, along with a certification that the data is acceptable for use at the National level.

Estimating highway vehicle travel

The FHWA uses daily vehicle-miles traveled (DVMT) [daily vehicle-kilometers traveled (DVKT)] as the primary measure of travel activity on the Nation's highway systems. The daily travel times 365 days (366 days for leap years) equals annual travel.

Travel is a calculated product of the annual average daily traffic (AADT) and the centerline length of the section for which the AADT is reported. In the HPMS, travel is accumulated for each universe section to develop appropriate totals for the higher functional systems. AADT is required for each section of Interstate, National Highway System (NHS), and other principal arterials; as a result, travel is computed for these functional systems on a 100-percent basis. For minor arterial, rural major collector and urban collector systems, travel is calculated from samples using the AADT, centerline length reported for each sample section, and the HPMS sample expansion factor for each section. Travel for the NHS on all functional systems is computed from the universe AADT data.

For the most part, travel for the rural minor collector and rural/urban local functional systems is calculated by the States using their own procedures and is provided in HPMS on a summary basis. Some States use supplemental traffic counts outside of the HPMS procedures; others employ estimating techniques, such as fuel use, to determine travel on these systems. In general, these methods are used in both rural and urban areas, including the donut areas of designated air quality non-attainment areas to meet traffic monitoring requirements of the Clean Air Act.⁴

AADT and travel estimates are edited by the HPMS software and reviewed by FHWA for unusual values and for unusual changes to previously reported values. FHWA routinely works with State data providers to modify reported AADT values that do not appear to be reasonable before final use. Although AADT is required to be updated annually in HPMS, counts are required to be taken only on a 3-year cycle. Usually, AADT for uncounted sections is estimated by factoring the latest year's count. States that follow the HPMS sampling instructions in developing traffic counting programs (Appendix F in the *HPMS Field Manual*) and the practices advocated in the *Traffic Monitoring Guide* have adequate counting and classification tools to prepare quality AADT and travel estimates for HPMS. These procedures should also provide comparable State-to-State traffic data.

³ Highway Performance Monitoring System: Field Manual, U.S. Department of Transportation, Federal Highway Administration, revised December 2005, <http://www.fhwa.dot.gov/ohim/hpmsmanl/hpms.htm>.

⁴ Further information about the Clean Air Act and the reporting of local area travel can be found at: <http://www.fhwa.dot.gov/ohim/statepractices.htm>.

Most States generally follow the recommended sampling, counting, and estimating procedures contained in the Traffic Monitoring Guide, although some State traffic count programs exceed the recommended 3-year cycle. The calculation and application of various adjustment factors to 24- or 48-hour coverage counts to enable them to represent AADT is as much art as science. Classification counts, which are needed to adjust pneumatic tube counts collected for three or more axle vehicles, are difficult to collect and to apply on a statewide basis. Equipment used to obtain count information is only accurate within certain limits and can suffer from malfunctions and breakdowns, factors that can affect the reliability of traffic counts. The user must recognize the shortcomings of the data collection and traffic estimation processes when using HPMS travel data. The degree to which recommended procedures are followed can impact the accuracy and consistency of the travel estimates in HPMS. Differences in State and local practices need to be taken into account when attempting to make State level comparisons.

Traffic Data Collection

As previously described, manual and portable tube counts comprise the majority of most States' traffic counts. Continuous ATR and WIM sites provide States with the information needed to develop accurate seasonal, day of week, and growth factors. Manual and continuous classification counts are used to develop axle correction factors. Figure 2 shows the typical relationship within a State's traffic counting section of manual and portable tube counts, and continuous ATR and WIM counts. It's important to point out that portable tube counts are expected to include coverage for at least 48-hour period. States typically count traffic on their own roads once every three years. While some States also count traffic on county roads once every six years, most do not and rely on the counties to provide these counts as needed. Few States count traffic within MPOs since they typically have extensive traffic counting programs.

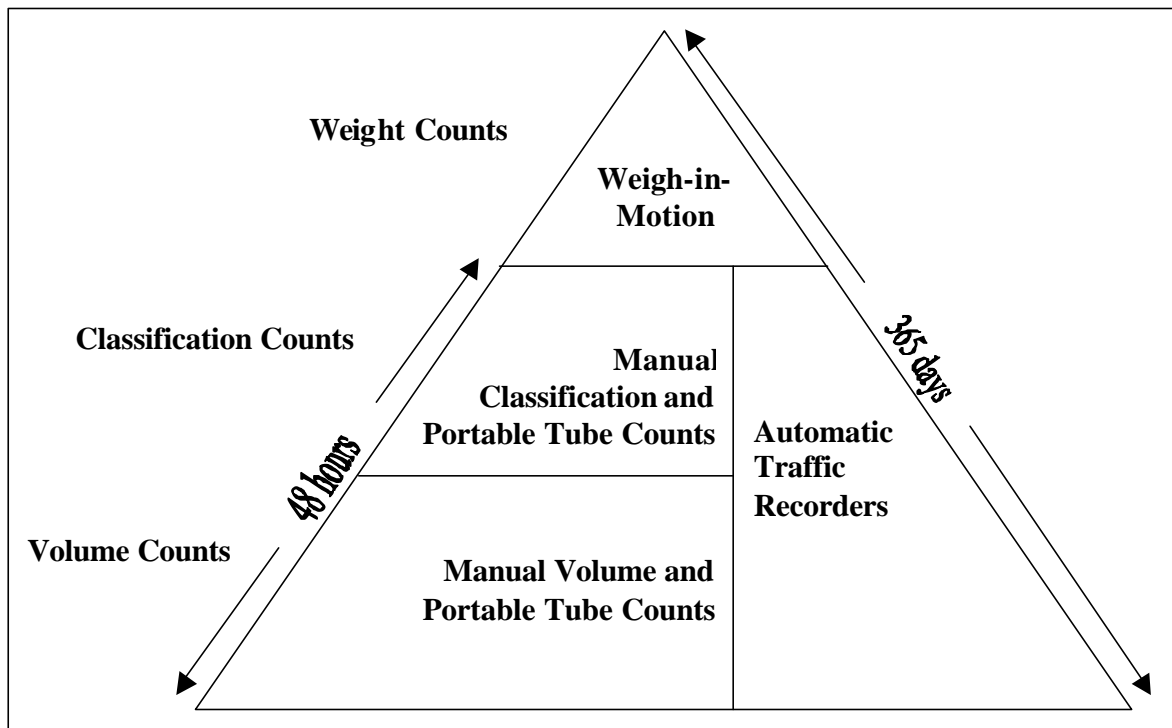


Figure 2. Typical State Traffic Monitoring Program

The integration of statewide traffic data has lately become more important as many States are adopting statewide travel demand models, which are supported by relational databases and geographic information systems (GIS). These models are similar to the smaller scale efforts of many MPOs, who have been using travel demand models for some time to help them better manage their current and future transportation assets.

Since the HPMS data are submitted by the States to FHWA only once a year, it cannot be used for tracking monthly traffic trends, which is part of the reason why FHWA also collects State provided ATR and WIM data. Since the latter two data programs are voluntary, monthly participation can range from 35 to 50 States. The ATR data are reported monthly in the *Traffic Volume Trends* report, which summarizes travel at the national, regional, and State level. The WIM data are available on the FHWA web site and are also summarized in the *Truck Weight Study* report. The location of ATR and WIM sites are at the discretion of the State, who often have their own business need for choosing the locations that they do. Consequently, these data are suspected of being somewhat biased and are usually not used for summarizing data below the State level.

Together, FHWA and the States play an active role in promoting the quality and consistency of these continuous ATR and WIM data. The *Traffic Monitoring Guide* and the *WIM Handbook* provide States with guidance on the preferred methods for collecting this information. A recent effort aimed at increasing participation in the ATR program allows States to use 100% of their Federal funds for the purchase of automatic traffic classifiers.

In addition to offering guidance on data collection, FHWA's Office of Highway Policy Information provides training and support through annual conferences and workshops, on-site support, and remote support through video conferencing and web training. The Office of Highway Policy Information also works closely with the Division Offices to provide support and training, as these staffs are often the first people that States turn to when they have questions.

Overview of Current Data

The following are a sample of some of the typical reports that FHWA produces to help others both within and outside FHWA understand the current performance and use of nation's highways. Table 2 provides a summary of public road length and travel by functional system.

By combining the various data programs into one summary chart we are able to see how travel compares to other data items such as population, motor vehicle registrations, and fuel sales for the past ten years. These charts, such as the one shown in Figure 3, are referred to as "Dashboard Charts." They are used for checking the reasonableness of the current year's data and for identifying long-term data trends that might not be caught by year-to-year comparisons.

Within the Office of Highway Policy Information, GIS is used extensively for data quality analysis. Figure 4 shows the change in travel data on a State-by-State basis between 2003 and 2004. These type of maps help identify potential data anomalies and regional trends.

Rural			Urban		
Functional System	Kilometers	Vehicle-Kilometers (millions)	Functional System	Kilometers	Vehicle-Kilometers (millions)
Interstate	50,603	430,331	Interstate	24,724	739,925
Other Principal Arterial	154,495	388,320	Other Freeways & Expressways	16,581	336,474
Minor Arterial	218,357	272,250	Other Principal Arterial	96,699	730,418
Major Collector	676,394	323,365	Minor Arterial	158,433	588,737
Minor Collector	431,446	97,008	Collector	166,377	264,468
Local	3,302,218	213,196	Local	1,136,894	414,599
Total	4,833,563	1,724,470	Total	1,599,709	3,074,621

Table 2. Functional System Length and Annual Travel

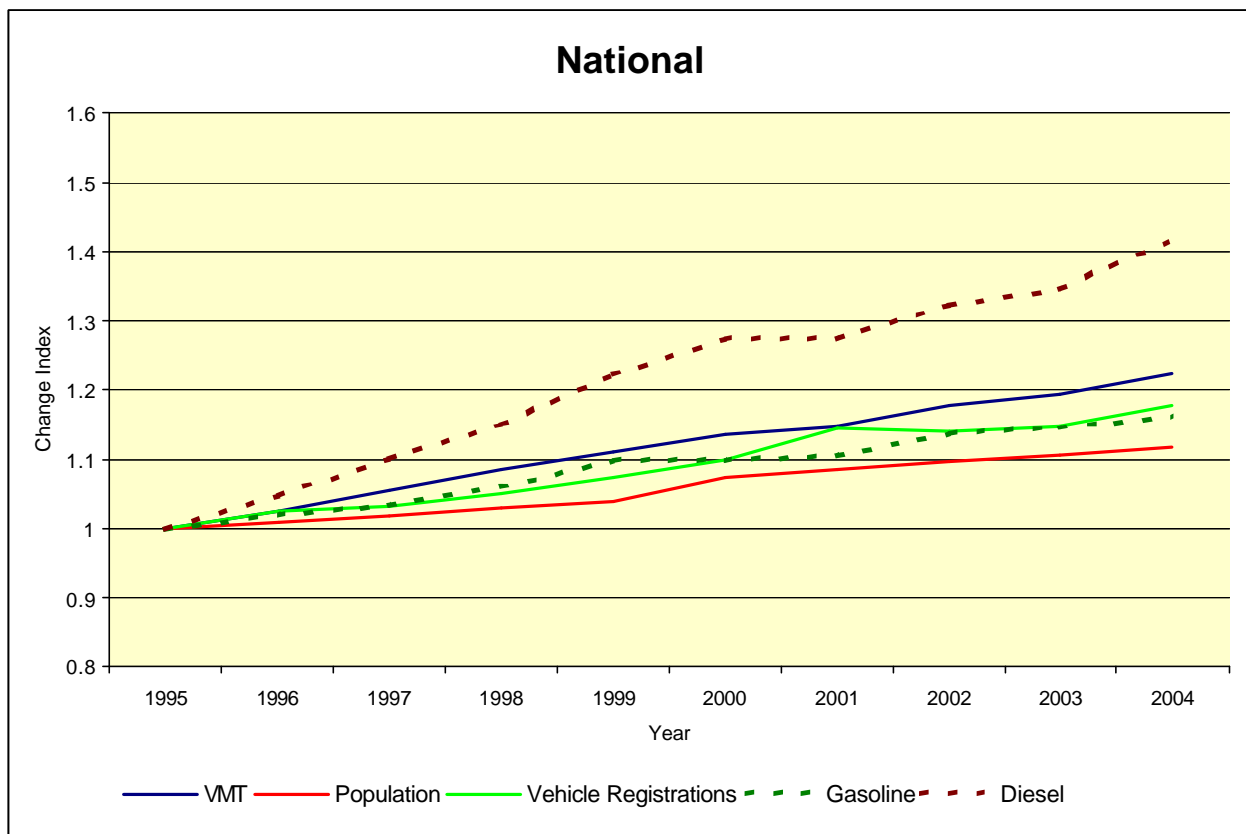


Figure 3. Dashboard Chart 1995 - 2004

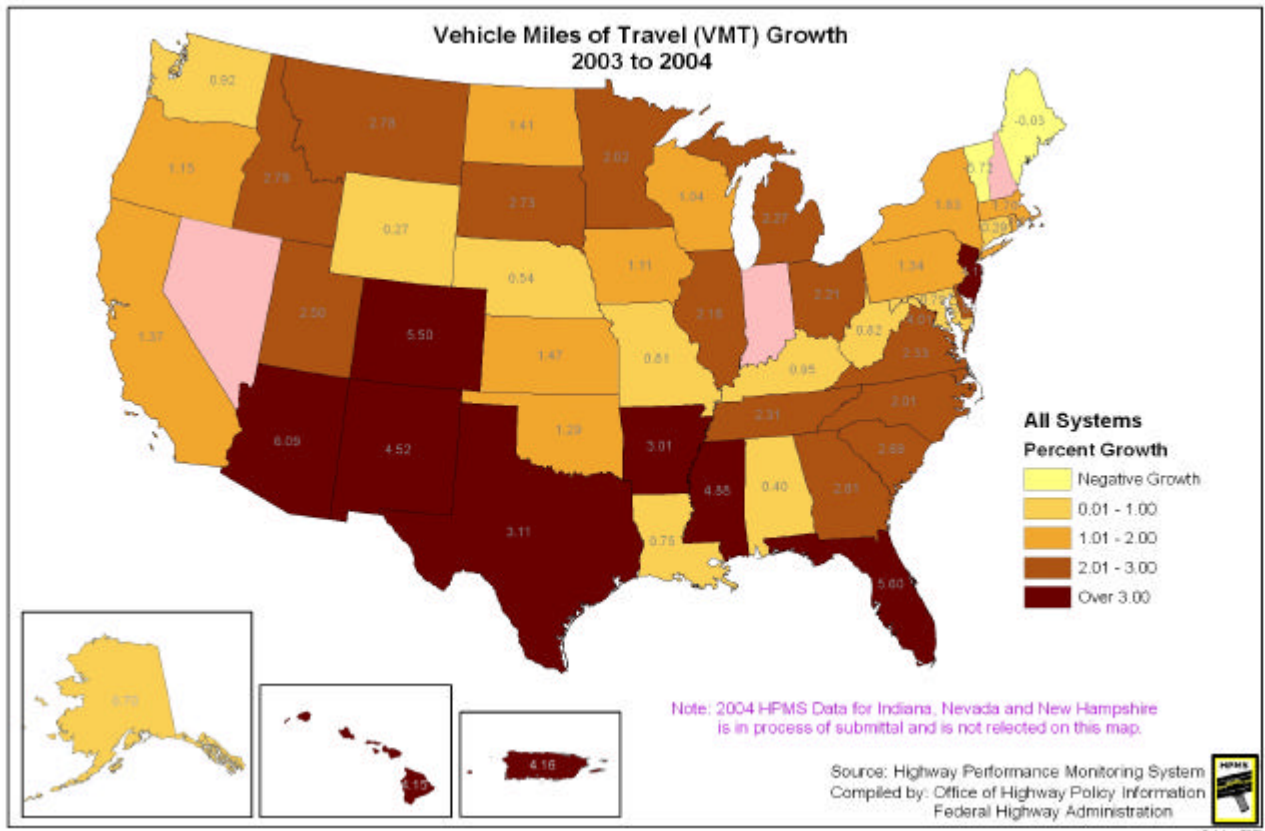


Figure 4. Growth in VMT by State 2003 – 2004