METHODOLOGY FOR PREPARING VMT ESTIMATES FOR THE NATIONAL EMISSION INVENTORY: 2003, 2004, AND 2005

TECHNICAL MEMORANDUM

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February 28, 2007

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TABLES

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CHAPTER I. INTRODUCTION

This memorandum documents the methods that were used to develop national onroad vehicle miles traveled (VMT) databases for the years 2003, 2004, and 2005 at the county, road type, and vehicle type level of detail. These data were prepared for use in EPA's 2005 National Emission Inventory (NEI), for input to EPA's National Mobile Inventory Model (NMIM), and to fulfill other EPA needs and requests. For each of these three years, a full VMT database at the county, roadway type, and vehicle type level of detail was developed from Federal Highway Administration (FHWA) information. For States and local areas that submitted VMT data that were incorporated in the 2002 NEI, the 2002 NEI VMT data were grown to 2003, 2004, and 2005 using growth factors developed from the FHWA data, and these grown VMT data replaced the baseline FHWA-based VMT data. The resulting VMT databases prepared for 2003, 2004, and 2005 include data for all 50 States, the District of Columbia, Puerto Rico, and the Virgin Islands for each of the 12 Highway Performance Modeling System (HPMS) functional roadway types and the 28 MOBILE6 vehicle classes, for a total of 336 records per year per county. The data were prepared in the NMIM National County Database BaseYearVMT table format.

The following sections of this memorandum describe the sources of data used, the methodology for preparing the FHWA-based VMT data, and the methods for projecting the State and local 2002 NEI data.

CHAPTER II. DATA SOURCES USED TO DEVELOP VMT

The FHWA 2003, 2004, and 2005 VMT databases were developed using data supplied directly by FHWA and as well as publicly available data from FHWA's *Highway Statistics* data series (FHWA, 2004; FHWA, 2005; FHWA, 2006). The FHWA data sets that were provided include the HPMS universe data, sample data, state data summaries for rural minor collector, rural local, and small urban local, and local daily VMT for urbanized areas (Rozycki, 2005; Rozycki, 2006). The *Highway Statistics* data used in the VMT development include:
- Table VM-2, "Functional System Travel, Annual Vehicle-Miles,"
- Table VM-1, "Annual Vehicle Distance Traveled in Miles and Related Data by Highway Category and Vehicle Type," and
- Table HM-71, "Urbanized Areas, Miles and Daily Vehicle-Miles of Travel."

Table VM-2 contains State-level summaries of miles of annual travel in each State by functional system and by rural and urban areas. Rural VMT is provided on a state level for the six HPMS rural functional roadway types: interstate, other principal arterial, minor arterial, major collector, minor collector, and local. Urban VMT is provided on a state level for the six HPMS urban roadway types: interstate, other freeways and expressways, other principal arterial, minor arterial, collector, and local. However, the 2003 urban local data reported for the District of Columbia appeared to have been double counted. The published VM-2 data for 2004 dated October 2005 did not account for

corrections that FHWA performed in 2006. On October 12, 2006, Pechan received the corrected 2004 HPMS data set (i.e., universe data, sample data, and state data summaries) (Rozycki, 2006). The publicly available 2004 *Highway Statistics* tables do not include these updates. Therefore, the FHWA-based VMT developed for the NEI will differ somewhat from the VMT data published in the 2004 *Highway Statistics*.

Table VM-1 provides annual VMT separated by rural and urban areas broken down into the following vehicle categories: passenger cars, motorcycles, buses, other 2-axle 4-tire vehicles, single-unit 2-axle 6-tire or more trucks, and combination trucks.

From the HPMS data tables, Pechan extracted daily VMT by urban area (areas with a population of 50,000 or more) and State in each of the six HPMS urban functional roadway categories. The resulting data is similar to that in Table HM-71 from *Highway Statistics* with the exception that Table HM-71 does not break down multi-state urban areas into the portion in each state. Pechan also calculated the year-specific roadway mileage by county and each of the 12 HPMS functional roadway classes from the HPMS data sets provided by FHWA.

In addition to the FHWA data, the 2003, 2004, and 2005 Census population estimates were used in developing the VMT data base (USCB, 2006). The population file downloaded from this site was labeled "County population and estimated components of population change, all counties: April 1, 2000 to July 1, 2005." The breakdown of population within a county by urban, rural, and small urban designation is only available from the decennial census. Thus, the population ratios of urban, small urban, and rural population to total county population are based on data from the 2000 Census, and are the same as those used in the 2002 NEI VMT development. These ratios are multiplied by the year-specific county population data to estimate the urban, small urban, and rural populations in each county for 2003, 2004, and 2005.

CHAPTER III. ESTIMATION OF VEHICLE MILES TRAVELED

As described in the Introduction to this document, the estimation of VMT is done by first developing a VMT database from the FHWA data and then replacing the FHWA-based VMT with State-based VMT grown to the year of interest for States and local areas that supplied VMT data used in the 2002 NEI. The development of the FHWA-based VMT starts with State-level VMT totals for each year from *Highway Statistics* Table VM-2. The State-level VMT are then allocated by county, roadway type, and vehicle type. There are four basic steps in this process: (1) allocate state-level rural VMT by roadway type to county/roadway type level; (2) allocate large urban area VMT by roadway type to the county/roadway type level; (3) allocate remaining state-level small urban VMT by roadway type to the county/roadway type level; and (4) allocate county/roadway type level VMT to each of the 28 MOBILE6 vehicle classes for each county and roadway type combination. Each of these steps is described in more detail in the following sections, followed by a discussion of the procedure for growing the State-based VMT.

A.   DEVELOPMENT OF FHWA-BASED VMT FILES

1.   Allocation of Rural VMT from State to County

Rural Interstates

Rural interstate VMT is allocated from the State level to the county level based on rural interstate roadway mileage. To estimate county-level VMT on rural interstates for each year being modeled, each county's fraction of the State's total rural interstate roadway mileage was calculated and then multiplied by the State's year-appropriate (i.e., 2003, 2004, or 2005) rural interstate VMT total from Table VM-2. Equation 1 shows this calculation.

Equation 1

$$\text{VMT}_{RI,C} = \text{VMT}_{RI,S} \times (\text{MIL}_{RI,C} / \text{MIL}_{RI,S})$$

where: $\text{VMT}_{RI,C}$ =   Rural interstate VMT in county C (calculated)
$\text{VMT}_{RI,S}$ =   Rural interstate VMT, State total (*Highway Statistics* Table VM-2)
$\text{MIL}_{RI,C}$ =   Rural interstate mileage in county C (from HPMS data sets)
$\text{MIL}_{RI,S}$ =   Rural interstate mileage, State total (from HPMS data sets)

Rural Local Roads

For the rural local roadway type, VMT was allocated from the State to the county level using rural population to determine the allocation fractions. The 2003, 2004, or 2005 rural population was first estimated at the county level by multiplying the Census Bureau's year-specific county-level population estimates by the ratio of each county's rural population from the 2000 Census to its total rural plus urban 2000 population. The rural local VMT at the county level was then calculated by multiplying the State's rural local VMT total by the ratio of a county's rural population to the State's rural population. The equation used for this calculation is the same as Equation 1, but with rural interstate mileage replaced by rural population.

Other Rural Roadway Types

The VMT for remaining four rural roadway types (other principal arterials, minor arterials, major collectors, and minor collectors) from the State level to the county level were allocated using rural county population as the primary source of the VMT allocation. Additionally, VMT for a specific roadway type was distributed only to counties with nonzero roadway mileage of the specified roadway type, based on the roadway mileage file data from the HPMS data sets. Thus, rural population within a State was totaled individually for each of these four rural roadway types, including only population from counties with nonzero roadway mileage of the specified roadway type.

Equation 2 shows the equation used to calculate county-level VMT on rural roadway types other than rural interstates.

Equation 2

$$VMT_{RX,C} = VMT_{RX,S} \times (POP_{RX,C} / POP_{RX,S})$$

where: $VMT_{RX,C}$ = VMT on rural roadtype X in county C (calculated)

$VMT_{RX,S}$ = VMT on rural roadtype X, State total (*Highway Statistics* Table VM-2)

$POP_{R,C}$ = Rural population in county C with nonzero mileage from rural roadway type X (0 if zero mileage from rural roadway type X in county C) (Census)

$POP_{R,S}$ = Rural population, State total of all counties with nonzero mileage from rural roadway type X (Census)

## 2.	Allocation of Urban Area VMT from State to County

The procedure for developing urban area VMT at the county and road type level involves allocating the HPMS State/urban area VMT data to the county level using the Census data on urban area population by county as well as the HPMS roadway mileage data by county and road type. The HPMS urban area VMT data are in units of average daily miles. These data are first converted to millions of annual miles to be consistent with the Table VM-2 State-level data by multiplying the urban area VMT data by 365 and dividing by 1,000,000.

The urban area population contributed by each of the counties contained at least in part by the urban area is prepared only for the decennial censuses. Therefore, fractions were calculated from the year 2000 population data of the ratio of the county population in each State/urban area combination to the total State/urban area population for each State/urban area. As shown in Equation 3, each county's share of a State/urban area's VMT were calculated by distributing urban area VMT from the HPMS State/urban area VMT data based on the fraction of the urban area's population contained in a given county. As with the rural VMT allocations, VMT for a specific roadway type is distributed only to counties with nonzero roadway mileage of the specified roadway type, based on the HPMS roadway mileage data. Thus, the county-level State/urban population fractions are divided by the total State/urban area population fraction from counties with nonzero roadway mileage of the specified roadway type. For the urban local roadway category, VMT is distributed strictly by urban population, assuming that all counties with urban populations have mileage in the urban local roadway category.

Equation 3

$$VMT_{X,C} = VMT_{X,A} \times (POP_{X,C} / POP_{X,A})$$

where: $VMT_{X,C}$ = State/urban area A's VMT on roadway type X in county C (calculated)

$VMT_{X,S}$ = Total of State/urban area A's VMT on roadway type X (FHWA)

$POP_{X,C}$ = State/urban area A's population fraction in county C with nonzero mileage from urban roadway type X (Census)

$POP_{X,A}$ = State/urban area A's total population fraction from all counties with nonzero mileage from urban roadway type X (Census)

3.   Allocation of Small Urban Area VMT from State to County

The 2003, 2004, and 2005 urban VMT included in Table VM-2 of *Highway Statistics* accounts for VMT from both urban (population greater than 50,000) and small urban areas. Thus, small urban VMT is calculated by subtracting the urban VMT, calculated as discussed above, from the urban VMT totals in Table VM-2. First, the resultant annual VMT for urban areas was totaled by state and roadway type and was then subtracted from the total urban VMT by state and roadway type reported in Table VM-2. This calculation results in total small urban VMT by state and roadway type. It should be noted that in developing the 2004 and 2005 VMT, data from the HPMS files were totaled to the same level as Table VM-2 and these values were used in place of the Table VM-2 data. The 2005 published *Highway Statistics* Table VM-2 and the data calculated from the 2005 HPMS data set are consistent. However, the published *Highway Statistics* Table VM-2 for 2004 differs from the corrected data provided by FHWA for the 2004 HPMS data set, which was used in the 2004 VMT development for this project.

To allocate the State-level small urban VMT to the county level, the county-level population in small urban areas was estimated. The Census 2000 urban area population from Census-defined urban areas was totaled by county to determine the population in each county falling in the Census-defined urban areas. This population was then subtracted from the Census total urban population for each county in 2000. The small urban population fraction was then calculated for each county as the ratio of the county small urban county population to the total county population. These 2000 small urban population fractions by county were then multiplied by the year-specific county-level population to estimate small urban population in a given year. Finally, each county's small urban population was calculated as a fraction of the total State's small urban population to use in allocating the small urban VMT from the State to the county level.

As with the rural and urban VMT allocations, the small urban VMT for a specific roadway type was distributed only to counties with nonzero roadway mileage of the specified roadway type, based on the HPMS roadway mileage data. Thus, the county-level State/small urban population fractions are divided by the total State/small urban population fraction from counties with nonzero roadway mileage of the specified roadway type. For the small urban local roadway category, VMT is distributed strictly by small urban population, assuming that all counties with small urban populations have mileage in the urban local roadway category. Equation 4 shows the equation used to calculate county-level VMT on small urban roadway types.

Equation 4

$$VMT_{SX,C} = VMT_{SX,S} \ X \ (POP_{SX,C} / POP_{SX,S})$$

where: $VMT_{SX,C}$ =   VMT on small urban roadtype X in county C (calculated)
         $VMT_{SX,S}$ =   VMT on small urban roadtype X, State total (obtained by subtracting large urban VMT from total urban VMT from *Highway Statistics* Table VM-2)
         $POP_{SX,C}$ =   Small urban population fraction in county C with nonzero mileage from urban roadway type X (Census data) (0 if zero mileage from urban roadway type X in county C)
         $POP_{SX,S}$ =   State's small urban population fraction total from all counties with nonzero mileage from urban roadway type X (Census data)

4.   Allocation of VMT by Vehicle Type

In order to be compatible with the VMT data contained in the NMIM National County Database, the 2003, 2004, and 2005 VMT must be allocated to the 28 MOBILE6 vehicle types for each county and roadway type. This allocation was done for each year using the distribution of the VMT among the six HPMS vehicle types found in Table VM-1 of FHWA's *Highway Statistics* for each year and a mapping of these HPMS vehicle categories to the 28 MOBILE6 vehicle types. First, the VMT totals for each of the six HPMS vehicle categories (passenger cars, motorcycles, other 2-axle 4-tire vehicles, single unit 2-axle 6-tire or more trucks, combination trucks, and buses) were calculated as a fraction of the total VMT. This calculation was performed separately for five groups of roadway classes. The resulting 2003, 2004, and 2005 HPMS VMT fractions for each roadway class group are shown in Tables 1, 2, and 3, respectively. Next, each of the 28 MOBILE6 vehicle types was assigned to one of the 6 HPMS vehicle categories, as shown in Table 4. This table also provides mapping of MOBILE6 vehicle classes to the eight MOBILE5 vehicle classes and the 12 SCC-level vehicle categories. Using the default year-specific MOBILE6 VMT fractions presented in Table 5, the MOBILE6 VMT fractions for all of the MOBILE6 vehicle types within a given HPMS vehicle category were renormalized so that the total of the renormalized VMT fractions from all of the MOBILE6 vehicle types within an HPMS vehicle category would be 1. Then the HPMS VMT fractions for each roadway group were separately multiplied by the renormalized MOBILE6 VMT fractions for all MOBILE6 vehicle types included within a given HPMS vehicle category.

For example, Table 4 shows that the HPMS Passenger Car vehicle category includes the MOBILE6 LDGV and LDDV vehicle types. Therefore, the default 2005 MOBILE6 VMT fraction for LDGVs (0.415795 in 2005) was renormalized by dividing it by the sum of the LDGV and LDDV default 2005 MOBILE6 VMT fractions (0.416352 in 2005). This number (0.415795/0.416352 or 0.998662) was then multiplied by the HPMS VMT fraction for Passenger Cars (0.473242 for rural interstates). This resulted in a LDGV VMT fraction of 0.472608 and LDDV VMT fraction of 0.000633 on rural interstates.

Table 1. HPMS 2003 VMT Fractions by Road Types and Vehicle Categories

Road Type	Passenger Cars	Motorcycles	Buses	Other 2-Axle 4-Tire Vehicles	Single-Unit 2-Axle 6-Tire or More Trucks	Combination Trucks
Rural Interstate	0.491345	0.004716	0.003219	0.307903	0.031177	0.161640
Rural Other Principal Arterial Rural Minor Arterial	0.538469	0.003584	0.002475	0.358102	0.034155	0.063215
Rural Major Collector Rural Minor Collector Rural Local	0.554259	0.003881	0.004543	0.362605	0.037335	0.037376
Urban Interstate	0.583887	0.004413	0.001958	0.329670	0.022326	0.057746
Urban Other Freeways and Expressways Urban Other Principal Arterial Urban Minor Arterial Urban Collector Urban Local	0.604713	0.002415	0.001514	0.348505	0.022119	0.020732

Table 2. HPMS 2004 VMT Fractions by Road Types and Vehicle Categories

Road Type	Passenger Cars	Motorcycles	Buses	Other 2-Axle 4-Tire Vehicles	Single-Unit 2-Axle 6-Tire or More Trucks	Combination Trucks
Rural Interstate	0.482719	0.004959	0.003623	0.305316	0.032016	0.171367
Rural Other Principal Arterial Rural Minor Arterial	0.532132	0.003429	0.002348	0.358206	0.036031	0.067855
Rural Major Collector Rural Minor Collector Rural Local	0.555731	0.004022	0.004216	0.358113	0.039691	0.038228
Urban Interstate	0.572072	0.004705	0.002126	0.339683	0.023136	0.058279
Urban Other Freeways and Expressways Urban Other Principal Arterial Urban Minor Arterial Urban Collector Urban Local	0.611622	0.002503	0.001449	0.341324	0.022022	0.021080

Table 3. HPMS 2005 VMT Fractions by Road Types and Vehicle Categories

Road Type	Passenger Cars	Motorcycles	Buses	Other 2-Axle 4-Tire Vehicles	Single-Unit 2-Axle 6-Tire or More Trucks	Combination Trucks
Rural Interstate	0.473242	0.005537	0.003750	0.317665	0.029980	0.169827
Rural Other Principal Arterial Rural Minor Arterial	0.521711	0.003536	0.002409	0.371768	0.035350	0.065226
Rural Major Collector Rural Minor Collector Rural Local	0.548301	0.004271	0.004360	0.367183	0.038705	0.037180
Urban Interstate	0.553440	0.004896	0.002055	0.354199	0.022367	0.063043
Urban Other Freeways and Expressways Urban Other Principal Arterial Urban Minor Arterial Urban Collector Urban Local	0.601088	0.002702	0.001412	0.352926	0.021652	0.020221

**Table 4. Mapping of HPMS Vehicle Categories to
MOBILE6, MOBILE5, and SCC-Level Vehicle Classes**

HPMS Vehicle Category	MOBILE6 Vehicle Classes	SCC-Level Vehicle Classes	MOBILE5 Vehicle Classes
Passenger Cars	LDGV	LDGV (2201001)	LDGV
	LDDV	LDDV (2230001)	LDDV
Motorcycles	MC	MC (2201080)	MC
Other 2-Axle 4-Tire Vehicles	LDGT1	LDGT1 (2201020)	LDGT1
	LDGT2		
	LDGT3	LDGT2 (2201040)	LDGT2
	LDGT4		
	LDDT12	LDDT (2230060)	LDDT
	LDDT34		
	HDGV2B	HDGV (2201070)	HDGV
	HDDV2B	2BHDDV (2230071)	HDDV
Single-Unit 2-Axle 6-Tire or More Trucks	HDGV3	HDGV (2201070)	HDGV
	HDGV4		
	HDGV5		
	HDGV6		
	HDGV7		
	HDDV3	LHDDV (2230072)	HDDV
	HDDV4		
	HDDV5		
	HDDV6	MHDDV (2230073)	HDDV
	HDDV7		
Combination Trucks	HDGV8A	HDGV (2201070)	HDGV
	HDGV8B		
	HDDV8A	HHDDV (2230074)	HDDV
	HDDV8B		
Buses	HDGB	HDGV (2201070)	HDGV
	HDDBT	BUS (2230075)	HDDV
	HDDBS		

Table 5. VMT Fractions by MOBILE6 Vehicle Categories

Vehicle No.	Vehicle Category	VMT Fractions		
		2003	2004	2005
1	LDGV	0.442395	0.428586	0.415795
2	LDGT1	0.073794	0.076069	0.078241
3	LDGT2	0.245658	0.253227	0.260463
4	LDGT3	0.075257	0.077564	0.079773
5	LDGT4	0.034606	0.035668	0.036686
6	HDGV2B	0.029423	0.029643	0.029718
7	HDGV3	0.001045	0.001050	0.001052
8	HDGV4	0.000479	0.000454	0.000430
9	HDGV5	0.001143	0.001130	0.001115
10	HDGV6	0.002447	0.002407	0.002365
11	HDGV7	0.001086	0.001042	0.001008
12	HDGV8A	0.000004	0.000003	0.000003
13	HDGV8B	0.000000	0.000000	0.000000
14	LDDV	0.000660	0.000587	0.000557
15	LDDT12	0.000189	0.000186	0.000192
16	HDDV2B	0.009302	0.009273	0.009221
17	HDDV3	0.002798	0.002802	0.002797
18	HDDV4	0.002552	0.002619	0.002671
19	HDDV5	0.001156	0.001195	0.001226
20	HDDV6	0.006131	0.006245	0.006316
21	HDDV7	0.009045	0.009172	0.009229
22	HDDV8A	0.011058	0.011116	0.011128
23	HDDV8B	0.039409	0.039632	0.039694
24	MC	0.005918	0.005815	0.005745

25	HDGB	0.000440	0.000400	0.000336
26	HDDBT	0.000943	0.000939	0.000941
27	HDDBS	0.001511	0.001566	0.001631
28	LDDT34	0.001551	0.001609	0.001666

Tables 6, 7, and 8 list the resulting VMT fractions for 2003, 2004, and 2005, respectively, for each of the MOBILE6 vehicle types and each of the five roadway groups from Table VM-1. Finally, each of the VMT records in the 2003, 2004, and 2005 VMT data base, at the state/county/roadway type level of detail was then multiplied by the fraction of VMT in each of the corresponding MOBILE6 vehicle type categories to obtain total annual VMT at the state/county/roadway type/MOBILE6 vehicle type level.

Tables 9, 10 and 11 present the resulting VMT totals from the FHWA-based data. Table 9 presents annual VMT at the State level. Table 10 reports annual VMT by functional roadway classifications. Table 11 provides annual VMT by the 28 MOBILE6 vehicle categories.

B.   STATE-PROVIDED VMT PROJECTION METHODOLOGY

A number of State and local agencies submitted VMT data in 2002 for incorporation into the NEI. Table 12 lists the States that submitted VMT. Unless a specific county is listed, VMT data were submitted for all counties. Otherwise, VMT data were submitted only for the county listed. For these States and counties, the 2002 VMT data from the 2002 Final NEI, as contained in the 2002 NMIM National County Database (NCD20060201) Base YearVMT table, were projected to 2003, 2004, and 2005.

Pechan developed VMT growth factors based on the FHWA-based VMT data files developed as described above for 2003, 2004, and 2005. A comparable file prepared earlier for 2002 was also used. The growth factors were calculated at the State, county, vehicle type, and road type level of detail by dividing the year 2003, 2004, or 2005 VMT value by the corresponding 2002 VMT value, all from the FHWA-based VMT databases. Next, each VMT value from the 2002 NMIM National County Database BaseYearVMT that was based on State or locally-provided data was multiplied by the corresponding growth factor at the state, county, road type, and MOBILE6 vehicle type level.

In cases where the growth factor was calculated to be 0, the 2002 NMIM NCD VMT was multiplied by a factor of 1. In cases where the growth factors are not equal to zero and the 2002 NMIM NCD VMT are equal to zero, the projected VMT values are reported as 0.

Tables 13, 14, and 15 provide sample data for projecting 2002 State-provided VMT to 2003, 2004, and 2005, respectively. The data presented in these tables are based on Kent County, Delaware, VMT data for vehicle categories LDGV, HDGV2B, and LDDT34.

Tables 16, 17, and 18 summarize the final 2003, 2004, and 2005 VMT by state, by functional classification system, and by MOBILE6 vehicle categories, respectively. This includes the projected VMT for counties with State or locally-provided 2002 NEI VMT data and FHWA-based VMT for all other areas.

Table 6. Allocation of VMT from HPMS Vehicle Categories to MOBILE6 Vehicle Classes for 2003

HPMS Vehicle Category	MOBILE6 Vehicle Classes	Rural Interstates	Rural Arterials	Rural Other	Urban Interstates	Urban Other
Passenger Cars	**LDGV**	**0.490613**	**0.537667**	**0.552235**	**0.583614**	**0.603813**
	LDDV	**0.000732**	**0.000802**	**0.000824**	**0.000871**	**0.000901**
Motorcycles	**MC**	**0.004716**	**0.003584**	**0.003873**	**0.004417**	**0.002415**
Other 2-Axle 4-Tire Vehicles	**LDGT1**	**0.048366**	**0.056251**	**0.056835**	**0.051838**	**0.054744**
	LDGT2	**0.161009**	**0.187259**	**0.189203**	**0.172568**	**0.182241**
	LDGT3	**0.049325**	**0.057367**	**0.057962**	**0.052866**	**0.055829**
	LDGT4	**0.022681**	**0.026379**	**0.026653**	**0.024310**	**0.025672**
	LDDT12	**0.000124**	**0.000144**	**0.000146**	**0.000133**	**0.000140**
	LDDT34	**0.001017**	**0.001182**	**0.001195**	**0.001090**	**0.001151**
	HDGV2B	**0.019284**	**0.022428**	**0.022661**	**0.020669**	**0.021827**
	HDDV2B	**0.006097**	**0.007091**	**0.007164**	**0.006534**	**0.006901**
Single-Unit 2-Axle 6-Tire or More Trucks	**HDGV3**	**0.001168**	**0.001280**	**0.001396**	**0.000838**	**0.000829**
	HDGV4	**0.000536**	**0.000587**	**0.000640**	**0.000384**	**0.000380**
	HDGV5	**0.001278**	**0.001400**	**0.001527**	**0.000916**	**0.000907**
	HDGV6	**0.002736**	**0.002998**	**0.003270**	**0.001961**	**0.001941**
	HDGV7	**0.001214**	**0.001330**	**0.001451**	**0.000870**	**0.000862**
	HDDV3	**0.003129**	**0.003428**	**0.003739**	**0.002243**	**0.002220**
	HDDV4	**0.002854**	**0.003126**	**0.003410**	**0.002046**	**0.002025**
	HDDV5	**0.001293**	**0.001416**	**0.001545**	**0.000927**	**0.000917**
	HDDV6	**0.006855**	**0.007510**	**0.008192**	**0.004914**	**0.004864**
	HDDV7	**0.010114**	**0.011080**	**0.012085**	**0.007250**	**0.007176**
Combination Trucks	**HDGV8A**	**0.000013**	**0.000005**	**0.000003**	**0.000005**	**0.000002**
	HDGV8B	**0.000000**	**0.000000**	**0.000000**	**0.000000**	**0.000000**

	HDDV8A	**0.035415**	**0.013850**	**0.008171**	**0.012665**	**0.004542**
	HDDV8B	**0.126213**	**0.049360**	**0.029120**	**0.045136**	**0.016188**
Buses	**HDGB**	**0.000489**	**0.000376**	**0.000689**	**0.000298**	**0.000230**
	HDDBT	**0.001049**	**0.000806**	**0.001477**	**0.000639**	**0.000493**
	HDDBS	**0.001681**	**0.001292**	**0.004533**	**0.000000**	**0.000791**
Total		1.000000	1.000000	1.000000	1.000000	1.000000

Table 7. Allocation of VMT from HPMS Vehicle Categories to MOBILE6 Vehicle Classes for 2004

HPMS Vehicle Category	MOBILE6 Vehicle Classes	Rural Interstates	Rural Arterials	Rural Other	Urban Interstates	Urban Other
Passenger Cars	**LDGV**	0.482059	0.531404	0.553894	0.571945	0.610786
	LDDV	0.000660	0.000728	0.000759	0.000783	0.000837
Motorcycles	**MC**	0.004959	0.003429	0.004014	0.004710	0.002503
Other 2-Axle 4-Tire Vehicles	**LDGT1**	0.048061	0.056387	0.056263	0.053533	0.053730
	LDGT2	0.159992	0.187707	0.187294	0.178205	0.178861
	LDGT3	0.049006	0.057495	0.057369	0.054585	0.054785
	LDGT4	0.022535	0.026439	0.026381	0.025101	0.025193
	LDDT12	0.000118	0.000138	0.000138	0.000131	0.000131
	LDDT34	0.001017	0.001193	0.001190	0.001132	0.001136
	HDGV2B	0.018729	0.021973	0.021925	0.020861	0.020938
	HDDV2B	0.005859	0.006874	0.006859	0.006526	0.006550
Single-Unit 2-Axle 6-Tire or More Trucks	**HDGV3**	0.001196	0.001346	0.001479	0.000865	0.000822
	HDGV4	0.000517	0.000582	0.000640	0.000374	0.000356
	HDGV5	0.001287	0.001448	0.001592	0.000931	0.000885
	HDGV6	0.002741	0.003085	0.003391	0.001983	0.001885
	HDGV7	0.001187	0.001335	0.001468	0.000858	0.000816
	HDDV3	0.003191	0.003591	0.003948	0.002308	0.002195
	HDDV4	0.002982	0.003356	0.003690	0.002158	0.002051
	HDDV5	0.001361	0.001531	0.001684	0.000984	0.000936
	HDDV6	0.007111	0.008003	0.008799	0.005145	0.004891
	HDDV7	0.010444	0.011754	0.012923	0.007556	0.007184
Combination Trucks	**HDGV8A**	0.000010	0.000004	0.000002	0.000003	0.000001
	HDGV8B	0.000000	0.000000	0.000000	0.000000	0.000000

	HDDV8A	**0.037535**	**0.014862**	**0.008357**	**0.012780**	**0.004617**
	HDDV8B	**0.133822**	**0.052989**	**0.029794**	**0.045563**	**0.016461**
Buses	**HDGB**	**0.000499**	**0.000323**	**0.000579**	**0.000293**	**0.000199**
	HDDBT	**0.001171**	**0.000759**	**0.001360**	**0.000688**	**0.000468**
	HDDBS	**0.001953**	**0.001266**	**0.004208**	**0.000000**	**0.000781**
Total		1.000000	1.000000	1.000000	1.000000	1.000000

Table 8. Allocation of VMT from HPMS Vehicle Categories to MOBILE6 Vehicle Classes for 2005

HPMS Vehicle Category	MOBILE6 Vehicle Classes	Rural Interstates	Rural Arterials	Rural Other	Urban Interstates	Urban Other
Passenger Cars	LDGV	0.472608	0.521013	0.546521	0.553338	0.600284
	LDDV	0.000633	0.000698	0.000732	0.000741	0.000804
Motorcycles	MC	0.005537	0.003536	0.004263	0.004901	0.002702
Other 2-Axle 4-Tire Vehicles	LDGT1	0.050114	0.058649	0.057815	0.055942	0.055676
	LDGT2	0.166828	0.195241	0.192465	0.186229	0.185346
	LDGT3	0.051095	0.059797	0.058947	0.057037	0.056767
	LDGT4	0.023498	0.027500	0.027109	0.026230	0.026106
	LDDT12	0.000123	0.000144	0.000142	0.000137	0.000137
	LDDT34	0.001067	0.001249	0.001231	0.001191	0.001186
	HDGV2B	0.019035	0.022276	0.021960	0.021248	0.021147
	HDDV2B	0.005906	0.006912	0.006814	0.006593	0.006562
Single-Unit 2-Axle 6-Tire or More Trucks	HDGV3	0.001118	0.001318	0.001441	0.000835	0.000807
	HDGV4	0.000457	0.000539	0.000589	0.000341	0.000330
	HDGV5	0.001185	0.001397	0.001527	0.000885	0.000856
	HDGV6	0.002513	0.002964	0.003239	0.001877	0.001815
	HDGV7	0.001071	0.001263	0.001380	0.000800	0.000774
	HDDV3	0.002973	0.003505	0.003830	0.002220	0.002147
	HDDV4	0.002839	0.003347	0.003658	0.002120	0.002050
	HDDV5	0.001303	0.001536	0.001679	0.000973	0.000941
	HDDV6	0.006712	0.007915	0.008649	0.005014	0.004848
	HDDV7	0.009808	0.011565	0.012639	0.007326	0.007084
Combination Trucks	HDGV8A	0.000010	0.000004	0.000002	0.000004	0.000001
	HDGV8B	0.000000	0.000000	0.000000	0.000000	0.000000
	HDDV8A	0.037183	0.014281	0.008125	0.013819	0.004427
	HDDV8B	0.132634	0.050941	0.028982	0.049293	0.015793
Buses	HDGB	0.000433	0.000278	0.000503	0.000238	0.000163
	HDDBT	0.001214	0.000780	0.001408	0.000666	0.000457
	HDDBS	0.002103	0.001351	0.004352	0.000000	0.000792
Total		**1.000000**	**1.000000**	**1.000000**	**1.000000**	**1.000000**

Table 9. FHWA-based Annual VMT by State

State	Annual VMT (in million miles)		
	2003	2004	2005
Alabama	58,637	58,869	59,658
Alaska	4,942	4,977	5,035
Arizona	53,896	57,179	59,797
Arkansas	30,639	31,566	31,971
California	323,592	328,018	329,267
Colorado	43,379	45,766	47,961
Connecticut	31,432	31,522	31,674
Delaware	9,044	9,275	9,507
District of Columbia	3,592	3,732	3,713
Florida	185,511	195,908	201,531
Georgia	109,246	113,308	113,509
Hawaii	9,312	9,700	10,083
Idaho	14,290	14,690	14,867
Illinois	106,536	108,837	107,706
Indiana	72,511	72,483	71,797
Iowa	31,108	31,452	31,060
Kansas	28,672	29,069	29,621
Kentucky	46,748	47,193	47,469
Louisiana	44,156	44,485	44,978
Maine	14,912	14,908	14,926
Maryland	54,701	55,133	56,319
Massachusetts	53,709	54,620	55,458
Michigan	100,756	103,046	104,053
Minnesota	55,296	56,415	56,903
Mississippi	37,467	39,326	42,185
Missouri	68,162	68,806	68,753
Montana	10,874	11,177	11,127
Nebraska	19,016	19,118	19,292
Nevada	19,301	19,322	20,774
New Hampshire	13,180	13,469	13,431
New Jersey	69,778	72,646	73,819
New Mexico	22,844	23,876	23,966
New York	135,046	137,521	137,521
North Carolina	93,757	95,642	101,269
North Dakota	7,468	7,571	7,569
Ohio	108,938	111,352	110,491
Oklahoma	45,725	46,315	47,020
Oregon	35,098	35,502	35,282
Pennsylvania	106,347	107,776	108,042
Rhode Island	8,365	8,448	8,299
South Carolina	48,120	49,415	49,434
South Dakota	8,527	8,760	8,397
Tennessee	69,153	70,748	70,815
Texas	223,418	230,375	235,171
Utah	24,029	24,629	25,159
Vermont	8,309	7,833	7,714
Virginia	76,867	78,661	80,335
Washington	55,015	55,520	55,475
West Virginia	20,082	20,246	20,524
Wisconsin	59,615	60,234	60,019
Wyoming	9,211	9,236	9,058
Puerto Rico	18,674	19,450	19,412
Total	2,909,003	2,975,125	3,009,216

Notes: -The posted *Highway Statistics* 2003 VM2 table reported for DC for urban local VMT appeared to have been double counted. Therefore, the 2003 VMT for DC reported in this table may not equal the total reported in the posted *Highway Statistics* Table VM-2 for 2003.
-The 2004 VMT data in this table are based on corrected HPMS data sets (dated 10/12/06) and may not match the published 2004 *Highway Statistics* data.

Table 10. FHWA-based Annual VMT by Functional Classification

Class No.	Functional Classification Name	Annual VMT (in million miles)		
		2003	2004	2005
11	Rural Interstate	270,320	265,917	259,203
13	Rural Other Principal Arterial	245,537	240,339	234,237
15	Rural Minor Arterial	171,401	168,467	165,202
17	Rural Major Collector	203,618	200,040	193,421
19	Rural Minor Collector	60,485	60,112	58,440
21	Rural Local	135,291	132,116	128,723
23	Urban Interstate	437,853	459,667	474,452
25	Urban Other Freeways and Expressways	200,608	208,830	214,853
27	Urban Other Principal Arterial	429,060	452,449	466,775
29	Urban Minor Arterial	352,199	366,284	375,187
31	Urban Collector	156,135	163,992	170,241
33	Urban Local	246,496	256,913	268,479
	Total	**2,909,003**	**2,909,003**	**2,975,126**

Notes:
- The VMT data reported in this table do not include VMT values for the Virgin Islands.
 - The posted *Highway Statistics* 2003 VM2 table reported for DC for urban local VMT appeared to have been double counted. Therefore, the 2003 urban local VMT reported in this table may not equal the urban local VMT reported in the posted *Highway Statistics* Table VM-2 for 2003.
 - The 2004 VMT data in this table are based on corrected HPMS data sets (dated 10/12/06) and may not match the published 2004 *Highway Statistics* data.

Table 11. FHWA-based Annual VMT by MOBILE6 Vehicle Category

Vehicle No.	MOBILE6 Vehicle Category	Annual VMT (in million miles)		
		2003	2004	2005
1	LDGV	1,669,089	1,710,430	1,698,984
2	LDGT1	157,744	160,349	168,239
3	LDGT2	525,125	533,787	560,064
4	LDGT3	160,871	163,501	171,534
5	LDGT4	73,974	75,186	78,885
6	HDGV2B	62,895	62,485	63,901
7	HDGV3	2,923	3,038	2,969
8	HDGV4	1,340	1,313	1,214
9	HDGV5	3,197	3,269	3,147
10	HDGV6	6,844	6,964	6,675
11	HDGV7	3,037	3,015	2,845
12	HDGV8A	11	8	8
13	HDGV8B	0	0	0
14	LDDV	2,491	2,343	2,276
15	LDDT12	404	392	413
16	HDDV2B	19,884	19,547	19,827
17	HDDV3	7,825	8,107	7,894
18	HDDV4	7,137	7,577	7,538
19	HDDV5	3,233	3,457	3,460
20	HDDV6	17,147	18,068	17,826
21	HDDV7	25,297	26,537	26,047
22	HDDV8A	30,447	31,897	31,611
23	HDDV8B	108,509	113,722	112,757
24	MC	9,595	10,086	10,837
25	HDGB	1,014	916	772
26	HDDBT	2,173	2,151	2,162
27	HDDBS	3,483	3,587	3,747
28	LDDT34	3,316	3,392	3,582
	Total	2,909,005	2,975,124	3,009,214

Notes:
- The VMT data reported in this table do not include VMT values for the Virgin Islands.
- The posted *Highway Statistics* 2003 VM2 table reported for DC for urban local VMT appeared to have been double counted. Therefore, the 2003 total VMT reported in this table may not equal the total VMT reported in the posted *Highway Statistics* Table VM-2 for 2003.
- The 2004 VMT data in this table are based on corrected HPMS data sets (dated 10/12/06) and may not match the published 2004 *Highway Statistics* data.

Table 12. List of States or Counties with State or Locally-Provided VMT in the 2002 NEI

State	County
Alabama	
Arizona	Maricopa County
Arkansas	
California	
Colorado	
Connecticut	
Delaware	
District of Columbia	
Georgia	
Idaho	
Illinois	
Iowa	
Kentucky	Jefferson County
Maine	
Maryland	
Massachusetts	
Michigan	
Minnesota	
Mississippi	
Missouri	
Nebraska	Lancaster County
Nevada	
New Jersey	
New Mexico	
New York	
North Carolina	
Oregon	
Pennsylvania	
Rhode Island	
South Carolina	
Tennessee	
Texas	
Utah	
Vermont	
Virginia	
Washington	
West Virginia	

Table 13. Calculation and Application of 2002 to 2003 Growth Factors for an Example County

State	County	Class No.	Road Type	MOBILE6 Vehicle Type	FHWA VMT		NMIM County Database 2002 VMT	Growth Factors	Projected State-provided VMT
					2002	2003			
DE	Kent County	11	Rural Interstate	LDGV	0.0000	0.0000	15.6954	0.0000	15.6954
DE	Kent County	13	Rural Other Principal Arterial	LDGV	277.9521	291.1782	280.5370	1.0476	293.8906
DE	Kent County	15	Rural Minor Arterial	LDGV	77.7315	78.1437	64.7866	1.0053	65.1300
DE	Kent County	17	Rural Major Collector	LDGV	119.0003	114.1094	101.2620	0.9589	97.1001
DE	Kent County	19	Rural Minor Collector	LDGV	19.3030	18.1937	5.1295	0.9425	4.8346
DE	Kent County	21	Rural Local	LDGV	106.6962	100.5439	18.3524	0.9423	17.2935
DE	Kent County	23	Urban Interstate	LDGV	0.0000	0.0000	0.0000	0.0000	0.0000
DE	Kent County	25	Urban Other Freeways and Expressway	LDGV	54.4402	54.6702	33.1769	1.0042	33.3162
DE	Kent County	27	Urban Other Principal Arterial	LDGV	59.0930	60.6584	37.7768	1.0265	38.7779
DE	Kent County	29	Urban Minor Arterial	LDGV	119.3383	139.0296	62.9360	1.1650	73.3204
DE	Kent County	31	Urban Collector	LDGV	68.2149	67.2337	19.7410	0.9856	19.4567
DE	Kent County	33	Urban Local	LDGV	54.8614	55.1623	1.4048	1.0055	1.4125

Table 14. Calculation and Application of 2002 to 2004 Growth Factors for an Example County

State	County	Class No.	Road Type	MOBILE6 Vehicle Type	FHWA VMT		NMIM County Database 2002 VMT	Growth Factors	Projected State-provided VMT
					2002	2004			
DE	Kent County	11	Rural Interstate	HDGV2B	0.0000	0.0000	0.9628	0.0000	0.9628
DE	Kent County	13	Rural Other Principal Arterial	HDGV2B	11.3431	7.9221	17.2089	0.6984	12.0187
DE	Kent County	15	Rural Minor Arterial	HDGV2B	3.1722	1.9641	3.9742	0.6192	2.4608
DE	Kent County	17	Rural Major Collector	HDGV2B	4.8983	3.8185	6.2117	0.7796	4.8426
DE	Kent County	19	Rural Minor Collector	HDGV2B	0.7946	0.4717	0.3147	0.5936	0.1868
DE	Kent County	21	Rural Local	HDGV2B	4.3919	3.0148	1.1258	0.6864	0.7727
DE	Kent County	23	Urban Interstate	HDGV2B	0.0000	0.0000	0.0000	0.0000	0.0000
DE	Kent County	25	Urban Other Freeways and Expressway	HDGV2B	1.9655	2.0824	2.0352	1.0595	2.1563
DE	Kent County	27	Urban Other Principal Arterial	HDGV2B	2.1335	5.1079	2.3173	2.3941	5.5478
DE	Kent County	29	Urban Minor Arterial	HDGV2B	4.3086	6.3040	3.8607	1.4631	5.6486
DE	Kent County	31	Urban Collector	HDGV2B	2.4628	3.1246	1.2110	1.2687	1.5364
DE	Kent County	33	Urban Local	HDGV2B	1.9807	4.5158	0.0862	2.2799	0.1965

Table 15. Calculation and Application of 2002 to 2005 Growth Factors for an Example County

State	County	Class No.	Road Type	MOBILE6 Vehicle Type	FHWA VMT		NMIM County Database 2002 VMT	Growth Factors	Projected State – provided VMT
					2002	2005			
DE	Kent County	11	Rural Interstate	LDDT34	0.0000	0.0000	0.0608	0.0000	0.0608
DE	Kent County	13	Rural Other Principal Arterial	LDDT34	0.5696	0.4891	1.0873	0.8587	0.9337
DE	Kent County	15	Rural Minor Arterial	LDDT34	0.1593	0.1185	0.2511	0.7439	0.1868
DE	Kent County	17	Rural Major Collector	LDDT34	0.2460	0.2242	0.3925	0.9114	0.3577
DE	Kent County	19	Rural Minor Collector	LDDT34	0.0399	0.0412	0.0199	1.0326	0.0205
DE	Kent County	21	Rural Local	LDDT34	0.2206	0.1549	0.0711	0.7022	0.0499
DE	Kent County	23	Urban Interstate	LDDT34	0.0000	0.0000	0.0000	0.0000	0.0000
DE	Kent County	25	Urban Other Freeways and Expressway	LDDT34	0.0987	0.1209	0.1286	1.2249	0.1575
DE	Kent County	27	Urban Other Principal Arterial	LDDT34	0.1071	0.3001	0.1464	2.8021	0.4102
DE	Kent County	29	Urban Minor Arterial	LDDT34	0.2164	0.3876	0.2439	1.7911	0.4368
DE	Kent County	31	Urban Collector	LDDT34	0.1237	0.1711	0.0765	1.3832	0.1058
DE	Kent County	33	Urban Local	LDDT34	0.0995	0.2451	0.0054	2.4633	0.0133

Table 16. Final Annual VMT by State

State	Annual VMT (in million miles)		
	2003	2004	2005
Alabama	56,841	56,961	57,660
Alaska	4,942	4,977	5,035
Arizona	54,580	57,865	60,574
Arkansas	30,608	31,335	32,076
California	303,724	307,189	308,605
Colorado	42,333	44,698	46,664
Connecticut	31,578	31,553	31,892
Delaware	9,072	8,585	8,952
District of Columbia	3,907	4,028	4,038
Florida	185,511	195,908	201,531
Georgia	107,896	111,562	111,458
Hawaii	9,312	9,700	10,083
Idaho	14,340	14,836	15,135
Illinois	106,635	108,685	108,292
Indiana	72,511	72,483	71,797
Iowa	31,692	32,004	31,767
Kansas	28,672	29,069	29,621
Kentucky	48,041	48,695	49,062
Louisiana	44,156	44,485	44,978
Maine	14,836	14,848	14,802
Maryland	53,322	53,718	55,239
Massachusetts	55,606	56,828	57,661
Michigan	99,723	101,850	103,316
Minnesota	53,755	54,845	55,589
Mississippi	36,882	38,549	41,313
Missouri	69,457	69,788	69,836
Montana	10,874	11,177	11,127
Nebraska	19,490	19,588	19,789
Nevada	20,540	20,538	20,695
New Hampshire	13,180	13,469	13,431
New Jersey	71,076	74,051	75,435
New Mexico	23,573	24,533	24,671
New York	143,284	145,912	146,659
North Carolina	81,060	82,757	84,245
North Dakota	7,468	7,571	7,569
Ohio	108,938	111,352	110,491
Oklahoma	45,725	46,315	47,020
Oregon	33,848	34,114	34,088
Pennsylvania	106,970	108,065	109,056
Rhode Island	8,481	8,616	8,459
South Carolina	48,139	49,269	49,790
South Dakota	8,527	8,760	8,397
Tennessee	69,974	71,717	72,119
Texas	219,902	226,700	230,949
Utah	24,411	24,875	25,524
Vermont	8,032	7,495	7,302
Virginia	79,453	81,055	83,943
Washington	54,880	55,387	55,548
West Virginia	19,740	19,912	19,972
Wisconsin	59,615	60,234	60,019
Wyoming	9,211	9,236	9,058
Puerto Rico	18,674	19,450	19,412
Virgin Islands	389	388	388
Total	**2,885,386**	**2,947,580**	**2,982,132**

Table 17. Final Annual VMT by Functional Roadway Classification

Class No.	Functional Roadway Classification	Annual VMT (in million miles)		
		2003	2004	2005
11	Rural Interstate	267,952	261,477	255,710
13	Rural Other Principal Arterial	248,172	242,640	237,386
15	Rural Minor Arterial	173,334	169,959	167,139
17	Rural Major Collector	196,590	193,034	186,988
19	Rural Minor Collector	59,920	59,519	57,930
21	Rural Local	143,244	139,964	135,605
23	Urban Interstate	433,115	455,504	470,033
25	Urban Other Freeways and Expressways	199,105	207,496	214,099
27	Urban Other Principal Arterial	427,389	449,886	464,642
29	Urban Minor Arterial	345,469	358,291	367,219
31	Urban Collector	157,075	164,751	171,402
33	Urban Local	234,018	245,061	253,978
	Total	**2,885,383**	**2,885,383**	**2,947,582**

Table 18. Annual VMT by MOBILE6 Vehicle Category

Vehicle No.	Vehicle Category	Annual VMT (in million miles)		
		2003	2004	2005
1	LDGV	1,516,999	1,552,677	1,537,235
2	LDGT1	177,805	180,762	189,372
3	LDGT2	601,991	611,995	641,119
4	LDGT3	179,934	182,913	191,175
5	LDGT4	82,998	84,372	88,184
6	HDGV2B	68,127	67,727	69,042
7	HDGV3	3,015	3,136	3,071
8	HDGV4	1,386	1,361	1,261
9	HDGV5	2,745	2,809	2,708
10	HDGV6	5,935	6,043	5,803
11	HDGV7	2,766	2,749	2,599
12	HDGV8A	90	72	72
13	HDGV8B	76	76	76
14	LDDV	3,814	3,556	3,448
15	LDDT12	1,268	1,233	1,311
16	HDDV2B	21,299	20,956	21,162
17	HDDV3	7,192	7,457	7,259
18	HDDV4	6,838	7,262	7,223
19	HDDV5	3,529	3,779	3,785
20	HDDV6	15,317	16,147	15,918
21	HDDV7	22,002	23,090	22,641
22	HDDV8A	28,021	29,307	29,052
23	HDDV8B	104,565	109,566	108,652
24	MC	11,678	12,270	13,171

25	**HDGB**	**1,121**	**1,022**	**862**
26	**HDDBT**	**2,929**	**2,930**	**2,936**
27	**HDDBS**	**4,446**	**4,629**	**4,821**
28	**LDDT34**	**7,502**	**7,685**	**8,174**
	Total	2,885,388	2,885,388	2,947,581

CHAPTER IV. REFERENCES

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