A STUDY ON THE DEVELOPMENT OF THE DATA COLLECTION SYSTEM OF THE VEHICLE MILEAGE TRAVELED IN TAIWAN

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Abstract: The Vehicle Mileage Traveled (VMT) of the motor vehicles is the total mileage of all the motor vehicles traveled in the highway network. There is no existing data collection system of VMT in Taiwan. The purpose of this study is to develop a data collection system to provide data basis for the related transportation studies. In this study, we evaluate the performance of five data collection methods with respect to the following criteria, i.e., data availability, data quality, application ability and limitation, reliability and effectiveness. The data collection methods under consideration are: 1) traffic volume survey, 2) computer simulation, 3) fuel consumption survey, 4) odometer survey and 5) driver interview survey. Finally, based on the performances of these five methods in the estimation of the 1997 VMT in Taiwan, a comprehensive VMT data collection system is proposed for the Taiwan highway system.

1. INTRODUCTION

The Vehicle Mileage Traveled (VMT) of the motor vehicles is the total mileage of all the mobile vehicles traveled in the highway network. The VMT data are the basis for the estimation of the accident exposure rate in the transportation safety study. These data not only provide the objective measure for the trend analysis of the traffic accident, but also provide the measure of effectiveness for the proposed traffic safety improvement policies. In addition, these data can be used in the following fields of transportation planning, i.e., highway resource allocation, energy consumption and air pollution of motor vehicles, and traffic impact study. Basically, these data provide the basis for the benefit evaluation of the proposed transportation planning policies.

A comprehensive data collection system of the basic traffic data is the symbol of the advanced country. There is no existing data collection system of VMT in Taiwan. Therefore, there is no data basis for the data validation of the related transportation

studies and traffic safety studies. In order to provide the basis for the estimation of the traffic accident exposure and the benefit evaluation of the proposed transportation planning and safety policies, an effective and reliable data collection system of VMT is proposed in this study. We evaluate the performance of various data collection methods with respect to the following criteria, i.e., data availability, data quality, application ability and limitation, reliability and effectiveness.

Depending on the purpose of the transportation planning study, the characteristics of the VMT required for data analysis are quite different. The data classification, data estimation precision, data sources and data collection cost of the VMT for each project are subject to the purpose and requirement of each project. There are four data classifications used in various VMT studies i.e., by vehicle type, by district, by route and nationwide. The estimation precision requirement is decided by the purpose of the related data. The factors to be considered in the determination of the precision requirement are the data collection procedure, time requirement, cost and human resource requirement. To meet data requirement of the related studies and analysis, the VMT data collection should be a routine operation, i.e., it should be updated regularly to ensure the validation of the VMT data. As for the sources of the VMT data, they should be derived from the annual publications or statistical data from the associated agencies or from the results of the related surveys or interviews. The feasibility of using these data to estimate the related VMY data should be evaluated before its implementation. In addition, the data structure and storage system are essential to the validity of a data collection system.

Based on factors discussed above, a short-term and a long-term implementation procedures were proposed in this study respectively. In the short-term proposal, a VMT estimation method was established which was derived from the periodical publications or survey data issued by the associated agencies, such as annual reports on traffic volume and fuel consumption. We then explored the procedures of these methods by estimating the annual VMT data from the existing data sources and conducted a cross-examination of the estimation values to evaluate the estimation qualities of these methods. Finally, we use 1997 data recorded in various agencies to conduct a statistics estimation of the annual VMT data to check the validation of our proposal. In the long-term proposal, we proposed a comprehensive and efficient VMT data collection system based on the odometer survey. By incorporating odometer survey into the regular vehicle inspection, we can collect the VMT data efficiently and precisely.

The rest of the paper is organized as follows: Section 2 explores the theoretical basis, data requirements, expected difficulties, and application feasibility in Taiwan area of each method considered. The performances of these methods on the 1997 VMT data of motor vehicles are reviewed in Section 3. In Section 4, we describe the necessary data maintenance procedure for the proposed data collection system. Summarization and recommendations were presented in Section 5.

2. COLLECTION METHODS OF THE VMT STATISTICS DATA

Based on the results of the literature reviews, the following five data collection methods are considered in this study: 1) traffic volume survey, 2) computer simulation, 3) fuel consumption survey, 4) odometer survey and 5) driver interview survey. The collection procedure, data source, advantages, limitations, potential estimation errors of each methods are discussed as follows:

2.1 Traffic Volume Survey

A. Collection Procedure

A set of roadway sections is sampling from the highway system under consideration. The 24-hour traffic volumes on these roadway sections are collected in vehicle type. The VMT value of the specific section is set as the product of the traffic volume and the roadway section length. The VMT value of the associated highway system is estimated with the following equation:

$$\text{VMT of vehicle type i} = \sum TR_{ij} \times L_j \times F \tag{1}$$

Where
  TR_{ij} = the 24 hour traffic volume of vehicle i on roadway section j.
  L_j = the length of roadway section j
  F = expanding factor

This is the estimation procedure of the traffic volume method for the VMT data. The Highway Performance Monitoring System (HPMS) of the Federal Highway Administration of the United State (Maring, 1990, Kimaley and Fricker, 1996, and Weiner, 1990) is the typical case of this method. In this method, the traffic volume of the roadway section used is the Annual Average Daily Traffic volume of the specific section, and the values of expanding factors are derived from related studies based on their roadway classifications and vehicle types of through traffics.

B. Data Source

The available traffic volume data sources for this method are 1) Freeway traffic volume obtained by the data recorded on detectors in toll stations and roadside detectors. This volumes are stored in the computer system of the Taiwan Area National Freeway Bureau (TANFB). In addition, some dynamic traffic volume survey data can be obtained from the related freeway projects. 2) Provincial highway traffic volume obtained from the annual AADT reports issued by the Taiwan Highway Bureau. 3) The traffic volumes of the metropolitan areas: there is some routine traffic volume surveys conducted by the public agencies, such as those in the City of Taipei. For the roadway system without data source, a traffic volume survey should be conducted to collect the volume of sample sites for the total volume estimations. The sampling should be based on the characteristics of the roadway.

The data sources of roadway length are the geometry data kept in Taiwan Area National Freeway Bureau, Taiwan Highway Bureau and highway agencies in the local governments. As for the values of expanding factors for total VMT estimation, they

should be determined by the statistics analysis from the historical data obtained in various agencies.

C. Errors Source

The major error sources in this method are resulted from the suitability of the sample sites selected and the incomplete time coverage of the survey.

D. Assessment

In theory, the traffic volume method can provide the VMT data through the vehicle type, district and route, but it is a labor-intensive data collection operation. The data estimation precision depends on the scale and estimation precision of the survey conducted. The larger the number of the sampling sites selected, the more reliable the VMT data estimated. Due to the availability of the routine survey data of traffic volume, if these existing data meet the estimation precision requirement, then the cost and workload of the auxiliary survey will be reduced tremendously. However, due to the precision of the expanding factors, this method can be applied to the small-scale roadway system only. The adoption of this method on the nationwide VMT estimation would result in significant estimation errors. In addition, the estimation of the values of expanding factors would take tremendous efforts and must be revised annually.

2.2 Computer Simulation Method

A. Collection Procedure

Most transportation planning softwares are capable of simulating and generating the future trip behaviors, such as UTPS, MINIUTP, TRAPLAN, TMODEL, EMME/2, and QRSII. By following the procedure of the zone designation, trip generation, trip distribution, modal selection, and traffic assignment, we can estimate the traffic volume of each section of the roadway system. Furthermore, the associated VMT data can be computed from these data and roadway length data.

B. Data Sources

The data required in this method are 1) a valid transportation planning software, 2) comprehensive land use and trip generation data of the study area, and 3) network link attributes data, such as roadway length, roadway width, traffic speed, and screenline traffic volume.

C. Error Source

The major error sources in this method are 1) the validation of the trip generation and trip distribution model, 2) the suitability of the application of the proposed model on the study area, and 3) the impacts of the network simplification on estimation.

D. Assessment

With a comprehensive transportation database and software, the VMT estimated by the simulation method is convenient.   However, this database does not exist in most areas.   The efforts to establish the required database and software tool may be a lot more than the efforts of the VMT estimation.

2.3 Fuel Consumption Method

A Estimation Procedure

The basic idea of the fuel consumption method for VMT estimation is the VMT of vehicle type i in the roadway system is the product of the annual fuel consumption of vehicle type i (L) and the average fuel efficiency of vehicle type i (Km/L).

B. Data Source

The data source of this method are 1) annual fuel consumption of various petroleum products (Energy Committee, 1997), 2) average fuel efficiency of each vehicle type (Energy Committee, 1996), and 3) volume and type of fuel consumed by each vehicle type.   Most of these data can be obtained from various agencies of the Ministry of Economics and petroleum companies.

C. Error Source

The major error sources of this method are 1) the misallocation of fuel consumption on vehicle types, 2) the misallocation of fuel consumption on area due to the difference in place fuel purchased and place fuel consumed, 3) the deviation in the fuel efficiency in individual vehicle, and 4) the unavailability of the fuel consumption data of the black market.

D. Assessment

This method is the easiest VMT estimation method.   But its error term will be more significant than others. Even we may ignore the fact that there might be difference in place fuel purchased and place fuel consumed; it is still difficult to distinguish fuels consumed by each vehicle type and route.

2.4 Odometer Survey Method

A. Estimation Procedure

Most commercial vehicles record their mileage periodically as a basic measure of business management.   By law, all the automobiles have to be inspected by the motor vehicle agencies periodically.   In addition, it is a regular policy for a vehicle maintenance facility to record the mileage when a car is checked in for maintenance or repair.   All these mileage records are the actual vehicle mileage that vehicle driven.   These records can be used to estimation VMT by a statistics process.

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B. Data Source

The data sources of this method are 1) mileage recorded in survey conducted in vehicle inspection stations, 2) mileage sampling survey in inspection stations, 3) mileage recorded in vehicle maintenance facilities, 4) mileage recorded in sampling survey in gas stations. In the long term, we should propose a law to regulate the mileage vehicle driven to be recorded in the regular vehicle inspection operation. For the convenience of the VMT estimation, the inspection time and mileage in the odometer should be recorded in the inspection. As for the nationwide highway surveliance database, the following items should be included: 1) last inspection time, T_1, 2) mileage in last inspection, K_1, 3) inspection time, T_2, and 4) mileage in this inspection, K_2.

The Total VMT can then be estimated by the followings:

$$TVMT = \Sigma \ VMT_i \tag{2}$$
$$VMT_i = \Sigma \ \{[(K_2-K_1)/(T_2-T_2)]*365\}*(V_1/V_2) \tag{3}$$

Where
V_1 = the total number of vehicles registered
V_2 = the total number of vehicles inspected

Since there is no routine motorcycle inspection system, the VMT data of the motorcycle is unavailable from inspection system. However, the motorcycle is required for annual emission test by the Environment Protection Agency(EPA). Therefore, we suggest the mileage data be recorded in the emission test in the inspection stations. By the motorcycle's age and its mileage, we should be able to estimate the annual VMT of the motorcycle.

However, the VMT of each district and route can not be obtained from the odometer survey. Based on the nationwide VMT estimated, the VMT of each district can be estimated by its fraction in the number of vehicle registered or inspected. And the VMT of each route can be derived from its fraction in total volume of through traffics.

Due to the fact that odometer record system is not enforced yet, in the short term, we need to establish a statistics process for the odometer survey method. We will evaluate the performance of the following three alternatives for the short-term proposal.

Alternative 1: Survey in vehicle inspection stations
All the mileage records are obtained from vehicle inspection stations only.

Alternative 2: Survey in vehicle repair units
All the mileage records are obtained from vehicle maintenance facilities only.

Alternative 3: Mixed strategy
Mileage of trucks and buses are obtained in vehicle inspection stations and mileages of other vehicles are obtained from vehicle maintenance facilities.

C. Error Sources

The major error sources in this method are 1) errors in odometers, 2) false records in odometers, 3) damage in odometers, 4) cross-district vehicle registration, 5) unused vehicles, and 6) vehicle not inspected or data record error.

D Assessment

This method is suitable for VMT estimation of each vehicle. But in the VMT estimation of each district estimated by this method might be misleading, if there are many cars registered in one district and used in another district. In addition, the VMT of each route is not easily estimated by this method. Finally, due to the absence of motorcycle inspection system, it is difficult to estimate the VMT of the motorcycle by this method.

2.5 Driver Interview Survey

A Collection Procedure

This type of data collection is interviewing the drivers sampled. For each driver interviewed, he was asked about his travelling distance, travel destination and trip frequency etc. The results of these surveys can be obtained from the annual reports of the survey of the drivers of passenger cars, and of motorcycles riders issued by the Department of Statistics (DOS), Ministry of Transportation and Communication (MOTC), Taiwan, such as 1997 annual reports. Another type of data collection is the driver diaries of the sampling drivers, which is a frequent practice in associated transportation studies. Based on the diaries collected, we can estimate the VMT of each district, vehicle type and route.

B. Data Source

The major sources of this method are the annual reports issued by the DOS and the reports of the associated studies.

C. Error Source

Human error is the major source of error. It is difficult for a driver to describe his travel historical data concisely.

D. Assessment

With the incorporation of the result of the routine survey of vehicle usage, we can estimate the VMT of each district or vehicle type. However, it is difficult to obtain the VMT of each route. Due to the limitation of human memory, it could result in significant estimation error. However, we can reduce these negative impacts by using a well-designed questionnaire and applying inside and outside cross-examinations.

According to the above discussions, there are significant differences in terms of time spending, cost consumption demands, human resource, data precision, and applications of the five data collection methods considered. Different user has different demands on VMT data characteristics. The measures of effectiveness of these methods are data availability, data quality, data suitability, and application area. Due to the conflicting nature of these measures, the selection of the suitable data collection method is not only subject to the data requirements, but also on the trade-offs among time, cost and human resource.

3. 1997 VMT STATISTICS DATA OF THE TAIWAN AREA

In consideration of the data availability and data quality, we eliminate the computer simulation and traffic volume methods. We apply the remaining three methods on the 1997 VMT statistics data of the Taiwan area. Based on the results of VMT estimation shown in Table 1, the estimation precision and limitations of these three methods are discussed as follows:

Table 1: Comparisons of the 1997 VMT estimations among three data collection method (units: in million vehicle-kilometer)

data collection method / Vehicle type		Auto Private	Auto Com-mercial	Pickup/Van Private	Pickup/Van Com-mercial	Bus Private	Bus Com-mercial	Truck Private	Truck Com-mercial	motorcycle
N A T I O N	Odometer survey — Toyota		85,785								50,090
	Odometer survey — Mitsubishi	75,163	4,526	12,449	194		1,116		7,218		50,090
	Odometer survey — adjusted	50,897	3,065	8,430	131						
	Fuel Consumption		62,523				7,986				36,033
	Driver interview — Lowest	27,649	NA	NA	NA	NA	1,115	NA	2,756		28,451
	Driver interview — highest	49,866									38,672
By District		Distributed by the fraction of total number of vehicle registrated in that district								
By route	Freeway	10,588		1,858		480		2,763			
	Provincial Highway	NA									
	Urban street	NA									

P.S. : 1. The adjusted values of the odometers survey method are computed by using the values obtained from the fuel consumption as the actual value. The value of each vehicle type is than allocated based on the fractions obtained from the statistics data of the Mitsubishi Company.

2. Shadow areas are the VMT values suggested by this study.

3.1 VMT estimation of the small size vehicle type

For the VMT estimation of small size vehicle type (auto, pickup and van), the figures obtained from the odometer survey method are the highest, those from fuel consumption are the second, and those from the driver interview are the lowest. The

figures from the odometer method are higher than those from fuel consumption by 37% to 48%. Since the fuel consumption data obtained from China Petroleum Company (CPC) is highly reliable, although there is some errors in average fuel efficiency and fuel consumption from the black market, the difference between the VMT estimation from these two methods should not as significant as the results shown. We can conclude that the result of the VMT estimation from the odometer survey method is highly overestimated. These figures should be treated as an upper bound of the VMT estimation. The reasons for its overestimation may be derived from the followings:

a. We conduct a statistics covariance analysis of the VMT and the car producer. We conclude that there in no covariance between VMT and car producer based on the result of the driver interview survey. Due to the fact that the VMT estimations from this survey are underestimated, their figures are 44% of those from the fuel consumption method. Therefore, the reliability of these surveys is questionable, which in turn may produce an unreliable covariance analysis result. Using only two car producers' mileage data for statistical assessment may be misleading.

b. The VMT value is closely related to the vehicle age. The use of two car producers with different distribution in vehicle ages may result in estimation errors.

c. The fewer the miles the vehicle drives, the fewer the number of maintenance the vehicle makes. With fewer samples on low usage vehicle may result in overestimation of VMT values.

d. Some unused cars may never report to their district motor vehicle agencies, which may result in the overestimation of VMT values with inaccurate total number of vehicles.

3.2 VMT estimation of motorcycles

The result of VMT estimation of motorcycles is quite similar with those of the small size vehicle. The values of motorcycles obtained from odometer survey method are higher than those from the fuel consumption by 44%, which is unacceptable. We should treat the values obtained from odometer survey as an upper bound on the associated VMT estimation as we did in the small size vehicle case. The reasons for these overestimated values may be driven from the followings:

a. Due to the data availability, we only use the sampling motorcycles with mileage records as data basis for the VMT estimation. With limited data source, the statistical results may be misleading.

b. Average annual mileage is estimated by the mileage recorded dividing by the motorcycle age based on the assumption that there is no covariance between motorcycle age and VMT. This assumption is without statistical validation, which may result in estimation errors.

c. There are quite portions of unused motorcycles in Taiwan. Based on the statistical results of license plate updated in 1987, only 77% of registered motorcycles are

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regularly operated. The inaccuracy of the motorcycle registration should be the main reason for these overestimations.

3.3 The VMT estimation of Truck and Bus

There is no significant difference among three methods of VMT estimation in this category. This may be owing to the highly reliable highway surveliance data on the commercial truck and bus, which are under close surveillance by the associated agencies. The result of the odometer survey method shows the VMT value of private buses is very low. However, without sufficient data, this result may not be justified.

4. THE MAINTENANCE OF THE VMT DATA OF MOTOR VEHICLES

In the long run, the VMT of each vehicle type should be obtained from the odometer survey method in the vehicle inspection stations. As for the VMT of each route, they should be obtained from dynamic traffic volume survey reports and volume records in roadside vehicle detectors. However, this can not be done immediately. For the short term, we need to use several data collection methods for cross-examination to get valid VMT estimation. Since there are various data items, data sources, collection procedures, and maintenance schedules in the short-term data collection system, we summarize the maintenance procedure of the proposed data collection system in Tables 2 and 3 for its implementation.

Table 2: The data maintenance of the short term VMT data collection system

			Data Item (Data Source)	Data collection and process methods	Agency In Charge	Update Frequency
N A T I O N V M T	auto	Private	1.Fuel consumption(China Petroleum Company) 2.Fuel efficiency of vehicle.(drive interview or sample collection) 3.Mileage record in vehicle maintenance (selected vehicle repair firm).	1. Ask CPC corporation by DOS 2. DOS routine survey 3. DOS contact the firms	Dept. of Statistics (DOS)	Annual
		Com-mercial				
	Pickup /Van	Private				
		Com-mercial				
	Bus	Private	1.vehicle mileage (vehicle inspection stations) 2.Fuel consumption(China petroleum company) 3. Fuel efficiency of vehicle.(sample collection) 4.Mileage of commercial truck and bus vehicle inspection stations)	1. DOS inform vehicle inspection stations 2. Ask CPC corporation by DOS 3. DOS survey 4. DOS routine survey	Dept. of Statistics (DOS)	Annual
		Com-mercial				
	Truck	Private				
		Com-mercial				
	Motorcycle		1. Fuel consumption (China petroleum company) 2. Fuel efficiency of vehicle.(drive interview or sample collection)	1. Ask CPC corporation by DOS 2. DOS routine survey	Dept. of Statistics (DOS)	Annual
	Freeway VMT statistics data		1. Freeway dynamic traffic volume data (Taiwan Area National Freeway Bureau) 2. Traffic volume on freeway toll stations (Taiwan Area Freeway national Bureau)	1.Taiwan Area National Freeway Bureau 2. Taiwan Area National Freeway Bureau	Dept. of Statistics (DOS)	Annual

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Table 3: The data maintenance of the long term VMT data collection system

			Data Item (Data Source)	Data collection and process methods	Agency In Charge	Update Frequency
N A T I O N V M T	Auto	Private	1. vehicle mileage of vehicle types (vehicle inspection stations, standard inspection data structure)	1. Depart of Land Transportation (DLT) authorize the Data Communication Group of the Chunghwa Telecom Company (CTC) for data processing, The statistics results inform the department of Statistics (DOS)	DOS DLT CTC	Annual
		Commercial				
	Pickup /Van	Private				
		Commercial				
	Bus	Private				
		Commercial				
	Truck	Private				
		Commercial				
Motorcycle			1. Motorcycle routine inspection data (EPA)	1. EPA provide DOS data	DOS	Annual
Freeway VMT statistics data			1. Freeway dynamic traffic volume data (Taiwan Area National Freeway Bureau) 2. Traffic volume on toll stations (Taiwan Area National Freeway Bureau)	1. Taiwan Area National Freeway Bureau 2. Taiwan Area National Freeway Bureau	DOS	Annual

Due to the fact that the highway surveillance system update, the supervision of vehicle inspection, and the application of VMT data are in the charge of the Department of Land Transportation (DLT), Ministry of Transportation and Communication, therefore, the implementation of the proposed data collection system should be conducted by the DLT. The agency should act as a coordinator of the system. It should propose operation guideline and coordinate with vehicle inspection stations and Chunghwa Telecom Data Company to update the inspection procedure and database. In addition, it should negotiate with EPA to incorporate the mileage data into regular inspection item for the emission test of motorcycles. As for the Department of Statistics, it should collect related VMT data from various departments such as vehicle inspection stations, EPA, China Petroleum Company, and highway agencies. After statistical analysis of these data, it should provide VMT data to the public for further study. The implementation and executive procedure of the VMT data collection system is shown in Figure 1.
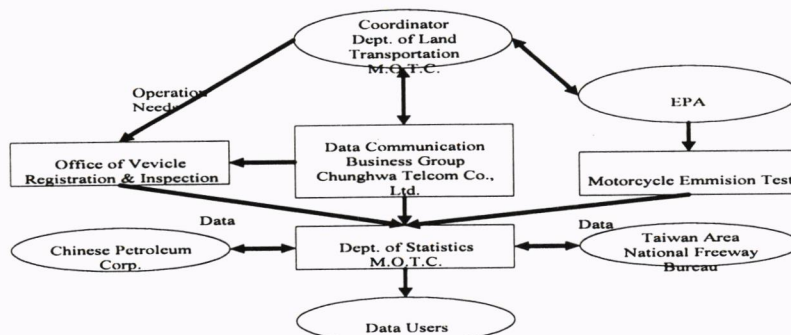

Figure 1. The implementation procedure of the VMT data collection system

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5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The purpose of this study is to develop an effective and reliable data collection system to provide data basis for the related transportation planning and safety studies. The following five data collection methods are considered in this study: 1) traffic volume survey, 2) computer simulation, 3) fuel consumption survey, 4) odometer survey and 5) driver interview survey. Based on the evaluation of the performances of these five data collection methods with respect to the following criteria, i.e., data availability, data quality, application ability and limitation, reliability and effectiveness, the computer simulation method and traffic volume method are eliminated. Therefore, we explore the theoretical basis, data requirements, expected difficulties, and application feasibility in Taiwan area of the remaining three methods. Consequently, a short-term and long-term data collection system are proposed for the estimation of annul VMT of various types of motor vehicles in Taiwan as shown in Tables 2 and 3. Finally, based on the performances of these five methods in the estimation of the 1997 VMT in Taiwan, a comprehensive VMT data collection system is proposed for the Taiwan highway system as shown in Tables 4 and 5.

Table 4   the long-term data collection system of VMT statistics of motor vehicle

Data classification \ Vehicle type		Auto	Pickup/Van	Bus	Truck	Motorcycle
Nation		Odometer Survey Method : Statistics analysis of mileage data obtained from records in vehicle inspection stations				Odometer Survey Method : Statistics analysis of mileage data obtained from records in emission test stations
District		Same as above				Same as above
route	Freeway	● Using the freeway dynamic traffic volume for statistics analysis ● Update annually by the changes in through traffic on toll stations				✕
	Provincial Highway	● Revise existing AADT survey by Taiwan Highway Bureau to improve its reliability ● Installation of roadway detectors on all the roadways				
	Urban street	● Installation of roadway detectors on all the roadways I ● Subtract the VMT ín the freeway and provincial highways from the total VMT value				

Table 5 the short -term data collection system of VMT statistics of motor vehicle

Vehicle type / Data classification		Auto	Pickup/Van	Bus	Truck	Motorcycle
Nation		●Conduct a statistics estimation of VMT based on the mileage records of vehicles maintaining in Mitsubishi and Toyota Companies ●Use the results of fuel consumption as the total volume control for distribution		●Mileages are recorded in Vehicle inspection Stations ●Use the results of fuel consumption as the total volume control for distribution ●Commercial bus and truck data obtained from associated annual reports		●Statistics analysis of mileage data obtained from records in emission test station
District		Distribution based on the fraction of volume in each district				Same as above
Route	Freeway	●Using the freeway dynamic traffic volume for statistics analysis ●Update annually by the changes in through traffic on toll stations				
	Provincial Highways	NA				
	Urban street	NA				

5.2 Recommendations

After numerical experiments of the proposed data collection system, the following recommendations are proposed to implement our proposal.

a. MOTC should coordinate all vehicle inspection stations to update their inspection procedure for the incorporation of the mileage data into their inspection items. In addition, it should direct the Chunghwa Telecom Data Company to update its inspection database and sofewares for the implementation of the long-term VMT data collection system.

b. MOTC should negotiate with EPA to incorporate the mileage data of motorcycles into item recorded in the regular emission test of motorcycles.

c. The installation of the roadside detectors should be a long-term goal for all highway agencies. This is not only useful in the VMT estimation, but also in the traffic control system. In addition, it will provide the implementation basis for the Intelligent Transportation System.

d. Due to the reliability of the fuel consumption method and availability of the total consumption data, we should conduct the comprehensive fuel efficiency test to establish reliable fuel efficiency data of each vehicle type, which can be used to acquire a reliable VMT estimation.

e. The existing questionnaire of driver interview has some inconsistencies in the statistical result. The questionnaire should be revised to provide valid estimation values.

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Waterfront Vitalization and Environment Research Center
WESCO Inc.

CIT (TAIWAN) & NCTU (TAIWAN)

Ministry of Transportation and Communications
Ministry of Education
Council for Economic Planning and Development
National Science Council
Public Construction Commission
Bureau of Taiwan High Speed Rail, MOTC
Civil Aeronautics Administration, MOTC
Institute of Transportation, MOTC
Taiwan Area National Expressway Engineering Bureau, MOTC
Taiwan Area National Freeway Bureau, MOTC
Tourism Bureau, MOTC
Taipei City Government
Taipei Rapid Transit Corporation