CHAPTER I

INTRODUCTION

1.1 GENERAL

In the new era of traffic, traffic information, the determinant of traffic data, is an important element for transportation system operations. Basically, the raw traffic data can be manipulated into several useful applications. One of the applications is to convert the data into useful information for drivers such as travel time information. Not only the amount of traffic information is needed, the quality of the information is of importance. In modern transportation system, quality of travel is dependent on the accuracy, accessibility and validity of traffic information. Data quality is the fitness of data for all purposes that require it. An understanding of all intended purposes for that data is required for measuring the data quality. When drivers have to make a decision, it is more important for drivers to use duly traffic information such as in case of being trapped in traffic congestion. Since traffic congestion seems to be one of the major problems in transportation system, the problem may be alleviated by providing timely and accurate traffic information so that drivers can avoid congested routes using alternative routes or changing their departure times to reach the destination in a short time, making the overall traffic system more efficient.

Traffic information such as travel-time is one of the most important pieces of information for both traffic management systems, such as Intelligent Transport Systems (ITS), and road users. Accurate travel-time information contributes to the reduction of congestion, cost and ameliorating environmental impacts. Moreover, it can also help the commercial fleet to promote their service quality by delivering goods in particular time-windows. The increasing trust on travel time information indicates a need to accurately and reliability measure travel times. In recent times, real time traffic information services become focused interest since the implementation of Intelligent Transportation System

(ITS) has resulted in the development of systems that capable of monitoring roadway conditions and disseminating traffic information to travelers in a network.

However, the limitation of data collection system causes insufficient information and impedes not only the operators from exercising better traffic management but also drivers from making proper driving decision. Given limited source of data, traffic engineers have faced decision of how to manipulate the limited data to provide sufficient and accurate data as compared to the case with plenty sources of data. Moreover, there is a problem whether to expand observation coverage or improve the accuracy of roadways that already covered. Normally, when accuracy is high, it is a good decision to expand coverage. Conversely, when observation coverage is already extensive, improving accuracy on network already covered may be the best option.

In view of the fact that there are a lot of arguments to produce sufficient and accurate traffic information particularly travel time, there are several studies conducted to overcome this problem. Nowadays, there are ample of technologies that can be used for gathering the traffic data. Traffic information such as travel time can be received mainly via traffic detection devices placed on the infrastructure which is commonly known as the indirect acquisition such as loop detector. Basically, there are two basic approaches used to collect real-time travel information. One approach relies on collecting information at isolated but many locations such as inductance loop, infrared, video, and other vehicle detectors. They are capable of collecting information such as vehicle volumes, time mean speeds, headways, classifications, and lane occupancy. With the implementation of ITS, there is another approach used to collect real-time information. Taylor, Bonsall and Young (2000) have stated that the other measurement is the use of moving observation platforms traveling in the traffic stream itself and recording information about their progress (vehicle based methods) that relies on instrumented vehicles traveling in the traffic stream. The instrumented vehicle, that is *probe vehicle*, maintains frequent communications with a central computer that "tracks" the vehicle location and speed

along the traveled route. Point-to-point travel time is the most common and useful information that probe vehicles collect. The previous research indicates that the probe vehicle measurement method is a potential method for obtaining traffic information, since it could expand the coverage area of the data and is capable of providing reliable data. In addition to the fact that no road based infrastructure is need, this method will indirectly reduce the maintenance cost and traffic disturbance. Furthermore, probe vehicle-based travel time studies are widely used to document congestion as it can also act as "portable detectors" that are considered as a valuable source of real time traffic data. Figure 1.1 shows the probe vehicle information system while Figure 1.2 shows the typical equipment setup for the GPS test vehicle technique.

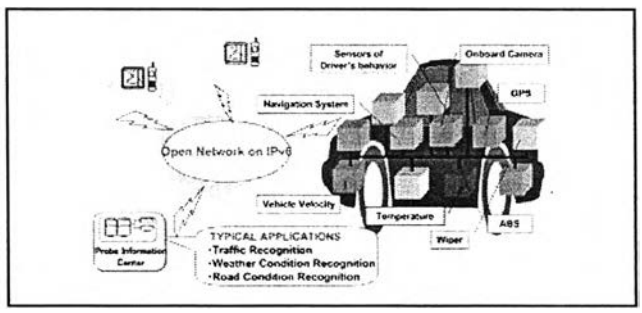

Figure 1.1 Probe vehicle information system (Maekawa, 2004)

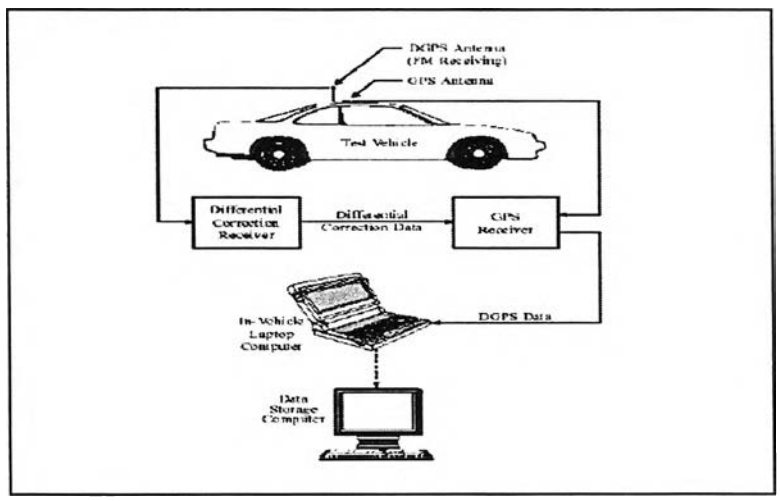

Figure 1.2 Typical equipment setup for the GPS test vehicle technique (Turner et al., 1998)

Although the previous studies indicate the strengths of the application of probe vehicle data in collecting traffic data, it is believed that the quality of traffic information using this measurement method is enhanced. However, due to several factors involved with the quality of resulting traffic information, it is questioned that the quality of the traffic information is sufficient using the probe vehicles. There are very few studies directly investigate the quality of the traffic information from the probe vehicle under various traffic conditions and environment. Thus, it is warranted that a quality of traffic information from probe vehicle is examined to yield better understanding and to imply the usefulness and potential of such collection system.

1.2 OBJECTIVES

1. To demonstrate the feasibility of using probe vehicles for real-time traffic measurements and to provide accurate and reliable traffic information.
2. To assess the effectiveness of probe vehicle in providing traffic information (travel time) under various traffic conditions.

1.3 SCOPE OF RESEARCH

This research is designed to examine the quality of traffic information in simulated traffic environments. Since the obtainment of traffic data is enormous effort, it is impossible to capture the reliable data from the real world. In the simulated traffic environments, however, the number of traffic conditions can be varied and controlled, and traffic data can be acquired. Moreover, it is appropriate to conduct the experiment in the research in the controlled environments so that the exogenous factors can be eliminated. The research poses a hypothesis that the quality of the data is directly related to the amount of data, or the amount of probe vehicles. Therefore, the study aims at exploring the quality of traffic information from various amounts of probes. This implies also the practical introduction of the vehicles equipped with the probe devices.

With the advancement of data collecting technologies, it is possible to study travel time's variability using real world data. However, the limitation of data collection system causes insufficient information and it is directly affecting drivers from making proper driving decision. To provide drivers with useful information on the travel routes, predicted travel times and alternate routes, it is necessary to ensure that the system has accurate travel time data and reliable data analysis. In this study, travel time is used as a performance indicator of the network along the corridor, which being derived from probe vehicle. Selecting travel time is due to the following reasons that it is the most common way that users measure the quality of their trip and it is a variable that can be directly measured. Furthermore, it is a simple measure to use for traffic monitoring. Cambridge Systematics, Inc. and Texas Transportation Institute (2005) have reported that one of the principles that FHWA has established for monitoring congestion as part of its annual performance plan is that meaningful congestion performance measures must be based on the measurement of travel time. Travel times are easily understood by practitioners and the public, and are applicable to both the user and facility perspectives of performance. Figure 1.3 shows the schematic diagram of travel time measurement.

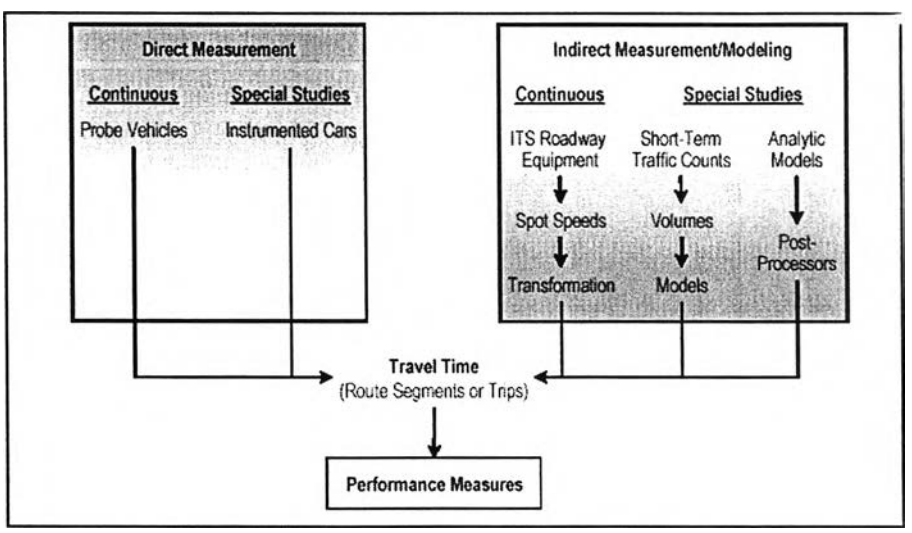

Figure 1.3 Schematic diagram of travel time measurement (Cambridge Systematics, Inc. and Texas Transportation Institute, 2005)

In order to manipulate the traffic data to yield the useful traffic information, several analytical techniques can be employed. Basically the expected outputs are not only the summary of traffic data (e.g. average travel time), but also traffic condition estimation and even prediction. The estimation requires not only the raw traffic data, but the understanding of traffic flow, condition, and relationship versus time. To yield more accurate traffic information, it is required that the manipulation of traffic data needs to be examined. Several methods are possible, ranging statistical updating to simulation exercise. Recently, the simulation method is widely used since the analysis of simulation data has given us a clear view how travel times are temporally and spatially correlated. Therefore, in consequence of the need of demonstrating the potential impact of the probe vehicle and detector based on manipulating travel time information, a computer simulation model will then be applied. The Paramics V5 which is an acronym derived from *Microscopic Simulation on Parallel Computers* traffic simulation model will be used for such analysis. The purpose of this is to simulate the traffic flow on the road as it might represent the real travel time condition. Simulation of the distribution of information will be accomplished by assuming that some percentage of the drivers will divert to alternative routes to avoid congestion. Paramics fits this purpose is because it can accurately simulate the traffic impact of signals, ramp meters and loop detectors (linked to variable speed signs) (McKay, 2000). Moreover, Paramics microsimulation cuts through the mathematical proxy misrepresentation of transportation models and their outputs (Druitt, 2000).

In this study, Paramics V5 was applied in order to produce relative traffic data detected by probe vehicle based sequentially. Data was generated by widely used traffic simulator i.e. Paramics owing to the difficulties in collecting field data as well as to fit the nature of the research reported herein. Several situations of traffic conditions were conducted and the percentage of probe vehicle was varies in each run of the simulation. Once all the relevant information (i.e., geometric characteristics, traffic parameters, and

traffic signal settings) have been input to the simulation model, the results of the travel time produced by the model were compared.

1.4 THESIS ORGANIZATION

The layout of this thesis is discussed in this section. Chapter one gives a general introduction to this study including the objectives and the scope of the study. The second chapter reviews the literatures related to the traffic information together with the brief discussion on using traffic simulation package. Subsequently, the third chapter describes the methodology carried out in this study while Chapter four contains the results and discussions for the study. Finally, Chapter five concludes this study.