CHAPTER V

CONCLUSIONS

5.1 Overview

Advanced Traveler Information Systems (ATIS) provide real time information on traffic conditions to users in order to reduce the travel time of the users and improve their travel experience. One of the main factors affecting the effectiveness of ATIS is the information strategy adopted. Depending on the information strategy adopted, the diversion patterns of vehicles vary and thus the system performance is affected. This study recognizes the need for developing a new modeling framework which enables testing the effectiveness of a wide variety of information strategies. The proposed new modeling framework relaxes certain restrictive assumptions imposed in many previous studies with regard to DMS information strategies. A new dynamic user class model has been proposed in which the users are classified into various classes depending on the information sources accessible to them. The dynamic user class model is formulated as a variational inequality and the equivalent minimization problem is provided. An algorithm based on the Frank Wolfe algorithm is provided to solve for the Dynamic User Class equilibrium.

The new framework enables the analysis of scenarios where the users receive different types of information from multiple information sources in the network including DMS and pre-trip information. The proposed Dynamic User Class framework permits users to belong to different information classes at different points in time, as they travel through the network. Using the DUC framework, a more realistic real-time information strategy is developed for DMS in this study. Through the use of this framework, the DMS information strategy provides three key advantages over several current models of DMS information: the proposed information strategy provides predicted consistent (information is made consistent by appropriately segmenting users on their awareness of incidents), and coordinated information (between multiple sources). In addition, the proposed model is also more behaviorally realistic since it captures the localized information scope of the DMS in real-world networks. Computational experiments are conducted to assess the practical impact of prediction, consistency and coordination on network performance. The experimental factors varied include: recurrent congestion levels, incident characteristics such as location, duration, severity, and information attributes such as market penetration and compliance. The performance of the proposed PCDMS strategy is compared against other benchmark information strategies such as: - Time Dependent User Equilibrium (TDUE) and prevailing, under various incident scenarios.

5.2 Results

Computational experiments conducted reveal that the PCDMS outperforms the TDUE over many but not all of the incident scenarios. The system performance under PCDMS is found to be significantly affected by the incident location. The system performance under PCDMS improves with increasing delay in incident start time. The system performance under PCDMS worsens with increasing incident duration and severity. The benefit of using PCDMS over TDUE information is found to be significant under higher compliance and market penetration levels. Note that providing TDUE information significantly overestimates the trip savings and hence does not provide a good benchmark under incidents. Simply providing coordinated information even if it is not consistent is found to yield significant benefits under higher congestion levels compared to uncoordinated information. Similarly, information which is consistent but not coordinated also offers significant benefits relative to inconsistent and uncoordinated information when the market penetration and compliance is high.

5.3 Future Research

This study provides a mathematical framework which enables us to model and evaluate a wide variety of information provision strategies. In the current study only two information sources are considered: pre-trip and DMS. The above framework can be extended to model several other information sources and information types. Some of the strategies that can be modeled include hybrid information strategies where predictive and prevailing information are combined. Traffic responsive information strategies could be developed where the level of information provided to the user depends on the traffic conditions in the system.

The algorithm developed in this study may also be applied in determining optimal locations for the placement of DMS. The DMS location problem can be formulated as a bi-level problem in which the upper level contains a tabu list of DMS locations. The lower level evaluates determines and compares the travel time performance of different candidate DMS locations by finding the expected travel times under different incident scenarios. The PCDMS information strategy proposed above can be embedded in the lower level problem and used to evaluate the locations of DMS contained in the tabu list.

This study makes several assumptions regarding the nature of network, number of DMS, market penetration levels, compliance with information, time-dependent O-D demands etc. These assumptions have been made for the sake of experimental control and to provide a better understanding of the PCDMS strategy in a controlled experimental setting. Therefore, due caution must be exercised in generalizing the findings of this study to large real-world networks. Given these assumptions, there is a need to validate the findings of this study with other networks, and real-world ITS data. Since a corridor network was used in this study, caution must also be exercised in generalizing these findings to other types of networks. Nevertheless, the proposed methodology and empirical insights enable relaxing key restrictive assumptions in many current DMS models and have important application for real-time traffic management and ATIS deployment.