6.0 Conclusions

6.1 Review

The Integrated Transit Planning Model (ITPM) developed in this study presents a multidisciplinary modeling approach in urban transportation planning. ITPM is intended to integrate various sub-models into a complete modeling framework that addresses the needs of future mass transportation systems. Specifically, those where APTS implementation is at stake. The modeling framework involves causality streams that help planners understand many variables related to the adoption of advanced technologies into mass transit. Those interactions reflect dynamic interrelationships between demand and supply variables which current models seem to neglect. All this integration is being done under the umbrella of Systems Dynamics. The benefit of Systems Dynamics is the integration of hundreds of variables in a dynamic, time dependent model where decision making polices can be studied varying model input parameters.

ITPM represents a prototype model for a comprehensive integration in time scale between microscopic mass transit models and their macroscopic UTPP type counterparts. Current techniques used to evaluate mass transit ITS technology have some shortcomings because the integration of a modern technology also requires better integration of planning and design models. The modeling framework presented in this study tries to bridge this gap. The results showed in this study demonstrate that this methodology has application to various APTS system technologies where variables of technological order affect the socio-economic perception of the mass transit system. Eventually these perceptions affect important measures of effectiveness of the system itself such as ridership. Considerations of the feedback structures resulting from this behavior are important and seldom considered in previous studies.

6.2 Future work

The ITPM model described in this study is a prototype model and needs to be refined to make the integration of sub-models seamless. The sub-models described in Chapters 3 and 4 have room to hold hundreds of variables together in a single microscopic model that will provide analysts with answers to quantify ITS problems. The integration steps described in this dissertation require some verification and future validation. This extra step would insure validity in the causal relationships among variables and improve the behavior of entire model. More attention is needed when two different models are connected with common variables as these connections are critical links. There are few well-known methods except sensitivity or steady state analysis to execute this procedure. In ITPM this step is substituted by i) comparisons between observed and estimated values of travel times and fuel consumption by regression and correlation analyses, ii) sensitivity analysis of mode choice procedure, and iii) traffic volume calibration step in traffic assignment analysis. However, these discontinuous analyses should be formally evaluated with other approaches used in hybrid simulation. ITPM is a prototype model categorized as a deterministic model. To cover varying, uncertain conditions encountered in the real world, the model can incorporate variables of stochastic character. For example, the pattern of travel volume, waiting/travel times, or demand on a bus stop is not deterministic. This model can easily incorporate stochastic distribution patterns for various parameters. MODSIM, the simulation language used to develop ITPM has built-in structures to facilitate this task.

Population is one of the critical parameters in most regional and transportation analysis. In this study, the definition of relationship between the passengers' behavior with other variables such as travel time, transportation service level and traffic demand needs more work.

The case study focused on only one route of the BT system. This tends not to only underestimate the amount of the total AVL impact by ignoring mutual impacts among routes and the effect of fleet size estimation, economic evaluation, etc..

This ITPM uses essential factors in transportation planning field such as the results of land use, bus operation micro simulation, UTPP and cost benefit analysis as coherent pieces that run under a single front end. However, as this ITPM model is a prototype, some refinement and integration details are still needed. Though the model concept in Systems Dynamics provides ITPM with desirable features such as continuous, self-iterative, and feedback procedures, actual case studies need planners attention and manual selection of decision variables in the mode choice step (LOS relative time, etc.), assignment of bus passengers to each bus stop, and the evaluation procedures. These manual interventions could be reduced and improved by connecting the model with a more sophisticated and dedicated software package. Various transportation planning tasks such as emissions analysis, bus fleet size study, bus scheduling, network planning and optimization analysis could also be incorporated into sub-models in these areas.