

Chapter 1 Introduction

1.1 Background

Transportation helps shape a metropolitan area's economic health and quality of life. Not only does the transportation system provide for the mobility of people and goods, it also influences patterns of growth and economic activity through accessibility to land. Furthermore, the performance of this system affects such public policy concerns as air quality, environmental resource consumption, social equity, "smart growth," economic development, safety, and security. Recognizing the critical links between transportation and other societal goals, metropolitan areas have been undertaking a formal process of transportation planning for many decades. The planning process is more than merely listing highway and transit capital investments; it requires developing strategies for operating, managing, maintaining, and financing the area's transportation system in such a way as to advance the area's long-term goals.

Transportation planning and operation are overlapped. One of the provisions that The Transportation Equity Act for the 21st Century (TEA-21) outlines, which must be addressed within the planning process, is to promote efficient system management and operations. There is a need for transportation planning and operation activities to coordinate with each other in order to accomplish more accurate system analysis on both demand and supply. While forecasting transportation demand for a region, some agencies may be interested in performing a more detailed investigation of traffic patterns within a sub area, such as the downtown area. This raises the question: Can we utilize a comparatively accurate existing or predicted demand information from a regional planning process to perform an operational analysis on an interested sub area in a easy, consistent way? In this thesis, the question is explored using the next generation transportation planning software package – TRANSIMS and the most state-wide used transportation operational software package – CORSIM.

TRANSIMS is a disaggregate, behavioral transportation planning package developed at the Los Alamos National Laboratory (LANL) over the last eight years from funding by

USDOT, EPA, and the Department of Energy. It is an integrated system of travel forecasting models designed to give transportation planners accurate, complete information on traffic impacts, congestion, and pollution. It brings the recent advances in the computer hardware and software to the field of transportation modeling. At the core of TRANSIMS is an agent-based simulation system capable of simulating second-by-second movements of every person and every vehicle through the transportation network of a large metropolitan area.

TRANSIMS is not a model. It is a modeling system that permits the modeler to keep track of and modify the behavior of each individual in a synthetic population. The TRANSIMS technology consists of software modules and file protocols that make this modeling process possible.

CORSIM is a comprehensive microscopic traffic simulation, applicable to surface streets, freeways, and integrated networks with a complete selection of control devices (i.e., stop/yield sign, traffic signals, and ramp metering). CORSIM simulates traffic and traffic control systems using commonly accepted vehicle and driver behavior models. CORSIM combines two of the most widely used traffic simulation models, NETSIM for surface streets, and FRESIM for freeways. CORSIM has been applied by thousands of practitioners and researchers worldwide over the past 30 years and embodies a wealth of experience and maturity. Traffic Software Integration System (TSIS) is a sophisticated toolkit built around CORSIM. Its strength lies in its ability to simulate traffic conditions in a level of detail beyond other regional simulation programs.

1.2 Problem Definition

The default application of TRANSIMS is on regional networks composed of thousands of links, e.g. 124,904 links in Portland Case Study. While forecasting transportation demand for a region, some agencies may be interested in performing a more detailed investigation of traffic patterns within a sub area, such as a downtown area. Even though a low-fidelity approach was adopted because of the need in TRANSIMS to model a much larger

geographic area at the level of the individual traveler in a relatively short period of time, the running of TRANSIMS on a small size network is very inefficient.

Also, as stated in FHWA Traffic Simulation Modeling Workshop in August 2000, there is a need for CORSIM Interfacing with other products, such as with TRANSIMS

- The CORSIM could be plugged in where the current TRANSIMS microsimulator module resides
- Allow TRANSIMS to take advantage of higher fidelity model for sub-network analyses
- Allow CORSIM to use planning inputs such as individual origin/destinations and trip chains

1.3 Thesis Objectives

The objective of this thesis is to provide a sub area focusing methodology from the TRANSIMS regional planning model and coordinate with CORSIM traffic simulation model. The methodology is then applied to Virginia Tech main campus, Blacksburg, VA, to conduct an evacuation study The results are explained and evaluated.

1.4 Organization of Thesis

The thesis first presents a review of the upcoming transportation-planning package, TRANSIMS, and of the most popular existing traffic operation package, CORSIM followed by a literature review. Subsequently, a sub area focusing methodology together with the development procedure of an interfacing TRANSIMS and CORSIM utility is presented. The application of the Virginia Tech main campus evacuation study in Blacksburg and its evaluation are stated afterward. Finally, conclusions and recommendations for further research are summarized.

Chapter 2 begins with an introduction of core modules on TRANSIMS followed by its current state-wide applications and particularly a TRANSIMS show-case project of

Blacksburg, VA development by Virginia Tech. The needs of a sub area focusing methodology for TRANSIMS are also discussed in this section.

Chapter 3 contains insight gleaned from the current literature on transportation planning and operation models, and evacuation models. In addition, some of the lessons learned and recommendations of others for further research are presented.

Chapter 4 focuses on the detailed explanation of the sub area focusing methodology in TRANSIMS and implementation on interfacing TRANSIMS with CORSIM.

Chapter 5 presents the application of the proposed sub area focusing methodologies on evacuation modeling in Blacksburg Study. The evaluation of the application's result is then discussed.

Finally, Chapter 6 presents a brief discussion and summary of the findings.