

Chapter 3: Methodology

Computer Simulation is a very powerful tool for traffic operation analysis. If a traffic system is simulated on a computer by means of a simulation model, it is possible to predict the effect of traffic control and its operational performance, as expressed in terms of measures of effectiveness (MOEs), which include vehicle speed, vehicle stops, delays, vehicle hours to travel and other environmental factors. It can also be used to test severe and extreme conditions, which are impossible to construct in field, difficult to observe, expensive or hazardous for experimentation.

3.1 Simulation Package Description:

3.1.1 Introduction

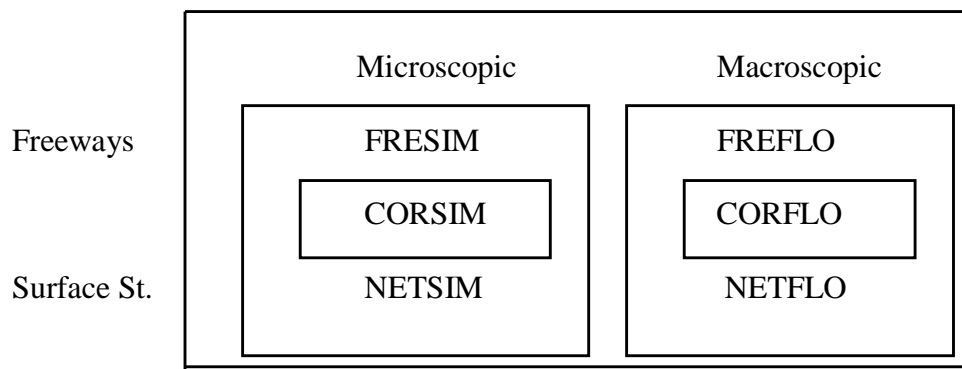
To test the effect of trip makers over a large area, there is a need for a simulation model that is capable of representing traffic flow in large urban areas containing surface streets and freeways. This concept of a single integrated simulation system that can provide the user with flexibility and easy use was conceived by FHWA. This led to the development of TRAF [39] family of models.

TRAF consists of an integrated set of simulation models that represents the traffic environment. Each component model in TRAF is designed to represent traffic on a particular physical environment and at a specific simulation detail. This system also includes traffic assignment program, which is designed to expand the applicability of traffic simulation model to transportation planners.

To provide an efficient framework for defining these specifications, the physical environment is represented as a network of nodes and unidirectional links. The links generally represent urban streets or freeway sections and the nodes generally represent urban intersections, trip generations or points at which a geometric property changes.

TRAF is an integrated software system, which consists of the following component models

- **NETSIM** , a microscopic stochastic simulation model of urban traffic
- **FRESIM**, a microscopic stochastic simulation model of freeway traffic
- **NETFLO** , a macroscopic simulation of urban traffic
- **FREFLO** , a macroscopic simulation of Freeway traffic



Another consideration in model selection is the intent of study. If the user is exploring traffic management concept and wishes to identify those variables that are viable candidates for more detailed analysis, CORSIM (CORridor SIMulator) would be used. In essence CORSIM and CORFLO are integrated simulation models at micro and macro simulation levels.

3.1.2 CORSIM (CORridor Traffic SIMulation Model)

To address the fluctuating traffic demand at detailed level CORSIM [17] is used. It is capable of modeling time varying entry level volumes at boundary nodes and time varying turning fractions at urban intersections and freeway off-ramps for each time period.

3.1.2.1 Input Data:

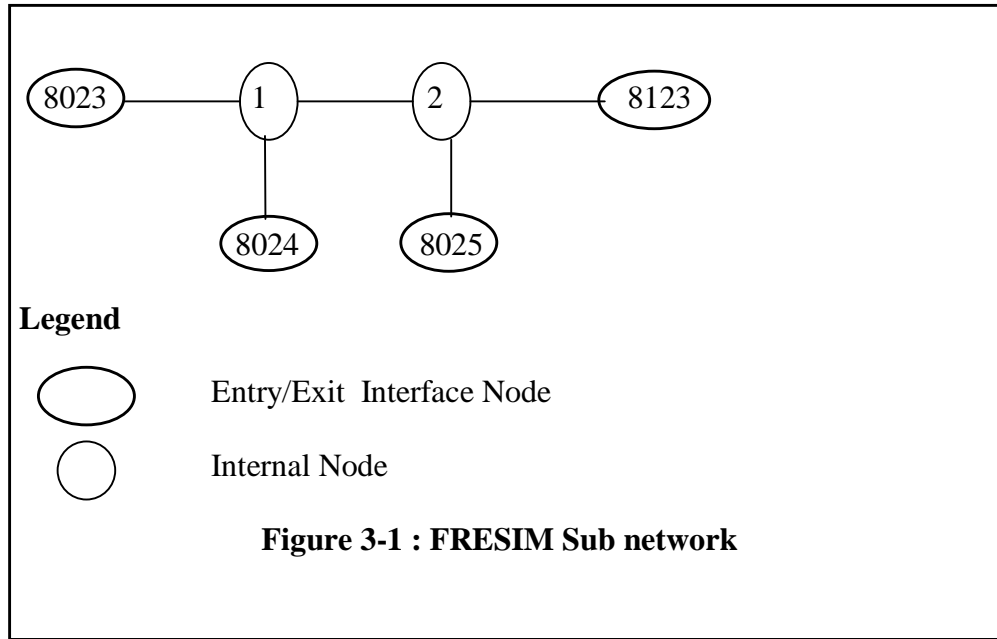
As CORSIM simulates traffic and traffic control conditions of a network over a period of time, the input must accommodate specifications that differ not only from one point to another but also that might change with time. The time varying portion of the simulation analysis is expressed as a sequence of “time periods” specified by the user. The user can specify upto 19 time periods and must specify the conditions that apply during each time period.

The CORSIM model, which contains both NETSIM and FRESIM, describes the traffic environment as a set of sub networks, which reflects the concept of network partitioning. Within each section, the input stream consists of a sequence of record types, which are also called cards. Each record type contains a specific set of data items as well as identification number

CORSIM contains a set of diagnostic tests for input which are executed in the following sequence

1. Test the structure of the input stream.
2. Test that each data item is valid and that it lies within a reasonable range
3. Test that the set of data items on a record is internally consistent.
4. Test that all data items on the set of records belonging to one record type are consistent and the set is complete.
5. Test that the data items of all classifications are compatible and completely define the network.

In a multiple model network, each of the component models of CORSIM simulates a different sub network. The interfacing of adjoining sub networks is accomplished by defining interface nodes (figure 3-1), which represent points at which vehicles leave one sub network and enter another. The term entry interface links, which receive traffic from adjoining sub networks and correspondingly exit interface links, which carry traffic exiting the sub network, are used to describe links as the boundaries of the sub networks.



AS the name suggests CORSIM is an integration of two models i.e. NETwork SIMulation (NETSIM) and FREeway SIMulation (FRESIM). NETSIM is used to simulate local surface streets while freeway and ramp merging scenarios can be simulated using FRESIM. Since our scope of study lies within freeway simulation the description of the FRESIM model is outlined below.

3.1.2.2 FRESIM Simulation Model:

FRESIM is a microscopic freeway simulation model that models each vehicle as a separate entity. The behavior of each vehicle is represented in the model through interaction with its surrounding environment. The FRESIM model is capable of simulating most of the prevailing freeway geometric like freeway blockage incidents, variations in grade, lane additions, lane drop anywhere in the freeway and auxiliary lanes, which are used by traffic to begin or end lane changing process or to exit the freeway

This simulation model also provides realistic simulation of operational features like warning sign distance (distance between the on ramp and place where the warning sign is placed on the mainline), the time required to change lanes (maneuver time), car following sensitivity factor, lag to accelerate and lag to decelerate, heavy vehicle movements and finally a comprehensive representation of freeway surveillance system.

3.1.2.3 TRAF Support Programs

As of now we had been talking about various simulation programs that are necessary to run a given model. But in order to create a model an interactive Windows based computer program called ITRAF (Integrated network editor) [42] is used. This program models the network as a sequence of nodes and links. It provides graphical interface to develop and speed up the task of creating data files that serve as input to the simulation model.

In order to view the simulation results, another interactive graphics program called TRAFVU is used. TRAFVU is an interactive graphics processor designed to display and animates the results of the CORSIM simulations. TRAFVU also provides an intuitive window environment to view the selected input data and all the output generated

by CORSIM. This program enables the user to animate traffic simultaneously in multiple views of the same traffic networks under the different traffic and control scenarios for alternative analysis. It provides a friendly environment that allows the user to analyze the multitude of simulation produced data via several presentation formats, including graphs, tables etc.