CHAPTER 1

1.0 Introduction

Human mobility has led to the growth and development of civilization through ages from the stage of cave man to the nomadic life, the markets and the capitals of ancient civilization to the present day megapolis. Transport systems have emanated to serve the mobility needs of the people and have shaped the growth and patterns of towns and cities from the beginning. Urban transportation has a very dominant role to play in the urban development per-se. An appropriate urban transport policy is important to any developing country in its economic, social, and environmental terms. It directly influences both the city efficiency and national economy along with the welfare of city population. There are strong linkages between urban development transportation, energy and environmental actions. Major reduction in vehicle operating cost can also be achieved through reducing traffic congestion resulting in major energy savings.

With the unpredictable traffic congestion in many cities the business efficiency is seriously constrained and the daily life of the people in these cities is also degraded. An effective traffic control can generate a large time-saving by reducing average journey time and its unpredictability. The economical cost of accidents both in terms of direct damage, hospitalization and loss of potential production while victims are not able to work are now recognized as of major importance in our country. A major contributor to air pollution is usually road traffic.

In recent years it has become evident that improving traffic flow in urban areas by building new highway facilities is to a certain extent a diminishing return solution. Attention is being shifted to the task of devising strategies that can improve traffic flow on existing facilities. Further more, there is a growing awareness that optimization of vehicular mobility does not necessarily result in maximum benefits for the urban communities. Other factors such as air and noise pollution and conservation of scarce energy resources have now been given great importance.

These circumstances draw attention to the fact that improvement in vehicular flow is not an end but a means of achieving better mobility of people and goods, which in turn is
a resource for enhancing the quality of urban life. The understanding of this fact has led to the realization that other methods for improving people and goods mobility such as expanding the role of mass transit and modifying urban configuration are not been given adequate attention.

The concept of traffic control is therefore giving way to border philosophy of traffic management where the purpose is not to move vehicles but to optimize the utilization of the urban resources for improving the movement of people and goods without impairing other community values. The application of traffic management philosophy to real life situations is the subject of the concern.

One of the most important analytical tools of traffic management is computer simulation. If a traffic system is represented on a computer by means of a simulation model, it is possible to predict the impact effects of traffic management strategies. These impact effects can be parameters such as average speed, travel time, energy consumption and vehicle emissions.

Construction of mathematical model of transportation networks plays a central role. The aim of analysis is to assist the selection of practicable and beneficial transportation actions. Mathematical modeling and simulation are very useful to evaluate and forecasting road traffic, traffic signals etc. For such short run problems it would appear that marginal change models would be most appropriate. The usual demand on the model is that it produces evaluations for one or more future years. The mathematical model's division makes it much easier to present our problems to experts on particular techniques-mathematical programming algorithm convergence, statistical estimation.

Planning process involves four phases. Planning in service level, planning vehicles and staff operations, carrying out the plan and controlling it. It essentially covers the determination of line networks and offered trips. The vehicle and duty schedules are determined at operational level. That is detailed instructions for carrying out vehicle and
staff operations, controlling the execution of vehicle operation and the deployment of the staff are most important.

Traffic management system actions are intended to increase the capacity and efficiency of the existing transportation system by improving traffic flow, smoothing out peak period loads, or diverting to high occupancy modes. General categories of actions include,
1. Actions to ensure efficient use of road space.
2. Actions to reduce vehicle use in congested areas.
3. Actions to improve transit management efficiency.

This can be achieved by reducing the vehicle-miles of travel or increasing travel speeds in congested areas.

The traffic management problem is a complex interaction between the urban traffic manager and the individual trip-maker reflecting their different objectives and differing perceptions of the performance provided by the transportation system. The traffic manager assesses the situation according to his measures of effectiveness and intervenes in the physical transport system to achieve his desired objectives. The trip makers on the other hand perceive the flows according to their own values, which may be different from those of the traffic manager. The manager's criteria for evaluating his action may include such measures of performance as travel time, energy consumption, noise and pollutant emissions and so on. In a city the coordinated strategic control system might fall within a wider city management that could be known as city traffic protocol. This would incorporate multi-model network which will include road traffic and vehicle for public transport. Important features of the network control framework would be a high co-operation between owners of parts of the network and model choice flexibility.
The hierarchy of city traffic control protocol is given below.

1.1 Traffic Problems

The urban transportation/traffic problem can be treated as a six sided problem.

1.1.1 Traffic movement and congestion

Congestion may be defined as waiting for other people to be served and is particularly found in service trades like transport where it is not economical to provide sufficient capacity to meet the highest levels of demand. Vehicle congestion is the delay imposed on one vehicle by another, while person congestion characterizes public transport subject to serve demand fluctuations through time. Congestion occurs in all developed cities no matter with their transport provision and is now a long term and apparently immutable fact of life. The effects of congestion are to delay goods movement, frustrate passengers and clog streets with stationary traffic. When traffic is at 98% of its maximum on road, journey time becomes seven times longer than in light traffic conditions.
1.1.2 Public transport crowding

The person congestion occurring inside public vehicles at such peak times adds insult to injury, some times literally. A very high proportion of the days' journey is made under conditions of peak hour loading during which there will be lengthy queues at stops, crowding at terminals, and ticket offices.

1.1.3 Off-peak inadequacy of public transport

If public transport operators provide sufficient vehicle to meet peak hour demand there will be insufficient patronage off peak to keep them economically employed. If on the other hand they tailor fleet size to the off-peak demand the vehicles would be so overwhelmed during the peak that the service would most likely break down. This disparity of vehicle use is the number of the urban transport for public transport operators.

1.1.4 Difficulties for pedestrians

Pedestrians form the largest category of traffic accident victims. Attempts to increase their safety have usually failed to deal with the source of the problem. (ie traffic speed and volume) and instead have concentrated on restricting movement on foot. Additionally there is obstruction by parked cars and increasing pollution of the urban environment, with traffic noise and exhaust fumes affecting most directly those on foot.

1.1.5 Environmental impact

It is now becoming more widely understood that transport is a major source of air pollution in many urban areas. The main pollutants are outlined below.

1. Carbon monoxide (Co): Can have detrimental health effects particularly in confined spaces and urban areas, but its major impact is its oxidization to $\text{CO}_2$
2. Nitrogen Oxides Nox: is nitrogen based pollutant which have harmful effects on health and global environment, especially when combined with other pollutants.

3. Hydro carbons Hc: including volatile organic components are compounds that result from the incomplete combustion of carbon based fuels. They play an important role in formation of photo chemical oxidants such as ozone, which irritate eyes in smog, damage plants, and contribute to acidification and global warming.

1.1.6 Noise and Vibrations

Noise is any disagreeable sound. Its effects will depend very much on the sensitivity of the individual, on the location, on the time of day and on existing noise levels. It disrupts activity, disturbs sleep, slows the learning process at school, impedes verbal communications. The sources of noise from road vehicles are many and varied, including brake, door slam, loose loads, horns, over amplified music system, and sirens in emergency vehicles. The major sources of noise pollutants are propulsion of vehicle at low speed. One certain way of reducing the nuisance from noise and vibration would be to reduce the amount of traffic in the first place.

There is an intolerable imbalance between expected trends in road based mobility and the capacity of the transport system. This is causing problems to industry, to the environment, and also to the ability of the people to lead comfortable and fulfilling lives. It is not possible to provide sufficient road capacity to meet unrestrained demand for movement. Whatever road construction policy is followed the amount of traffic per unit of road will only increase not decrease. In other words all available road construction policies only differ in speed at which congestion gets worse. It is possible to overcome to all problems provided they are properly harmonized. They will include land use planning, extensive use of traffic management, comfort and cost of public transport and traffic calming schemes.