CHAPTER 2
Existing Traffic Management System

2.0 Introduction

Transport is all embracing in the widest possible sense, incorporating a multitude of different skills, systems, and services. The different modes have their different applications and the common thread is a function of transport, namely to move people or goods from where they are to where their relative values are greater. As communities became larger, so individuals began to specialize in certain crafts and hence division of labour evolved. Specialists worked in a single trade in which they became skilled and thus simulated a demand for their products. People were by this time no longer dependent entirely upon themselves but collectively upon each other; specialization improved workmanship in the form of better clothes, better habitations, better food, and hence an improved quality of life. Such development is synonymous with the development of transport and traffic control and communication and it is necessary only to reflect on our present day economic system to realize the part played by transport/traffic in the fulfillment of the standard of living that we now expect.

People use transport for a variety of reasons. They travel between home and place of work or school and they may travel during the course of their work. This is regarded as essential traffic. The demand for travel is elastic which means that it is more likely to respond to the price and quality of the service. Distance is another characteristic. Works and schools traffic are often local and the journey relatively short. It is unfortunate from the point of view of transport economic, but nevertheless inevitable, that the demand for travel is not easily spread in terms of time and there are periods of heavy traffic concentration. As far as the daily peaks are concerned business and school traffic is likely to clash to create heavy unidirectional flows. Other types of traffic have a more seasonable element.

The characteristics of goods traffic are different from those of passenger traffic. It has been shown that passengers travel for a variety of reasons but their demand and
expectations can be accessed accordingly subject only to class of travel. The passengers are standard units. They load and unload themselves. This brings in to focus the term loadability which is a characteristic of goods traffic. Traffic that has good loadability has the property of being able to accommodate itself within the vehicle. The basic characteristic of scheduled service is planned and advertised in advance and will operate regardless of the demand at the time. However that as general freight can sometimes be diverted or delayed due to heavy traffic in a manner that would be unacceptable to passengers.

2.1 Traffic Planning

Major street plans should take into account all types of traffic. Commercial traffic desires might be markedly different from other traffic movements. Peak hour requirements might vary from street to street and so forth. Traffic needs that are measurable through continual traffic studies. The desires and needs of an existing land use pattern can be measured by volume counts and by origin destination surveys. The amount of traffic in the central business district has no basic desire to be there, and that could be better accommodated by new routes around the district could be readily ascertained. The amount of traffic of each type that could be bypassed around the entire city could be measured. The relative importance of each form of transportation should be indicated. When these and other things are known about travel in a community, road way improvements and new roadway developments can be evaluated in terms of aids to existing traffic. Roads and other devices cannot be only for immediate needs, it also serves for future needs like the control of land use, the projection of land development, population shifts and trends and many other planning data.

The street plan might include express ways, major through ways, and local service streets. As the city grows and traffic volumes increase- the new type facility comes into being. Provision should be made for modernization of existing net works when traffic requires accommodation.
Topographic data have major effects upon highway transportation. Rivers, valleys, hills and lake's might impose hardships in planning highways and traffic improvements. A bluff or a hill might pose serious impediments to major flows within a city or a region. While topographic conditions often increase transportation cost, there are many opportunities to take advantage of these conditions.

Population distributions are valuable to traffic controls, since people make traffic. Traffic controls need data on the distribution of populations, income groupings, ages, modes of travel and trends. For simple evaluation of the adequacy of traffic services to the design and location of major routes, these data are valuable.

Vehicle ownership and its data are often used by traffic controllers. These data are related to population and traffic studies to determine travel generation characteristics and potentials. They also serve the traffic authorities in other ways in dealing with general planning matters. Economic factors have the most direct bearing on the capacity of the community to undertake highway and traffic improvements. Studies of other transportation media and terminals commonly made by the planner have applications in traffic. The city planning agency will usually develop the information as part of the over all city plan. The traffic and highway agencies often desire to subject it to different analyses and to put it to different uses - uses which integrate all forms of traffic.

Standards for roadways should be reviewed by traffic authorities to ensure safe condition and long range capacity. This applies particularly to the following: corner setbacks, subdivision controls, roadside plantings and median plantings, sidewalks, and driveways. The planner can well use the knowledge of the traffic authorities in developing and administering these and other standards which affect vehicle operations and pedestrian safety. Location of schools and public buildings involves standards which relate directly to traffic.
2.2 Mathematical Models for Traffic Planning

The main objective of transport model is to predict the number of trips that will take place by different available modes of transport to predict the origin and destination. The accuracy of the traffic forecasting model dictates to the user that can be made of the transport planning process and the scope for evaluation. The transportation planner may observe the situation in an urban area in which journeys are made. The number of trips made is directly proportional to the number of people in the area. If \( T_i \) is the number of trips and \( P_i \) is the population in the area the relationship may be given as

\[
T_i = gP_i
\]

From the model we can predict (calculate) the new number of trips made by new population.

The full transport planning model is more complex. It attempts to describe the travel patterns of large number of people using a series of linked sub models and can be considered a description of the decision-making process the average person might be expected to use when he considers making a journey. He first decides to make a journey (trip generation), he selects destination (trip distribution) and then makes a journey (trip assignment). Generation, distribution, and assignment can together consider as transport planning model.

**Trip Generation**

The trip generation stage of the transport planning model describes the reason why trips are made and determines the places where trips start and finish. Trips are usually made by people in three ways.

1. Pedestrian movement
2. Journeys by public carrier
3. Other modes (Private carriers)
For example, a trip from home to place of work is a home-based trip, like the return journey from work to home. The most important factor affecting the trip rate of household is the number of cars that the household owns.

**Trip Distribution Model**

The previous section has looked at trip generation and the development of the models relating trip ends to planning parameters. The outcome of the trip generation stage was the production of trip ends by purpose and perhaps by mode. It is the function of trip distribution to calculate the number of trips between one zone and another given the determined number of trip ends in each zone together with further information on the transport facilities available between these zones. The trip distribution model attempts to explain trips from zone i to zone j. Assuming that the trips from i to j are proportional to some attractiveness factor for zone j and inversely proportional to the spatial or temporal separation from zone i and zone j.

The model can be:

\[ T_{ij} = P_i A_j F_{ij} K_{ij} \sum A_j F_{ij} K_{ij} \quad \forall j \]

where

- \( T_{ij} \) = trips produced in zone i and attracted to zone j
- \( P_i \) = trips produced in zone i
- \( A_j \) = trips attracted to zone j
- \( F_{ij} \) = travel time factor which is the function of the spatial separation between zones.
- \( K_{ij} \) = Specific zone to zone correction factor for special social or economic effects

For example, the trip distribution model is considered for the inter-zonal interchanges. 100 trip generation at zone 1, with 250 attractions at zone 2 and 100 attractions at zone 3 and 600 attractions at zone 4. Assume that 1 to 2 is 5 minutes, 1 to 3 is 10 minutes, 1 to 4 is 15 minutes. Assume all \( K_{ij} \) factors are unity and that \( F_{ij} \) factors are shown below.
## Trip Assignment Model

In the assignment problem we are given a set of ordered pairs of points on the network that are called (O/D) origin destination pairs. For each O/D pair \((x,y)\) there is a given function \(R_{xy}(t)\) \(0 \leq t \leq T\) where \(R_{xy}(t)\) is the rate at which vehicle leave \(x_i\) at time \(t\) to go to \(y_j\). The assignment problem is to determine traffic pattern or flows on the links of the network satisfying specified optimality conditions.

Consider a net work \(G\) is asset of nodes \(\{x\}\) and a set of links \(\{x,y\}\) connecting pair of nodes. Some of the nodes are origins and others are destinations. By a path \(P\) we mean a sequences of links \((x_1,x_2),(x_2,x_3),(...,(x_{n-1},x_n)\) where \(x_1,x_2,x_3,...,x_n\) are distinct nodes, \(x_1\) is an origin and \(x_n\) is a destination. Let \(P\) denote set of all paths of \(G\), \(Px\) the set of all path originating at the origin \(x\), \(Py\) set of all paths terminating at the destination \(y\) and \(Pw\) the set of all paths connecting the origin destination pair \(w=(x,y)\)

### Zone 1
- 100 Generations
- \(F_{12} = 20\)
- \(F_{13} = 5\)
- \(F_{14} = 2.22\)

### Zone 2
- 250 Attractions

### Zone 3
- 100 Attractions

### Zone 4
- 600 Attractions

<table>
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<tr>
<th>Zone</th>
<th>(A_i)</th>
<th>(F_{ij})</th>
<th>(A_jF_{ij})</th>
<th>(\Sigma A_jF_{ij})</th>
<th>(P_i)</th>
<th>(T_{ij})</th>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>250</td>
<td>20</td>
<td>5,000</td>
<td>0.732</td>
<td>100</td>
<td>73</td>
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<td>4</td>
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<td>0.195</td>
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</table>

\[ \Sigma A_jF_{ij} = 6832 \]

Table 2.2.1
Traffic flow produced at the origin and traveling along the path of the network terminate at the destination nodes thus generating a flow pattern $F=\{F_p\}$ where $F_p$ denotes the traffic flow on path $P$. The total no of trips generated in the origin node $X$ (trip production) will be denoted by $Ox$. The total no of trips terminating at the destination node $y$ (trip attraction) will be denoted by $Dy$. Finally the travel demand associated with origin-destination pair $w$ will be denoted by $dw$. Then $dw, Ox$ and $Dy$ must satisfy the flow conservation equation.

$$dw = \sum_{P \in Rx} F_p$$

$$Ox = \sum_{P \in Rx} F_p$$

$$Dy = \sum_{P \in Ry} F_p$$

If $T$ denotes the total no of trips produced at all origin nodes (and equal to the total no of trips terminating at all destination nodes). We must also have

$$T = \sum_{\text{org}} Ox = \sum_{\text{dest}} Dy = \sum_{P \in \Gamma} f_P$$

We assume that each user travelling on a path $P$ incurs a travel cost $C_p$ which depend on flow patterns $C_p=C_p(F)$

The total no. of $Ox$ of trips produced in each origin node $X$ is given. Determine the origin destination travel demand $dw$ and the flow pattern $F$

Consider the simple network consisting of a single origin $x$ and three destinations $y_1, y_2, y_3$. We assume that users travel cost on link $i, i=1,2, \ldots, 6$ of the network is of the form

$$C_i = g_i f_i + h_i$$

where $g_1=4, g_2=1, g_3=2, g_4=1, g_5=4, g_6=2$

$h_1=380, h_2=400, h_3=410, h_4=430, h_5=440, h_6=800$.

The total demand produced at origin $Ox = 10000$. We now add the imaginary destination $\Psi$ and we join $y_1, y_2, y_3$ with $\Psi$ by the links $(y_1, \Psi), (y_2, \Psi), (y_3, \Psi)$ with zero travel cost.

The problem reduces to single origin-destination pair $(x, \Psi)$ with associated with travel demand $Ox$. Nodes $x$ and $\Psi$ are connected by six paths which will again be numbered by
1, 2, 3, ..., 6 where path i is the path containing link i. $C_i$ denotes the flow and users cost both on link i and its corresponding path.

$$\lambda = \frac{\sum_{i=1}^{k} h_i}{\sum_{i=1}^{k} g_i}$$

and we determine index $x$ for which $h_x < \lambda < h_{x+1}$ then the solution is

$$f_k = \frac{\lambda x}{g_k} \quad k = 1, 2, 3 \quad s = 0 \quad k > s+1$$

the Determination of s is given

<table>
<thead>
<tr>
<th>$k$</th>
<th>$\sum_{i=1}^{k} \frac{1}{g_i}$</th>
<th>$\sum_{i=1}^{k} \frac{h_i}{g_i}$</th>
<th>$\lambda_k$</th>
<th>$h_k$</th>
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<td>4300</td>
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<td>400</td>
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<td>2</td>
<td>1.25</td>
<td>495</td>
<td>1196</td>
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<td>3</td>
<td>1.75</td>
<td>700</td>
<td>971</td>
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<td>3.00</td>
<td>1240</td>
<td>747</td>
<td>440</td>
<td>800</td>
</tr>
</tbody>
</table>

Table 2.2.2

\[
\begin{align*}
    f_1 &= \frac{747 - 380}{4} = 91 \\
    f_2 &= \frac{747 - 400}{1} = 347 \\
    f_3 &= \frac{747 - 410}{2} = 168 \\
    f_4 &= \frac{747 - 430}{1} = 317 \\
    f_5 &= \frac{747 - 440}{4} = 77 \\
    f_6 &= 0
\end{align*}
\]

The resulting origin destination travel demand

\[
\begin{align*}
    d(x, y_1) &= f_1 + f_2 = 438 \\
    d(x, y_2) &= f_3 = 168 \\
    d(x, y_3) &= f_4 + f_5 + f_6 = 394
\end{align*}
\]
Land Use Model

The land use model may be formulated as follows.

\[ G_i = \frac{\sum_{i \neq j} G_i A_i v_i}{\sum_{i \neq j} A_i F_{ij} v_i} \]

where \( G_i \) = the forecast growth for zone \( i \)
\( A_i \) = accessibility index for zone \( i \)
\( v_i \) = vacant available land in zone \( i \)
\( A_i = \sum_{j} E_j F_{ij} \)

\( E_j \) = total employment with in zone \( j \)
\( F_{ij} \) = fraction factor for travel time between zone \( i \) and zone \( j \)

2.3 Drawback of the Existing System

The above mentioned models do not yield accurate results and are time consuming, since all the parameters used in various models are not interrelated to one another and have huge volume of datum. Also each models depends on its own functional parameter. The traffic and transportation system in our country is forced to look for new methods to reduce the conflicts between the demands for retention or even expansion of available service. A practical way of escaping from this situation consists in establishing computer aided planning and control systems.

2.4 Proposed Traffic Management System

Present city traffic control management provides poor access to poor quality data. The development and implementation of the effective traffic control requires accurate collection of high quality data. The quality of decision depends on data that are readily available, accurate and relevant to the current problem. The city department of traffic must maintain large amount of related data such as assign, signal and pavement
conditions. Though large amount of data is available at present only meagre resources are available to use those data. Consequently city traffic management programs are often inadequate for current and projected management needs. Given the spatial character of these data computer information system technology would greatly simplify the extraction and presentation of data providing a higher degree of user friendliness, better access to data, and the ability to integrate data from many sources.

TMS (Traffic Management System) is a computerized database management system. It will be based on a detailed representation of the urban and motorway road network together with the attributes both static and dynamic required to provide a common network database. This will provide the basis of the net work model that will be used in the urban and motor-way traffic control centers and in the travel and traffic information system. The TMS will also provide a basis for storing and analyzing strategic information relating to traffic and accident statistics, weather, environmental data and road condition.

The configuration of TMS has been given below

![Diagram of TMS Configuration](Fig 2.4.1)
2.5 Objectives

Creating an user friendly interacting system for Information
Automated computer schedule for bus and crews
Developing Mathematical models and algorithms for traffic flow to predict Traffic
Developing Mathematical models for accident forecast and accident severity

2.6 Scope of the Proposed System

Increase the use of the public transport to gain more revenue
Reducing operating cost for a given timetable or providing increased capacity for given cost
Analyze the consequence of change some of the parameters governing the operation.
Supporting the decision process by simulating different scenarios
Handling time -observing routine work on a computer
Utilizing the savings in labour time for more intensive checking as well as for handling additional time tables in order to adopt the service level to seasonal variations.
Shortening the planning time-scale by applying the optimization technique construct admissible solutions.
Reacting immediately to interruptions in the traffic network and alternations in the service level.
Last but not least economic and political aspects must be considered.
By reducing private transport in favour of public transport it is possible to save energy and air pollution

2.7 Methodology

Mathematical models for speed, travel time, optimization technique for scheduling.
Network methods for Information system and Traffic control.
Computer simulation for the above.
To forecast the traffic volume and density test data has been taken from two centers in Ernakulam where the traffic volume is maximum during peak hours. This has been applied in various statistical distributions.

**Hardware Configuration**

To install TMS for traffic it must have the following hardware requirements:

- **Processor**: AMD Duron Processor 1 GHz
- **Main Memory**: 128 MB
- **Total Disc Space**: 20 GB
- **Display unit**: 15" SVGA COLOR

**Software support**

- **Operating System**: Windows 2000
- **Software used**: Structured Query Language and Pascal

**2.8 Literature Survey**

The traffic and transportation discipline has been increasingly developed in the world in recent times and can make essential contribution to improved operations of an entire transportation system. The application of existing theoretical models, modifying them and creating new ones can achieve considerable economic effects and improve the level of service. The fundamental developments in computer aided planning originate from the time of World War II and the years which followed. The field of public transport has of course benefited, as the development of computer techniques. The data management system for public transportation in chapter 3 leaves the evaluation of the plans being developed to the experience and perception of the planner. The evaluation programs are introduced to the computer system. This measures various descriptive characteristics of the plans and can be used to evaluate the quality of different plans objectively. The traffic data collection has been widely studied by John B. and Sullivan T. [11] and Date C. [31]. Hunt I.D. and Simmons [45] have discussed the land use model. Wren A. [48], [82],
[51], and [11] have discussed the Computer oriented-planning model. Berg W.D. [87] has introduced the transportation system management idea.

 Effective distribution management presents a variety of decision-making problems at all three levels of strategic, tactical and operational planning. Decisions relating to the location of facilities (depots) may be viewed as strategic, while the problem of fleet size and mix determination could be termed as tactical. On the operational level, various decisions concerning the routing and scheduling of vehicles and the staffing of such vehicle with crews require ongoing attention on a day today basis. Clearly the distinction between strategic, tactical and operational planning should not be interpreted too rigidly, especially in view of the close interaction between the decisions involved. Generally, the locations of all facilities are required as input data for planning the local transportation activities. Conversely such decisions rely upon distribution or transportation costs between various geographic locations.

 In addition to the location of depots, effective planning of deliveries generally requires inputs concerning a variety of other exogenous decisions, which include

- Fleet size at each depot
- Customer service level

 Given the decisions listed above route and schedule its vehicle to perform the assigned functions at minimal cost. This requires an optimum-seeking algorithm to identify the best configuration of route and schedules which brings us to the main focus chapter. Further more, it should be remarked that recent advance in routing and scheduling procedures. In mass transit one must determine the locations of garages to house buses so as to allow for a cost effective servicing of existing bus lines by the fleet vehicles similar issues arise in the location of emergency units. Although cost minimization is the primary objective of most routing and scheduling problems. Other objectives may assume primary importance especially in the context of service operations in the public sector. Safety and convenience are other two objectives.

 Many routing and scheduling problems can be formulated as instances of as a special class of zero-one integer programs known as set partitioning or set covering problems.
Basically, a set covering problems involves a given 0 – 1 matrix with cost attached to all columns. The objective is to choose a minimum cost -—colleclion of columns such that the number of 1s appearing in each row of selected columns is at least one. If this number is required to be exactly one the set partitioning problem results set covering and the set covering problems have been studied extensively over the last two decades by Balas & Padberg [95] and Garfinkel [97] and Nemhauser[94]. Travelling salesman problem is the basic mathematical programming formulation for routing problems. The multiple travelling salesmen problem is a generalization of the travelling sales problem that comes closer to accommodating real world problems where there is a need to account for more than one sales man (vehicle). Multiple travelling salesmen problems arise in various scheduling and sequencing applications.

In the multiple travelling sales men problem M –salesmen are to visit N given nodes of the network in such a way that the total distance traveled by all M –salesmen is minimum. Each salesman must travel along a sub tour of the nodes, which include a common depot, and exactly one salesman must visit every node except the depot exactly once. The mathematical programming formulation of (MTSP) is a natural extension of the assignment-based formulation of the travelling salesman problem.

\[
\text{Min } z \sum_{i=1}^{n} \sum_{j=1}^{m} c_{ij} x_{ij}
\]

subject to

\[
\sum_{i=1}^{n} x_{ij} = b_j \quad \text{m if } j = 1
\]
\[
1 \quad \text{if } j = 2 \quad n
\]

\[
\sum_{j=1}^{n} x_{ij} = a_i \quad \text{m if } i = 1
\]
\[
1 \quad \text{if } i = 2 \quad \ldots \ldots n
\]

\[
x_{ij} \in S
\]

\[
x_{ij} = 0 \text{ or } 1 \quad (i, j = 1, \ldots n)
\]
The travelling salesman problem requires the Hamiltonian cycle in $G$ of minimal total cost, where $G = [N, \ A, \ C]$ is a network be defined with the set of nodes, $A$ the set of branches and $C = [c_{ij}]$ the matrix of costs. That is $[c_{ij}]$ is the cost of moving or the distance from node $i$ to node $j$. This has been discussed by Christofides [98] and Nemhauser [6].

Karp [99] has shown that the TSP is NP complete. Due to the difficulty of the TSP many heuristic (approximate) procedures have been developed. This heuristic may be compared analytically. Steams and Lewis [100] has studied their worst case behavior. The articles by Stewart [102], Golden [101] is the best source of this topic. In the bus-scheduling problem, which consists of optimally linking trips to form feasible schedules for individual buses operating in an urban area. A large number of short trips are considered and divided into chains of trips so that all trips in the same chain can be connected to form a feasible schedule for a bus. These chains always begin and end at the same bus depot.

The vehicle routing problem consists of designing a set of least cost vehicle routes in such a way that every route starts and ends at base station or other than the base station. But every city is visited exactly once precisely one vehicle and some other constrains are satisfied. This field has been studied by the authors Sohvat [112], Golden B.L [119], Fadden D.M.L. [122] and Bearley J.E [144]. The Lagrangean based heuristic is one recent approach in vehicle scheduling. The nodes are linked by compatibility arcs. Connections with the depots are explicitly represented by introducing depot source and sink nodes are connected to all trip nodes. A block corresponds to a path from a source to a sink depot. The idea is to find a set of blocks covering the service such that this set can be partitioned in to feasible vehicle schedules as well as in to crew duties, all complying some global constraints. The idea of converting blocks into duties has recently received much attention by Ball M [146], Gallo G [147], and ztoth P. [148] and it is exploited in depth in this work.
Given the timetable for numerous trips one aims to construct bus schedules that minimize the costs incurred by fleet size and deadheading time, while satisfying other operational requirements. This problem is encountered in our country by the public sector operating throughout the state. The assignment of buses to schedules has been dealt with by several researchers, namely Gavish [105] and Hoffstadt [35]. The problem is formulated as a transportation model. The assignment of buses to schedules was first formulated as a transportation problem. Let \( I = 1, 2, 3 \) denote an index set of short trips to be operated in a planning interval \( T \). Each trip \( i \in I \) is characterized by its starting and ending. The depot is also considered as a short trip which is given the index \( n+1 \). Hoffstadt formulated the bus-scheduling problem as an assignment model. The linking cost \( c_{ij} \) for each feasible pair \((i, j)\)

\[
x_{ij} = 1 \text{ if trip } i \text{ is directly connected to trip } j
\]

\[
= 0 \text{ otherwise}
\]

where the coefficients \( c_{ij} \) correspond to the cost relative to the linkage of trip \( i \) to trip \( j \). If this is an unfeasible linkage then \( c_{ij} \) is taken to \( D \).

Traffic monitoring is probably one of the oldest activities falling under the umbrella of highway planning in our country. The changing uses of traffic data are however requiring significant changes in our traffic-monitoring program. Data is demanded by finer levels of system and geographic. Data users are demanding finer stratification by vehicle type. Management wants data quicker for a number of reasons. Transportation system management has continued but has been enhanced and broadened by the anticipation of the of innovative vehicle, computer and electronic technology. Two closely related challenges are envisioned for the remainder of this century and the beginning of the twenty-first century. A more systematic and comprehensive transportation system management activity and a gradual implementation is the most promising new technologies. Both will be directed towards making maximum use of the existing transportation system. Traffic flow fundamentals will play an important role in meeting these two challenges.
Planners, designers and operators of the transportation system all have a role to play in developing a more systematic and comprehensive transportation system management activity. The skills of planners will be needed to develop and apply improved techniques for evaluating the impacts of land use changes and in developing more precise behavior models of the effects of system changes on spatial and temporal model and total traveler responses. The ingenuity of the designer will be required to identify critical links in the system where capacity increases are urgently needed and to develop design plans that meet the needs, but with serious constraints on available right of way and environmental impacts.

Innovated vehicle, computer and electronic technology are on the threshold of developments that have the potential of making maximum use of the existing transportation system. Technologies with the greatest potential must be identified and a gradual implementation plan developed. New vehicle technologies include in vehicle longitudinal and lateral information warning system, radar brakes and perhaps ultimately fully automatic controlled guidance systems. Computers can play an even greater role in the future in both off-line and on-line operations. Off-line computer packages are becoming faster, more flexible and user friendly. The use of the on-line computer systems provides the opportunity of engaging improved control, theory algorithms, such as artificial intelligent expert system, fuzzy sets and the like to make the maximum use of the highway system under normal and unusual traffic conditions. New electronics technologies interact strongly with vehicles and computer technologies. New detectors communication links and control processors are being developed that may lead toward navigation systems and route selection under dynamic traffic conditions.

The highway system today carries a more significant number of vehicles –miles of travel than ever before – greater than that for which it was designed. Demands continue to grow at faster rates than improvements are being made. The movements of persons and goods have gradually deteriorated. Transportation system management and new technologies offer the greatest challenge and hope for improving the quality of movement. The ability to understand and apply traffic fundamentals is an essential ingredient in working toward improving the transportation system.
The general requirements of up to date software systems for computer aided planning and especially realization of plans have become more difficult within the last years. This is not only related to public transport systems. The changed requirements lead to changed tasks for the planner and he sometimes has to come up with inadequate planning tools. Three aspects can be seen as the main reasons of the development.

1. Compared with the past, planning objectives are seen with greater differentiation, at least the objectives are introduced more decisively.
2. Instead of a few alternatives more alternatives must be presented to come to decision today.
3. To let the decision makers participate already in an early stage – this is more and more necessary – the planning process must as far as possible be transparent and understandable also to non-experts.

One way to solve the planner's problem is to use modern computer technology, which offers a variety of chances to improve the planning process. Today the computer capacity of relatively small installations is in a range which some years ago could only be provided by large computer centers. Looking at the software there are some gaps at the movement but this is self evident. Besides the handling of data which is of special interest in the planning process, modern computer technology offers the possibility to evaluate measures in the planning stage by use of models with a model. We try to describe reality as well as possible. The data set coming from the existing situation normally serves as a basis for calibration of model parameters. To find the best solution for a given data set and given objectives optimization methods have been applied to planning in transportation for a long time. The results of optimization methods depend on the quality of the input data set.

Traffic flow fundamentals have been extensively studied by May A.D. [91]. Haight F.A. [17], [16], and [22] have defined the statistical methods for flow theory models. Haight F.A. himself has discussed counting distribution. Sample datum from Ernakulam City have been taken and tested to see whether this is suitable for statistical distributions. Queue estimation and Queuing Theory in traffic has been established Hoose N. [13] and Harris C.M. [106]. Queuing analysis in traffic also been discussed. Net works on traffic has been done by Robertson D.I. [80]. When two or more intersections are close in
proximity, some form of linking is necessary to reduce delays in traffic and to prevent frequent stopping. A signal-controlled intersection has a platooning effect on the traffic leaving it, and it is advantageous to have the signals synchronized. The usual procedure for setting signals on arterioles and in networks involves three steps. First is common cycle then splits of green time and finally computer optimization procedure. Several computer programs have been developed for determining offsets in network. Hillier J.A. [103] have extensively worked this on. Gartner N. [10] introduced an idea in Dynamic programming in traffic signal networks. Also the idea of artificial neural network has been introduced to create an expert system in traffic.

2.9 Scheme of the Study

In Chapter 3 we have defined the Network Configuration. All traffic data has been controlled through Network Database Management in the state. Geographic Information system has been developed with user friendly manner which gives an easy access to the ordinary people. All the required field has been given in this work. Mathematical models for traffic planning and forecasting methods has been discussed. The traffic planner collect the data from Network database management system and the data has been given as an input in the suitable mathematical model for simulation.

Chapter 4 is concerned to meet the public transport demand. That is scheduling the vehicles and their crews in scientific way with minimum number of vehicles. It is the purpose to set appropriate timetables for each transit route to meet the variation in the public demand. Then schedule the vehicle to trips for given timetable. The major objective is to minimize the number of vehicles required. Then assign crew as per the outcome of the vehicle scheduling. The assignment must comply with some constraints regarding starting point, ending point, relief point and so on.

Chapter 5 is devoted to monitor and control the traffic flow with the help of the electronic devices and computer. Statistical count distribution has been discussed to find volume and density of the traffic. The role of artificial neural network and computer vision to control traffic flow has been discussed widely. Queuing analysis and queuing patterns gives a clear idea about level of congestion and the delay in traffic. Mathematical model for area wide traffic network control helps to have a centrally co-ordinate system.
Chapter 6 has been given the importance of the traffic safety. While acceleration of transport activity contributes to economic development and improvement in the quality of human life, it also brings in its wake the problem of traffic risk to the people. To one's dismay, traffic risk on roads has become a common phenomenon in all countries in general and developing countries in particular. India is one among high fatality rates in road accidents. The basic causes of traffic safety problems are those forces or situations that bring about over crowding, a decline in maintenance of roads. The use of fossil fuels, and spillage in the oceans lakes and rivers affect the ecosystem. This work gives a detail description about accident problems and adverse effect of pollution.

Chapter 7 highlights the summary of the work. The importance of the implementation of Traffic Management System has been discussed. The future developments in this field may lead the way to have an effective management in road traffic.