**Chapter 1**

**INTRODUCTION**

**1.1 Definition**

“Data acquisition and prediction for dynamic transport infrastructure planning and simulation”- states the collection of quantitative data of current traffic provided by Google maps and learning the data to estimate the future traffic flow in order to reduce the traffic congestion and increase the country’s economy.

**1.2 Problem Definition**

India is said to be the fastest developing country today only after China. Although India is doing exceptionally well in fields like education, industrialization and fashion there are still certain areas where the country is lagging behind [1].

India's road network is gigantic and said to be only after the United States of America. India has a road network of over 4,689,842 Kilometres (2,914,133 miles) in 2013, the second largest road network in the world. At 0.66 km of roads per square Kilometre of land, the quantitative density of India's road network is similar to that of the United States (0.65) and far higher than that of China (0.16) or Brazil (0.20) [2]. However, qualitatively India's roads are a mix of modern highways and narrow, unpaved roads. But one of the striking underlying facts is the condition of the roads.

Since roads indirectly contribute to the economic growth of the country it is extremely essential that the roads are well laid out and strong. India is the home to several bad roads be it the metropolitans, the cities or the villages. Bad road conditions are nothing new to India and the problem is being addressed since the last 30 years [1].

In India on an average scale an individual spends 1500 hours per year on the road stuck in traffic congestion. Considering the cost of 100 Rupees per hour, with the population of just Bangalore the cost to the state would be approximately 6500 cores [3]. Further, due to the increased density of traffic on roads, accidents, breakdowns and other random events also increase. These incidents further increase the congestion on road of a typical city.

The cities like Bangalore which were not expected to grow so rapidly and did so due to the advent of Information Technology boom have not been planned for such huge traffic population. Majority of the road in such cities across India are unplanned, haphazard and crooked. Further, acquiring lands in the city for infrastructure development is a political concern. Planning roads, fly-over and crawl-under now comes with obligation and obligatory points across the city.

**1.3 Traffic Congestion**

**1.3.1 Definition**

Traffic congestion is a condition on road networks that occurs as use increases, and is characterized by slower speeds, longer trip times, and increased vehicular queuing. When traffic demand is great enough that the interaction between vehicles slows the speed of the traffic stream, this results in some congestion.

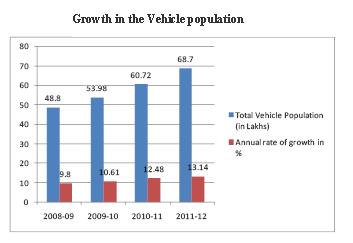
As demand approaches the capacity of a road (or of the intersections along the road), extreme traffic congestion sets in. When vehicles are fully stopped for periods of time, this is colloquially known as a traffic jam or traffic snarl-up. Traffic congestion can lead to drivers becoming frustrated and engaging in road rage.

**1.3.2 Problems**

India loses Rs 60,000 crore a year due to congestion (including fuel wastage), slow speed of freight vehicles and waiting time at toll plazas and checking points, a study on operational efficiencies of freight transportation by roads has claimed [3].

The Transport Corporation of India and IIM (Calcutta) study said while India's freight volume was increasing at a compounded annual growth rate of 9.08% and vehicles were growing at 10.76%, the road length was increasing at only 4.01%. This has resulted paucity of road space to accommodate vehicles and to increase the speed.

India has more truly congested cities than any other nation, which is not surprising, since it is also the world's second-most populous country, after China. Vehicles in India are distributed somewhat unevenly. Delhi, Mumbai, Kolkata and Bangalore have 5% of India's population but 14% of its registered vehicles [4]. Traffic is growing four times faster than the population in six cities: Mumbai, Delhi, Ahmedabad, Bangalore, Chennai and Hyderabad [5].

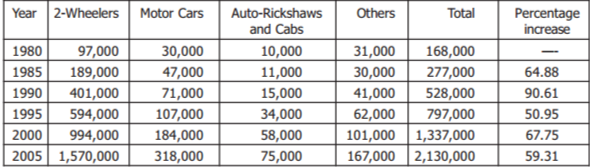


**Figure 1.1: Growth in vehicle population**

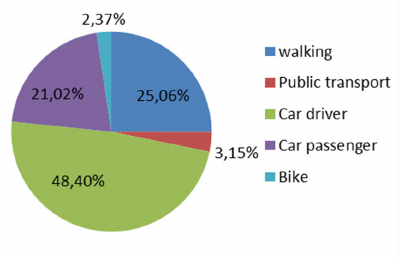
According to the statistics and as shown in Table 1.1 Vehicle population is illogically doubling every year. Road space can never keep pace with the vehicle population.

Reasons for Increase in Number of Vehicles:

1. Increase in population is mainly due to migration and growth of IT and service sectors in Bangalore offering better job opportunities.
2. Inadequate public transport which is unable to meet the demands of the growing population and convenience and comfort of private vehicles and auto-rickshaws. Unpopularity of public transport in case of educational institutions and the trend in hiring cabs by ITeS sector and public has increased the private and intermediate mode of transport.
3. Comfortable cars which are bigger in size which have occupancy of 2 during peak hours have become a status symbol with more people preferring to buy such vehicles.
4. Auto rickshaws which are a popular mode of intermediate transport during peak hours in Bangalore has a vehicle occupancy of only 1.1 adding to the increased volume during peak hour traffic in a large way.
5. Affordability and easy access to financial institutions which have reduced the interest rates on vehicle loans from 15 percent to 8 to 10 percent.
6. Increase in the household income and improvement in the standard of living [5].



**Table 1.1: Bangalore number of motorized vehicle and growth rate.**



**Figure 1.2: shows the factor that causes the traffic.**

Traffic congestion occurs when a volume of traffic or modal split generates demand for space greater than the available road capacity; this point is commonly termed saturation.Traffic congestion is a condition on road networks that occurs as use increases, and is characterized by slower speeds, longer trip times, and increased vehicular queuing.

Traffic congestion has a number of negative effects:

1. Wasting time of motorists and passengers ("[opportunity cost](https://en.wikipedia.org/wiki/Opportunity_cost)"). As a non-productive activity for most people, congestion reduces regional economic health.
2. Delays, which may result in late arrival for employment, meetings, and education, resulting in lost business, disciplinary action or other personal losses.
3. Inability to forecast travel time accurately, leading to drivers allocating more time to travel "just in case", and less time on productive activities.
4. Wasted fuel increasing [air pollution](https://en.wikipedia.org/wiki/Air_pollution) and [carbon dioxide emissions](https://en.wikipedia.org/wiki/Greenhouse_gas) owing to increased idling, acceleration and braking.
5. Wear and tear on vehicles as a result of idling in traffic and frequent acceleration and braking, leading to more frequent repairs and replacements.
6. Stressed and frustrated motorists, encouraging [road rage](https://en.wikipedia.org/wiki/Road_rage) and reduced health of motorists.
7. Emergencies: blocked traffic may interfere with the passage of emergency vehicles travelling to their destinations where they are urgently needed.
8. [Spill over effect](https://en.wikipedia.org/wiki/Spillover_effect) from congested main arteries to secondary roads and side streets as alternative routes are attempted ('[rat running](https://en.wikipedia.org/wiki/Rat_running)'), which may affect neighbourhood [amenity](https://en.wikipedia.org/wiki/Amenity) and [real estate](https://en.wikipedia.org/wiki/Real_estate) prices.
9. Higher chance of collisions due to tight spacing and constant stopping-and-going.

**1.3.3 Causes**

Traffic congestion occurs when a volume of traffic or modal split generates demand for space greater than the available road capacity, this point is commonly termed saturation. There are a number of specific circumstances which cause or aggravate congestion, most of them reduce the capacity of a road at a given point or over a certain length, or increase the number of vehicles required for a given volume of people or goods.

Road connectivity network of Bangalore has no consistency in road widths and roads are discontinuous. The arterial roads are intersected by local roads at frequent intervals leading to bottlenecks and congestion. Although the ring roads can take the increased volume of traffic, people tend to use the CBD as thoroughfare, as the ring road is about 8 kilometres away from the city centre. To travel this extra distance is a burden on the public in terms of time and cost.

The number of vehicles on the road is much more than the carrying capacity of the roads leading to congestion, reduced speed and delay in travel time. The other reason for congestion is that Bangalore has buses as the only mode of public transport as the railways contribute to only intercity passenger traffic and cargo traffic and are not aligned to integrate with the city network to carry the intra-city commuters.

Due to lack of adequate parking facilities, on-street parking has reduced the width of the roads, more so in the CBD which has narrow roads. Moreover, spill over of pedestrians on to the road due to ill maintained, inadequate or absence of pavements has increased the congestion on the roads. In the areas such as Kalasipalyam, Tharagupet and other parts of the CBD trucks enter during late night hours and are parked throughout the day on the roads reducing the efficiency of the road for movement of other vehicles and pedestrians.

With industries and residential development moving out to the suburbs due to better amenities and incentives, the segregation of land use has taken place. The CBD, which has concentration of government offices, transport nodes and commercial activities, both wholesale and retail, attracts city dwellers, which has resulted in large number of vehicles moving in and out of the CBD.

Since India is a developing nation there is a constant demand for good quality infrastructure, transportation and services to avoid traffic congestion caused. But since India is a huge country with quite a sizable population this problem still has not been addressed in totality. In the increased need for transportation on land and commutation for various professional, personal and emergency needs, the need for a better civil infrastructure for transportation. The transportation planning plays a crucial role in solving traffic problems. As discussed before majority of the road in cities across India are unplanned, haphazard and crooked. Further, acquiring lands in the city for infrastructure development is a political concern. Planning roads, fly-over and crawl-under now comes with obligation and obligatory points across the city.

Transportation planning software is developed from the 1960’s and is widely used by the planners when the personal computers are widely used. Transportation planning software was a leap in the development of transportation infrastructure. The transportation planning software comes to a new stage when the GIS, Remote sensing, simulation of traffic and other similar technologies are used. The transportation planning software is hardly an indispensable tool for transportation planners. There is hardly any transportation planning project which does not use transportation planning software today.

As mentioned earlier, in the rapidly growing country like India a major hurdle to plan is the survey data. The density of traffic, the environmental conditions, soil conditions, and so on. Further, calculating the deviation ratio with high precision of the traffic from an existing clogged road into newly constructed roads would take its own sweet time for the survey engineers; for this cannot happen overnight. As per the stats, very few software can forecast the traffic demand with the current traffic conditions.

Adjusted for its large population, India has less than 3.8 kilometres of roads per 1000 people, including all its paved and unpaved roads. In terms of quality, all season, 4 or more lane highways, India has less than 0.07 kilometres of highways per 1000 people, as of 2010 [7]. These are some of the lowest road and highway densities in the world.

As the population is increasing disastrously number of vehicles is growing at an average pace of 10.16% per annum over the last five years [6]. The basic problem is not the number of vehicles in the country but their concentration in a few selected cities, particularly in metropolitan cities.

There is a need of comprehensive tool that can forecast, plan, and design considering all the parameters and at hand dynamically change the designs as per requirement in matter of minutes. This will not only facilitate the engineers with the survey but also will provide templates for design scientifically.

We intend to develop a tool which acquires the current traffic data and predict the future traffic data near to accurate to facilitate the engineers with the survey.

**1.4 Summary**

In this chapter statistics regarding transportation management is established. The need for managing and auditing traffic along with its live survey becomes very important and the same has been explained.