CHAPTER-7
DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction:
Transportation is one of the vital sectors supporting human activity because without any movement it is impossible for people to fulfil their needs. People need is closely related with the social and economic interaction. Working is one of the people activities to fulfil their need, and to achieve this need through movement, mode of transport is needed. This thesis explored the subjective quality of transport and its interrelation with land use pattern. Exploration of transportation pattern based of behavioural theories in addition to urban planning and transportation theories provided interesting context for this research. This chapter presents a critical appraisal of the present study that facilitates comprehension, construction and demonstration of the outcomes and its integration with the existing body of knowledge and hypothesis testing. This study sought to identify in detail the choices preferences and perceptions with respect to mass transportation that may contribute to enhanced integration of land use and transportation that is imperative for a sustainable development. The findings from the empirical inquiry and collusions are presented in the following sections.

7.2 Findings from Stage I: Naturalistic Observation, Structured Interviews:
- The city was not planned to accommodate BRT as it needs more space. Existing land use of the city not responds BRT corridors.
- The intersections are not adequately designed hence resulting in chances of accidents, traffic conjunctions.
- There is no idealization of lanes found in addition to a lack in adequate traffic signal system.
- There is no adequately designed traffic segregation system like one way, two ways.
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- Inadequately designed over pass and under pass result in their less use where pedestrian's safety is at stake.
- Permission to buses operated by MSRDC to use BRT corridor created confusion to the users and sometimes creates traffic jam.
- Unauthorized entry of private vehicles in BRT corridor results in accidents and inconvenience to users.
- The whole system suffers with lack of adequate parking.
- Land available for transportation accounts for 4.46% against 13% as per the city's Development Plan which is very less.
- Number of buses is very less to cater for travel demand.

7.3 Conclusions based on land use Survey:

Most of the gaonthan areas have unauthorized constructions by local landlords and private builders. Tremendous change in land use which is not reflecting in regional plan, development plan or village of the respective villages. Growth of the area is very fast in each and around the settlements. The ribbon development along the highways sides and at junctions, such as Khed-Shivapur, Shirval-Lonand, and Velu-NH 4 etc. noticed. The fringe area is developed in the form of mixed land use comprised of residential units, industries, institutional and commercial usage. The road conditions are highly pathetic with variety of land usage along both the sides which adversely affecting traffic flow. Many junctions become bottleneck resulting in delays particularly in peak hours. The rural area is facing large scale land use change as the areas which were under agricultural belt with high potential of fertility are changed into other zones like industrial, residential etc.

In adequate land use development has increased vehicle traffic and resulting external costs like congestion, accident risk, energy consumption, pollution emissions. It is also adversely affecting public safety and health.

An examination of trends in travel behavior in this research shows increases in the number of commuters, vehicles and average trip length. Both employment and housing are growing at faster rates in the fringe area than at city core. Increased of private vehicle resulting in a decline in auto occupancies and the percentage of single-
occupant commuting is increasing. Overall, vehicular travel in most areas is growing at a higher rate than either employment or population. The result of these trends is an increasing level of traffic congestion in core and fringe areas particularly during peak commute periods. This indicates to increase the effectiveness with which existing transportation resources are utilized. It is necessary to consider both the expansion of highway capacity and increasingly sophisticated systems of traffic engineering and control, a variety of transportation demand management measures also need to be implemented.

This research established the importance of land use patterns as determinants of travel conditions and choices to avoid and manage traffic problems through more forceful land use planning. It has been believed that the effectiveness of a particular transportation demand measure depends, in large part, on user’s perception and choices that are explored and analyzed in the following section.

### 7.4 Accessibility to Land-Use Destinations:

The trip length is considered as the actual network distance travelled by the residents from their own residence to various destinations. The common travel destinations are workplaces, shops, educational institutions, healthcare facilities, and recreational places. In this research the varied trip lengths to different destinations across the neighbourhood categories was found. Literature established that the distance to work place is directly proportional to the number of trips. The survey results revealed that the remote location of workplace result in more trips everyday which indicated the need for the proximity to the workplace and other destinations as far as possible. Children living in fringe areas need to travel more than 25 kms to reach school. It has been found that a large number of residents have to go outside the living areas to access almost all amenities and travel around 9.5, 5.5 and 4.5 km on an average for work, school, and health facilities. This phenomenon indicated the need for an efficient mass transit system and its integration with land use pattern for fringe areas.

### 7.5 Mode of Travel:

Survey results identified various mode of travel to the destination which includes two-wheeler, four-wheeler, walking or travelling by cycle, and bus. In this research the
mode share of public transport does not show a relationship with the land-use mix which indicates that the land-use mix does not promote the use of public transport. Residents prefer to use a personal vehicle rather than public transport because of non availability of efficient public transportation, greater commuting distance to work, and residents do not prefer to walk or use bicycles. For many people use of four wheelers is not a viable option given the economic constraints.

7.6 Vehicle Ownership:
It has been observed that two-wheeler ownership is high irrespective of the income group and location of residence. Vehicle ownership is observed to be linked with the income levels as cycle ownership is high in low income residents whereas, car ownership is higher in high income residents. However, many respondents reported that, they can afford a car but are discouraged to own one due to the high fuel prices and traffic congestion.

7.7 Travel Expenses:
The average household income of residents is high to low. Total travel expenses per month are explored in terms of money spent as bus tariff every day. It is observed that residents spend more on travel.

7.8 Safety and Satisfaction:
The research included study of road and spatial safety where road safety is studied through accidents and spatial safety in terms of natural surveillance, citizen’s safety, and safety from theft. Satisfaction is studied in terms of quality of service, availability of amenities. Dissatisfaction with the quality of the transportation facility observed which may lead to an urge to migrate to a better place. The overall satisfaction level is above average even when there is inadequate infrastructure. Safety concerns were reported by women respondents and majority of respondents were not satisfied with road safety. The reported that they suffer from poor quality of travel experience due to high congestion and, lack of infrastructure.
7.9 Pollution and Traffic Problem:

High pollution level and the problem of traffic congestion are observed. However, some residents mentioned that they are used to the high noise level and do not even notice or feel uncomfortable. Very less people perceived travel experience as less polluted and do not have pollution issues while most of them reported high pollution level in terms of air and noise both. It was found that the main source of pollution was due to continuous construction work. The areas with a mixed land-use pattern had more pollution and traffic congestion particularly in case of presence of small scale industry within residential land use this phenomenon was considerable.

7.10 Conclusions based on Focus-group Discussions

In the process of urban development, the residential land use is replaced with commercial activities and unauthorized construction disturbs city development. The middle and low income group cannot afford to purchase home at core of the city. They prefer to live in fringe areas and travel to city for education and job. The survey analysis showed that people are not satisfied with present transportation facilities as it is observed that there is lack of infrastructure facilities for travellers. Problems regarding non motorized transport were one of the concerns particularly for women. Due to intense traffic the mobility of pedestrians, bicycles and vehicles was impaired. Indian cities suffer with a blatant lack of consideration for pedestrians and bicycles in the physical design of infrastructures and facilities. The majority of roads in fringe areas increased traffic has adverse impacts on public activities which once crowded the streets such as weekly markets, religious processions, community festivals and interactions. These have gradually disappeared to be replaced by automobiles. In many cases, these activities have shifted to remote places while in other cases, they have been abandoned altogether. Traffic flows adversely influenced the life and interactions of residents and their usage of street space which is a common phenomenon in Indian cities. More traffic impedes social interactions and street activities. People tend to walk and cycle less when traffic is high. The territorial imprint of transportation is
found significant, particularly for the land owners who are supposed to sale their land for road construction.

7.10.1 Problem faced by Public transport users:
The most significant negative experiences that shared by respondents who use to travel by bus was long waits at bus stops, and being prevented from boarding due to crowding. Passengers were more likely to be angered by delays at a stop in between than an origin stop, where they first board the bus. Another concern was no access to real-time arrival information. Major issues were:

- Long waiting time at bus stop.
- Missed departure due to wrong real-time information.
- Unable to board or denied boarding due to crowding.
- Delayed on board due to emergency or mechanical failure
- Delayed on board due to traffic.

Respondents overwhelmingly cited traffic congestion as the most significant transportation issue affecting them in their region. Respondents commonly named population growth, a lack of road space, an influx of college students, construction, and poorly timed traffic signals as causes of traffic congestion. Ongoing road construction was one of the most frequently mentioned issues by respondents, which was slightly negative. Most comments regarding construction pertained to the impact of construction on traffic delays and congestion. Multiple areas of the roads are being worked on peak hours making traffic worse”. Temporary lane changes and detours with poorly marked stripes and deflectors have made some areas dangerous. Non availability of adequate Public transportation was the fourth most frequently mentioned issues. The comments provided by respondents regarding public transportation called for additional facilities or increased access to public transit, while some also offered specific fixes to improve transit service for certain populations or locations.

The following are several typical responses about public transportation:

- Not enough affordable public transit options
- Busses not operating late enough at night or early enough in the morning.
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- Lack of public transportation for the elderly
- No public transportation in suburbs/rural areas
- Lack of comprehensive public transport which presents a practical alternative to driving a car

7.10.2 Road maintenance emerged as one of the core category where main concerns were:

- The inconvenience caused by road maintenance and poorly maintained roads.
- Potholes and terrible roads
- Poor roads which haven’t been maintained properly
- Poor road quality due to rural setting and excessive traffic (heavy vehicles and school buses) which slow traffic to major highways

A large number of respondents blame traffic congestion on a lack of road space. Majority reported traffic congestion because of less road capacity, the number of lanes, or the number of roads. Congestion came out as one of the most prevalent transport problems. The demand for transport infrastructures is spelled out. It has been stated that the supply of infrastructures has not been able to keep up with the growth of mobility. Parking along the roads has created space consumption problems particularly in core areas where the spatial imprint of parked vehicles is significant.

Congestion and parking were considered interrelated since looking for a parking space creates additional delays and impairs local circulation; Congestion resulted in spending an increasing amount of time for travel between their residence and workplace. Growing traffic is linked with a growing number of accidents and fatalities, especially on highways. It has been spelled out that accidents account for a significant share of recurring delays because of disruption along the roads.

7.11 Conclusions based on Questionnaire Survey:

Based on focused group discussion five major determinants of sustainable transportation emerged viz. service quality, financial aspects, safety, availability of amenities and environmental impacts.

Statistical analysis indicated a significant association between level of education and people’s perception about overall traffic system. The results exhibit a strong association between travel time and traffic congestion as more traffic congestion
means more time to reach destination and difficulty in reaching on time. Chi square statistics indicate strong association between timely reaching to destination and need to change bus. This calls for increasing number of routes as well as frequency of the service. The results indicated association between cost of travel and time involved in travel. Significant chi-square value indicated that people’s perception regarding transportation is highly influenced with the amount they are supposed to spend for the same. This phenomenon stresses the need of mass transit system which is not only efficient in terms of service frequency and quality but also needs to be cost effective. Statistical analysis established that time needed to reach their everyday destinations like places of work, education as well as entertainment affect their opinion regarding the quality of transportation system. This indicates need for transportation system that assures the travellers that they will reach to the destination in stipulated time. This phenomenon has bearing on following time schedule as well as various associated factors which may cause delay along the travel route. Significant correlation between level of pollution and perception observed. To address this issue the use of transportation system that generates less emission becomes imperative. Provision of mass transit system can be another effective measure as it will reduce number of motorized vehicles on the roads which cause large scale air and noise pollution. Safety of passengers is one of the major concerns which affect people’s perception about transportation system. The effect of safety concerns that users have during every day travel from their homes to the desalinations like work places, education, shopping and entertainment is statistically examined. Very strong association between people’s perception regarding transportation and safety aspects found. This factor is of prime importance for female users while safety from traffic is associated with both the gender. This research identified that there has been an over-emphasis upon the technological, environmental aspects, at the expense of social considerations, especially user’s attitudes and aspirations creating a dissonance between the sustainability agendas to the detriment of achieving integration between transport and land use.
7.12 Conclusion Based on Research questions:

7.12.1 What is the current status of transport in the city of Pune?
Transport system in Pune includes various modes of transport which is not found able to fulfil the current demand. Transport systems here are predominantly disaggregated and consider modes of transport as private motorized vehicles, public motorized vehicles, and non-motorized vehicles. Land use survey indicated that socioeconomic and physical characteristics of land-use patterns tend to be homogeneous for people of similar income levels to certain extent. The existing transport network involves several levels that is, the vehicles and modes of travel which have very different characteristics. Each mode has different requirements for efficient and safe movement which are not catered by and large.

The characteristics and modes of transport system and infrastructures required in addition to the land-use patterns are not based on a detailed analysis of the spatial and temporal spread of activities. As a result recent development in terms of land use and transportation is not found adequate to fulfil the varied demands of users. Traffic congestion, pedestrians’ inconvenient and unsafe road designs further made situation grave.

7.12.2 Do existing transportation system responds to the needs of end users?

The condition and status with reference to availability of mass transit which is in the form of buses operated by Pune Municipal (PMPML) is not adequate. The present infrastructure and not fulfils the aspirations of the people. The present BRT system partially working but creating inconvenience to the users. the junction and crossing level. The transport mechanism is not reaching in fringe area as there is no adequate transport plan.

7.12.3 What is the current land use pattern between core and fringe?
Current land use pattern is of mixed type which includes residential, commercial, public and semi public etc. The most of the current land uses is not in accordance with the assigned land use per Pune Municipal Corporation. Most of the area studied if found with unauthorized constructional practices with modified land usage.
7.12.4 Fringe area:
It has a mountainous terrain where existing road network is located within ghat section. Another road is newly developed as a by-pass. The area is now merged with Pune municipal corporation limit it was fringe area. This area has unauthorized development by the land lords and small land owners which suffers with lack of amenities and facilities. The unauthorized layout has inefficient road network which experience congestion of traffic and accidents frequently. In rainy season inadequate run off facilities leads to the flood like situation. This development put pressure on existing facilities of core area. Increase in population of fringe area found due to migration of people from core to fringe. This is because of industries, mining and other business activities. Socio-economic condition is not good and Crime rate is more in rural areas. Land less worker and small farmers do not have good resources of income. Most of the population is literate but without skilled knowledge. Core area is found overpopulated. Increased transport exert burden on infrastructure and amenities. The area has un-hygienic living conditions which suffer with problem of waste management.

7.12.5 The city Core:
Pune's core areas are where a large portion of city’s jobs growth has occurred in the characterized with medium to high density development. The journeys people need to make in these areas tend to be shorter and more frequent, with large numbers of commuters travel into and around the city core for work and education purposes each day.

Inner Suburbs: Inner suburbs have more access to core as well as the residents enjoy good local amenities in attractive, well-established living areas. This area has experienced the largest amount of population growth in which less rapid, growth is likely to occur. Here public transport trips to various areas of the city are longer and more dispersed, where the bus network provided by PMPML having a major role. Trips by private vehicular traffic are also more dispersed as housing, services and jobs are located further apart than in the core.
7.12.6 Is existing transportation responds to the land use pattern?

The city is overcrowded and as a result there is more than double load on existing services. Reserved green spaces are encroached by slums and unauthorized constructions. As a result existing land use pattern is different from what is sanctioned in Development Plan. Increase in motor vehicles and worst road working conditions and availability of space to accommodate required transportation facility is a matter of concern. The existing land use pattern in core area does not favour development of new transportation system like BRT and Metro.

7.12.7 What change occurred in Land use pattern in the study area?

Alarming change observed in land use pattern in study area particularly in agricultural land use. In about 45% of the study area the agricultural land use is changed to commercial, residential and industrial by 60% which is affecting the transportation network because of consequent change in travel pattern. Travel demand is increased for people engaged in commercial and industrial sector. Increase in residential land use observed which was marginal but it has put additional load on existing transportation infrastructure which was developed considering existing land use pattern. Fringe area is developed without adequate amenities and facilities which are there in the core area. Presence of more educational campuses increased the traffic demand. Introduction of new small scale industries mostly along the main road and minor road result in very crowded streets which are not in accordance with the development or regional plan. Change of agricultural land to commercial uses is another feature which has put additional load on road and transportation network. No control on land use observed particularly in villages and settlements near the areas under PMC limit.

7.12.8 What are the people's perceptions, needs regarding transportation for commuting between core and fringe?

The present transportation within core and fringe area is not responding to the end users in terms of frequency, number, connectivity and overall quality of service. Non-availability of mass transit at many destinations is one of the important concerns which affect people belonging to middle and lower-middle income group who cannot
afford travelling by their own vehicle. In absence of direct buses in many routes people need to change busses to reach to their destination. This phenomenon results in increase in travel time, inconvenience as well as increased cost of travel. The study shows that the transportation is not economical and there are a number of safety concerns. Increased number of traffic accidents resulted because of bad road conditions particularly this affect safety of travellers in monsoon season. Bad traffic management in addition to inadequate infrastructure add to events of road accidents. Women’s safety particularly in evening and night is another concern which needs urgent attention. Absence of adequate street lights in core areas is coupled with absence of active surveillance measures such as CCTV cameras. Increased number of vehicle on road exceeding capacity of roads resulting long traffic jams which affect smooth running of transportation as well as adversely affect the users in terms of delay in reaching to destination. Parking is another issue which affects the flow of traffic as in absence of assigned parking lots people are used to park their vehicles along the roads which decrease the space on the road for traffic movement.

What are the determinants of sustainable transport from user’s perspective?

Five major determinants of sustainable transportation emerged viz. service quality, financial aspects, safety, availability of amenities and environmental impacts. Service quality included frequency and connectivity to various destinations which were not found satisfactory. Many remote areas there was lack of service noticed which adversely affected travel pattern and consequent user’s satisfaction. Less frequent service caused inconvenience to people in terms of reaching in time to the desired destination as well as overcrowding. Increased travel cost because of need to change buses is found one of the major determinants for daily commuters for which need for subsidized mass transpiration stressed. Safety from traffic as well as crime is another determinant which is to be taken into consideration in planning for

7.13 Changing social trends:

A remarkable change in social trends observed because of a number of factors. Factors such as population growth and longer life expectancy have increased the demand for goods and services, including transport services. Transport demand is found disproportionately affected in some cases, such as where the mobility needs of people increase, or where housing and lifestyle choices require greater flexibility from
the transport system. Increased economic level demands for a shift towards high-
value, information-based services.

This research established that individual choices and decisions regarding the transport
network affect land use determinations and vice versa, because the two aspects form
part of an integrated system. It has been stressed that individual transportation choices
and social changes affect transport policy which will have a direct impact on land use
decisions. In addition the impact on land use will in turn alter the context in which
transport decisions are made through feedback effects throughout the system.

7.14 Land use impacts on the responsiveness of transport:
Land use pattern affect efficiency of a transportation system as land use regulation
sets the conditions under which significant investment is made in development
process. Land use decisions should dictate the direction of affected transport policy
decisions which in turn will affect the choice and value offered to users of transport
networks.

7.15 The Key Challenges:
This research has identified six key transport challenges facing Pune as below:

7.15.1 Development of public transport system:
The city has faced tremendous economic growth and subsequent large scale change in
land use pattern leading to growth of the central city, suburban activity centers and
fringe areas all of which need to be serviced by mass public transportation system.
Major changes are required as the development of required bus network cannot
continue to expand simply by implementing small incremental changes. Bus service
planning must support the substantial investment in road network and other
infrastructural needs.

7.15.2 Providing efficient connections to commuters and goods:
Provision of mass transit system with enough and efficient connections are the key to
achieve satisfactory travel objectives and trade competitiveness.
7.15.3 Prioritizing transport infrastructure and services to fringe areas with mixed-use development:
Providing adequate transport services to fringe areas having comparatively low density is needs to be a priority. Mixed land use development can reduce the need of people to travel for job, education and other purposes. It will also support the vitality and sustainability of communities, with attracting new residents, businesses and investors adding to the city’s livability, as well as boosting economic growth.

7.15.4 Developing system that ensures integrated transport and land use:
The research found that Pune have highly diverse and dispersed land use patterns that generate complex, and sometimes conflicting, transport responses. Effectively integration of mass transit and land use planning is critical to address these problems. It calls for a better and more efficient use of existing infrastructure as well as and maintaining the existing transport assets in good repair in order to manage growth in travel demand with limited financial and technological resources. It will also help to reduce the environmental impacts imposed by existing transportation system and improve economic efficiency.
Pune has seen unprecedented levels of investment into transport over the last two-three decades, much of which has been targeted at revitalizing Pune’s public transport network. The steps are to be taken:
- To improve the amenity of bus stops
- Get more buses for increasing frequency of the service.
- Develop road network with separate key pedestrian and level crossings.
- Use of technology to provide real time information about services.
- Expand the public transport catchment area and mode transfers with coordinated timetables and improved amenities.
- Strategies aimed to encourage the adoption of more sustainable forms of transport with use of the *Low Emission Vehicles* to reduce emissions from vehicles and check environmental pollution.
- Strategies to encourage sustainable design, use of new technologies, targets and practices, in order to contribute to the sustainability of built and social environment.
Being one of the fastest growing cities in India and industrial and educational center Pune needs to concentrate not only for its industrial and development but also invest for its livability and quality of life. In past two decades knowledge intensive services particularly Information Technology have become more prominent, attracting skilled labour force in addition to traditional industries such as automotive and manufacturing. This has resulted in development of industrial areas in and around Pune and consequent job opportunities with more people seeking to live in the city core and fringes. This in turn needs a more accessible and efficient transportation network.

Study of Pune’s geography and history demonstrated that the city’s travel needs and patterns are defined very loosely where travel needs and patterns are driven by distinctly different land use patterns. The current land use lacks proximity to employment and services in newly developed fringe areas. The travel pattern within core area is broadly covering 5 to 15 kilometers of stretch. Travel patterns outside 15 kilometers of the core city become increasingly dispersed as population density reduces and employment is more widely distributed.

Pune’s outer metropolitan suburbs extend further outwards in fringe areas. Growth in these areas has been driven largely by people choosing to live in new suburbs and housing complexes with medium high-rise apartments. Pune over the last 10 years and future growth is expected to mostly occur in fringes. Transport options in fringes needs to be developed with mass transit system as in absence of which the residents typically rely more heavily on private vehicles to travel to work and access services. The costs of providing transport infrastructure in low density areas are found high. Trips in the fringe areas are typically longer, with public transport journeys currently focused on travel to core, inner areas and the adjoin villages which is not found efficient. This research found that the bus network is important in reaching more dispersed residential and employment areas which is frequently used for trips into the central city. A considerable proportion of private vehicle travel is widely distributed, as greater distances need to be travelled to access jobs and services. The outer fringe area also includes areas that are more rural in nature, extending to Satara which attract
residents and retirees seeking lifestyle changes while still enjoying the benefits offered by living relatively close to a major city.

7.16 The strategies for Core and Inner suburbs:

- The focus on provide more transportation services to core to make the city core as a creative, lively and energetic district where more people live and businesses are located.
- Providing more transportation choices with a network of fast buses and metro to support and actively encourage business growth in inner urban areas.
- An increasing focus on inner suburbs with an increased accessibility with expanded provision of the public transport system with a simpler, better designed bus network, and supporting a more active city through better connected walking and cycling networks.
- Providing small scale industries and businesses the efficient, reliable transport connections they need to deliver goods and services in and around the city and to interstate markets.
- Large scale investment for development of new routes and intersection and road upgrades.

7.17 The strategies for Fringe Areas:

- Strategic development for an improved connection between the core city, inner suburbs and adjoining villages and cities. Providing facilities to communities to jobs, services and opportunities with focusing on a high quality, well maintained road network and mass transit systems.
- Managing the growing volumes of freight moving around the state and making sure the it should not affect other vehicular traffic flow.
- Creating a network of well-connected mass transit system where people have good access to jobs, shops, services and recreational activities by a range of different travel modes like buses and metro where communities grow in strength through closer bonds and greater shared experience.
Transport investment focused largely on making sure that the population growth in fringe areas will be taken into consideration.

Address the under-investment into the bus and road network with

Major road revitalization connecting Pune’s core and inner suburbs to fringe areas, featuring bus corridor improvements, upgrading condition of busses.

Provision of required amenities like toilets and drinking water as well as providing new bus stops and upgrading old ones.

Use of high-tech methods and equipment’s in road construction and infrastructural development to complete work in stipulated time. This is aimed to reduce traffic congestion caused by ongoing constructional activities as well as reducing accidents.

Need a focus on fringe areas recognizing that the investment in transportation sector needs to boost the fringe areas as a creative, lively and energetic district where people want to live and businesses want to locate. To achieve this bold decisions to refine the existing transport system to not only support medium density communities, industrial and business growth, but to actively encourage and drive these developments in the fringe areas.

7.18 Contribution of the Study:

This research provided indicators for sustainable and liveable transportation planning. It defined sustainability and liveability in the context of Pune as a case. The sustainable development and sustainable transport concepts are discussed. This research demonstrated the application of sustainability indicators in transport evaluation and planning. This research has described the factors which are to be considered in the process of selecting sustainable transportation indicators, and provided recommendations for selecting sustainable transport indicators for use in a particular context.

This research provided rich data which is supposed to help decision makers to understand the consequences for transport of certain land use decisions before they are implemented. This will increase the likelihood that land use decisions weigh
competing priorities appropriately including transport implications which do not lead to significant unforeseen consequences.

The study has demonstrated the significance of individual preferences such as environmental preferences, safety, comfort, convenience and flexibility in determining travel modes in addition to personal attitudes about flexibility, convenience, comfort, and environment important in defining sustainable transport. It is found that socio-demographic and socioeconomic variables as well as awareness of alternative transportation have affected the perception of the users.

7.19 Future Research:

This research provided an understanding of the current attitudes and behaviours of people, but it is concluded that further research is needed to gain a deeper understanding of why they hold these attitudes and perform these behaviours. Studies from developed economies have analysed the key factors for understanding urban mobility, which are important to design appropriate interventions to reduce the volume of transport needs and to promote more sustainable modes of transportation which is to be done in the Indian context.

7.20 Epilogue:

Extensive review of literature indicated the importance of use of mass transit system and its integration with land use to achieve of sustainability. It has been found that sustainable development of areas located on fringes largely depends on integration of land use with transportation pattern. Availability of an efficient mass transit system and research of the issues related to its integration with land use will have huge applied implications on the quality of life of people is living urban areas particularly in fringes. For comprehensive and sustainable transportation planning it is usually best to choose a balanced set of indicators reflecting a combination of economic, social and environmental objectives. An indicator set that focuses too much on one type of impact or overlooks others can result in decisions that are not overall optimal. It is important that users understand the perspectives, assumptions and limitations of each indicator.
There are currently no standardized indicator sets for comprehensive and sustainable transport planning. Each jurisdiction or organization must develop its own set based on needs and abilities. It would be useful for major planning and professional organizations to establish recommended sustainable transportation indicator sets, data collection standards, and evaluation best practices in order to improve sustainability planning and facilitate comparisons between jurisdictions, organizations and time periods.

The analysis in this research reveals that land use and urban design characteristics do impact commute mode share, communities may wish to encourage developers of new employment sites to incorporate land use and urban design characteristics that support a lower drive alone mode share into their site designs. These characteristics also can be introduced as part of a major site rehabilitation or modernization project. The findings of this research give an understanding of how the Indian decision makers and planners can stimulate sustainable transportation and change the arrangement of transportation system. The analysis provided the determinants that should be considered in planning for sustainable transport with integrating land use. The main outcome of the study is making an emphasis on the importance of socioeconomic, cultural, and preferences of the end-users in defining sustainable transport. It identified the land use changes and its impact on transportation the information of which may prove instrumental in establishing strategies for an integrated land use and mass transit aimed at sustainable development.