CHAPTER-3

CONCEPTUAL FRAMEWORK & METHODOLOGY

3.1 Introduction:

This research is an inquiry into sustainable transport aimed to achieve integrated land use and Mass Transit System with reference to Core and Fringe. The first part of this chapter deals with a theoretical framework wherein this research can be situated more specifically, it includes the issue of research methodology. This work integrates both empirical and theoretical knowledge based on initial literature review in the belief that this can contribute to a more nuanced picture of the issues investigated. Second part includes a brief description about Pune as case study to provide the context of research. In the final part methodological approaches and analytic procedures in terms of research schedule, logistics, insights, reasons for methodological decisions are discussed.

3.2 Theoretical Framework:

This thesis reflects on the relationship between land use and transportation aimed at exploration of strategies for integration between them for a Sustainable urban development. Literature established that sustainable development needs transportation needs an adequate integration of land use and transportation system. Urbanization is defined as the process of transition from a rural to a more urban society. This research refers urban form as the spatial imprint of an urban transport system as well as the adjacent physical infrastructures. Jointly which confer a level of spatial arrangement to cities. Research indicated that urban spatial structure is a set of relationships arising out of the urban form and its underlying interactions of people, freight and information. The growth of the city directly affects on the transportation & land use pattern which result into the urban sprawl into the fringe areas of the city. They are located well outside the urban core and the suburbs, but are within reasonable commuting distances. An appropriate land use planning represents minimum need to travel, friendly transportation network for all classes of people, availability of transportation modes causing minimum amount of air pollution, and transportation options demanding least cost and effort of people can be considered as various aspects of a sustainable transportation system. Thus sustainable transportation concerns with
the impacts of transportation developments on economic efficiency, environmental issues, resource consumption, land use, and equity. Various concepts which provided theoretical foundation for this research are briefly discussed in the following section.

3.2.1 Accessibility:
There is a strong link between Accessibility and sustainable urban development. A sustainable urban development invariable needs a robust transportation system that provides equitable accessibility to all of its residents. Accessibility is defined as the “potential for reaching locations” (Haugen 2012). In order to make accessibility meaningful a spatial separation is required between a fixed origin and desired destinations as well as impedance on mobility (Weber 2006). Research indicated there are two types of accessibility: place-based accessibility and individual or personal accessibility (Cascetta, Carteni et al. 2013, Haugen 2012). Place-based accessibility refereed as the ease of access from one ‘place’ or location to another desired ‘place’ and individual accessibility is the ease with which people can reach their destinations (Kwan 1998). Sustainable Planning for accessibility is a complex phenomenon which requires not only large scale investments of capital and time, complex management of space but also a thorough understanding of human behavior. As Bertolini (2005) for a sustainable land use and transport planning there is a need for discovering accessibility measure that is both theoretically and empirically sound.

The accessibility attributes are considered as one of the important aspects which is classified into four different components (Geurs and van Wee2004):

- land use component (locations and characteristics of opportunities and of demand)
- Transport component (location and characteristics of infrastructure for passenger and freight travel
- Temporal component (opening hours of shops, available time for activities)
- Individual component (income, gender, educational level, mobility resources like vehicle ownership etc.).

3.2.2 Travel Behaviour:
This research is aimed to identify the transportation patterns and choices of users where a dominant approach adopted is analyzing human travel behavior. As per Rosen travel pattern is influenced with the spatial separation of activities, the needs and constraints imposed on travelers by their time, schedules, socio-demographic
characteristics and network characteristics” (Rosen et al., 2004, 162). Transportation planning analysis is generally based on quantification, prediction and understanding of human travel behaviour. For application and use of sustainable transportation networks a better understanding of human travel behaviour more specifically understanding why the changes in travel behaviour occur is required in order to find out the ways to motivate them.

3.2.3 The theory of reasoned action:
This work considers theory as a valuable tool in the scientific study of phenomena which is related to human behavior which includes travel behavior. It includes various urban planning and behavioral theories which are explained in the following section. The theory of reasoned action (TRA) (Fishbein & Ajzen, 1975) is found applicable for travel behavior analysis suggesting that the relationship of attitudes and social norms on travel behavior is mediated by intention. This suggests a role for attitudes, beliefs, and perceptions in the modeling of travel behavior choices. TRA indicate that a motivation or an intention to perform a behavior is the biggest driver of actual behavior. Here travel choices are likely to be influenced by many factors outside the control of the individual like characteristics of the built and natural environments, capability constraints as well as the decisions of other travelers. These factors influence the perception of behavioral control which in turn affects intention and travel choices. This theory is considered for analyses and interventions with reference to travel mode choice (Bamberg, Ajzen, & Schmidt, 2003; Bamberg & Schmidt, 1998, 2003). The theory of reasoned action (TRA) (Fishbein, 1980; Fishbein & Ajzen, 1975; Montaño & Kasprzyk, 2008) is considered as it suggests a role for attitudes, beliefs, and perceptions and social norms on travel behavior which is mediated by intention. This theory guided this research to explore role these factors from user’s perspective.

3.2.4 Random utility maximization (RUM) theory:
In addition to this social and psychological aspects, spatial and urban structure, demographic and socio-economic factors, social situation, lifestyles and mobility styles, attitudes and norms, transport system, temporal structures are taken into account as basic conditions for the genesis of travel.
Analysis used Random utility maximization (RUM) theory which indicates that the decision-maker always selects the best alternative for him or her-self, the one with the
highest utility which is a measure of value when making a choice from available travel modes.

Based on Transportation planning theory which relies on equilibration theory it has been assumed that the transportation system is invariably interrelated with the socioeconomic system. The transportation system (supply) will affect the way in which the socioeconomic system grows or changes (demand) and vice-versa the socio-economic system demand for changes in the transportation system. [Manheim, 1979].

3.2.5 Research Design:
Transportation research generally employs a quantitative and predictive approach, but for exploration of travel behavior patterns for non-linear rapid change which are often associated with social psychological studies a qualitative approach is found appropriate. In such cases variables cannot be held constant what to measure is not known (Gunnar Roe, 2000; Finke & Schreffler, 2004; Cao & Mokhtarian, 2005). A qualitative research paradigm is considered as a holistic, inductive and value-laden approach which emphasize on human process by capturing development, description and discovery in an open-ended fashion from a smaller sample.

This research aimed at an understanding of the complex processes involved in adopting a lifestyle of Indian population that is less automobile intensive, a qualitative and inductive approach was adopted (Patton, 1990). This approach was chosen because it is most appropriately applied to exploratory, individual, processes-oriented research (Patton, 1990). The research is designed to facilitate an in depth experiential understanding of the decision-making processes of city dwellers with respect to mode choices and to elucidate how various factors with reference to architecture and planning factors work together.

To understand the process of how the factors work a more open inductive dialogue with the participants is required for which a deductive approach is adopted informed from social science discipline. It is exploratory in nature where the aim is to extend the understanding of travel behaviour change and various factors that govern a decision-making process. An inductive approach following concept of grounded theory is selected for study and analysis as it allows a researcher to uncover the overarching themes expressed in vastly different personal experiences without putting limitations on the data.
Qualitative approaches are often associated with social psychological studies that probe changes in human behaviour, values, and attitudes which is required to study transportation behaviour in its broadest sense. Appropriate applications of a qualitative approach not only monitors process it also gauges the quality of an experience, explores new research areas particularly in cases where correct measures are unknown in order to generate new insight (Patton, 1990). The use of qualitative paradigm in this research is supposed to prove instrumental in analyzing the effects of various transportation strategies and programs that have already been implemented, to understand how to improve new/existing programs as well as in exploration of new ways of planning a transportation system with providing new insight.

The focus of inquiry in this research is three-fold. First is to find out current status of transportation network second is to examine the changes in land use pattern and its impact on transportation and third is to find out people’s concerns regarding sustainable transport. For this different methods were adopted as found suitable to achieve objectives.

3.2.6 Naturalistic Observation:
Naturalistic observation which is assumed to “not interfere with the people or activities under observation” (Angrosino 2005), this method allow people to vary their individual and social responses” (Sackett, Ruppenthal et al. 1978). The response of people is different when they know they are being observed versus when they don’t think they are being observed” (Patton 2002). Structured observation is considered as the way of quantifying behavior (Robson 1993) which focuses on the frequency of actions (Gray 2004) and employs explicitly formulated rules for the observation and recording of behavior (Bryman 2008).

The research approach involved documenting travel pattern using data obtained from an observational survey. The premise of the selection of variables is that behavior is a function of the individual’s characteristics as well as contextual/environmental variables.

3.2.7 Selection of Indicators:
Indicators for examining sustainable transport are based on The PSR framework which analyses the interactions between environmental pressures, the state of the environment and environmental responses (Tony Friend) which is based on the
concept of causality. It has been conceptualized that use of a travel mode by society exert pressures on the environment which change the quality and quantity of natural resources and society responds to these changes through environmental, general economic and sectoral responses. The Organization for Economic Cooperation and Development (OECD) (1999) has developed the Indicators for the Integration of Environmental Concerns into Transport Policies. This research is informed by the OECD’s transport indicators which are based on a modified version of the Pressure-State-Response (PSR) model. It is adapted to take into account specificities in the transport in the study area. The indicators selected for analysis are grouped into the following groups: economic, transportation-related, environmental, safety-oriented, socio-cultural/ equity-related. As shown in figure 3.1

Figure 3.1: The OECD Pressures-State-Response Framework.

3.3 Grounded Theory:
It refers to theory that is developed inductively from a corpus of data. It is based on a case-oriented perspective which assumes that variables interact in complex ways, and is suspicious of simple additive models. It involves a systematic method called comparative analysis in which descriptive data are coded and organized into conceptual categories. The comparison brings out the distinctive elements or nature of the case studied (Glaser). Grounded theory methodology is selected for this study as it focuses on everyday life experiences and value participants’ perspectives which are
found important in context of sustainable transportation. In this methodology enquiry is an interactive process between researcher and respondents which is primarily descriptive and rely on people's words. The process includes an iterative cycle of induction and deduction, consisting of collection of data and constant comparison between results and new findings in order to guide further data collections.

3.3.1 Research Context: Pune:

Pune the second largest city of Maharashtra state of Indian union is witnessing large scale urban sprawl and its negative ramifications in last couple of decades. Urban sprawl is defined as dispersed and discontinuous suburban land development associated with low population densities and high auto dependence. This phenomenon is adversely affecting sustainability of the city because of its negative environmental, social and economic impacts. It saps local resources, destroys open space and farmland, and increases the energy consumption of mobility by promoting long travel distances. Another problem is high levels of traffic congestion and harmful emissions causing environmental pollution. There is a plethora of research that sought to address the issue of urban sustainability and combat sprawl; little has been done on developing analytical tools that could be used to assess the future of urban sustainability for Indian cities and for Pune in particular. This explores that how particular land use development patterns or the expansion of the current urban transportation infrastructure are likely to impact urban sustainability.

3.3.2 Location:

Pune district lies in the Bhima and Nira river basins. The district has an area of 15643 km2 and is surrounded by Ahmadnagar district in the north and northeast, Solapur district in the east and southeast, Satara district in the south, Raigad district in the west and Thane district in the northwest. The headquarters of district is located at Pune on the banks of River Mula-Mutha. Pune is known as "The Queen of Deccan" because of its own historic associations, picturesque surroundings and its importance as a major cultural social and political center in the Deccan.

3.3.3 Physical Settings:

Pune (180 31’ N, 730 51’ E) is a plateau city situated near the western margin of the Deccan Plateau. It lies on the leeward side of Sahyadri (Western Ghat) and located 50 km from crest of the Ghat. It is almost 160 km southeast of Mumbai. It is situated at
an altitude of 560 m above the mean sea level near the confluence of Mula and Mutha rivers. The city is surrounded by hills on the west and the south. The Sinhagad - Katraj-Dive Ghat range is the southern boundary of the urban area. The highest point within the city is the Vetal hill whereas the highest point of urban area is the Sinhagad. Two more rivers, Pavana and Indrayani traverse the northwestern outskirts of urban area. Mula and Mutha rivers meet Bhima River and therefore Pune is located in upper Bhima basin.

3.3.4 Economy and Activity Centers:

Pune, the district headquarter of Pune district has diversified economy. At present Pune is bustling with economic activity. Areas around Pune like Baramati, Khed, Mundhwa, Loni, Yerawada, Talegaon, Alandi, Warje, Wadgaon etc are agriculturally active with the first six accounting for a majority of Pune's agricultural produce. Although not an 'agricultural city' or an agriculturally developed city Pune has a reasonable population connected to agriculture. A number of large-scale industries (MIDC) are also present around Pune. These companies produce a variety of goods such as commercial vehicles (light and heavy), locomotives, electronic consumer durables etc. Location of Pune and extent of Pune Municipal Corporation are shown in Figures 3.2.
Pune city is well known the oxford of the east. It has top leading Universities such as Savatribai Fule Pune University, Bharati Vidyapeeth Deemed University etc. It is also well connected with national industrial corridor starting from Delhi-Mumbai, Chennai-Kolkata. The region of Pune connected with well known golden quadrangle of India. On this corridor Pune city is connected by Mumbai –Bangalore express way. Further industrial hub starting from Mumbai to Pune District well connected by Pimpamp-Chinchawad Industrial estate, Ranjangaon industrial estate, Chakan-Shikrapur Industrial estate, Shirval-Khandala industrial estate. Secondly physical setting of Pune district is surrounded by Himalaya hills towards west and southern site as shown figure 3.3 &3.4 respectively.
3.3.5 Administrative Set up:

Pune city is the divisional headquarters of Western Maharashtra i.e. the Pune Division and headquarter of the district. Administratively, Pune District is divided into 14 Taluka, 13 Panchayat Samitis (Blocks), and 2 Municipal Corporations, 11 Municipal Councils, 3 Cantonment Boards and 1,844 villages.

Transportation Network: Pune is well-connected to other cities by Indian highways and state highways. National Highway 4 (NH 4) connects it to Mumbai, Bangalore and Kolhapur. NH 9 to Hyderabad, and NH 50 to Nasik. State highways connect it to Ahmednagar, Aurangabad, and Alandi. Pune is well-connected to other cities by
Indian highways and state highways. National Highway 4 (NH 4) connects it to Mumbai, Bangalore and Kolhapur. NH 9 to Hyderabad, and NH 50 to Nasik. State highways connect it to Ahmednagar, Aurangabad, and Alandi. Pune is served by two intra-city highways: Old Pune-Mumbai Highway and Katraj-Dehu Road Bypass, a part of National Highway 4. The Nashik City-Pune Highway NH 50 will be part of the golden triangle (Nasik-Pune-Mumbai).

3.3.6 Public Transport:
Buses are the major public transport mode in the city of Pune which is operated by Pune Mahanagar Parivahan Mahamandal Limited (PMPML) within the city and its suburbs. The PMPML operates the Bus Rapid Transportation System (BRT) in some parts of the city. Maharashtra State Road Transport Corporation (MSRTC) provide bus service from its main stations in Shivajinagar, Pune station and Swargate to all major cities and towns in Maharashtra and neighboring states. In addition many private companies run buses to major cities all over India.

3.3.7 Pune Transportation options:
3.3.8 The Study Area Delineation:
The area under study consists of a 50 kms stretch of road network connecting Swargate to Khandala. A part of which lies within PMC boundary while the rest is connecting villages on the fringes. The stretch possesses a varied character because of the presence of BRT route up to Swargate to Katraj, presence of adjoin different land uses ranging from commercial, residential, rural, institutional purposes. This segment is selected considering its potential to provide a rich empirical data to address the objectives of this research.

The study area is divided into two parts where part one include 30 kms stretch which is referred as Core area as it is located within PMC boundary starting from Swargate to Katraj. Second part is referred as Fringe area as it is located beyond PMC boundary starting from Katraj to Khandala of this research which is done in two stages.

3.3.9 The study area:

![Map showing study area Swargate to Khandala. Source: survey of India maps.](image)

The core area includes area between Swargate and Katraj which include the following segments:
Table 3.1: showing the destination and length of particular areas.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Description</th>
<th>S. No</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Swargate</td>
<td>8.</td>
<td>Padamawati chowk</td>
</tr>
<tr>
<td>2.</td>
<td>Laxminarayn theatre</td>
<td>9.</td>
<td>K.K. Market chowk</td>
</tr>
<tr>
<td>7.</td>
<td>City Pride junction</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The fringe area under study which covers the villages and settlement up to 20 kilometre long segment that is as follows in table 3.1

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Village</th>
<th>S.No.</th>
<th>Village</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Jambhulwadi</td>
<td>16</td>
<td>Shindewadi</td>
</tr>
<tr>
<td>2.</td>
<td>Shindewadi</td>
<td>17</td>
<td>Dhangarwadi</td>
</tr>
<tr>
<td>3.</td>
<td>Sasewadi</td>
<td>18</td>
<td>Yewalewadi</td>
</tr>
<tr>
<td>4.</td>
<td>Khed</td>
<td>19</td>
<td>Mangadewadi</td>
</tr>
<tr>
<td>5.</td>
<td>Shivapur</td>
<td>20</td>
<td>Bhilarewadi</td>
</tr>
<tr>
<td>6.</td>
<td>Khopi</td>
<td>21</td>
<td>Gogalwadi</td>
</tr>
<tr>
<td>7.</td>
<td>Varve Budruk</td>
<td>22</td>
<td>Velu</td>
</tr>
<tr>
<td>8.</td>
<td>Kelawade</td>
<td>23</td>
<td>Kasurdi</td>
</tr>
<tr>
<td>9</td>
<td>Nasrapur</td>
<td>24</td>
<td>Shivare</td>
</tr>
<tr>
<td>10</td>
<td>Kamthadi</td>
<td>25</td>
<td>Varve- khurd</td>
</tr>
<tr>
<td>11</td>
<td>Umbare</td>
<td>26</td>
<td>Naigaon</td>
</tr>
<tr>
<td>12</td>
<td>Kapurhol</td>
<td>27</td>
<td>Ketkawale</td>
</tr>
<tr>
<td>13</td>
<td>Dhangwadi</td>
<td>28</td>
<td>Sarola</td>
</tr>
<tr>
<td>14</td>
<td>Bhor Phata</td>
<td>29</td>
<td>Shirwal</td>
</tr>
<tr>
<td>15</td>
<td>Kikavi</td>
<td>30</td>
<td>Pisalwadi</td>
</tr>
</tbody>
</table>
3.4 Methodological Framework:
This research used a mixed methodology approach where grounded theory is selected which enabled this study to focus research questions that call for real-life contextual understanding of sustainable transportation as a phenomenon from multi-level perspectives. The analysis in this work is based on theoretical frameworks from the social, behavioral, urban design and planning to inform all phases of the study which provided opportunities for the integration of a variety of theoretical perspectives. This is basically an inductive research it uses a systematic and rigorous form of inquiry was in which various methods of data collection such as naturalistic observations, structured interviews, land use survey, focused group discussion and questionnaire survey are used that are discussed in detail in the following sections.

3.4.1 Methods:
The basic idea of the grounded theory approach is to read a textual database (such as a corpus of field notes) and "discover" or label variables (called categories, concepts, and properties) and their interrelationships (figure. 1.3.1).

Figure. 3.8: Methods of grounded theory

Open coding:
- Open coding is the part of the analysis concerned with identifying, naming, categorizing and describing phenomena found in the text.
- Coding can be done very formally and systematically or quite informally.
- In addition, as codes are developed, it is useful to write memos known as code notes that discuss the codes.

Axial coding:
- Axial coding is the process of relating codes (categories and properties) to each other, via a combination of inductive and deductive thinking.
### Table 3.2: Axial Coding

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phenomenon</strong></td>
<td>In grounded theory, it is sometimes the outcome of interest, or it can be the subject.</td>
</tr>
<tr>
<td><strong>Causal Conditions</strong></td>
<td>These are the events or variables that lead to the occurrence or development of the phenomenon.</td>
</tr>
<tr>
<td><strong>Context</strong></td>
<td>It is the specific locations (values) of background variables. Researchers often make a quaint distinction between active variables (causes) and background variables (context).</td>
</tr>
<tr>
<td><strong>Intervening Conditions</strong></td>
<td>Identify context with moderating variables and intervening conditions with mediating variables.</td>
</tr>
<tr>
<td><strong>Action Strategies</strong></td>
<td>The purposeful, goal-oriented activities that agents perform in response to the phenomenon and intervening conditions.</td>
</tr>
<tr>
<td><strong>Consequences</strong></td>
<td>These are the consequences of the action strategies, intended and unintended.</td>
</tr>
</tbody>
</table>

**Selective coding:**
- Selective coding is the process of choosing one category to be the core category, and relating all other categories to that category.
- The essential idea is to develop a single storyline around which all everything else is draped.

**Memos:**
- Memos are short documents that one writes to oneself as one proceeds through the analysis of a corpus of data.
- The final theory and report are typically the integration of several theoretical memos.

**Process:**
- A process as a synonym for "explanatory mechanism".
- Describing and coding everything that is dynamic -- changing, moving, or occurring over time -- in the research setting.
3.4.2 Study Methods:
This study is conducted in three parts. Based on Grounded theory this study used different methods for Part I, part II and part III as follows:

**Part I:** Naturalistic Observation, Visual Survey, Structured Interviews and Land Use survey (appendix-I)

**Part II:** Land Use Survey in Fringe area

**Part III:** Structured Interviews and focused group discussions with stake holders. And questionnaire Survey

Part I
In part I of the study analyzed land use and transportation in core area with 4 methods starting from naturalistic observation followed by visual survey structured interviews and land use survey.

3.4.3 Naturalistic Observation:
Naturalistic Observation method adopted in core area starting from Swargate to Katraj which is divided into 10 segments. To gather a consistent set of data, all segments were observed three times a day 8:00 A.M., 3.00 pm and 6:00 P.M on weekdays. In order to ensure the consistency of observations a set of guidelines for each variable was used. Observations with any kind of ambiguity were eliminated from the sample. The activity pattern observed and recorded with the help of photographs and field notes. The dominant reasons for employing this method are that: it is an unobtrusive method which can be used in public places with a few ethical issues, e.g. no need for personal consents. It is conducted in a ‘natural setting where people generally do not know they are being observed and they behave naturally so it can yield a large amount of robust quantitative data in a relatively short time.

3.4.4 Visual Survey:
Photographic survey conducted of all the roads sub-roads and junctions in peak hour. The study area segment is divided into12 segments which were studied to find out visual characteristics of the area under investigation. It included photography which is done from Katraj to Swargate on the both sides of the road. Main thrust was given to capture images of the street junctions and landmark buildings.
3.4.5 Structured Interviews:
Structured interviews were conducted at identified junction and bus stops in order to explore people's perception regarding current status of transportation facilities. The interview schedule included the following concerns.

The travel experience cost of travel, safety issues, frequency and efficiency of the service, traffic conditions, congestions, travelling and waiting time and their aspirations and suggestions.

The sample composed of 45 people both male and female of age group from 20 to 70 years. The interviews were audio taped and transcribed with verbatim coding. Verbatim responses which have generated high volumes of valuable information were used for analysis.

3.5 Land Use Survey:
The method follows practices for linking social survey data to satellite data using sketch maps during interviews to establish rapport between interviewer and respondent and to improve comprehension of land use in the survey. This includes linking the two sources of data, for accurately identifying the current land use of properties (or fields) and linking it with satellite-based data. It is aimed to provide comparable spatially explicit information on the organization of land use and infrastructure on surveyed areas. In the core area identified corridor was physically observed based on which land use and typology of the buildings was plotted on the base map. The existing land use like public and semi public building, open spaces and other ancillary land uses were marked. The details of Part I study and analysis is presented in chapter 4.

Part II: In part II land use and transportation in fringe area was examined with land use survey as explained in the previous section. It is aimed to identify the changes in land use pattern in fringe area and its impact on transportation. The details of Part I study and analysis is presented in chapter 5.

Part III
Focused group discussion and structured interviews conducted with the stakeholders in the fringe area in order to explore their perception and aspirations regarding
Sustainable Planning Strategies for an Integrated land use and Mass Transit System with Reference to Core and Fringe: “A Case Study of Pune”

transportation system and land use. Details of methods adopted in the three parts are presented in following section

3.6 Focus Group Discussions and Structured Interviews:

It is one of the methods to collect data. It is dealing with qualitative research. In this, group, consists of 6-25 no., guided by moderator, can produce interaction to provide comments spontaneously rather than manipulated. It gives an outlook about belief, opinion, perception and attitude towards unexpected issues. Main advantage is it takes place in natural settings. This is also known as the group effect where group members engage in - a kind of „chaining“ or „cascading“ effect; talk links to, or tumbles out of, the topics and expressions preceding it. (Lindlof & Taylor, 2002: p182).

This considered that semi-structured interviews were most appropriate for this study. The semi-structured interviews were carried out with representative stakeholders i.e. developers, members of the local community, transport planners and local authority officials. The interview guide included the following issues:

1- Their view on current development pattern in light of transportation facilities and land use.
2- Problems in current transportation system.
3- Their needs and aspiration regarding adequate mode of transport.
4- Awareness regarding environmental issues.
5- Awareness regarding advanced transportation options and their feasibility.

3.6.1 Participants and settings / Sample Design and Ethical Considerations:

The sample was selected so as to be composed of balanced selection from different age groups as well as from various income groups. Respondents were contacted formally with appointment. They were informed that the interview will be audio-recorded and used only for the purpose of study and recording done. In addition to audio-recording, manual notes were taken down with reference to the guideline questionnaire.

3.7 Data Collection:

The interview duration range from 45 minutes two hours which were audio recorded with a portable tape recorder. The interviews were transcribed and returned to the interviewee / informant for verification and they were then invited to make alterations.
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to the text. The transcriptions then went through an iterative process until the transcripts were suitable for contextual analysis. The interviews often produce a large amount of data from which the most relevant material is selected for further analysis.

Sampling Design: The following four categories of respondent were interviewed:

**Table 3.3: categories and number of respondents**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Type of people or community</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Representatives from the local community in areas which included Sarpanch and members of Grampanchyat and citizens</td>
<td>16</td>
</tr>
<tr>
<td>2.</td>
<td>Developers, Estate Agents Industrialists and Local Businesses owners.</td>
<td>12</td>
</tr>
<tr>
<td>3.</td>
<td>Local and district administration officials.</td>
<td>09</td>
</tr>
<tr>
<td>4.</td>
<td>Transport providers</td>
<td>10</td>
</tr>
<tr>
<td>5.</td>
<td>School and college teachers</td>
<td>20</td>
</tr>
<tr>
<td>6.</td>
<td>Staff members from Revenue, forest, highway departments and M.S.E.B MIDC staff</td>
<td>14</td>
</tr>
</tbody>
</table>

Representatives from the local community in areas which included Sarpanch and members of Grampanchyat and citizens from the following villages/settlements:
### Table 3.4: group of villages and number of participants

<table>
<thead>
<tr>
<th>No.</th>
<th>Type of people or community</th>
<th>Size in nos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Katraj , Mangadewadi, Bhilarewadi</td>
<td>20</td>
</tr>
<tr>
<td>2.</td>
<td>Sasewadi, Velu, Shivapur, Verve,</td>
<td>15</td>
</tr>
<tr>
<td>3.</td>
<td>Kamthadi, Nasarpur, Saraola,</td>
<td>18</td>
</tr>
<tr>
<td>4.</td>
<td>Shirval, Paragon-Khandala</td>
<td>30</td>
</tr>
<tr>
<td>5.</td>
<td>Zillaparishd block area representatives of Satara and Pune districts within the study area</td>
<td>25</td>
</tr>
<tr>
<td>6.</td>
<td>Khandala police station, M I D C authority etc.</td>
<td>12</td>
</tr>
<tr>
<td>7.</td>
<td>Shripatrao Kadam educational campus, Savatribai Fule projected school Shirval, Other primary and secondary schools, primary health centres etc.</td>
<td>50</td>
</tr>
</tbody>
</table>

### 3.7.1 The Interview Structure:
The semi-structured interview, designed to be open and non-directed in nature, was used to interpret the experiences and processes of mode choice and discover the meanings related to the factors involved (Patton, 1990) which was approximately hour-long. It started with a general talk about transportation network to provide context and refresh memories, the interview proceeded to talk about components of participant’s travel space, travel pattern, engaging participants to think about the relative importance and combined effects of various factors of their travel decision. The final portion of the interview was dedicated to find out their aspirations and ideas about sustainable transport. Sample interview questions and order are listed in APPENDIX- III.

### 3.7.2 Focused group discussion:
Focused group discussion was conducted with the people from 19 villages, six industrial setups, 5 administrative bodies and 7 educational institutes. The discussion was audio recorded and data was processed based on grounded theory methodology the details of which are presented in chapter no 5.


### 3.8 Data Analysis:

In qualitative research the belief, understanding, opinions, views etc. of people are investigated - the data gathered may be unstructured, at least in their „raw“ form, but will tend to be detailed, and hence „rich“ in content and scope. Consequently, the objectivity of qualitative data often is questioned, especially by people with a background in the scientific, quantitative tradition (Fellows and Liu, 1997: p19).

#### 3.8.1 Textual / Content analysis:

What makes the technique particularly rich and meaningful is its reliance on coding and categorizing of the data. The categorizing can be summed up in these quotes: A category is a group of words with similar meaning or connotations and Categories must be mutually exclusive and exhaustive (Weber, 1990: p37). Holsti (1969) offers a broad definition of content analysis as, “any technique for making inferences by objectively and systematically identifying specified characteristics of messages.” It is well applicable method in social sciences for analysis of qualitative research. It is systematic method. Based on rules of coding it reduces many words of text into fewer content. (Berelson, 1952; GAO, 1996; Krippendorff, 1980; and Weber, 1990). For researcher it can be a useful technique to discover and describe the focus of individual, group, institutional, or social attention (Weber, 1990).

Glaser adopted this method in 1960. He called it - The Constant Comparative Method of Qualitative Analysis in an article published in 1964-65. Glaser and Strauss (1967) refer to their adaption of the method as Grounded Theory'. It involves a systematic method called comparative analysis in which descriptive data are coded and organized into conceptual categories. The comparison brings out the distinctive elements or nature of the case studied.

#### 3.8.2 Questionnaire Survey:

For these survey 600 questionnaires in two languages English and the local language Marathi were distributed to the residents of study area in survey period. 548 questionnaire forms were filled and 456 questionnaires forms were found complete which were considered for analysis.
3.8.3 Questionnaire Design:

Questionnaire design was based on the factors that influence travel behaviour. Cultural context with reference to demographic character

- Service Quality
- Financial Aspects
- Safety
- Availability Amenities
- Environmental impacts.
- Present scenario

The questions are arranged according to the flow of the questions to be answered. Each question was detailed and designed carefully to maintain the flow or order of answers as well as sentence structure was aimed to maintain simplicity and clarity where care was taken to avoid confusion or ambiguity. The number and length of the questions was kept as short as possible.

The questionnaire included three types:

3.8.4 Numerical Rating or Likert scale:

Likert scale was used as it is found the most appropriate tool for this research. Response choices range was specified in each such question (Check & Schutt, 2012).

3.8.5 Matrix Questions:

Questions having a particular focus are assigned with same response choices which are prepared in a tabular form in which column headings provided for response choices and Row headings for the series of questions.

3.8.6 Multiple Choice Questions:

With check boxes were provided where respondents have to choose options more than one.

3.8.7 Tool Testing:

The questionnaire was tested to identify flaws in sentence structure, syntax errors which may cause confusion as it may lead into no or invalid response. Based on testing with 25 respondents some of the questions were modified and few questions were added.
3.8.8 **Survey Administration:**
The printable form of the questionnaire prepared for in-person survey is attached for the reference (Appendix III). To reach more respondents, the questionnaire was also translated and printed in Marathi (Appendix IV). To balance the samples from different strata as mentioned in stratification as well as from different demographic character such as gender, age, etc. efforts were made to reach more people.

3.8.9 **Methods of data Analysis:**
The manually entered data in Microsoft Excel was coded first and then imported to statistical analysis software SPSS 20 (Statistical Package for Social Scientists). For advanced statistical analysis of the data, it was imported to software SPSS that is especially designed for advanced statistical tests such as one/two way Anova, Chi-square tests, T-tests, Correlations, etc. The details of Part I study and analysis is presented in chapter 6.

3.9 **Summary:**
In this chapter conceptual framework is discussed which helped in the research design. Further, the context of the study in terms of the geographical, socio-cultural and socio-economic context of study area Pune is presented. This study is done in three parts each of which has followed a different methodology. Each methodology, the procedures, protocol of inquiry and methods are explained with details regarding sampling and data collection procedures, measures of the study variables and data analytic techniques used are presented. The details of empirical work, observations, and analyses are discussed in next Chapter Four, Five and Six.