CHAPTER – I

INTRODUCTION

Transport Geography is a sub-discipline of Geography concerning to movements of freight, people and information. It seeks to link spatial constraints and attributes with the origin, destination, extent, nature and purpose of movements. Transportation is of interest to geographers for two main reasons. First, transport infrastructures, terminals, equipments and networks occupy an important place in space and constitute the basis of a complex spatial system, and secondly, since Geography seeks to explain spatial relationships, networks are of specific interest because they are the main support of these interactions.

Transport Geography, as a discipline, emerged from economic Geography in the second half of the 20th century. Traditionally, transportation has been an important factor over the economic representation of the geographic space, namely in terms of the location of economic activities and the monetary cost of distance. The growing mobility of passengers and freight justified the emergence of Transport Geography as a specialised field of investigation. In the 1960s transport cost was recognised as a key factor in location theories. However, from 1970 onwards globalisation challenged the centrality of transportation in many geographical and regional development investigations. As a result, transportation became under-represented in economic Geography in the 1970s and 1980s.

Since the 1990s, transport Geography has received renewed attention, especially because the issues of mobility, production and distribution are interrelated in a complex geological setting. It is now recognised that transportation is a system that considers the complete relationship between its core elements. These core elements are networks, nodes and demand. Transport Geography is linked with numerous others.

Transportation has been described as the life-line of civilization constituting an important item of infrastructure for socio-economic and cultural development. In the present scenario, no economy can flourish in isolation. Transport network is a
prime physical linkage creating a host of other linkages like economic, social, technological, and administrative linkages to open up an economy and to ensure greater circulation within it. Therefore, transport network is a vital key in the development of an economy.

Transport is a functioning of various activities. Means of transportation play a key role in the world like the circulatory system does for the body. It is important to the individual carrying life blood of commerce, supplies necessary substance for population groups (Davis, 1984 quoted by Meena, 2003). Transportation is the movement and exchange of people, goods and ideas. It is ubiquitous and there is no escape from it. It is difficult to believe that transport does not play a major role in regional development. Transportation is an important observer of scarce resources, enormous wrong directed or misplaced investment and has a serious impact upon the whole economy. Poor transport is an obstacle in making effective use of regional resources. Most of regional resources lie idle or are partially utilised due to their inaccessibility. It is the function of transport to bridge the geographical gap between producers and consumers so that goods and services may be exchanged to their mutual benefit. Transportation by definition implies a movement and every individual from the earliest times possessed his own building ability to move, albeit within a limited area. Means of transportation and communication are vital for smooth working and further development of the economic life of the nation (Meena, B.R., 2003).

The regional development of any country and more so India is dependent on three important networks i.e. irrigation, power and transport, out of which transport plays an important role in the process of regional cum economic development. Transport network enables integration among all other economic activities. It is presumed and observed that, in any developed nation, the higher the regional development, the higher is the transport network development and there is always a high positive correlation between these two.

Transport network of region plays a pivotal role in reducing the spatial disparities and bringing about a balanced and integrated development. This could be basic infrastructure helping in proper exploitation of the regional resources of the
region, and transport network is thus, a necessary element of spatial expression. It influences not only the economic life of a region but also affects the social, cultural and political aspects of life. Growth with equality and distributive justice is possible only with a proper development of transportation network (Vaidya, B.C., 1998).

Means of transport patterns are based on four elements: road, rail, water and air. The development of each type of transportation varies according to the stage of development of the country concerned. Roads and rails are the principal means of transportation. The railways, however, serve as the backbone of transportation, while the roads fill up inaccessible gaps, especially in the rural interior where a large chunk of our population actually resides. Railways do not serve every part of country even in the most advanced and developed countries. When these do not and cannot go, the gap is filled by road transport. Road provides the economic infrastructure for the industrial and agricultural sectors. In the several modes of communications, roads occupy an important place. The road systems, in fact, are economic arteries which spell progress and growth of the economy. They form the life-line of industry and commerce. It is most important among all modes of transport on account of its cheapness. It is said that “If the country is stagnant, roads will indicate the facts: if they have no roads they are savages.”

Rail network also plays an important role in the process of socio-economic development. This provided, for the very first time, cheap pleasure travel and, as the railway network spread, large areas of country and many coastal locations were opened up to the townsman. Railway is very useful for long distance travel because of its high speed, carrying capacity, punctuality and good service.

Transport development has great significance in the socio-economic development of a country. It is important that those developments are sustainable. Such development of transport network introduced an element of dynamism and mobility in the region for locational structure and patterns. The means of transport provide an effective system of vital arteries which could be considered as a functional organisation. It serves both the short-term purpose of satisfying the demand for movement between areas and the long-term purpose of helping the development of places by inducing changes in inaccessible locations (Hodder,
1974). Basically, transport network is regarded as a set of inter-connected routes linking numerous destinations and provides means for movement of people and commodities. In real sense, it serves manifold purposes for regional development. Transport may have influence on services performed by human beings. In case of industry and industrial workers, the effective production and efficiency of labour is influenced by timely transport means or demographic influences in the form of generating demand for transport in the region.

Transport modes and means act like a circulatory system in any region. It provides the basis for economic, social and commercial progress as well. Therefore, facilities of transport are considered as an index of mobilising local and regional resources at the best. India is a developing country and requires the basic need of a good network of transport to mobilise raw materials and final products as well. Urban commuters in big cities could be best quoted in this regard as they consider transport means as a part assisting their life. Accessing a taluka or a village is possible through developed means of transport (Vaidya, B.C., 2003).

The development of transport system is closely associated with the socio-economic development of the region. The transport system created tie with various points which have desire to interact with each other. As postulated by Ullman (1956), three conditions affect interaction, and thereby, the development of transport - Complementarity, intervening opportunity and transferability. The first condition for the establishment the transport system is existence of the demand for things, services, ideas etc. which are in surplus at other places. Those goods and services don’t avail intervening opportunities and at the same time, it should be feasible to transfer them from their places of surplus to market areas. In this sense ‘transport lines, networks and systems are brought into being only by the demand for transport generated by the economy and the society of the areas they serve’ (White and Senior, 1983). But in turn, the provision of a transport network will alter the nature and distribution of socio-economic system. Thus, development of both transport system and socio-economic level are mutually interdependent (Haggett et al., 1977).
While in developing countries, transport facilities are considered as an essential component of infrastructure in the developed realm, it is seen as a basic and necessary social amenity. Whichever view is ascribed to the conclusion remains the same. Thus, transport services are intrinsic to contemporary civilization. The importance of transportation can be understood in terms of its three capacities in fostering development (Maovenzadch and Gettner, 1984 quoted by Saikia, 2003). Firstly transport serves as a basic physical and economic infrastructure that enables raw materials, intermediate products and final products to be distributed to various locations, local, regional or international and also expands the geographical extent of markets fostering large scale production. Secondly, transport serves as a basic social and political infrastructure, facilitating the flow of ideas, people, information and goods, at the same time enhancing the political and social integration of territories, and thirdly, transportation can serve as a force for industrialisation through its requirements of infrastructure and equipment, which, if produced locally can boost industrial development.

Present day society which involves large scale production, regional and product specialization and international trade relies heavily on the transport sector so much so that a modern economy simply can not exist without an efficient transport system. Transport and economic development are symbiotically linked and development of the former is a necessary precondition for the later (Rostow, 1964 quoted by Saikia, 2003).

Transport system is a mirror of economic development and material prosperity. Division of labour, areal specialization and commercialization which are integral part of modern civilization, are the off springs of modern means of transport and communication (Tiwari and Tripathi, 1987). The greater the centralization and specialization of man’s activities, the higher is the need for efficient transport (Janelle, 1969). As a matter of fact, transport provides the basic infrastructure for the growth and development of agriculture and industry (Tiwari and Yadav, 1990). In modern society, transport has attained much more significant role not only in terms of economic development but removing scarce conditions, maintaining uniform price line or safeguarding the people from hunger, disease and natural calamities. It
is with this view that an attempt has been made in this study to evaluate the development of transport network structure and socio-economic transformation and suggest suitable guidelines for its scientific planning taking Ambala Division of Haryana as a case study.

The Present Study

In the present study, an attempt has been made to examine the transport network structure and socio-economic transformation in Ambala division of Haryana at block level. The study is spread over a time-span of 30 years (1971-2001). The penetration of roads in this division provides a strong stimulus to the development but, on the other hand, rail transport also plays an important role. Thus, it is realised that there is a need to evaluate and examine critically the road and rail transport network in the study area.

1.1 REVIEW OF LITERATURE

Transportation Geography has now emerged as a distinct branch of economic Geography. A survey of research in transport Geography reveals that during the last six decades, a lot of work has been done on a variety of themes by social scientists, including geographers. Transportation was treated formerly as a fundamental factor influencing the pattern of area differentiation and character of places operating through various economic and human activities, but, after 1950s, it is regarded as a geographical phenomenon more than an economic factor, reflecting the complexities of economic interdependence and demanding topological and objective analysis and spatial structural formulation. With the introduction of quantitative techniques in Geography, a new avenue for transportation studies have been created.

The beginning of transport Geography in India dates back to the second quarter of the present century, though in a somewhat restricted sense it is a development of the last two decades only. Some attempts have been made to review the state of transport Geography in India. The objective of the present section is to catalogue the literature in this field at regional, national and international levels.

Ullman (1954) was the scholar who had put forward the concept of "transportation Geography" as a distinct field of study in a research paper published
in American Geography Inventory and Prospect. A systematic approach to the study of transportation in the context of spatial interaction was developed by Ullman (1954, 56, 57, 67, 70, 73). The fundamental concept developed by him is known as Ullman’s Principles or ‘Ullman’s Traid’. Ullman put forward (1954, 1957, 1973) three main reasons of interaction involving transportation:

(i) complementarility;
(ii) intervening opportunity; and
(iii) transferability.

Studies of this type, including works by Garrison, Berry and others (1959), have identified various levels of nodes and a structural hierarchy on the basis of interaction attributes.

Garrison (1960) has applied some techniques of graph theory to analyse the connectivity of the inter-state highway system of United States for the year 1957. He had underlined the usefulness as well as some of the limitations when the methodologies of graph theory are applied to the analysis of transport network.

Lalanne (1963) analysed the density and pattern of the rail–road network of the continental France. He observed regular tessellations of the rail–road network and suggested a hierarchical relationship between the network and political divisions in the France.

Kansky (1963) argued that the structure of the transportation network of any area cannot be studied in isolation from geographic characteristics. Kansky had undertaken an extensive empirical analysis of transport network structures and had suggested a number of measures for analysing complex transport network structures.

Vaislevskly (1963) designed transport Geography to cover transportation, its development, location and operation within the territorial economic complexes of countries and region and its inter-relationship with the location of industry, population and cities, and natural phenomena and resources.

Taffee, Morrill and Gould (1963) undertook a comparative analysis of the development of transport in developing countries and they were able to show that certain broad regularities permitted “a descriptive generalisation of an ideal typical sequence of transportation development.” They identified six phases in their
sequence of transportation development. Their spatial model of transport network
development in developing countries has proved to be a valuable help in the
understanding of transport development and has been widely applied. That model
was based upon the Ghanian and Nigerian experience, but it has been found to be
applicable to other developing lands, for example, Latin America.

Since 1970 the network and flow analysis have been rapidly shifting from
analysis of abstract economic system to real-world problems that are social issues,
public policies and applied Geography. Smith, D.M. (1971) noted “While the 1950’s
and 1960’s saw major advances in geographical techniques, conceptualization and
research methodology, the 1970’s promise to be a decade of fundamental
philosophical realignment.” Reed (1970) modified the powering technique applied
to a connectivity matrix. Muller (1976) reviewing the literature of transportation
geography explained the growing use of the quantitative and conceptual research
applied in social transportation problems and transport policies. Taffee (1972)
emphasised that the geographical research should maintain a reasonable balance
between activism and scientism in which the spatial review would be more closely
articulated in a revitalised man land view.

Hullur, Dharwar and Sinha (1971) had been made collective efforts to
explain the accessibility of roads in the Mysore state as accessibility is one of the
most important aspect of network analysis. The study of accessibility is measured
only with relation to roads, as they are the most important means of
communications. The first part of this paper deals with the regional analysis of
accessibility while the second part of it deals with the accessibility of urban centres
in relation to the network of roads.

Singh, I.D. (1972) worked on the topic, “Patterns of Rail Traffic Flow in
Rajasthan”. In this study, he had made an attempt to analyse the rail traffic flow of
Rajasthan in order to assess its role in the spatial interchange of the region. He
concluded that regional variation regarding the passengers traffic flow is very
important. It is seen that the eastern part of the state shows the heaviest traffic,
moderate traffic lies in the central region, while western region enjoys with the
The intensity of traffic decreases from east to west.

Singh and Kayastha (1972) in their study intended to bring out salient features pertaining to some aspects of transportation in the Dhanbad town by way of analysing the characteristics and patterns of the transport network, the incidence and structure of traffic and few other relevant points. After detailed discussion, it was found that Dhanbad is an important mining town of the country. Roads and road vehicles constitute the main structure of transport of Dhanbad. Railways, which are doubled-tracked, electrified and broad gauge, function as means of extra town transportation. The traffic flow which consists of trucks, buses, taxies and non-power driven vehicles has marked concentration along a few routes.

Hoyle (1973) observed that the interaction between the level and pattern of transportation facilities and the average level of living of the population of an area is a critical factor affecting economic and social progress and it needs to be taken into account at all stages of national and regional development planning. As a matter of fact, the formation of regional hierarchies is initially related with the levels and patterns of development of network of transportation and communications. He described that in the advanced countries, much attention was paid to transport innovation during the formation years of industrial growth; today new strategies of economic planning require the modification or renewal of inherited transport systems. In the less-developed countries, there is widespread concern for transport in the context of the desire to promote rapid economic development. He observed that the transport/development relationship is essentially a two-way interaction that depends upon the type of economy involved and upon the level of development at which transport improvements are affected.

Mukerji (1974) tried to seek correlation between the road transportation network structure and levels of urbanization in Rajasthan. The district level data had been used for the purpose. However, the newly introduced concept of aggregate transportation score (ATS) had been computed and shown to be an important determinant of level of urbanization. It has been observed that all the structure indices are highly positively correlated among themselves, with ATS and level of
urbanization, thus supporting a major premise that transportation may be treated as an independent variable in the study of level of urbanization which itself is an element in the matrix of socio-economic development.

Dutta (1975) presented her views in the research paper entitled “The Network Pattern of Indian National Highways from Major Urban Centres to the National Capital”. In this study an attempt had been made to study the road network of Indian National Highways of 1961 and 1971, taking the shortest routes to Delhi, the national focus of India. Strahler’s combinational ordering system for drainage network has been taken. The importance of roads with reference to Delhi has been analysed from the standpoint of the hierarchy of path ordering.

After the analysis of the path network of 1961 and 1971, it is seen that though some minor changes are taking place in the first-and second-order paths, no remarkable change has taken place in the network in spite of growth of cities.

Ramchandran (1975) conducted a study about the analysis of a network geometry. In this study, the measures of network structure had been discussed. The author defined clearly the basic terms used in a transport network like vertices, edges, sub-graphs, planner graphs, non-planner graphs, etc. He also reviewed the measures of connectivity like cyclomatic number, Alpha, Gamma, Beta, Diameter, Eta, Theta, Iota, degree of connectivity, Turtuosity ratio, associated numbers, accessibility, etc. The knowledge of the above is necessary for any type of transport studies.

Dasgupta (1982) presented a research paper entitled “Formation of Transport Network in Brahmaputra Valley (1939-1914).” The aim in the present study is to focus attention on the spatial structures formed by each mode of transport and role of plantation in this development. After examination, it is found that the three modes of transport i.e. roads, river-ways and railways, set up a system of transport network in the Brahmaputra Valley by the beginning of the 20th century. Roads connected the region with other provinces and linked tea estates and the administrative centres to the steamer ghats and railway stations. River-ways connected the province with a part of Kolkata and also linked the tea estates with the main routes on the rivers. The railways connected the region with the part of Kolkata
and Chittagong and linked the administrative centres and tea areas to the trunk routes.

Deen and Singh (1982) had been made an attempt to present an occupational analysis of population engaged in transport activities in the urban centres of Eastern Uttar Pradesh. Eastern Uttar Pradesh is a distinct socio-economic unit of Uttar Pradesh. As much as 8.91% of the total labour force was found contributing to this function (1971). Transport and communication centres in this region are less numerous than those of any other functional category. It is found that out of 69 towns, only 6 are considered as transport centres and that they are not evenly distributed. These are classified on the basis of functional specialization intensity and regional ranking. Demographic and socio-economic characteristics and their correlation with the said activity have also been statistically analysed.

White and Senior (1983) in their book 'Transport Geography' have stated that "geographers by virtue of their training and experience, have an important contribution to make to the development and methodology of transport studies." They have described three major aspects of transport Geography. First, it deals with the interaction between the environmental factors and human activities by adopting a 'system approach'; secondly, the study of systems in terms of spatial variables; and thirdly, the geographical approach to create an awareness of technological development as an input factor to transport systems.

Sahariah and Bhagabati (1984) presented their views on the topic "Urban Centres and Spatial Pattern of their Road Accessibility in Assam". In this study, an attempt had been made to analyse the pattern of road accessibility of some selected urban centres of Assam and the relationship between the degree of accessibility and the population size of the towns. The Connectivity Matrix method had been adopted to assess the degree of accessibility of the urban centres to roads. In order to understand the nature of relationship between road accessibility and the population size of towns, the product moment correlation coefficient was calculated.

After deep analysis, it is concluded that the spatial shape and natural environmental framework of this state had greatly influenced the degree of accessibility of different centres. The significant positive correlation between the
accessibility and town size also indicated some points in regard to urban growth. The existing differences in the degree of accessibility and number of towns located in different spatial units may further intensify the regional socio-economic disparity between the hills and the valleys, in particular, for which rational regional development planning is of utmost concern.

**Famisa and Ogunjumo (1986)** tried to explain the pattern of road networks in Ondo State, Nigeria. The main objective of this study is to analyse the existing road networks in all the local government areas of Ondo State, Nigeria, in relation to several other socio-economic variables so as to determine their relative adequacy.

Findings of this study clearly show that there are variations in rural road networks and socio-economic characteristics of the rural dwellers whom they serve in Ondo State. The adequacy of the road networks needs to be assessed for a purposeful rehabilitation programme in the state. Road networks are selective in the areas served at the initial stage of development.

**Kanchan and Shukla (1987)** presented their views on the topic “Dynamics of Transport and Industrial Trends in Madhya Pradesh.” In this paper, transport study has been undertaken for the state of Madhya Pradesh at the district level. First, the growth of roads is calculated for 1982 in reference to 1958. After analysing the growth of roads, accessibility is calculated on per lakh population and per 100 sq. kms. and then the level of road transport is calculated by taking five indicators into consideration. Finally, transport connectivity is drawn for railways and roadways separately. After the study, it is inferred that though Madhya Pradesh occupies the central position in the country, but it has insufficient roads. The state’s physical features, forest regions, numerous small and big rivers all militate against an efficient system of transport. In fact, the absence of proper communication is the cause of slow pace of economic growth, unexploitation of resources and wide gap between the industrialised and resource districts. To enhance the process of development, the need is not only to construct roads but also to make metalled roads and to coordinate rail–road transportation.

**Saxena (1991)** expressed his view on the topic “Road Transport Connectivity Pattern and Economic Development in Rajasthan.” The objectives of
The present study are: (i) to compute road transport connectivity and levels of economic development in each district of Rajasthan; and (ii) to find out the relationship between connectivity and economic development. Connectivity has been calculated by using three indices i.e. beta (β) index, cyclomatic number (μ) and connectivity index (c). The composite connectivity score (CCS) has been computed by adding respectively ranks of beta, cyclomatic number and connectivity index. With the help of different indicators, the composite score has been computed for determining the levels of socio-economic development.

After deep analysis, he concluded that out of 26 districts of Rajasthan, seven districts record high connectivity and high level of development, four districts have low-level development profiles and low connectivity and four districts come under the medium category. In 11 other districts, the levels of development do not correspond with their degree of connectivity. The rank correlation coefficient between levels of development and degree of connectivity is 0.26 which is statistically insignificant. This means that the factors governing the road development of road connectivity are not related to the factors governing the regional pattern of economic development.

Shukla (1991) tried to study the development of roads in West Bengal during the plan periods (1951-81). She compared the position of road development in different plan periods. Development of roads in West Bengal was rather slow in the pre-partition period. The main emphasis of the five-year plans was laid upon long-distance roads. The first five-year plan, in general, connected passages for long-distance points of the state and national highways. The second five-year plan concentrated on relatively short-distance roads, the third five-year plan concentrated mainly on arterial roads and the fourth five-year plan concentrated on rural roads.

After detailed study, she concluded that the road development programme through successive five-year plans and annual plans since the third five-year plan suffered immensely. This is only because of the fact that roads have not been placed in the priority sector in the plan programmes.

Tripathi and Mishra (1991) conducted a study on the topic "The Levels of Transport Development in Basti District, U.P" In this study, an attempt has been
made to measure the level of transport development and its impact on the socioeconomic transportation.

To measure the level of transport development in Basti district, the following four indicators were selected:

i) length of roads/1000 sq.km;
ii) length of roads/lakh population;
iii) percent of villages on road;
iv) percent of villages beyond 3 kms from the road.

The foregoing discussion leads to conclude that the district is not uniformly developed in terms of transport facilities. But, undoubtedly, the impact of transport on the growth and expansion of socio-economic facilities is positive and appreciable.

Mishra, Tripathi and Sharma (1992) worked on a paper entitled “Transportation Network in Amethi Taluk, Uttar Pradesh”. The present paper tries to look into an optimum network of transportation system after analysing the existing position for the Amethi Taluk of the Sultanpur district in Uttar Pradesh, India. The Taluk, an agricultural region, is characterised by inadequacy of social facilities and basic infrastructures. The available data indicates that there are sub-regional disparities in the density of roads; for example, Sangrampur and Amethi blocks have higher density of roads than that of Bhadar and Bhetua. It appears that in the recent past road development has been more in the neighbourhood of the Amethi town.

The foregoing analysis of the transport network indicates spatial disparities and imbalances in their distributional pattern and connectivity. The density of roads and connectivity are higher in the Amethi block and Sangrampur than those of Bhadar and Bhatua. The link and feeder roads are inadequate in rural areas. The connectivity of all the central places except Amethi, Bhadar, Navgirwa and Vishesharganj is low.

Rodrigue (1994) presented a research paper on the topic “Transportation and Territorial Development in the Singapore Extended Metropolitan Region” published in ‘Singapore Journal of Tropical Geography.’ The objective of this paper is to
identify transportation factors affecting territorial development in the Singapore Extended Metropolitan Region (EMR) and to address notions and processes of urbanisation over a vast territory. This would provide a theoretical and empirical framework of large-scale urbanisation. In the next section, an EMR spatial model is presented in order to provide a theoretical framework for investigating the territorial processes affecting the Singapore region. Thirdly, the preliminary assessment of the territorial development of Singapore’s extended metropolitan region is offered, based upon the model. At the end, the study concludes with a discussion of the role of transportation in the territorial development of extended metropolitan regions in general and Singapore in particular.

Lancelet and Saravanan (1997) tried to describe the road network of tourism centres in Thiruvananthapuram district in the state of Kerala, India. A transport network map on 1:250,000 scale connecting 22 points (nodes) of all major tourist centres had been prepared. A connectivity matrix was then prepared using Garrison’s method. From the connectivity index, it is seen that Palayan, Venjaramodu, Aruvikara and Kattakada nodes are well connected on routes to all other places of tourist’s interest. Shortest-path matrix indicates place like Varkala, Veli and Kovalam having less degree of direct accessibility from other centres. On the basis of results, it is assumed that with a well-developed road network and infrastructural facilities, there is enough space for a systematic development of organised and coordinated tourism promotion, actively and effectively involving the services and resources of all concerned governmental and non governmental agencies.

Barman (2003) tried to study the spatial differences in the conditions of transport and Agromarketing services that exist in the district of Medinipur of West Bengal and their influence on the agricultural activities. Medinipur, having a great variety of relief features, has a distinct agricultural typology which is influenced to a great extent by the variety of landforms. In this study, it has been tried to bring out the importance of better marketing of agricultural products which is only possible by improved rural transport network.
Fazal (2004) had tried to find out the role of accessibility in land transformation. In the present study, he aims to study the land use pattern of the Aligarh city, its expansion and find out the pace and direction of land transformation in the city. The major finding of the study is that the land transformation of the Aligarh city is clearly the outcome of the operation in the urban land market. Accessibility has been a major factor for changes in land use. The characteristic feature of urban land use in the Aligarh city is its high mix and it is very difficult to make out any pattern out of it. Specialisation of activities in a specific area, so common in the western cities, does not exist here.

Marr and Sutton (2004) in their study attempted to show the impacts of transportation changes on the woodworking industry of Mexico's Purepecha region. The Purepecha region of Michoacan state, in West Central Mexico, has a strong tradition of craft production, especially wooden items. Transportation improvements in the region since the mid-twentieth century have led to a higher level of integration of the regional economy. This study focused on seven towns located in the Meseta Purepecha of West Central Michacan. The seven towns were chosen because they are representative of the various levels of accessibility within the region and have some form of woodworking as their single, dominant craft industry. After a detailed study, it is found that although overall accessibility increases throughout the region, but the growth was not uniform. Some settlements saw dramatic improvements; while others remains isolated. The uneven nature of this process has led to significant differences in craft production among the studied area settlements.

Mondal (2004) has been made an attempt to find out the regional disparities in the levels of nodal accessibility and spatial pattern of non-primary activities in the Mewat region. The distributional pattern of workers engaged in various non-primary activities has been explained. Spatial pattern of non-primary activities has been discussed. Finally, the relationship between transportation accessibility and non-primary activities has been highlighted. It is seen that there exists positive relationship between transportation and proportion of workers engaged in different non-primary activities in the area. There exist large regional disparities in the levels
of nodal accessibility and in the proportion of workers in the various non-primary occupations from one part of the region to the other part.

**Fazel (2006)** conducted a study on the topic “Land Transformation in Relation to Distance in Developing Economy.” This study was based on remote sensing data and processing using the GIS technique. Aligarh city was selected for the purpose of study. The urban land use map of the city was prepared using satellite imageries. After deep analysis, the study reveals that with distance from the city centre, the internal structures observe afferential land reorganisation and changes. The study also point towards haphazard unplanned and unwarranted expansion of city, which is destroying the fertile agricultural hinterlands.

### 1.2 OBJECTIVES OF THE PRESENT STUDY

Transportation arteries in any region exercise tremendous influence over the structure of economy by virtue of providing major guideline for industrial locations and market orientation. In a sense, the status of transport network in a region is the same as that of circulation system in human body. Main objectives of the study are:

(i) To study the development and pattern of transport network structure.

(ii) To examine the level of transport network structure in the area.

(iii) To identify the nodes and their linkages.

(iv) To find out the connectivity pattern and nodal accessibility between different nodal points.

(v) To analyse the land-use transformation in the study area.

(vi) To study the impact of transport network structure on socio-economic transformation.

### 1.3 DATA SOURCE

The present study is essentially based on secondary data. The following data have been collected from difference sources to achieve the objectives of the present study:

1. The data related to socio-economic characteristics of population have been collected from census handbooks of Haryana, 1971 and 2001.
2. The data related to total road length and density have been collected from the statistical abstract of Haryana for the year 2001 and 2008.

3. Empirical Gazetteer of Ambala (1923-24, 1986), Karnal (1923-24, 1976) and Jind (1986) have been consulted to collect the information about the development of roads and railways in the Ambala division.

4. Topographical sheets related to the study area have been used to generate the data of road length for the year, 1971.

5. Road maps of all the concerned districts (2001) have been collected from B & R Head office, Chandigarh.

6. Some information related to road length for the year 2001 has been collected from internet (www.haryanapwd.nic.in).

7. The detailed information about national highways has been obtained from the office of the Surface Transport and National Highway Authority of India, Delhi.

8. General information about the study area has been collected from different sources like census handbooks, magazines, empirical gazetteers, general books about Haryana, etc.

9. Satellite Imagery (LISS-III) has been used to generate the location map of Ambala Division.

1.4 STUDY AREA

The study area is one of the four major administrative divisions of Haryana. Ambala division is selected for the present study which is situated in the north-eastern and north-central part of the state includes districts Ambala, Panchkula, Yamunanagar, Kurukshetra and Kaithal. The division is surrounded by the Himachal Pradesh in north, Punjab on the western part, Uttar Pradesh on the eastern side and the southern part touches the Jind and Panipat districts of Haryana. The total geographical area of the study is 8087 sq. km. with 12 tehsils, 26 blocks and 30 urban centres. The total population of the region is 4296037.

The general slope of the area is from the north-east to south-west direction in which most of the streams flow. Yamuna, Saraswati and Markanda are the major streams of the area. In the north-east, the Shivalik hills form a narrow belt, extending
mainly to the north-eastern margins of the Panchkula, Ambala and Yamunanagar districts. These hills constitute extremely outer Himalayan ranges. The selected area is situated near the state capital Chandigarh. Important railways, roads and highways pass through this area which connects it with the other districts of the state, districts of surrounding states and the national capital of India. The military cantonment and industries are the special features of this area.

**Need of Block Planning for Transport Development**

Small units like blocks reflect the physiographies, socio-economic and cultural diversities of the country which need special attention. The blocks also provide the area where various sectoral plans sponsored either by the centre or by the state can be integrated to the maximum. Duplication redundancy, which is the characteristics of Lal sectoral plans implemented in isolation, can be eliminated in a block level plan. Thus, realising the problems of planning both at district and village, since the late 1970s, arguments have been made in favour of block level planning.

The significance of transport system for all-round development of a block is obvious from the fact that it exercises tremendous influence in giving orientation to political, social, cultural and economic pursuits. Inadequate and inefficient transport facilities cannot initiate any sort of development in an area. Due to the absence of adequate and efficient transport facilities, resources and potentials of an area cannot be fully utilised and exploited. Therefore, it is essential to integrate the isolated villages of the block with a network of transport system, so that the block may not remain cut-off from the main stream of socio-economic developments and deprived of the benefits from the effective utilisation of institutional services. A sound and rational planning for development of transport system is essential for all-round development of the block.

1.5 **RESEARCH METHODOLOGY**

The present study has been conducted with the help of two principle sources which are common in Geography and Social Sciences:

(i) Maps, statistics and Available literature; and

(ii) observation of phenomena associated with the transport network.
A systematic and analytical study has been carried out to obtain the above mentioned objectives. The following four steps has been taken:

(i) collection of data;
(ii) tabulation and analysis of data;
(iii) cartographic representation;
(iv) interpretation of facts and their critical analysis.

A smaller administration unit, 'block', has been taken for comparative analysis of two different census years 1971 and 2001. Block boundaries as on 31.3.2000 has been taken as the base map. On the basis of the map of 2001, same block boundaries have been delineated for the year 1971. Total 24 blocks have been identified in the census year 2001 and the same has been treated in 1971 by summing up the village level data. All data related to the transport network and socio-economic development has been converted into tabular form.

In order to assess the level of transport network structure and socio-economic development, the Z-score method has been adopted. Z-values of individual indicators of different aspects have been calculated with the help of mean and standard deviation techniques and then by adding up the Z-values of selected indicators, Z-score or composite score has been identified. To show the change in transport network and socio-economic conditions, the values of 1971 have been simply subtracted from the values of 2001 and in this way positive or negative change has been identified during the time span of thirty years.

In the analysis of transport network structure, it has also been tried to find out the connectivity pattern and accessibility of roads and railways. A topological graph of road and railway network has been prepared to calculate the connectivity and accessibility. The network has been abstracted as a graph and different ratio measures suggested by Kansky (1963) with certain modifications have been adopted to examine the nature of connectivity. The following three empirical and measures structure indices have been used to calculate the connectivity in the present study:

(i) Alpha Index ($\alpha$) = \frac{e - v + 1}{2v - 5};
(ii) Beta Index ($\beta$) = \frac{e}{v};
Gamma Index ($\gamma$) = \( \frac{e}{3(v-2)} \);

where $e$ and $v$ refer to the number of edges and vertices in the above mentioned formulae.

Accessibility indicates a spatial relation between the given vertex and remaining vertices in the network; in other words, it measures geometrical centrality of centres in the network. To calculate the accessibility, a shortest path matrix has been prepared and the Shimbel Index method has been adopted in the present study. Mathematically, it can be represented as:

\[ A_i = \sum_{i\neq j} D_{ij}, \]

where $n =$ nodes in the network

$A =$ accessibility

$i =$ symbol of particular index

$ij =$ origin and destination place

$d_{ij} =$ topological distance of path between $i$ and $j$.

To examine the impact of transport network structure on the socio-economic development. Karl Pearson's correlation technique has been used and by applying the 't' test, significance level of the relationship has been tested.

Suitable cartographic techniques like Choropleth maps, Dot maps, Bar and Pie Maps and diagrams have been used to interpret the data and results. The remote sensing technique has been applied to prepare a location map of study area and to measure the length of roads and railways. Data processing has been done by computer and partially manual.

1.6 ORGANISATION OF THE STUDY

The present study comprising of eight chapters tries to compress in a short the development of transport network structure and socio-economic transformation in Ambala Division from 1971 to 2001.
First chapter deals with the general introduction of transport geography, a brief review of literature, objectives, data source, selection of the study area, research methodology and chapter scheme.

In the second chapter geographical and cultural aspects of study area have been discussed in detail.

Third chapter of the present study describes the historical development of roads and railways network in Ambala Division. The development level and pattern of transport network have also been discussed. In the last section of this chapter, change in transport network structure from 1971 to 2001 has been examined.

Fourth chapter is a brief study of network analysis which is the main part of transport geography. In the network analysis, connectivity pattern and accessibility have been analyzed.

Fifth chapter deals with the land use transformation in the study area and an attempt has been made to correlate it with transport network structure.

Sixth chapter of the study illustrates the transformation in socio-economic development during last thirty years in the division. Sixteen different indicators related to socio-economic development have been taken into consideration for the present study.

Transport plays a key role in the socio-economic development of a region or a nation. Therefore, the aspects related to the relationships between transport network structure and socio-economic development have been discussed in detail in the seventh chapter.

Finally, chapter eight deals with summary, conclusion and suggestions for the development of the division.

In the last, Bibliography and references have been enlisted.