CHAPTER - VIII

SUMMARY AND CONCLUSION

The transportation constitutes to be pace setter of a growing economy as it forms the basic study of growth potential to future development. In the developed and developing countries, the urban centres are required to be linked with countryside or rural area in order to mobilize the existing economic resources. Moreover, to exploring and movement of primary resources, it badly needs the road and railway access to reach interior places wherever the potential of such resources are found in the region. In the words of Munby (1968) “Yet, there is no escape from transport, even the most remote and least developed of inhabited region, transport in some form is a fundamental part of the daily rhythm of life.”

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 piece of research to evaluate the existing network of roads and railways and its relationship with socio-economic development taking Ambala Division of Haryana as a case study.

In this last chapter of the study, an attempt has been made to explain all the points and salient features in brief which we find out from the present study. It has been tried to conclude the essence of the study and the following points can be ascertained as the brief and summarized form of description and interpretation of result obtained from the analysis of the present study.

The present study is an attempt to examine the development of roads and rail network structure, land use transformation and socio-economic transformation during the census year 1971 to 2001. It has also been tried to find out the relationship between the development of transport network structure and socio-economic development.

Ambala Division is selected as study area for the present study. It extends from 29°30'00" to 30°55'05" North latitude and 76°9'20" to 77°36'05" East longitude. The division spreads on the area of 8087 sq.kms with population of 4296037 and
density of 531 persons per sq.km. The division is administratively divided into five districts, twelve tehsils and twenty four blocks.

In this study, both primary and secondary data pertaining to transport network structure, land use pattern and socio-economic aspects have been employed. The District Census Books, Statistical Abstracts, Gazetteers, Topographical Sheets, Road Maps, Railway Maps, Census Atlas Maps etc. have been used to extract informations.

A systematic approach has been adopted throughout the study. The tables have been used for the presentation of data. Spatial patterns of different aspects have been cartographically presented with the help of maps (Choropleth, Pie and Bar) and diagrams at block level. Connectivity and Accessibility by roads and railways have been calculated with the help of ratio measures and Shimbel Index method respectively. Level of different types of developments have been evaluated with the help of Z-score method. Karl Pearson’s correlation coefficient method has been used to examine the relationship between transport network development and socio-economic development.

The pace of progress is entirely depended on transport facility for real development. Ambala division has extensively expanded road and railway routes which attract people for their daily commuting to urban centres and good transport to countryside along with movement of people. With considering main thrust of movement, researcher has attempted to assess and examine the trends and development of road and railway transport in Ambala division. During the first half of 19th century nothing much was known about the ancient routes passing through the division except the possibility of existence of old grand trunk road. No improvement had been observed till 1947 in the field of road network structure in the division. Only few roads were metalled at that time. The phased progress of road development was marked after the formation of Haryana in 1966. In 1971, there was only 1335 kms. metalled roads exist in the division. Out of total road length, national highways were 89.80 kms. state highways were 619.10 kms. major district roads were 84.00 kms. and other district roads were 541.70 kms. On this behalf, it can be said that the road network was poor in the division at that time.
Three Important Indicators have been taken into consideration to determine the level of road transport network structure viz. (i) Index of Road Network Development (ii) Road Length / 100 sq.kms. (iii) Road Length/ 100000 Persons. The values of index of road network development range from the maximum of 2.94 in Raipur Rani block to the minimum of 0.03 in Momi block. In Raipur Rani block, geographical area is too small but road length was comparatively good, whereas in the Momi block, area is large but road length was only 2.00 kms. Ladwa block had perfect proportion of road length by getting value ‘1’ of road index in 1971.

Road density discerns the degree of connectivity and accessibility of road network system. It is noticed that there was only 16.50 kms and 74.32 kms road length per 100 sq.kms. and per 100000 person respectively in the division at the time of census year 1971. Highest road density per 100 sq.kms. was recorded in Raipur Rani block with 49.74 kms. followed by Jagadhri block (38.72 kms) and lowest was recorded in Momi block with only 0.80 kms. Large portion of the area of Morni block was unsurveyed and that’s why the road development was not taken up. Raipur Rani and Morni blocks were recorded again highest and lowest values of the indicator road length per 100000 persons in 1971.

After the individual analysis of all these three indicators, level of road network development has been calculated by applying Z-score method. Raipur Rani block had scored highest value in Z-score analysis and achieved very high level of road network development due to its small geographical area and comparatively dense road network. On the other hand, Morni block had achieved very low level of road network development due to very small inhabited portion and large unsurveyed area.

After a time span of thirty years, Ambala division is having well-knit system of surface roads with 5088 kms total metalled roads in the division in 2001. 99.80 percent villages are connected with metalled roads. Among four types of roads, other district roads share maximum percentage having 80.3 percent whereas in 1971 these roads were sharing very low percentage. The same three indicators which have been taken into account in 1971, selected again for 2001 to determine the level of road network development in the division. The values of road network development index range from 0.57 in Kalayat block to 1.46 in Pinjore block. Due to agricultural based
economy, lack of urbanization and industrialization, Kalayat block has very less proportion of road length in the area. On the other hand, spread of secondary and tertiary activities, urbanization, industrialization etc. are responsible factors behind having the highest value of the road network development index in Pinjore block.

The average length of roads/100 sq.kms measure about 62.90 kms in 14 blocks which is above the average and remaining 10 blocks are below to it in the division in 2001. The values of this indicator range from 36.20 kms/100 sq.kms. in Kalayat block to 94.70 kms/100 sq.kms. in Pinjore block. The average length of the roads/ 100000 persons approximates to 161.80 kms. in 17 development blocks ranging above the divisional average and remaining 7 blocks are below it. The values of this indicator range from the minimum of 54.70 kms. in Jagadhri block to the maximum of 649.10 kms in Morni block. Because of urbanization and industrialization, Jagadhri is an over populated block and Morni block is a sparsely populated due to lack of any developmental factor.

After a details analysis of these three indicators, the general level of road network development has been calculated with the help of Z-score method. In Ambala division, three development blocks namely Pinjore, Raipur Rani and Naraingarh are having very high level of road development. The main contributing factors for the very high level of road network development in the aforesaid three blocks are their location (nearness to big cities), number of markets and service centres and dense road network in comparison to area and population. On the other hand, only two blocks Kalayat and Rajound exist in the category of very low level of road network development. Both of these blocks are agriculturally dominant and the market centres and industries are not developed. The development of roads have been ignored due to lack of industries and market centres in these blocks.

After a detailed study of level of road network development for the census year 1971 and 2001, interest has been focused on to identify the properties of patterns of road network structure. Patterns are commonly defined as a property within an object, or between objects that is regularly repeated. Many patterns of road network exist in the study region like Radial, Heringbone, Quadrilateral and Delta. Kaithal, Cheeka, Ambala, Panchkula, Kaul and Jagadhri are the good examples of nodes for
radial pattern in the division. In Heringbone pattern of road network, short transverse lines linked together by a longitudinal line at a frequent interval. The longitudinal roads from Bilaspur to Dhanaura, Chhachhrauli to Ledi and Gulnera to Kharkan are connected by different transverse lines are the examples of Heringbone pattern. Quadrilateral and Delta patterns are integrated patterns with circuits. These patterns are formed by close finite path in which the initial nodes coincide with the terminal nodes. Both of these patterns are spread over the whole division due to the dense road network and good connectivity.

Railway transport is one of the important modes of transport for movement of people and commodities in India. Railway set the pace of the industrial growth in the country, being the principle carrier of bulk and essential commodities for mass consumption. The evaluation of railway network of Ambala division can not be studied in isolation. In is closely linked with evolution of railway network of the country as a whole. Britishers introduced the concept of railway to our country in the middle of 19th century. They planned the railway routes mainly to serve the commercial and political interest of British Empire. Only those places were connected by railway which were suitable for the export of raw materials and also provide markets vulnerable for the finished goods imported from England. In this route system no care has been taken to connect the continuous trade points nor were feeder lines constructed to promote the internal trade. Thus the railway lines in Ambala division were the part of National Railway Network.

The idea of railway in India first occurred to Mr. George Clark, the Chief Engineer of Bombay Government in 1853 and the first train in India began in the middle of 19th century on 16th April 1853 from Mumbai to Thane of about 32 kms. long. The first railway line was introduced in the state of Haryana in 1873 from Delhi to Rewari. The first railway line in the Ambala Division was constructed in 1886 from Saharanpur to Ludhiana passing through Jagadhri, Mustafabad, Barara and Ambala.

In 1971, there were four railway lines in the division and till 2001 no improvement in the railway track in terms of length and gauge. That’s why the level of rail network development has been determined only once for the year 2001 in the present study. The Ambala division is served by the Northern Railway Zone of the
Indian Railway and the total length is 223 kms., out of which 219.2 kms in broad
 gauge and 3.83 kms in narrow gauge. Meter gauge railway line is not available in the
division. There are three broad gauge and one narrow gauge railway lines serving the
division. Ambala cantonment is an important railway station, where Saharanpur-
Ludhiana railway line and Delhi-Kalka railway line cross each other. Kalka is the
railway terminus of Delhi-Kalka railway line and provides a transit for upward traffic
to Simla from broad gauge to narrow gauge. Out of 24 blocks, only 10 blocks are
served by railway lines in the division. Nearly 60 percent area of the division is
devoid of railway facilities. On an average, there is only 3 kms of rail length for every
100 sq.kms area and 5.2 kms for every 100000 persons in the area. The highest length
of railway has been recorded in Ambala block with 40.12 kms and the lowest rail
length has been recorded in Kalayat block with only 8.06 kms.

Three indicators have been selected to calculate the level of rail network
development in the division (i) Index of Rail Network Development (ii) Length of
Railway Line per 100 sq.kms (iii) Length of Railway Line per 100000 Persons.

The index of rail network development shows the proportion of railway length
in a block to the area of that particular block. Values of the index range from
minimum of 0.90 in Kalayat block to maximum of 3.36 in Pinjore block. Average
density of railway line in the division is 5.67 kms. per 100 sq. kms. Values of density
range from 2.50 kms per 100 sq.kms in Kalayat block to 9.40 kms per 100 sq.kms in
Pinjore block. Pinjore, Ambala, Mustafabad and Thanesar which are relatively
developed and densely populated blocks have attained higher density of railway line
than the division average. On the other hand, the average density of railway line per
100000 persons in the division is 8.64 kms. It records a maximum of 14.50 kms in
Mustafabad block to a minimum of 3.20 kms in Jagadhri block. Jagadhri is a highly
urbanized block. Urbanization is a progressive factor and due to increase of
population, the rail length per 100000 persons is automatically decreased in this
particular block. Reverse is true in the case of Mustafabad block.

Z-score analysis has been done to determine the level of rail network
development in the division. It is evident from Z-score analysis that the marked
variations exist among the various blocks of the division in respect to the level of rail
network development. Four blocks viz. Pinjore, Ambala, Thanesar and Mustafabad have attained high level of rail network development. These blocks have attained high level because of urbanization, industrialization, cantonment area, big junction and connectivity to the tourist places. On the other hand, Kalayat and Pundri block exist in the category of low level of rail network development. Lack of industrialization, urbanization and agricultural based economy is responsible for low level of rail development in these blocks.

In the present study, an attempt has been made to find out the pattern of rail network structure. Rail transport requires a more specific form of a special track on which locomotives and stock can operate. The plain topography of Ambala division enables the railway lines to run for long distances without changing the course. Only two patterns simple radial pattern and linear pattern of rail network structure are found in the study region.

The present study is based on time span of thirty years (1971-2001). This time span of thirty years is too long in itself and there is a possibility of a major change in every sphere of life during this period. But it is seen that no change has been observed in the length of railway line in the division from 1971 to 2001. Hence attention is focused to identity the changes in the level of road network structure only. The total road length in the division was only 1335 kms. in 1971 which has been increased to 5088 kms. in 2001. During the last thirty years, the total increase of road length is 3753 kms. It is seen that state highways show negative growth and all other three types of roads (national highways, major district roads and other district roads) show positive growth during the last thirty years. The reason behind is that at the time of 1971, there was a wide spread of state highways in the division and till 2001 some of the state highways have been converted into national highways. That is why length of national highways have been increased even more than four times. Other district roads have the highest growth just because of government’s policy to connect every village by metalled road and as a result 99.80% villages are connected with metalled road in 2001, while in 1971 this figure was only 48.50%. During last thirty years, highest increase in total road length is recorded in Kaithal block with 304.30 kms followed by Ambala (293 kms), Guhla (261 kms), Barara (249 kms), Pundri (248 kms) and
Thanesar (222 kms). On the other hand lowest increase is recorded in Raipur Rani block with 50.20 kms and followed by Barwala (84.80 kms). Sadaura (82.80) and Rajound (88.70 kms).

The road length per 100 sq.kms has been increased from 16.50 kms to 66.70 kms in between the census years of 1971 to 2001 in Ambala division. Highest growth rate is recorded in Morni block with 6087.50 percent in terms of road length per 100 sq.kms. In 1971, the block had only 0.80 km /100 sq.kms which has been increased to 49.50 kms/ 100 sq.kms in 2001. Lowest growth rate is recorded in Raipur Rani block with 74.91 percent. Raipur Rani was already in a better position in terms of road length per 100 sq. kms in 1971 because of its small geographical area and thus records least growth. Road length per 100000 persons has been increased from 73.52 kms in 1971 to 161.80 kms in 2001 in the division. Morni block again records highest growth rate with 3448.93 percent. Morni is a less populated block and population has not much increased due to large portion of uninhabited area, lack of urbanization, and industrialisation, but roads are constructed all over the block during last thirty years. It is interesting to note that three blocks namely Jagadhri (-8.80%), Raipur Rani (-11.96%) and Pinjore (-11.13%) have recorded negative growth in road length per 100000 person. In the case of Jagadhri and Pinjore blocks it may be due to very high growth rate of population and Raipur Rani had already attained good position in terms of road length / 100000 persons because of comparatively dense road network at that time in 1971.

The geometrical analysis of transport network has become an important part of geographical studies. Transport networks are highly complex spatial systems and their analysis is based on graph theory. A topological map or graph reduces a transport network to its simplest form and in such a map, the line patterns or networks are described in terms of their topological characteristics, which do not rely so much upon distances and directions but rather rely upon contiguity, relative locations and systematization of lines and functions. In the present work, six criteria have been taken into consideration to study the connectivity and accessibility of road network structure: (i) Settlements having population above 5000 (ii) All administrative headquarters (district, tehsil, block) (iii) All urban centres (iv) All tourist places (v)
Settlements having technical institutions and degree colleges (vi) Settlements having three or more crossings on national highways, state highways and major district roads. On the basis of above six criteria, 222 nodal points and 251 edges have been selected in the division. In order to count the number of edges and vertices for the each block, many edges and vertices have been counted twice. In this way total number of edges and vertices that counts up to 410 and 367 respectively.

“The connectivity of a network may be defined as the degree of completeness of the links between nodes” (Robinson and Banford, 1978). Following the Kansky’s method to calculate connectivity, only ratio measures including Alpha, Beta and Gamma indices have been selected for measuring connectivity in the study area. The values of the Alpha Index would vary from 0 to 1. The value 0 would mean a maximal connected network, whereas a value of 1 would refer to a maximal connected network. As per Alpha Index, the division’s average value is .066. This value indicates that the division has no well connected network. Eight blocks viz. Morni, Shahzadpur, Bilaspur, Mustafabad, Chhachhrauli, Radaur, Ladwa and Babain score 0 value as per Alpha index. Maximal connected network is found in Shahbad (0.255), Pundri (0.219) and Naraingarh (0.200).

The beta index is the simplest form of the three measures which record the relation between two individual elements of a network. There is a variation in the beta index values which indicates that there is no uniform spatial pattern of connectivity in the study area. Maximum value of beta index is recorded in Shahbad block with 1.423 and minimum value is recorded in Morni block with 0.800. The connectivity as measured by gamma index varies from a set of nodes having no interconnections to the one in which every node has an edge connected to every other made in a graph. Some different picture has been evolved as per gamma index in the division. There is a little variation in the blocks according to the gamma index values. The values of this index range from the minimum of 0.323 in Shahzadpur block to the maximum of 0.514 in Shahbad block. The division’s average is 0.378. Higher values of the index are found in the Shahbad (0.514) and Pundri block (0.492) and lower values are found in Bilaspur (0.370), Mustafabad (0.370), Ladwa (0.370 and Babain (0.389).
In the end it is concluded that although connectivity has been calculated by three different indices viz. alpha, beta and gamma but result remains almost the same by all three measures.

Accessibility is one of the most important attributes of a transportation network. It indicates spatial relation between a given vertex and the remaining vertices in the network. The present study is concerned with nodal accessibility. All the block headquarters are taken as main nodal points to measure the nodal accessibility. A shortest path matrix has been prepared and Shimbel index method has been adopted to calculate the nodal accessibility from the matrix. It is noticed that there is a great variation in the values of accessibility at different block headquarters. Lower value of accessibility indicates good accessibility and vice versa. The values of accessibility range from minimum of 149 at Babain block to 333 at Guhla block. Six block headquarters of the division namely Babain, Barara, Shahbad, Thanesar, Ladwa and Naraingarh are varying in the category of very high accessibility centres. Barara, Shahbad, Thanesar and Babain are centrally located. Ladwa and Naraingarh are directly connected with other nodes. On the other hand, four block headquarters namely Pinjore, Guhla, Kalayat and Rajound are recognized as very less accessible centres. These centres have to cross many paths to connect with other centres because of their farthest locations.

The measures of rail network structure also derived from graph theory and all the railway stations are taken as nodal points for the measurement. On the basis of this criteria, 32 nodes and 22 edges has been identified in Ambala division. Due to double counting of edges and vertices in different blocks to show the interconnection of network, the total number of edges and vertices in the division are 40 and 50 respectively. Connectivity of rail network has been calculated by three ratio indices viz. Alpha, Beta and Gamma Index. All ten blocks which are served by rail network score o value as per alpha index. It means that all ten blocks are minimal connected by rail network, only one or two lines are passing through the blocks. There is disparity among the blocks of the division as per beta index values. The values range from the minimum of 0.500 in Kalayat block to the maximum of 0.875 in Ambala and Thanesar block. Two railway lines are crossing in both the blocks and Ambala
cantonment is identified as a big junction. On the other side, Kalayat block is served by single line with only few kms. length. Average value of beta index for all ten blocks is 0.757. Four blocks have higher value and six blocks have lower value of beta index than the division average. Some amount of homogeneity is observed in the values of gamma index in the study region. Kalayat block score 0 value, and four blocks namely Pinjore, Mustafabad, Jagadhri and Shahbad score 0.500 value as per gamma index. Overall result obtained from all three indices shows that the division is minimal connected by rail network.

Accessibility is another important aspect of network analysis. Nodal accessibility is reachability to one node from all nodes on the basis of presence or absence of actual links. It becomes clear from the shortest path matrix that Mohri (197) and Shahbad (197) are most accessible nodes followed by Ambala Cantt. (199) and Dhala Majra (197), while Kalayat is having least accessibility (427) followed by Sajooma (397), Kalanaur (397), Kutubpur (369) and Yamunanagar (367). Mohri, Shahbad and Dhala Majra are highly accessible from all other nodal points because of their central locations and Ambala Cantt. is a big junction which is connected from all four sides with railway lines. Kalayat, Kalanaur, Sajooma, Katubpur are located near the periphery of the division and that’s why scored high in shortest path matrix. It is concluded that accessibility by railways is locational because railways have fixed track, hence the stations which are centrally located in the division are highly accessible and which are located peripheral are less accessible.

After a detailed study of network analysis, the emphasis has been shifted towards the land use transformation during last thirty years and it has been tried to find out the impact of the development of transportation on the land use transformation in Ambala division. It is seen that the urban and forest lands had minimum share of the total area of the division in 1971. Lack of forest land indicates the ecological unawareness among the people of the division at that time. Urban areas were not so developed because of very less transport facilities, industrilisation and basic infrastructure at that time. It is also noticed that the percentage of unirrigated land was more than the irrigated land. This proportion reflects the less development of
the division in the field of agriculture which was a dominant economic activity of the division.

The division had only 2.28 percent area which came under the forest in 1971. Highest percentage share of forest land was found in Chhachhrauli block with 19.0% because of the Kalesar forest. Seven blocks namely Morni, Raipur Rani, Mustafabad, Shahbad, Babain, Kaithal and Rajound had no forest land. Percentage of net area sown varied from the minimum of only 10.50 percent in Morni block to the maximum of 91.73% in Rajound block. The Rajound block had purely rural economy and most of the area was utilised for the purpose of agriculture. On the contrary, Morni was also purely rural block but the maximum part of the block was uninhabited and agriculture was spread only on small area. In 1971, only 32.48% land was irrigated in the division. It is noticed that south-western part of the division was served by comparatively better irrigation facilities. 42.71% land remained unirrigated in the division in 1971. The lowest percentage of unirrigated land was recorded in Rajound block with 29.20%. Net area sown was the highest and unirrigated land was the lowest in the block. It means the block was in the developed stage of agriculture in 1971. In terms of culturable wasteland, the division’s share was only 3.91%. The highest share of culturable wasteland was recorded in Bilaspur block with 12.10% and the lowest share was found in Rajound block with only 3.35%. Overall, it is concluded that where the irrigated land was more, the culturable wasteland was comparatively less. In 1971, 105481 hectares (13.01%) area was not available for cultivation in the division. Morni block had the least share with 1.28% and Pinjore block had the highest share with 43.77% of area not available for cultivation in the division in 1971. The urban area was not so developed at that time and the urban land was only 15815 hectares (1.96%). 11 blocks of the division were completely deprived of urban land. Highest urban land was found in Jagadhri block with 15.36% followed by Ambala with 8.20%. It is noticed that except two blocks (Ambala and Jagadhri), all the blocks of the division had lesser share of urban land. The reason behind this is that the industries and transport network were less developed at that time in the division, which act as pull factors in the process of urbanisation.
In 2001, the share of net area sown is the highest with 74.41% in the division which explains itself the agricultural dominant economy of the division. Land under forest is lowest with only 1.21 percent. It is a matter of concern from the ecological point of view for the division. Culturable waste land is also too less with only 1.85 percent of the total area of the division. It means efforts have been made to utilise the maximum land for gainful activities with the help of modern technology. The condition of the division is very poor in the share of forest land in 2001. 14 blocks are having complete absence of forest land. South western part of the division has higher share of net area sown. Actually this area falls in main agricultural belt of Haryana. The division records 67.44% irrigated land out of 74.41% net area sown. Babain records the highest share of irrigated land with 100% and Morni records lowest share with only 4.35% irrigated land followed by Pinjore with 13.73%. Overall, it is noticed that south western part of the division has higher share of irrigated land whereas northern blocks have lesser share. On the other hand, it is interesting to note that the division has only 6.97 percent unirrigated land in 2001. The lesser share of unirrigated land indicates the sign of progress in the field of agriculture in the division. In terms of culturable wasteland, highest share is found in Pinjore block with 4.93% land and lowest share is in Rajound block with only 0.04% land. Area not available for cultivation is 103922 hectares in 2001 which is 12.84 percent of the total area. Due to hilly area, lakes, developed road and rail network, Pinjore block records the first rank with 36.42% in terms of land not available for cultivation. Lowest share is observed in Morni block with only 1.62% land because only some part of the block has been divided into different land use categories. The division accounts for 4.29% urban land of the total land in 2001. Pinjore (17.66%), Jagadhri (17.17%) and Ambala (11.66%) have the higher share of urban land. On the other side, six blocks of the division namely Barwala, Morni, Shahzadpur, Barara, Babain and Rajound have completely absence of urban land. Absence of urbanisation reflects the backwardness in terms of standard of living of people in these blocks.

The time period of thirty years has been taken for change detection in land use pattern and after detailed analysis of land use pattern of 1971 and 2001, it is found that land use / land cover has been changed considerably from 1971-2001. The area
under forests has been decreased to 1.07 percent in the division. This decrease may be caused by population growth and expansion of urban areas. Irrigated land has been increased to 34.96% and unirrigated land has been decreased to 35.74%. This drastic change in these two land use categories explains the impact of green revolution on the agricultural development. But it is interesting to note that the net area sown has been decreased to 0.78 percent during the last 30 years. It means that the agricultural land utilisation was at its highest peak, and due to increasing pressure of population on land, the net area sown is on decreasing trend upto 2001. In the land-use transformation from 1971 to 2001, a progressive point is that the area under urban land has been increased to even more than double. Rapid growth in urban land is noticeable mainly due to the development of transport network structure and the growth of industries in the division during the last 30 years.

It may be concluded that the decreased area of forests has been converted into urban area, built-up area and road network development etc. An incredible increase in irrigated land and too much decrease in unirrigated land is noticed during last thirty years in the division. In real sense transport network is an important factor for the adoption of modern farm technology. With the help of transportation network the farmer can acquire or absorb knowledge about the new techniques of agriculture and can convert the acquired knowledge into practice in the field. The change in net area sown, culturable wasteland and area not available for cultivation may not be significantly affected by transport network structure. Many other factors like population growth, new technology and innovation would be responsible for this change. A big transformation is seen in urban land from 1971 to 2001 which is highly affected by transport network structure. Actually the process of urbanisation and transport development are interlinked and dependent on each other.

Another important aspect of present study is related with socio-economic transformation in the study area. As many as 16 indicators of socio-economic development have been considered in the present study to depict regional pattern of development in the division: (i) Population Size (ii) Population Density (iii) Percentage of Urban Population (iv) Sex Ratio (v) Total Literacy Rate (vi) Female Literacy Rate (vii) Total Workers (viii) Female Workers (ix) Percentage of Net
Irrigated Area to Net Area Sown (x) Percentage of Net Area Sown to Total Area (xi) Percentage of Villages having Educational Facilities (xii) Medical Facilities (xiii) Post and Telegraph Facilities (xiv) Telephone Facilities (xv) Banking Facilities (xvi) Pucca Road Facilities.

The highest population size was recorded in Ambala block (314589) in 1971, it may be because of high degree of urbanization and comparatively better transport facilities. Lowest population size was recorded in Momi block (10932) due to large portion of uninhabited area. Average population density in the division was 253 persons per sq km in 1971. 8 blocks had higher population density and remaining 16 blocks had lesser population density than the division average. There was a great variation in terms of urban population in the division. It ranged from the minimum of 0 to the maximum of 63.12% in Jagadhri block. The divisional average of urban population was only 13.20%.

The division was characterized by a considerable deficiency of female population in 1971. There was only 856 females for every 1000 males in the division. Sadaura block ranked first with 898 females per 1000 males whereas Jagadhri block ranked last with 795 females per 1000 males in 1971. Other attributes of social development are related to the total literacy rate and female literacy rate. No wonder, the trends in literacy are considered as an index of pace at which the socio-economic transformation of a society is taking place. As per 1971 census, the total literacy of Ambala division was 25.74%. Jagadhri recorded 45.96% literacy rate and ranked first in the division. Jagadhri was highly urbanized with sufficient educational facilities which led to high literacy rate. On the other side, Rajound block recorded 13.45% total literacy rate and ranked last in the division. This was purely rural block and people were not aware of the importance of education. In terms of female literacy rate, the divisional average was only 15.96%. Regionally almost same picture as compared to total literacy was observed in the division in 1971.

In the category of economic characteristics, first two indicators are related to work participation rates. Workforce of an area is an important part of its economy. In terms of total workers, the divisional average was 27.10%. The proportion of total workers varied from a minimum of 21.84% in Ladwa block to a maximum of 30.85%
in Barwala block. Ladwa had the lowest work participation rate because of poor industrialization and transport network, whereas Barwala was located near to state capital Chandigarh and had comparatively good transport facilities. Work opportunities in Chandigarh positively affected the percentage of working population in this area. Female work participation rate was very low (1.30%) in the area as it was almost negligible. It may be because of the thinking of the people that the earning of bread was primarily a responsibility of males as females had no privilege to go outside the home.

In the year 1971, the division had only 37.30% net irrigated area to total net area sown. This shows that at that time irrigation facilities were limited and production of crops was depended mainly upon rainfall. As compare to north -eastern part, south western part of the block recorded higher percentage share of net irrigated area. People of this area were more interested in the development of agriculture at that time because agriculture was the only source of income for them. The division had 75.19% net sown area to total area in 1971 which indicates that the area was based on agricultural economy. 16 blocks had higher percentage share, while remaining 8 blocks had lower percentage share of net area sown than the divisional average.

Availability of basic amenities provides a strong base for overall development in any area. The basic amenities or infrastructure facilities were not good in the division in 1971. Generally education is considered to be a chief factor for the rapid development of a region. On an average, there was 61.10 villages that had any kind of educational facilities in the division. Rajound was the only block where 100% villages had been served by educational facilities in the year 1971. The division had 22.01% villages having medical facilities, 18.20% villages having post and telegraph facilities, only 3.70% villages having telephone facilities, 2.30% villages having banking facilities and 48.50% villages having pucca road facilities in 1971. It can be concluded that the availability of basic amenities in the rural areas of the division was not up to a level of satisfaction in the year 1971.

On the basis of these 16 indicators, level of socio-economic development has been determined with the help of Z-score method. Two blocks namely Ambala and Jagadhri had attained very high level of development in 1971 which is because of
very high degree of urbanization. On the other hand, Momi block had attained very low level of socio-economic development. Lack of communication facilities was the main responsible factor for low level of development in this block.

In 2001, Ambala block (584851) again ranks first while Momi block ranks last in terms of size of population among the 24 blocks of the division. Average population density of the division is 531 persons per sq. km. Jagadhri (1645) and Morni block (76 persons / sq. km) lie on first and last rank respectively in terms of population density in 2001. In terms of urban population, the divisional average is 34.40%. Six blocks namely Barwala, Morni, Shahzadpur, Barara, Babain and Rajound do not have urban population. Jagadhri, Pinjore and Ambala blocks have been pushed on higher side of urbanization by industrialization and better transport network.

All the blocks of the division are suffering from a considerable deficiency of females. The division has only 858 females per 1000 males as per 2001 census. 17 blocks are above the division average while 7 blocks are below to it. Total literacy rate of the division is 57.20%. Regionally Ambala block ranks first with 69.45% and Kalayat block ranks last with 44.39% total literacy rate. In terms of female literacy, the divisional average is 49.00 as per 2001 census. Female literacy presents irregular dispersion and almost same spatial pattern as compared to total literacy rate. It can be concluded that over all picture of literacy rates account for good quality in Ambala division and it is seen that where the degree of urbanization is high, the literacy rate is also high which means that urbanization provides better facilities for education and it helps in an increase of the level of literacy.

Ambala division accounts 37.30% in terms of total workers and 20.50% in terms of female worker in 2001. It is noticed that the south western part of the division has higher work participation rate because of its location in the main agricultural belt of Haryana and most of the people are engaged in agricultural activities. Female participation rate is very low in all the blocks of the division.

The division is good in terms of net irrigated area to net area sown and net area sown to total area in 2001. It records 83.10% irrigated area and 74.40% net area sown. Babain attempts 100% net irrigated area and followed by Pehowa (99.89%) and Thanesar (99.29%). All these three blocks received sufficient water for irrigation from
Narwana Canal branch and tubewells. Farmers have taken keen interest in agriculture and adopted new technology and irrigation facilities to increase their agricultural production. On the other hand, lowest irrigated land is recorded in Pinjore block (37.47%). People are mainly engaged in secondary and tertiary activities because of high degree of urbanization and industrialization.

The infrastructural facilities are good in the division in 2001. The division accounts 91.10% villages having educational facilities, 47.00% villages having medical facilities, 79.00% villages having post and telegraph facilities, 78.80% villages having telephone facilities, 7.20% villages having banking facilities and 99.60% villages having pucca road facilities. It can be concluded that all the blocks are served satisfactorily by all types of infrastructural facilities. Efforts are being made by the government to provide the basic infrastructural facilities to the area for development in real sense.

In the Z-score analysis of all sixteen indicators for the year 2001, three blocks Ambala, Jagadhri and Pundri fall in the category of very high level of development. Urbanisation is the only responsible factor which provides different types of facilities like employment opportunities, education, transport, communication. It calls for opportunities not only in the employment but also in the field of income, power and status. On the other side, Barwala, Sadaura, Bilaspur and Chhachhrauli have attained very low level of development in 2001. No developmental factor is available in these blocks.

By the comparative analysis of two census years 1971 and 2001, it can be concluded that all types of development have increased in the division from 1971 to 2001. A remarkable improvement is noticed through all the 16 indicators of development during last thirty years. Main factors responsible for the increasing level of development in the division are growing economy, industrialization, urbanization, good transport facilities and awareness about standard of living among the people etc.

For the deep analysis, it is tried to find out the relationship between transport network structure and socio-economic development in the division. This has been done with the help of Karl Pearson’s coefficient of correlation technique.
Three indicators of transport network structure (Chapter III) and sixteen indicators of socio-economic development (Chapter VI) have been selected to find out the mutual relationship.

In the road network structure for the year 1971, it is observed that there was positive relationship of road development index and road length per 100 sq. kms with demographic characteristics. It means as the road length increases, population size, population density and urban population also increase in the study area. Correlation values of road development index with population size was +0.245, population density was +0.494 and urban population was +0.389. Correlation of road length / 100 sq. kms with population size was +0.200, population density was +0.467 and urban population was +0.408. But road length / 100000 persons was negatively correlated with all the three indicators of demographic attributes in 1971. Only three relationships viz. road development index and population density, road length/100 sq. kms. with population density and percentage of urban population were found to be significant at 0.05 level.

There was feeble negative correlation between road network development and sex ratio in 1971. Road length per 100000 persons again negatively correlated with all three indicators of social characteristics. Total literacy and female literacy were positively correlates with road development index and road length/100 sq. kms. It means that with the increase of road network facility, literacy rate also increase.

The relationship of road network structure with total workers was feeble positive and with female workers was moderate positive. It means the work participation rate was not much affected by road development in the division. It is noticed that the correlation of the net irrigated area and net sown area with all the three indicators of road network development was negative. This negative relationship proved that the areas which were developed in terms of road network structure have comparatively less irrigated land and net area sown in the division. On the basis of this it can be concluded that secondary and tertiary activities are expanding and agricultural land is narrowing down with the development of roads in the area. Availability of basic amenities were negatively correlated with existing road network in 1971.
In 2001, there is a strong positive relationship between demographic attributes and road development index and road length per 100 sq. kms as compared to 1971. But as the road length/100000 persons is concerned, there is moderate negative correlation with demographic attributes which was feeble negative in 1971. It can be said that due to the increase in population size, all types of facilities are shared automatically because of the increase of recipients.

It is evident that there is feeble positive and negative relationship between sex ratio and road development in 2001. It means sex ratio is not highly affected by road network. On the other side, correlation between literacy rates and road network development is highly positive and significant at 0.01 level. This result proves that development of road network become a positive factor in the improvement of literacy in the division.

The relationship of road development index and road length per 100 sq. kms with all four attributes of economic characteristics is feeble negative in 2001. The relationships between road length/100000 population and total workers and female workers are high and moderate positive which was feeble in the division in 1971. It means that with the increasing population, work participation rates are also increasing. Again the same category as in 1971 is seen in the negative relationship of irrigated land and net area sown with road length per 100000 persons because with the development of roads, agricultural land used to decrease due to growing urban centres and industrial sectors.

It is evident that road network development is negatively or feeble positively correlated with all types of basic amenities (except pucca road facility and road length/100000 persons (-0.884) in the division in 2001. Other factors of development like economy, political stability and government’s interest are equally important in the over all development of the division.

The relationship of rail development index and railway length per 100 sq. kms. with all three demographic attributes is high and moderate positive and road length/100000 persons is feeble positive. This relationship clears that where rail network development is good, the concentration of population is also high in the area.
In terms of social characteristics, sex ratio is negatively and literacy rates are highly positively correlated with rail network development in the division in 2001. Literacy is a good indicator of social development and also influenced by the development of rail network in the division.

There is no significant relationship between rail network development and four economic attributes in the division. On the basis of this result, it can be concluded that the economic attributes are not influenced by rail network development in the division.

There is feeble positive relationship between the rail network development and availability of basic amenities in the division. But the division is in good position in terms of availability of basic amenities in 2001 and relationship between these two shows a different picture, such type of relationship can be called non spurious correlation.

In brief it is concluded that transport development and socio-economic developments are closely interrelated but other factors like urbanization, industrialization, technology, new innovation, people’s awareness, education, government planning etc. are equally important in the process of development.

**MAIN FINDINGS AND SUGGESTIONS**

1. The Ambala division is strategically located in between two major cities of north India-the state capital of Haryana- Chandigarh and the national capital of India-New Delhi. Both the cities are well connected to other parts of the country by Road, Rail and Airways. The New Delhi airport being an international airport provides easy connectivity between other countries of the world and the division. The geographical location of Ambala division is suitable to make it an important business and economic centre and it helps in distressing the overburdened city of New Delhi and its adjoining areas which are one of the main business hubs of the country.

2. The area under investigation has shown tremendous growth between the years 1971 and 2001. Fifty percent blocks of the division have undergone high or
very high development. 20 percent blocks have shown moderate growth while the remaining 30% blocks have little or less development.

3. The different blocks in the Ambala division have a great variation in degree of development. While Shahbad and Pundri blocks are highly connected by road network and recorded high socio-economic development. On the other hand, the blocks like Rajaund and Kalayat have poor road network connectivity and remain backward both socially and economically. It is recommended that government should allocate resources to underdeveloped blocks so that their socio-economic standards may be uplifted at least to moderate levels.

4. Similarly the road network in Jagadhry block has shown high degree development but shows least progress in terms of road length per lack persons as compared to Morni block where no significant road development has been taken place but road length per lack persons is still highest. It is recommended that the development of transport network structure and other basic facilities should be in accordance with the population growth of the area which will help in overall uniform growth of the study area.

5. Raipur Rani and Naraingarh blocks have been emerged as developed blocks in terms of road network structure and also situated near industrially developed cities like Panchkula, Ambala and Jagadhri. It is well known that good transport facilities are the backbone of industries. Moreover, the industries can be shifted in these two blocks to reduce congestion and over burden of these cities it will also be proved better from ecological point of view.

6. Kaithal is a district headquarter and large urban centre. One important national highway, two state highways, one major district road, many other roads and a railway line which joins with Delhi-Kalka line at Thanesar are passing through the city but the town is still not so developed. More industries can be planned as compare to present situation for real development of the city since the city is well connected with other states (Punjab, Rajasthan, Uttar Pradesh), national capital, state capital and other big cities.

7. In contrast to road network, the rail network has not undergone any important development in last 30 years. Only 10, out of 24 blocks in the division are
connected with rail network. The socio-economic development in Ambala division would have been at much larger scale if it was better connected with rail network as this would have provided a cheap and fast means of transferring the people and goods. The expansion of the rail network structure in Ambala division is recommended.

8. The waste land and net area sown have been decreased in 30 years. The decrease in forest land has been noticed tremendously to the levels upto 50 percent. This is a major shift considering the present grim situation of natural imbalance and environmental pollution in the country or globe. It is recommended that government ensures the prevention of deforestation and depletion of agriculture land. The wastelands can also be utilized for the development of industries, this will generate employment to the people and contribute to economic upliftment of the area.

9. The ultimate objective of the national development policy is to improve the standard of living of the rural people. To achieve this objective, the rural transport system should be operated considering the large interest of the society.