SOLAPUR DISTRICT: A STUDY IN TRANSPORTATION GEOGRAPHY

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INTRODUCTION

Geography as a social science is concerned with the analysis of the spatial dimensions of social phenomena and with the synthesis of natural as well as social variable within a regional frame. The subject matter of Geography is changed with paradigm shift from Determinism to Spatial Organization. Spatial Organization paradigm initiated after the quantitative and theoretical revolution in Geography. It is the 1960s period, when the Transportation Geography, has emerged out from the realms of Economic Geography, which is main branch of Human Geography. Geographers take interest in transportation due to two main reasons: Transport infrastructure, terminals and networks occupy an important place in space and constitute the basis of a complex spatial system, second since Geography seeks to explain spatial relationships, networks are or specific interest because they are the main support of these interactions. Simply, transport geography is a sub-discipline of geography concerned about movement of freight, people and information. It seeks to link spatial constraints and attributes with the origin, the destination, the extent, the nature and the purpose of movements (Rodrigue, et. al., 2006). As Hoyle and Knowle described, transport geography is concerned with the explanation from a spatial perspective of the socio-economic, industrial and settlement framework within which transport networks develop and transport systems operate (Hoyle and Knowles, 1998).

Transport, an important phenomenon of cultural landscape, works as a potent factor for the regional and national development. Any type of development whether economic, social or cultural is based on a good transport network (Singh, 1977). As a factor of production it’s availability for the development of an area is essential (Finch and Trewartha, 1949). It not only fulfils the needs of the people but it also stimulates human- resources for further development. Bruhnes has aptly remarked that “Communications are not only a factor in the physical transformation of the surface, they transform, also, the quantity and aptitudes of human population; they conquer space, space derives its value only from its connection with life; and the progress of communication always takes the form of a more or less conscious recrudescence whether cynical or disguised of the spirit of domination” (Bruhnes, 1920). Certainly, the cheap, efficient and fast transportation is a dominant factor of our modern industrial and scientific age (Finch and Trewartha, 1949).
Unlike natural resources transport is a man-made resource which interacts with men and various commodities of different areas. Transport, therefore, is a form of capital good, just as a piece of factory equipment, which can be used to produce a service.

In the absence of means of transport the regional development cannot get momentum and it cannot enhance the socio-economic conditions of developing countries (Singh, 1977). In other words without transportation and communicational lines most of economic activities are barred. Consequently, a broad gap in human civilization is created. It is a strong tool for the exchange of views, cultures, traditions, religions etc. In brief, transport eases the movement of man, goods and ideas and just as manufacturing creates ‘Form Utility’, so transportation creates ‘Place Utility’ (Finch and Trewartha, 1949). Transport, therefore, is a means to minimize the time and distance in rural and urban, national and international and war and peace lives. This is the first and foremost aim of our national planners to accelerate the pace of development by developing the means of transport, so that the per capital income and living standards can be raised and industrialization and urbanization may be accelerated in national interest. In short, the form and extent of transport facilities is fairly indicative, like a registering apparatus, of the human and economic development of an area (Kayastha, 1964). Like veins, transport artery, is amplificated in every part of economic body in which conducts a life of merchantile transport. Transport artery, counts the first importance in economic development of a region (Singh, 1974).

Geography of Transportation is concerned with study of Transportation, its development, location and operation within the territorial economic complexes of countries and regions and its relationship with the location of industry and agriculture, of population and cities and of natural phenomena and resources. Thus Transportation has several characteristics that make it a unique geographical phenomenon (Singh, 1964). N. P. Pandy states that, the Geography of Transportation is major part of ‘Geography of Circulation’ and provides a new and deeper insight to the meaning of Areal Differentiation (Pandy, 1990).

Transport Geography deals with various aspects of transport. In the beginning, of 1960s, transport costs were recognized a key factor in location theories and Transport Geography began to rely increasingly on quantitative methods, particularly
over network and spatial interactions analysis. However, from the 1970s globalization challenged the generality of transportation in many geographical and regional development investigations. As a result, transportation became under-represented in Economic Geography in the 1970s and 1980s even if mobility of people and freight and low transport costs were considered as important factors behind the globalization of trade and production.

Since the 1990s, Transport Geography has received renewed attention, especially, because the issues of mobility, production of distribution are interrelated in a complex geographical setting. It is now recognized that transportation is a system that considers the complex relationships between its core elements. Transport Geography must be systematic as one element of the transport system is linked with numerous others (Rodrigue, et. al., 2006). During this short (1960 to 1990) but rapid progress of Transport Geography strengthen the subject matter. This subject matter categorized as below

1. Geographical pattern of transport network
2. Study of functions and nodal points or terminals
3. Study of commodity movement, farming commodity flow and flow analysis
4. Study of people movement forming Traffic Flow and Flow Analysis
5. The entire system of hinterlands and hierarchical relationship associated with network. (Vaidy, 1998)

**CHOICE OF TOPIC AND STUDY AREA**

Transport in some form is a fundamental part of the daily rhythm of life (Hoyle, 1973). Transport leads to reshaping the economy as well as social activity of region. Transport system is just a fabric which weaves the threads not only urban but rural interaction. These permeating and sustain towns’ location, growth, rank size and morphology. Regional hierarchy is witnessed due to transport. It promotes the formation of growth pole, growth foci and growth center. Thus, the transport becomes interesting and important subject to many fields.

Transportation Geography is newly emerging branch of Economic Geography and research carried out regarding to this branch is limited not only in India but around the world. Therefore, here an attempt has been made to study in-depth about the transport network in Solapur District.
The district is situated on the strategic position from historical time and at present southern part of Maharashtra and have potential to develop itself with the help of available resources such as water, fertile soil, and mostly plain area. The development of district is not achieved at certain level as compared to other districts in Maharashtra. The main reason behind it, the availability of transport facility is less developed within region and intra-regional. Although the railway facility is available, it provides facility to only major urban or industrial centers. The record of road facility is available in region from 1960s but both railway and road facility are less developed and not associated with regional development. As stated earlier, Solapur District occupies a significant position, not only in Maharashtra but also in India. In future, it works as nodal place for the adjoining regions rather industrially developed regions with more efficiently than present. The district experienced so many up and downs in its crises period such as closing of the some textiles mills due to the lack of development in transportation facilities. The south western part of the district affected by drought hence agricultural, industrial and level of urban ratio is not homogenous and equal. For the overall development of tehsils, the transport facility should be developed. It helps in penetrate the development from highly develop region to low and minimize regional imbalance.

**RELEVANCE OF TOPIC**

Transport plays very significant role in the development of region. The transportation system of any region represents the interaction of various physical, historical, and economic factors. The transport problem of the region is to be studied in the context of its location and the requirements revolved the basic needs of transport mode.

It is strategic infrastructure that is embed in the socio economic life, individuals institution and corporation that is often invisible to the consumer, but always part of all economic and social functions. This is paradoxical, since the perceived invisibility of transportation is derived from its efficiency. If Transport is disrupted or ceases to operate, the consequences can be dramatic; the paradox gives rise to several fallacies about transportation, such as fallacies in accessibility and distance. It is possible to its central location in relation to the network; second one is the distance; which is uniform attribute of the Geography and it is time relative.
Therefore, the present topic of the study is related to the road transportation systems of Solapur District.

HYPOTHESES

Hypothesis is statements that assert something. It is facts and realities that present in region. Hypothesis is prepositions which have not verified yet. For the present study certain hypotheses are formulate.

1. Transportation leads to overall development of the region.
2. Industrialist chose their factory locations according to local resources.

OBJECTIVES OF THE PRESENT STUDY

The main purpose of research is to obtain the result by fulfilling its objectives. Every research is carried out on the basis of certain objectives. The present study entitled, “SOLAPUR DISTRICT: A STUDY IN TRANSPORTATION GEOGRAPHY” has the following objectives.

1. To examine the impact of physiography on road transportation.
2. To examine the nature and history of transportation development within study region.
3. To study the structural analysis of the transport network.
4. To measure the accessibility in the study region.
5. To find out the relationship of transport and development of study region.

METHODOLOGY

Research Methodology describes the methodological frame works used in attaining the stated objectives of the study; hence it is the soul of entire research. In this particular research, methodology focuses on the source of data, analysis of data and presentation of collected data and limitations of data.

SOURCES OF DATA AND INFORMATION

The present research work is completely based on secondary data. The secondary data has been collected from various Government Offices and reliable resources. The data has been collected from the Census Report of Solapur District, Socio-Economic Abstracts, Tehsil Headquarters, District Industrial Office and District
Planning Office. Data of Road Development Plan obtained from Executive Engineers office of Public Works Department, Solapur and www.solapur.gov.in.

DATA ANALYSIS

Collected data has been classified in two sets namely: data regarding road network and indicators development. These two data sets divided in two groups: non-analytical part and analytical part for analysis purpose. The non-analytical part consist the data regarding historical development of roads. It is shown variation between categories of roads. Data of three road development plans (1961-1981, 1981-2001 and 2001-2011) compiled and compared with the help of quantitative analysis. The analytical part of the study explained in the next paragraph.

To examine the connectivity pattern tehsil level road maps of 1981 and 2001 were converted into topological maps for its each small village or big urban centers considered as node and each type of road whether it is National Highway or Village Road treated as edges. From the wide range of connectivity measures indices, only three index were applied (chapter IV).

Regarding to accessibility, both Physical and Relative Accessibilities was counted. The Physical Accessibility measured from the National Highway and Major State Highway for the year 1981 and 2001. By using ArcGIS 10 software buffer analysis was made and counted the area of accessible and inaccessible from these major roads. Relative Accessibility is determined on the basis of urban centers. The total urban centers neither increased nor decreased from 1961 to 2001, hence the data of urban centers 2001 and 2011 are used to develop connectivity matrix. By this matrix; degree of node, total accessibility and shortest path matrix are calculated. The Degree of node is determined with the help of Direct Connectivity. The Accessibility Matrix (T) is product of matrix multiplication. Shortest Path Matrix finds out by the Shimble Index (chapter V).

To identify the relationship between transport and development, Aggregate Transportation Score (ATS) is calculated and it is average of summed values of Road Density, Alpha Index, Beta Index and Gamma Index. With the help of fourteen indicators Composite Index of Development is calculated in two steps. Finally the tehsils placed in appropriate cells according to their values of transport development and development level and examine the correlation of it (chapter VI).
1.6.3 LIMITATION OF DATA

The present study focused on development and analysis of road network of Solapur District. In the present investigation attempt has been made to study only road transport. Prior to 1960 data about road length was not available. The emphasis is given on the quantity of roads rather than quality of roads. Only three measures of Graph Theory applied for calculating connectivity pattern; alpha, beta and gamma. The basic configuration values of beta index are not found hence it is the limitation of data. The Physical accessibility by roads determine only from National Highway and Major State Highway. In 1981 and 2001, Number of total urban centers in district are found same hence, in that analysis researcher select the year 2001 and 2011 for reference to show variation in Nodal accessibility pattern. The fourteen indicators of development selected from population, infrastructure and economic sectors are used to find out development level.

The Road Development Plans were not implemented as per their scheduled therefore it was difficult to collect the information.

BENEFICIARIES OF PRESENT RESEARCH

The Research work ‘Solapur District: A Study in Transportation Geography’ will be benefited not only to further research but in number of ways detailed as below.

1. The present study will understand detailed tehsil wise and category wise data of total road length. Upon this, one can determine the future needs of roads to particular tehsil and of each category.

2. Researcher will set benefit from this study by knowing methods of assessing transport networks by graph theory.

3. As far as policy makers are concerned, they can apply these index values for formulating traffic performance within region.

4. Find out the accessible area and inaccessible area from arterial roads which can be used for promote further development of these types of roads in study area.

REVIEW OF LITERATURE

Various works regarding to Transportation Geography have been carried out both by the scholars of foreign researcher as well as Indian researcher. These studies illuminate on the different aspect of Transportation Geography.
The most important research was done in U. S. A. A few of these studies were related to the analysis of the different aspect of the transportation system. Such studies were initiated by E. L. Ullman in his article entitled, “The Rail-road pattern of the United States”. This work was followed by more exhaustive analysis of the “American Commodity Flow”. W. H. Wallance studied the, “Rail-road densities and patterns” and ‘Railroad Transport in New Zealand’. These studies further made advancement, in the field of Transport Geography. Afterwards, E. J. Taffe and et. al. made study on, ‘Transport Expansion in under-developed countries: A comparative Analysis’. This study further widened the scope of this branch of Geography. E. L. Ullman viewed that complementarily along with the lack of intervening opportunity and transferability as a fundamental factor explain the “Structure of Transport Net Works” and correlate them to the general economic. Later on, K. Kansky has made use of the graph-theoretic measure to explain in the “Structure of Transport Networks” and correlate them to the general economics. D. E. Perle presented a study of the behavior of the “Demand for Transportation” between alternative forms of Transport with reference to National and Regional economics for different commodity groups.

Another group of geographers have studied the effects of highway development. Later on W. L. Garrison and others studied the Highway cost allocation. Garrison made an estimation of the “Benefits of Rural Roads to Rural Prosperity”, While B. O. Wheeler assessed the Effect of Freeway Access upon Sub-Urban Real Prosperity Values. W. R. Seyfried under the Highway Economics studies laid emphasis in his study on the “Determination of Special Benefits resulting from Highway Location. Further, the Bureau of Public Road Studies includes two significant works,” Studies of Highway Development and Geographic Change “and” Studies of the central Business District and Urban Freeway Development”. They highlighted much of the role of Transportation in economy and the evolution of the morphological structure of cities.

In U. K. descriptive type of studies were undertaken, with the help of maps and tables they put forward a great deal of information about the movements of goods and people and reemphasize the mutual interdependence of a specialized economy circulation and traffic and Transport system. A. C. O. Dell interpreted the relationship between rail way routes and physical features in his work, “Railway and Geography.”
K. R. Sealy has made a study of the factors of airport location in his work, “The Geography of Air Transport.” F. H. W. Greens’ extensive study was significant of the bus-routes, bus traffic and urban hinterlands.

W. Linden examined the role of railroads in the economics of Germany. R. Hoffman, in his empirical study, evaluated the difference between the pre-war and post-war circulation pattern in Germany and Role of Autobahnen in space economy where Esenwein Rothe examined the role of branch lines in the secondary economic regions. Further, four essays in RAUM UND VERKEHR II is comprised of five essays relating somewhat divergent aspects of economy-circulation-Transportation relationship. B. L. Berry has presented the gist of all these studies in his review article entitled, “Recent studies concerning the role of transportation in the space economy”. In short, it may be said that in Germany the transportation studies were more concerned with the role of transportation in the economy with a little bent towards formulation an articulated transport network (Singh Jagdish, 1964).

Significant contribution in formulating a general principle of transportation has been put forward by Sven Godlund. He also studied a sequence of growth process for bus route in his work entitled “Bus services in Sweden”. He has also formulated useful methods for the analysis and planning of bus transportation. He also evaluated the relationship between bus traffic and urban hinterlands and showed the relationship of the growth and decline of urban centers to strategic location of the bus traffic network.

The research in Transport Geography in the USSR is based on planning oriented. Valuable methods for analyzing the transport pattern the traffic flow features and future transport requirements have been developed to reorient the transport network for the proportionality between the different sectors of economy. A few recent works and “methods of forecasting freight flows in planning a transport net” by Kazansky N. N. and Lewis, W. V. Basic Research Problems in the Geography of Transportation of capitalist and under-developed countries and others found in Soviet Geography: Review and Transportation depicts the intensity and magnitude of the research work carried on there (Singh Jagdish, 1964).

Remarkable work on volume of Bus-traffic flows and its related problems has been studied by R. L. Singh. Jagdish Singh has presented an exhaustive work to study the systematic analysis of a transformational system and a regional-
Chotanagpur region of Bihar State- transformational features in India to serve a background for planning the transport work. **Santosh Kumar** was done work on bypass roads in Magadh Plain, Bihar and Suresh Prasad has presented a study of the “Communication and Transport in Gaya District” (Jagdambika Prasad, 1992).

**H. P. White and M. L. Senior** (1983) firstly examined the basic factors in Transport development and then gave detailed case studies of spatial inequalities of Transport pattern; finally they concentrated on quantitative aspect of Transportation. **Peter Haggett, et. al.,** (1997) shown how the order of settlement may be discovered through locational method and explain the ways in which information may be gathered, measured, classified and described so as test, modify, reject or accept hypothesis or model.

**Shukla Bhaduri** (1992) worked on the Transport Geography of West Bengal with special emphasis on roads. The study covered mainly two aspects a) the growth of roads, b) road transportation and growth potentials roads based on accessibility and transportation efficiency. **Naresh Kumar** (1991) dealt with almost all dimension of Transport Geography and profile of development in an advanced region of India. It studied the rate of Meerat city as a nodal centre in regional and in national perspective by analyzed the spatial and temporal trends of commodity flows and human interaction. **N.P. Pandey** (1990) provided a substantial contribution to the new dimensions of geographical knowledge and environmental planning. His work traced the evolution of Transport system of western Madhya Pradesh. **P.S. Goutam** (1992) gave great explanation of Transportation system of Chambal division of Madhya Pradesh. Chambal Division, which is physically major portion of the Chambal valley widely known for its deep ravines and ruthless robbers. **Subbah Mehtani and Amarjit Sinha** (2010) provided various illustrations and diagrams in their book and the discussion of methodologies; techniques used in practical application of the field serve to gave a sufficient overview of process of working within the ambit Transport Geography. **Ratan Kumar Singh’s** (1988) studied to evaluate the crucial role played by road transport as a basic infrastructure in economic development.

**STRUCTURE OF THESIS**

The whole study is well organized and orderly set into seven chapters.
Chapter I deals with Introduction which consists; Choice of topic, Relevance of topic, Objectives of the study, Data collection, Methodology, Research matrix of research work, Beneficiaries of present research and Review of literature.

Chapter II explains about Profile of the Region which comprises Spatial relationship, Geology, Relief, Drainage Pattern, Soil, Irrigation, Climate, Population, Settlement Pattern, Industrial development and Marketing System which give detailed picture of Physiography and Socio-Economic condition of Solapur District. These features directly or indirectly affect on road development.

Chapter III Solapur District: Development of Roads, it states the historical development of roads in study region, especially from independence period. This study presents the systematic and analytical description of road development consist, total road length, tehsil wise and category wise road length, and satisfactory level of each road in development plan.

Chapter IV Spatial Structure of Transportation Network, it examines the structure of Transport network. In the first half of the chapter, the description of Transport network indicators i.e. Alpha, Beta and Gamma index are presented. For this support road density technique is implied. At the end of the chapter the ideal categorization of two indices were given.

Chapter V Accessibility in Solapur District describes the nature of accessibility. The Physical Accessibility has been considered as the significant element. It is determined with the help of distance from arterial roads and it is shown by maps. In the second section, Nodal Accessibility of urban centers analyzed on the basis of their population size.

Chapter VI Role of Transportation in Regional Development in Solapur District describes the correlation of transport development and regional development of Solapur District. Calculated data of Aggregate Transportation Score (ATS) and Composite Index of Development (CID) are given in this chapter.

Chapter VII Summary and Conclusion, this chapter summed up the finding of the work. Trace out the major conclusions and stated suggestion on them. In the support of that, at the end directions for further research were given.
SUMMARY AND CONCLUSIONS
The following conclusions are drawn from the second to sixth chapters.

1. With the reorganization of the states in 1956, the Solapur district was included in the larger bilingual state of Bombay. Since 1st May 1960, it forms a part of Maharashtra State. The district has eleven tehsils including thirteen towns. This change in territorial boundaries largely influence on the development of roads.

2. The hilly region occupies 3.34 percent of total district area. Ramling hill, which lies on north-west boarder of Barshi tehsil affect locally on road connectivity in that area. In south –west part of Malshiras tehsil, Mahadev range affect on local connectivity.

3. Due to this, Malshiras and Barshi tehsils are falls in low road development in 1981. Karmala and Madha tehsil have hills, poor in terms of agriculture hence human settlement is meager. Due to this thin road network, Madha and Karmala categorized in low road development category. Thus, it is indirectly affected on roads development in that area.

4. Plateau covers 80.00 percent and low land plain region occupies rest 16.66 percent area which promotes the development of roads.

5. The district lies entirely in the Bhima, Sina and Man basins. These rivers not form major obstacles. Some times in rainy season small streams made considerable disruption in village connectivity.

6. Initially Nagpur Plan ensues twenty years plans establish the landmark in the road development planning.


8. Under the influence of energy crises, environmental degradation, technological change and change in techniques formulate Lucknow Plan (1981-2001). This plan takes bold step of making Expressway on the basis of other counties. But up to end of this plan, in study area there were neither found expressway nor achieve the physical target of road length which is amendments time to time (1987, 1993 and 1997). So that next twenty year Road Development Plan prepared in 2012.
10. In the **Vision 2021** Plan for the Solapur District first time attention is given towards *Palkhi Marg* and start it to convert in State Highway and Major District Road. The route of Saint Dyneshwar Palkhi is Alandi to Pandharpur which passes through Pune, Hadapsar, Sasvad, Jejuri, Nira, Lonand and Dharmapuri. It has total length 211 Km but within district 80 Km. The route of Saint Tukaram Palkhi is Dhehu to Pandharpur which going through Pune, Hadapsar, Yavat, Patas, Vasud, Baramti, Indapur, Akluj, Lonand Fata, and Tondale Bondale. It has total length 214 Km but within district 32 Km.

11. Soviet scholars have developed a topology that takes into account the network density and degree of connectivity and the proportion of transportation and level of development.

12. For the structural condition of developing region like Solapur District, above indicators will be better suited. That’s why the above choice of technique of analysis the transportation network of study region is correct and the obtained results are empirically verified as below.

13. In 1981. Mangalvedha (0.80) witnessed high road density followed by North Solapur (0.70), Akkalkot (0.69) Madha (0.66), Karmala (0.63), Malshiras (0.63), Pandharpur (0.62), South Solapur (0.62) and Sangola (0.60) tehsils which falls in moderate density spread over major study region. Relatively small patch of low density area located on Barshi (0.59) and Mohol tehsil (0.59).

14. In 2001, Malshiras (1.01), Mangalvedha (0.98) Sangola (0.99), Madha (0.94), Mohol (0.91), Akkalkot (0.88), Barshi (0.95), South Solapur (0.85), North Solapur (0.82) and Pandharpur (0.81) tehsils score highest road density and formed large area over Solapur district and only Karmala tehsil (0.74) registered moderate road density.

15. The calculated values of alpha, beta and gamma index for 1981 shows variation, as per ranks Karmala stood first and Madha was ranking last.

16. In 2001, Malshiras tehsil ranks first while Karmala tehsil was having lowest rank because of fewer connections of roads as compared to nodes.

17. Mean value of alpha index shows 23.53 percent growth in 2001 as compare to data of 1981. (0.34).
18. Mean value of beta index shows 9.52 percent growth shows in 2001 as compare to data of 1981. (1.68)
19. Mean value of gamma index shows 7.02 percent in 2001 as compare to data of 1981. (0.57)
21. In 2001, more than eight tahsils registered in delta pattern.
22. This study revealed that, overall growth of transportation network is registered in 2001 as compare to 1981.
23. In 1981, Barshi (0.00), Malshiras (0.00), Akkalkot (0.33), Pandharpur (0.57) tehsils registered less than one percent area in the 0-5 Km buffer zone from arterial road.
24. Highest percent of area about 59.27 percent found in North Solapur tehsil. Followed by Mohol (57.11), Sangola (42.82), South Solapur (39.83), Mangalvedha (38.08) and Madha (25.94) orderly comes.
25. The new roads initiated from Pandharpur to rest nodes change the pattern of physical accessibility in 2001. Another remarkable change found due to Mangalvedha to Jath road degree and categorized in State Highway hence not present in accessibility figure 2001.
26. Barshi (0.00) and Akkalkot (0.33) remain same in term of area lying under the 0.5 Km. tier.
27. Highest area is 58.89 found in North Solapur. Mohol (51.22), Mangalvedha (50.56), Pandharpur (44.60), South Solapur (39.83), Malshiras (36.32), Karmala (33.64), Sangola (30.65) and Madha (30.70) tehsils denotes the orderly number as per their registered areas.
28. In 2001 in case of direct connectivity Pandharpur and Solapur scored highest direct connection (5) followed by Kurduvadi (4), Karmala, Mangalvedha and Barshi (3) Sangola, Akkalkot and Mandargi (2) and Dudhani (1) have respective direct connections.
29. In terms of indirect connectivity these ten nodes arrange as per their scores then they falls as Pandharpur, Solapur, Kurduvadi, Karmala, Barshi, Mangalvedha, Songola, Akkalkot, Maindargi and Dudhani.
30. As per the shortest path matrix results Solapur ranked first and Dudhani ranked least.

31. In the 2011, direct connectivity scores of the centers are shown in bracket. Pandharpur (6) Akluj (5) Kurduvadi (5), and Solapur (5) scored highest direct connection. Followed by Karmala (4), Mangaledha (3), Barshi (3), Sangola (3), Akkalkot (2), Mandargi (2) and Dudhani (1) centers have respective direct connections.

32. In terms of indirect connectivity nodes arrange as per their scores then they stood as Pandharpur, Kurduvadi, Akluj, Karmala, Solapur, Barshi, Sangola, Mangalvedha, Akkalkot, Natepute, Maindargi and Dudhani.

33. As per the shortest path matrix results Pandharpur stood first and Dudhani stood at least.

34. The general stage of development suggested by Rastows observed (agriculture society to industrial society) in district.

35. The transport development is not associated with Karmala and Mohol tehsil in the 1981.

36. Only Mangalvedha tehsil is perfectly development according to transport development.

37. The total scenario of transport and development has change in 2001.

38. The Karmala and Mangalvedha tehsils revealed the perfectly low transport development and low regional development.

39. On the other hand, North Solapur and Malshiras emerge with high transport development and high regional development.

40. The study highlighted that, the transport and development of district is yet in developing stage and tehsil wise data also shows wide regional variations.

The analysis confirmed that there is a strong coherence between the transport and development rather the spatial distribution of socio economic phenomena. It can be stated that this relation is not linear in Solapur District. The influence of spatial interaction characteristics can over write in the formation of development positions it can be both negative and positive.
SUGGESTIONS
Some possible suggestions are given below for improvement of road development in the region under study.
1. The proposals for the transportation planning suggested above during twenty year plans, if properly implemented, will not only solve the problems of transport but will also enhance the efficiency of the network, the mobility of the area. But unfortunately, it has not happened in Solapur District from beginning hence it is suggested that to implement the present plan efficiently and promote the transport development.
2. The role of Public Works Department, Zilla Parishad and Nagarparishad should have constructive attitude. They are proposing and constructing new roads in district.
3. Not only Solapur City but the other centers are not performing according to their competency (Solapur city has already crossed ten lakh populations). Hence have to create new growth pole centers to promote regional economy.
4. These centers are provided with good road transport and communication facility.
5. Akkalkot, Pandharpur and Tuljapur (Osmanabad District) and fall on the religious circuit. Here still more transport ease to desirable keeping in view of the lakhs of tourist arrivals. Presently four lane roads sanctioned but it is not in progress it should be complete as early as possible.
6. Mohol tehsil is growing cash crops in recent period hence it is promoting it in developed region. Hence in coming period it requires the proper road development.
7. Barshi tehsil is transformed due to change in agriculture sector therefore it requires new roads.
8. Karmala tehsil is now inclined towards to take cash crops due to increase in irrigation facility. It is necessary to develop roads length also.
9. Akkalkot tehsil also need to sustain its agriculture sector to improve development. Therefore the tehsil require quality roads to develop.

FURTHER DIRECTIONS FOR RESEARCH
Finding of this research work is used as stepping stone to another research which is not attempted in present work. The development of roads is pinpoint issue in
developing countries like India. In this regard the following paragraphs provide some topics for further research. This will enhance the understanding of transport geography of study region.

1. Passenger Flow In and Around: A Case Study of Solapur District.
2. Urban Transport and Regional Development in Solapur District.
3. Rural Transport and Regional Development in Solapur District.
6. Travel Behavior Pattern of Women in Solapur District.
8. Transport And Tourism Promotions A Case Studies In Solapur District.

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