IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

ROAD TRANSPORT NETWORK ANALYSIS OF HAVERI DISTRICT

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ABSTRACT

Transportation means movement of people and goods from one place to another. In the present day economy the movement has gained so much of importance that without the media of movement and movement facilities the life will almost come to a standstill, which many of us have experienced quite often at the time of power and fuel shortages due to transport bottlenecks. The development of the economic system is a long term and a continuous process and is a result of Geo - historic, socio – cultural and political factor. This fact is true for all the economic activities including transportation which forms one of the basic economic activities. Because through this process men and materials move from one place to another place, thus form spatial linkages between them. Therefore there is a need of hour to make an attempt to study the pattern of road transportation, types of roads and its network as exists today.

KEY WORDS: 1) Road network analysis, 2) Communication Network, 3) Transport Network,

4) Settlement Pattern, 5) Efficiency of transport network, 6) spatial linkages,

INTRODUCTION

The road network analysis is one of the important concepts in the transportation Geography. The location and form of the communication network basically reflects and effect the location and movement of people, goods and services within and between the regions. As per the settlement pattern of Haveri district is concerned, the pattern of settlement uniformly distributed and this has been calculated through the nearest neighbor method (Fig. No.1). Transport network is an integrated structure that link center of nodes, such as towns or cities and each link in the network not only connects but also connections between many other pairs

of nodes. The attempt has been made in the present study to analyze the road transport network therefore the Detour Index has been used to evaluate the efficiency of transport network.

Objectives

The main objectives of the present study are as fallows.

1) To study the spatial patterns of roads in Haveri district.

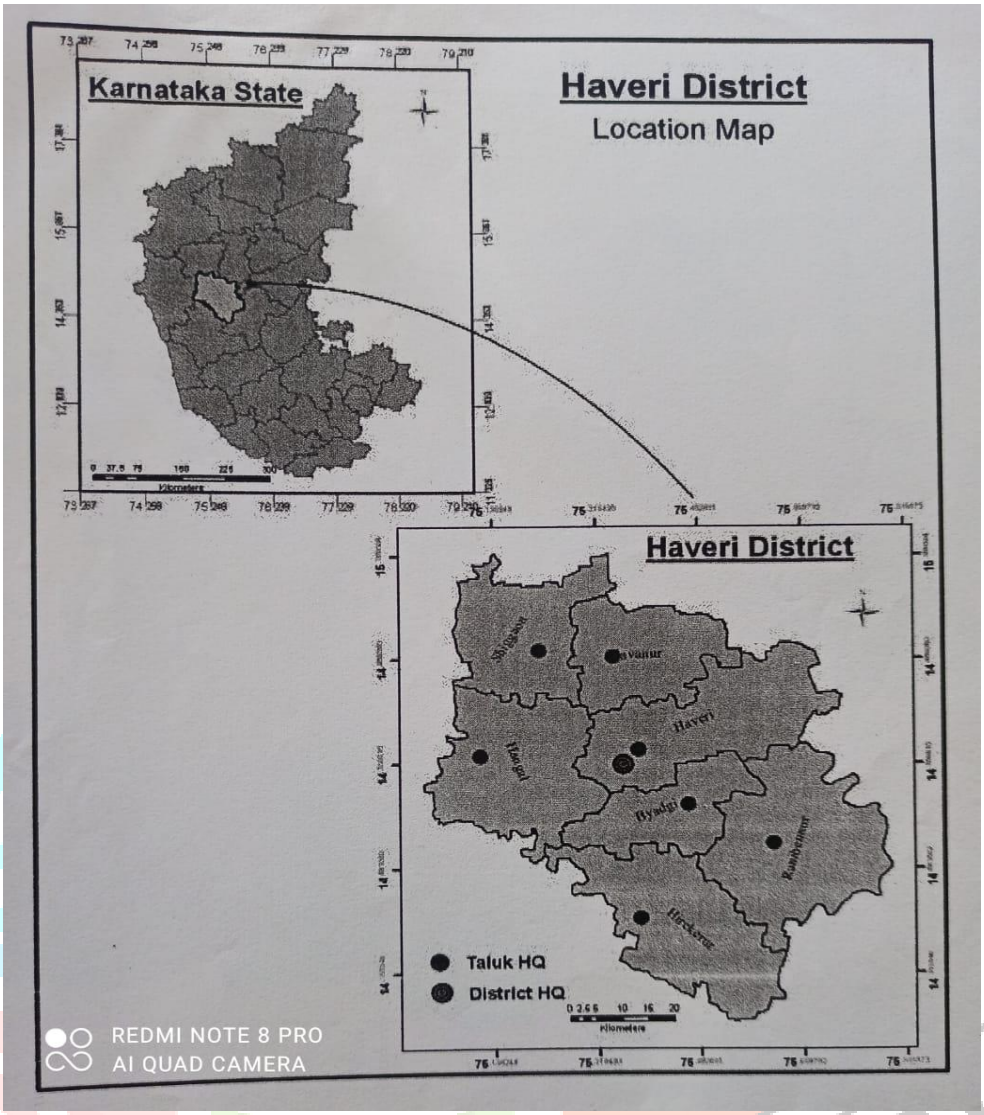
2) To plan for the development of the transport network in the study region.

Data Base

In the present study the information is collected from primary and secondary sources so with regards to this the secondary data has been collected from various offices of Haveri district. Data on national highway from the sub-division of Dharwad and state highway, major district roads and minor district roads from the executive engineer, public works department Haveri and the information about road transportation is collected from district statistical office Haveri.

Methodology

The quantitative techniques have been employed in the present study to arrive at meaningful results. The techniques are developed by geographers and other experts have been used with suitable modifications to suite the nature of the study region. The pattern of road network development is largely influenced by the physical and cultural makeup of the region. It is very essential to understand the salient geographical features of the region. A physical aspect gives the real picture of the region. The human activities prevailing on the geographical space are reflecting the prosperity of the region. The resources and their utilization are the indicators of the economic development of the region. To understand the existing physical characteristics of the region is the base and reflect for further planning. Therefore an attempt has been made in this article to deal briefly with settlement characteristics. These are considered as the basic factors and give the real picture of the district for planning and development of the study area.



DISTRBUTION OF SETLLEMENTS

The analysis of rural population and rural settlements is the most important aspect of the present study and changes have been observed for the last two decades. The rural settlement especially the backward settlements and continued with typical socio- economic traits. After the formation of new district, the landscape of Haveri district has been changing rapidly with an initiative to provide infrastructural facilities.

The distribution pattern of settlements are significantly influenced by their size and spacing. Generally, small settlements or villages are located at smaller distance, and big centers have relatively longer distance apart. Areas which are densely populated due to fertile soil, plain land and availability of various resources like irrigation, transport and villages are much in number lying at smaller distance from each other. On the contrary, in uneven and unproductive or less productive areas, density of population is very low and resultant number of villages is few denoting low village density. The village size is one of the main determinants of the density and distributional pattern of rural settlements. As a result, the diverse physical and cultural environment, uneven distribution pattern of settlements is found with varying shapes and size in different parts of the district. To study the dispersion of settlements a quantitative approach has been applied considering different indices, size, density, spacing and dispersion of rural settlements.

DISTRIBUTION OF RURAL SETTLEMENTS:

According to the 2011 census, there are 696 inhabited villages in the district with a population of 1242176 persons. The rural settlements of the study area have been categorized according to population size in seven groups from less than 200 persons to more than 10,000 persons (table No-1). The first category hardly has 2.01 percent of the settlement with 0.17 percentage of rural population. But these small size villages account for the only 0.17 percent of the population of the study area. Considering the villages up to 1000 population, it constitutes about 33 percent of the rural settlements but account for only 12 percent of rural population of the district. The next higher order of settlement categories (IV and V) Constituted with 60.77 percent of the villages and 67.76 percent of population have been found in class size of less than 5000 population.

Table No: 1 - Size wise Distribution of Rural Settlements in Haveri District – 2011

Population Size	Byadagi	Hanagal	Haveri	Hirekerur	Ranebennur	Savanur	Shiggaon	District
<199	0	3	0	0	5	2	4	14
200- 499	7	19	6	19	7	3	15	76
500-999	12	45	23	27	17	9	17	150
1000-1999	25	52	25	49	41	29	35	256
2000-4999	17	30	27	26	31	18	18	167
5000-9999	3	4	8	3	5	4	2	29
>10000	0	1	1	2	0	0	0	4
Total	**64**	**154**	**90**	**126**	**106**	**65**	**91**	**696**

The remaining 4.75 percent villages with the population of more than 5000 persons account for the 20.44 percent of population and 95 percent of villages of the size of less than 5000 persons have 79 percent of the total population of the district. On the other hand only 5 percent of the villages have been observed in the large size of settlements i. e. more than 5000 persons of population.

Table No: 2 - Size wise Distribution of Rural Population in Haveri District- 2011

Size Class	Byadagi	Hanagal	Haveri	Hirekerur	Ranebennur	Savanur	Shiggaon	District
<199	0	426	0	0	759	317	672	2174
200-499	2764	6895	2593	6668	2797	1084	5905	28706
500-999	9790	34689	18764	20941	12627	6584	12366	115761
1000-1999	33492	74230	35537	70970	59973	41879	49179	365260
2000-4999	45576	81097	79004	69620	101764	47555	51732	476348
5000-9999	19388	22669	62268	19652	37634	23535	17320	202466
>10000	0	12294	15094	24073	0	0	0	51461
Total	111010	232300	213260	211924	215554	120954	137174	1242176

Distribution is also illustrated by the fact that nearly 50 percent of district rural population concentrated in only 17 percent of settlements. This shown that there is a significant amount of inequality in the distribution of the rural population of Haveri district in relation to rural settlements.

SIZE AND SPACING OF RURAL SETTLEMENTS:

The spacing of rural settlements is largely governed by their size. Large rural settlements would be widely spaced, which smaller settlements would be closely spaced. These spatial patterns are constantly changing in time and space which resulted in an increase in the size of settlements and reduction in their spacing. The attempts have been made by Mukherjee (1970) to measure the spacing of rural settlements in Rajastan and Ganga – Yamuna Doab. Mukherjee assumes that the average area of village will be a circle 22/7xr2. So the transformation of average village area into circle, results in the theoretical distance between two villages. According to him area of the village will be 22/7xr2

SPACING OF RURAL SETTLEMENTS

The spacing within taluka or region has been analyzed on the basis of taluka wise data for area under number of inhabited villages. Using the formula which is mentioned above, the region has an average spacing (r) of rural settlement of 2.87 kilometers among 696 inhabited villages. The taluka wise results were categorized into three groups in depending upon average spacing. Spacing of settlements is very high in Haveri taluka (3.31 kms) followed by Savanur(3.23 kms) and Ranebennur (3.20 kms), while the central and western parts have moderate high spacing of settlements namely Byadagi (2.94 kms), Hirekerur (2.84 kms), Shiggaon (2.81 kms) and Hanagal (2.12 kms) talukas in the district. There are three talukas have been observed the high spacing of settlements in the eastern part of the district, while only one Taluka has been come under the moderate spacing of rural settlement in the central part of the district.

DISTRBUTION OF MEAN SIZE OF RURAL SETTLEMENTS:

It will be interesting to study the relationship between average spacing and average size of the settlement, to get an idea to extent of size to govern the space. In the study area, relief determines not only location but also size of settlements other factors also influence the size of settlements like drainage, transport routes, location of urban centers in the district. The mean size of settlements has been categorized into three major groups. The very high mean size has been found in the talukas of Haveri (2369 persons) and Ranebennur (2033 persons). Thus the talukas are surrounded by areas characterized by medium and low mean size of settlements. It has been observed that urban centers have much influence on the size of villages. Generally, villages which are located in the vicinity of urban centers are large in size in compare to others. The medium size settlements whereas the average size of settlements with 1861 persons in the rain shadow area of the district, most of the talukas in the district fall in the low average size of settlement. There are four talukas namely Byadagi (1735 person), Hirekerur (1682 persons), Hanagal (1508 persons) and Shiggaon (1507 persons) come under mean size of settlement (for details table No 2).

The analysis indicates that the size of villages is largely determined by the topographic factors, social structure of the society and the productivity of land. Undulating and dissected forested areas have generally small size of villages. There are largely inhabited by the Lamani and Backward people. The area with resources are available and accessible to open plain topography have high and medium size villages. The north and

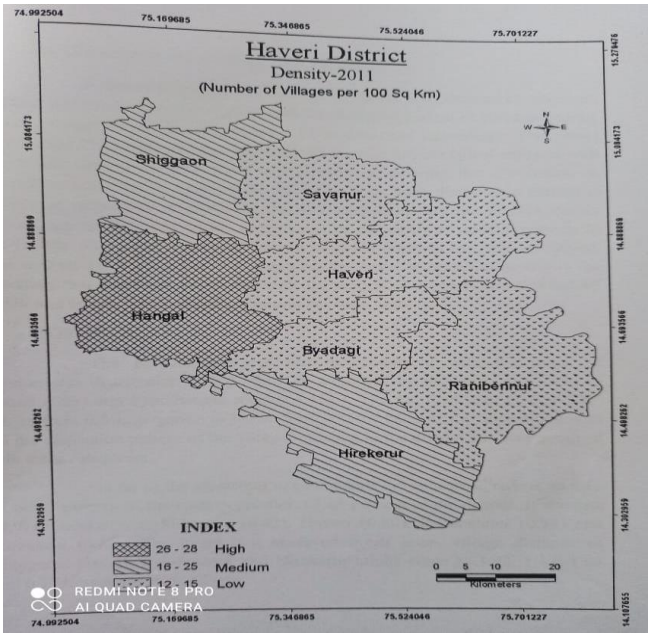
western part of the district have undulating topography are inaccessible due to the absence of railway and to some extent roads.

Table No: 3 - Size, Spacing and Density of Rural Settlement in Haveri District – 2011

Name of Taluka	Total Village	Total Area of Rural Settlements	Spacing (in kms)	Average Size of Settlements	No of Villages/100 sq kms(density)
Byadagi	64	433.14	2.94	1735	15
Hanagal	154	543.15	2.12	1508	28
Haveri	90	778.42	3.31	2369	13
Hirekerur	126	795.79	2.84	1682	16
Ranebennur	106	854.05	3.20	2033	13
Savanur	65	533.54	3.23	1861	12
Shiggaon	91	565.80	2.81	1507	16
District	696	4503.89	2.87	1785	15

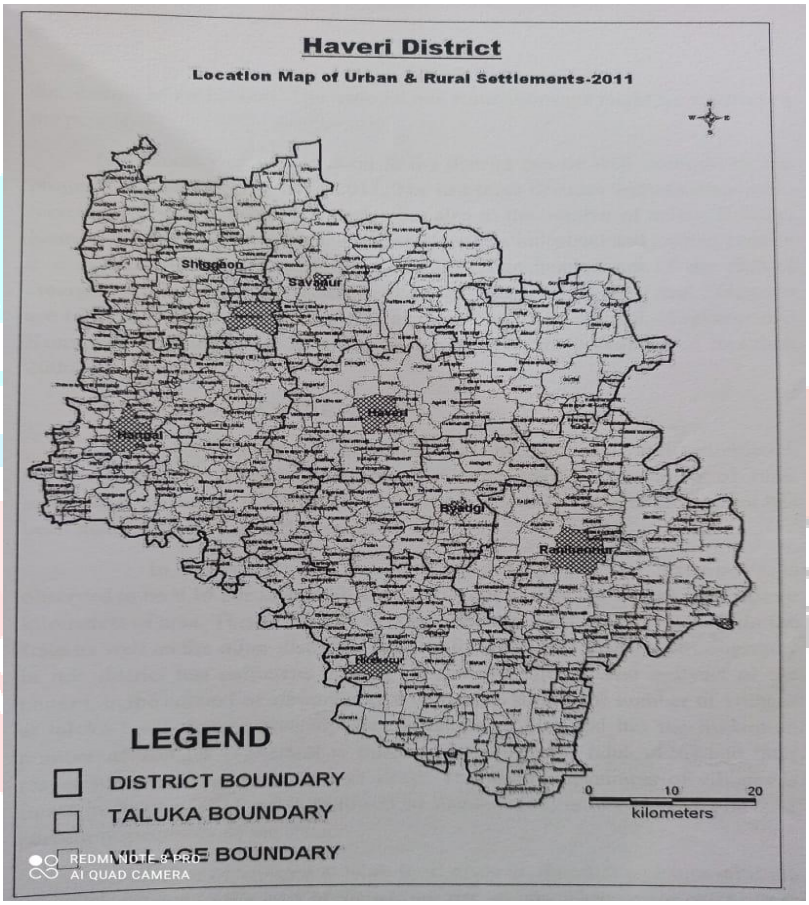
DENSITY OF RURAL SETTLEMENTS:

The density of villages varies from Savanur (12 villages) to Hirekerur (28 villages) per 100 square kilometers. It has been observed that in eastern part of the district, density of settlements is low and the areas lying towards the western talukas of the study area experience high density of villages. This is because of the fact that areas of higher village density have relatively smaller size of settlements (below 500 persons), the area with lower village density have medium size villages (500-2000 persons). The rising of small village has been possible largely because of fertile land of Byadagi (15 villages), Hanagal (28 villages), Hirekerur (16 villages) and Shiggaon (16 villages) talukas. The physical factors are not so strong, though important, influences on the pattern of settlement distribution. Physical factors with combination set of cultural factors like irrigational and agricultural practice, land tenure and distribution of holding and more practically cultural contacts in the district.



DESPERSION OF RURAL SETTLEMENTS:

Dispersion analysis of several attributes is influenced by physical, cultural environment and evolution with the changing pattern of socio-economic forces working with the development of science and technology. The actual distribution of settlements can be predicted through any statistical analysis with every unit having its own trend and identity considering the distribution in general as random. To measure the deviation from such distribution pattern is termed as dispersion analysis. In fact the settlements are not always evenly spaced, nor on the other hand, are they spaced in strictly as random pattern. In the present study, the concept of nearest neighbor analysis has been employed. The nearest neighbor value (Rn), applying the index of randomness shows the situation that has been computed with the statistical expression advanced by Clark and Evans. The following formula has been employed.



The Rn statistics can also be compared with the index of randomness distribution (Di) which is measured by the correlative ratio of actual (Obs) and hypothetical spacing (Hd). The ratio between Obs and Hd varies from 0.6 aggregation to 1.0 uniform. On the basis of Rn value along with Di the dispersion pattern of the villages existing in the district has been grouped into three categories.

As far as the clustering of settlements are concerned covers an area of 66.47 percent of the rural population 62.63 percent of the district. It consists of four talukas viz, Shiggaon (0.82), Haveri (0.80), Ranebennur (0.74) and Hirekerur (0.61). The index and observed mean inter- village distance of Shiggaon, Haveri, Ranebennur and Hirekerur talukas come to 1.02, 1.17, 1.05 and 0.77 kilometers respectively.

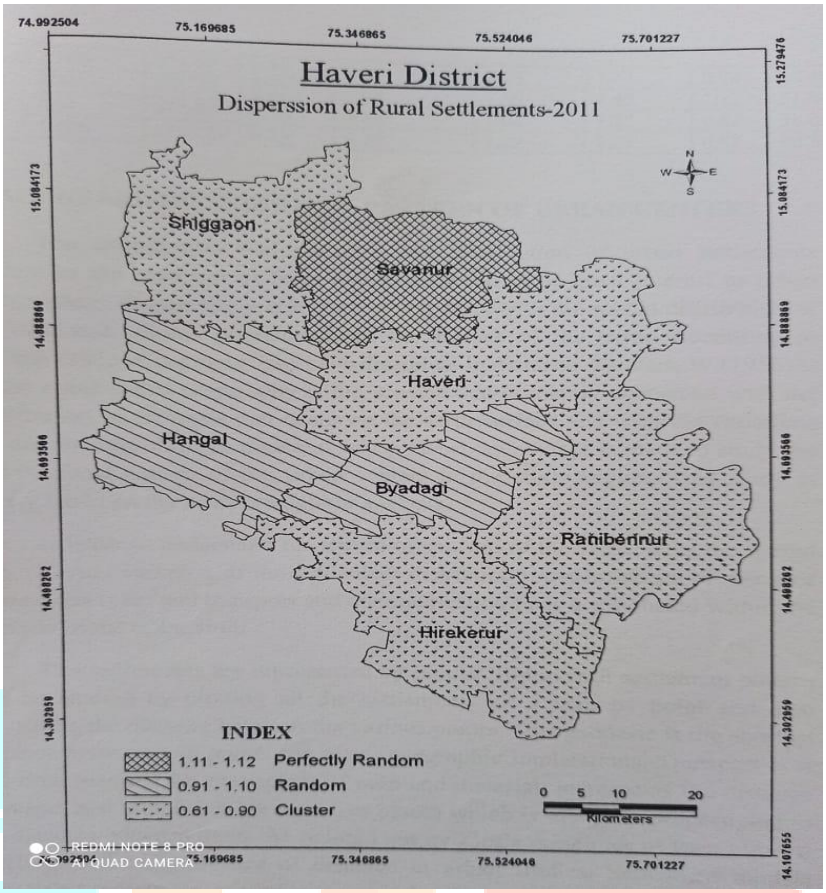


Table No: 4 - Dispersion of Rural Settlements in Haveri District – 2011

Name of Taluka	Total Village	Total Area	Density of Village	Hypothetical Spacing in kms (Hd)	Observed Distance (Do)	Expected Distance (De)	Rn Value	Nature of Dispersion (Di) %
Byadagi	64	433.14	0.14	2.81	1.23	1.30	0.95	43.85
Hanagal	154	543.15	0.28	2.02	0.98	0.94	1.04	48.78
Haveri	90	778.42	0.11	3.17	1.18	1.47	0.81	37.14
Hirekerur	126	795.79	0.15	2.71	0.77	1.26	0.61	28.38
Ranebennur	106	854.05	0.12	3.05	1.05	1.42	0.74	34.40
Savanur	65	533.54	0.12	3.08	1.59	1.43	1.12	51.64
Shiggaon	91	656.80	0.16	2.68	1.02	1.25	0.82	38.01
District	696	4503.89	0.15	2.74	1.12	1.27	0.88	40.75

SPACING AND DISTRIBUTION PATTERN OF URBAN CENTERS

The quantitative analysis of a real distribution of urban settlements discern to the presence of form and pattern and is of great interest to urban Geographers. Geography is a science which deals with the spatial distribution of physical and cultural phenomena on the surface of the earth. According to Waston (1955) Geography itself is a discipline in distance. Sanders, W (1956) is of the opinion that Geography is the science that is mainly concerned with the distribution of elements that occur on the earth surface and with the variations the distributions through time and space. Hence an attempt is made to study the distributional pattern of the urban centers in the study region. This study is purely based on the nearest neighbor analysis. In

order to understand the nature of spacing of the settlements the spatial and temporal variation of the settlement distribution, the influence of resource inequalities relief and transport and communication lines are included within the purview of the discussion.

The settlements are represented by points. The overall settlement pattern can be studied by plotting all the settlements on a map by point and also measuring the distance between the various points. This geodesic is the shortest distance between two points has many geographic implications. Transport cost and time required for movement of men and material, increase as the distance increases and interaction between two places which is inversely proportional to the distance between them. As pointed out by Zip's principles of least effort it testifies to the significance of distance in urban studies. Settlement models reveal that movement minimization greatly affects the geometry of settlement patterns. Spacing from this point of view is an important aspect of distribution. Hence by applying the nearest neighbor technique the spacing of urban centers can be studied.

NEAREST NEIGHBOUR ANALYSIS

The technique tries to describe the main distributional characteristics of settlement. This technique is used because of the inaccuracy and subjective of description based on visual impressions. This led to find out some new way of analysis such as pattern of relative location. Urban geographers from all over the world tested various technique to make descriptions of relative location more accurate. One such is nearest neighbor analysis.

The nearest neighbor technique was originally developed by the plant ecologists Clark and Evans (1954) subsequently, Dacey (1962) King (1962) Tomas (1962) and Browning H L and Gibbs J P (1961) in their seminal studies on spacing of settlements had fruitfully employed the technique. Hagett (191965), Chorley and Hagett (1968), Cole and King (1968) had reviewed and examined the efficacy of the technique.

Clark and Evans (1954) in their attempt to measure departure of an empirical distribution from the hypothetical random distribution developed the nearest neighbor statistics (Rn) which is a ratio between the mean nearest neighbor distance (Do) of an observed distribution and the mean nearest neighbor distance (De) that is expected theoretically if the distributed elements are randomly distributed. On the basis of this statistic they designed a scale called ' Rn- scale' with reference to three bench mark scores 0, 1 and 2.15 to indicate cluster pattern, random distribution and uniform distribution respectively.

In this study the following formula is selected to analyze the study region.

$$Rn = \frac{Do}{De} \times 100$$

Where,

Rn = nearest neighbor statistic

Do = the mean observed distance

De = the mean expected distance

Expected distance can be calculated by the formula which is given below.

$$De = 0.5 \sqrt{\frac{A}{N}}$$

Where,

De = expected distance

A = the area of the unit

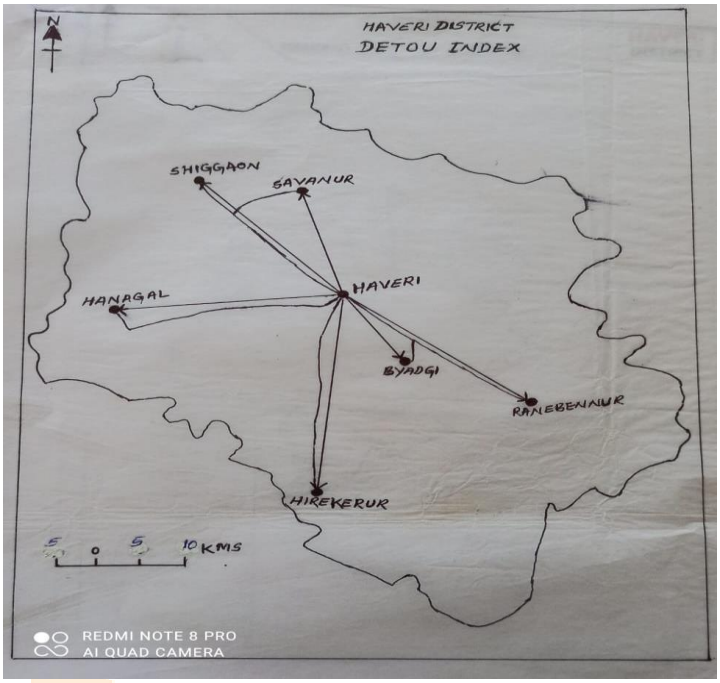
N = the number of urban centers

The attempt has been made in this study to analyze the network and to evaluate the efficiency of transport network by the Detour index. The efficiency of transportation network can be measure by comparing the direct distance between pairs of nodes and the shortest actual distance between them. In general few nodes have connected by a single straight line a numeric Detour index is obtained by expressing the shortest distance between a given pair of nodes on a network as a ratio of the direct distance between the same nodes and the two distances are measured in the same unit.

Table No: 5 - DETOUR INDEX

Sl No	Name of the Taluka	Distance in Kilometers		Rn (index) Value
		De	Do	
1	Haveri - Byadagi	18	14	77.77
2	Haveri – Hanagal	32	27.5	85.93
3	Haveri - Hirekerur	45	32.5	72.22
4	Haveri – Ranebennur	29	28.5	98.27
5	Haveri – Savanur	32.5	18.5	56.92
6	Haveri - Shiggaon	29	26.5	91.37

As per as the Detour index values are concerned (Table No. 5) it has categorized into three categories that is high efficiency moderate efficiency and low efficiency of transport network. Accordingly the analysis has made. The Detour Index of Savanur Taluka is having low efficiency, Byadagi and Hirekerur taluka have moderate efficiency and Hanagal, Shiggaon and Ranebennur talukas are having high efficiency.



DISTRIBUTION OF URBAN CENTERS:

According to 2011 census hardly nine urban settlements have been emerged in Haveri district. Ranebennur urban center has registered highest population more than a lakh and contributes 88.87 percent of urban population of the district remaining of the eight urban centers fall in the population range of 10,000 to 100000. In the district of Haveri five talukas have each urban center due to the taluka head- quarters namely Byadagi, Hanagal, Haveri, Hirekerur and Savanur. On the other hand Ranebennur and Shiggaon talukas are the most urbanized talukas. The taluka of Ranebennur has two towns out of which Ranebennur has relatively large size of urban center, Kodiyal – Hospet and Ranebennur have grown because of industrial activities. The taluka of Shiggaon has two towns out of which Shiggaon and Bankapur have the third category of urban centers in the district. These talukas are situated in the southern eastern and north eastern part of the district. The table – depicts that greater numbers of towns are extremely small in size discharging services of lower order. Most of the towns have emerged either as taluka head- quarter or market centers or as service centers. However, the present trend of urban growth in the district is that a large number of towns of smaller size are emerged primarily, either due to development of railway or the towns along with the national highway No- 4 and upgraded as Golden Quadrennial Highway.

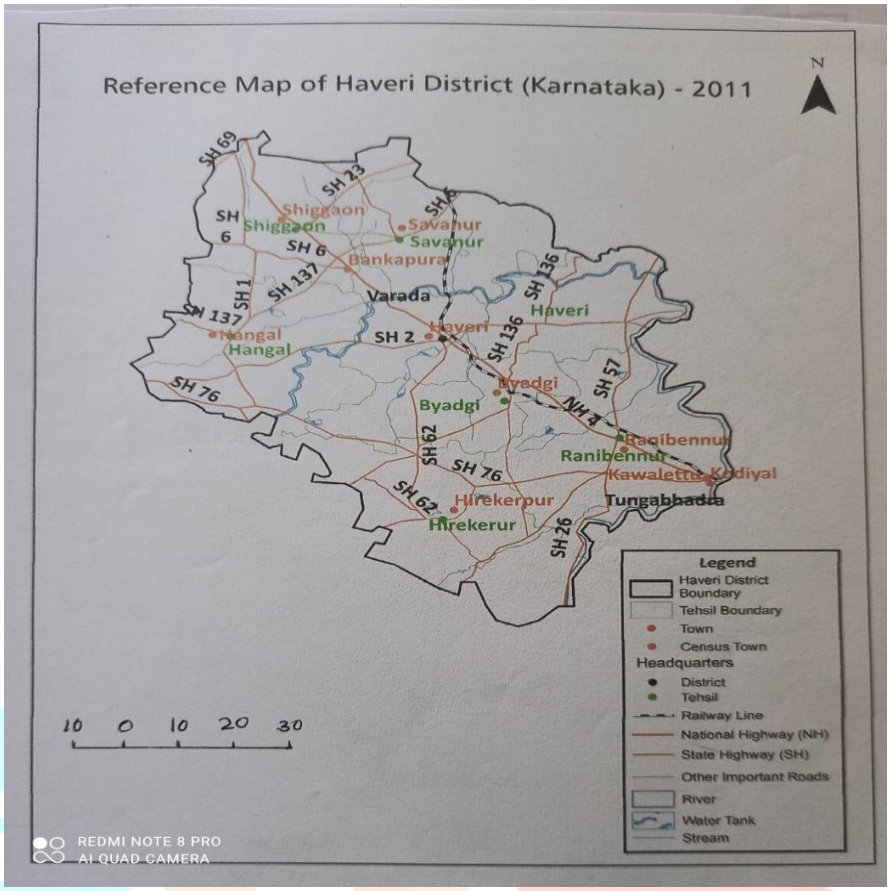


Table No: 6 - State Highway Efficiency of Haveri District:

Sl No	Name of the State Highway	Distance in Kilometers		Rn (idex) value
		De	Do	
1	Padubidri – Chikkalagudda	31	32.5	104.83
2	Ekkumbi – Molakalmur	70	65	92.85
3	Karwar – Ilakal	40.5	35	86.41
4	Kalmala – Shiggaon	18	16.5	91.66
5	Halgeri – Hulikal	27.5	25	90.90
6	Bagalkote – Biligiri Rangan Betta	77.5	64	82.58
7	Haveri – Sagara	42.5	35	82.35
8	Kumta – Sirasi	10	7.5	75
9	Beerur – Sammasagi	55	45	81.81
10	Gajendragad – Sorab	71.5	46	64.33
11	Navalgunda - Banavasi	29	22.5	77.58

As per the study region is concerned, there are eleven state highways. State highways are the main arteries of trade and commerce and passenger transport in the district, connecting every towns. These are the second important roads in the district there are eleven state highways, which passes in the district with length of 587.21 kilometers.

1) padubidri – Ckkalagudda: state highway No – 1 consisting of total length 64.62 kilometers passing through Hanagal and Tadas. Efficiency is 104.83 percent.

2) Ekkumbu – molaklmur: The state highway No. 2 is having the total length of 77.82 Kilometers and passing through Guttal, Basapur, Haveri, Adur, Akkialur. The efficiency of this state highway is 92.85 percent.

3) Karwar – Ilakal the state highway No- 6 is having the total length of 42.62 Kilometes and passing through Bankapur and Savanur. The efficiency of the road is 86.41

4) Kalmala – Shiggaon: the state highway No – 23 is having the length of 19.97 kilometers and passing through Shiggaon, Hulgur and Attigeri. The efficiency is 91.66.

5) Halageri – Hulikall: the state highway No – 26 is having the total length of 28.95 kilometers and passing through Ranebennur, kuppelur and Tumminakatti. This state highway efficieny is 90.90.

6) Bagalkote – Biligiriranganabetta: the tsate highway No – 57 is having total length of 55.65 kilometers and passing through Moral, Negalur, Guttal, Ranebennur, Halageri, Rattihalli and Masur. The efficiency is 82.58.

7) Haveri – Sagar: the state highway No – 62 is having the total length of 56.64 kilometers and passing through Haveri, Kaginele, Haunsbhavi, Hirekerur. It indicate the efficiency 82.35.

8) Kumata – Sirasi: The state highway No – 69 is having the total length of 15.90 kilometers and passing through Tadas and efficiency of the road is 75.

9) Beerur – Sammasagi: The tsate highway No – 76 is having the total length of 8.37 kilometers and passing through Hirekerur, Koda and Halgeri , its efficiency is 81.81.

10) Gajendra gada – Sorba: The tsate highway No – 136 is having total length of 61.05 kilometers and passing through Hosaritti, Motebennur, Byadagi and the efficiency of the road is 64.33.

11) Navalguda – Banavasi: The state highway No – 137 is having total length of 47 kilometers and passing through Hanagal and Bankapur. The efficiency of this state highway is 77.58.

As concerned to state highway efficiency there are three categories the index 60 – 70 its conceder as low efficiency, the index value ranges 70 – 80 it is moderate efficiency, 80 – 90 index value high efficiency and 90 – 100 it is very high efficiency. As concerned to this index value, the state highway No – 1 which is Padubidri – Chikkalgudda has very high efficiency. The high efficiency state highways are Beerur – Sammasagi S H – 76, Haveri – Sagar S H – 62, Bagalkote – Biligiriranganabetta S H - 57 and Karwar – Ilakal S H – 6. Moderate efficiency state highways namely Kumta to Sirasi S H – 69 and Navalguda – Banavasi S H – 137 and low efficiency roads are i.e. Gajedragada – Soraba S H – 136.

CONCLUSION

The road network analysis is one of the important concepts in the transportation Geography. The location and form of the communication network basically reflects and effect the location and movement of people, goods and services within and between the regions. As per the settlement pattern of Haveri district is concerned, the pattern of settlement uniformly distributed and after the formation of new district, the landscape of Haveri district has been changing rapidly with an initiative to provide infrastructural facilities.

The village size is one of the main determinants of the density and distributional pattern of rural settlements. As a result, the diverse physical and cultural environment, uneven distribution pattern of settlements is found with varying shapes and size in different parts of the district. Nearly 50 percent of district rural population concentrated in only 17 percent of settlements. This shown that there is a significant amount of inequality in the distribution of the rural population of Haveri district in relation to rural settlements.

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The mean size of settlements has been categorized into three major groups. The very high mean size has been found in the talukas of Haveri (2369 persons) and Ranebennur (2033 persons). Thus the talukas are surrounded by areas characterized by medium and low mean size of settlements. It has been observed that urban centers have much influence on the size of villages. Generally, villages which are located in the vicinity of urban centers are large in size in compare to others. The medium size settlements whereas the average size of settlements with 1861 persons in the rain shadow area of the district, most of the talukas in the district fall in the low average size of settlement. There are four talukas namely Byadagi (1735 person), Hirekerur (1682 persons), Hanagal (1508 persons) and Shiggaon (1507 persons) come under mean size of settlement.

The analysis indicates that the size of villages is largely determined by the topographic factors, social structure of the society and the productivity of land. Undulating and dissected forested areas have generally small size of villages. There are largely inhabited by the Lamani and Backward people. The area with resources are available and accessible to open plain topography have high and medium size villages. The north and western part of the district have undulating topography are inaccessible due to the absence of railway and to some extent roads.

As per as the Detour index values are concerned (Table No. 5) it has categorized into three categories that is high efficiency moderate efficiency and low efficiency of transport network. Accordingly the analysis has made. The Detour Index of Savanur Taluka is having low efficiency, Byadagi and Hirekerur taluka have moderate efficiency and Haveri, Hanagal, Shiggaon and Ranebennur talukas are having high efficiency.

As concerned to state highway efficiency there are three categories the index 60 – 70 its conceder as low efficiency, the index value ranges 70 – 80 it is moderate efficiency, 80 – 90 index value high efficiency and 90 – 100 it is very high efficiency. As concerned to this index value, the state highway No – 1 which is Padubidri – Chikkalgudda has very high efficiency. The high efficiency state highways are Beerur – Sammasagi S H – 76, Haveri – Sagar S H – 62, Bagalkote – Biligiriranganabetta S H - 57 and Karwar – Ilakal S H – 6. Moderate efficiency state highways namely Kumta to Sirasi S H – 69 and Navalguda – Banavasi S H – 137 and low efficiency roads are i.e. Gajedragada – Soraba S H – 136.

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