Transport Network Analysis Of Kasaragod Taluk, Kerala Using GIS

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ABSTRACT

"Transportation is a measure of relations between areas and therefore an essential part of geography" (Ullman, 1954). Transport network development is considered to be one of the keys to rapid modernization and development, especially for better traffic efficiency. Other than the dense network of roads in cities, roads are often built in sub urban areas to accelerate the development and economic growth of these areas. The study of the network includes an analysis of intersections (nodes), density of roads, and accessibility. The laying of roads are usually decided by political, social and economic factors, and it is not well balanced by natural conditions. As a consequence, problems are often faced from rain, flood etc.

Aim and objective of this paper is to study transport network of roads and railways in Kasaragod taluk, Kasaragod district of Northern Kerala. Kasaragod district was formed by the bifurcation of Kannur district for the purpose of effective implementation of developmental plans. The district has an area of 1961.30 sq. kms and a population for the district is 12,03,342 (2001 census). It has two taluks viz. Kasaragod and Hosdurg. The study area viz. Kasaragod taluk is the northern most taluk in the Kasaragod district as well as the Kerala State. The population of the taluk is 6,16,176 (2001 census). This constitutes 51% of the population of the district. National High way No17 is passing through this district along the coast.

Survey of India's topographic maps on 1:50,000 scale is used as base map and roads have been updated with IRS satellite imagery. Road network, nodes, connectivity density, and accessibility studies are made by using Map Info GIS software.

The accessibility was derived from the buffer zonation. The density of roads nodes, connectivity and accessibility were compared with relief, drainage and population distribution. Panchayat boundaries are super imposed over the maps and relative positions of each Panchayat with reference to network of roads are studied to help the local self-government to develop the transportation network in the region. This will be useful for the planners in designing developmental projects for the region. From the analysis, it is found that the coastal area is well connected with road network and the eastern hilly region has poor connectivity and accessibility. Lack of bridges across rivers pose problem with connectivity of roads in the study area. Most of the roads run along east - west direction than north- south. Relief and drainage play dominant role in the road network development in the district.

INTRODUCTION

Any one making a journey has a number of decisions to take. All kinds of things have to be considered before it is decided to make a journey, or one journey is chosen in preference to another." (Robinson -1976). The factors mentioned above include the purpose of journey, mode of transport, the route if a number of routes are available, type of vehicle, etc.

Transportation is the factor, which determines the speed of growth and development of a place. Transportation literally means to carry some thing from one place to another. It can be executed by any means such as through roads, rails, airways, waterways pipelines etc. Roads and its network only are considered in this paper. There are a number of planners, researchers, engineers and others who have some different parts of the country and world to analyse the behaviour of transportation in different context using different methodologies. Some of the works are Ullman (1954) Kansky(1963),R.W. Bradnock((1976) , B. Rajagopal (1976), G. Ramaswami (1976) etc.

The settlements in Kerala are found along the roads as linear / ribbon pattern. The pattern gives an additional emphasis on the roads. It is an observed fact that road junctions in Kerala are centre of development. The number of road junctions is the sole criteria for the development of the region.

AIM AND OBJECTIVE

The study is aimed to study road network in Kasaragod taluk of Kerala State. An attempt has been made to analyse the characteristics of transport network in the Kasaragod taluk Panchayat wise.

STUDY AREA

The area selected for this study is Kasaragod taluk of Kasaragod district in Kerala state. It is the northern most district in Kerala. It extends between 12^0 02'31" N and 12^0 50'33"N latitudes and 74^0 51'54"E and 75^0 25'59" E. longitudes. The district is located far away from the administrative capital of the state and this is one of the major factors for the backwardness of the district in developmental activities. To accelerate the developmental activities, the district was formed by dividing Kannur into two. The district consists of two taluks namely Hosdurg and Kasaragod.

The present study area Kasaragod taluk (map:1) is bounded by Karnataka state in the north and Hosdurg taluk in the south. The taluk consists of two blocks namely Manjeswaram and Kasaragod. It has 20 Panchayats and a Municipality. The population of the taluk is 6,16,176 (2001Census). This constitutes 51% of the population of the district and an area of 973 sq. km.

METHODOLOGY

All the roads are digitised from the Survey of India's topographical map of scale 1:50,000. The roads are updated with the help of IRS IC LISS III 1998 satellite imagery. (Map: 2) The road junctions are taken as nodes. The nodes are connected by straight lines to form arcs (edges). (Map:3) The alpha, beta and gamma indices for connectivity are derived using the formula developed by K.J. Kansky (1963), Panchayat boundaries are superimposed on the network map and above indices were calculated as shown in Table - 1.

Beta index (B) for connectivity is a simple measure of connectivity which can be derived from the formula

B=arcs/nodes

Here nodes are road junctions and arcs are connections between the nodes as straight lines. Beta index ranges from 0.0 for network, which consists just of nodes without any arcs, through 1.0 and greater where networks are well connected. For instance, very simple networks and trees possess values less than 1.0, a connected network involving a single circuit has a value of 1.0, while networks of greater complexity, which include several circuits, have values higher than 1.0. It is most useful in very simple networks where no circuits are involved.

Another index, the gamma index,(g) is a simple ratio of the actual number of edges in the network to the maximum possible number of edges, describes in numerical terms the connectivity of a network given by the formula

g = arcs/3(nodes-2)

The value 1 will be applied to any completely connected network and 0 is given to poor connectivity.

The alpha index (A) for connectivity is the ratio of the number of fundamental circuits to the maximum possible number of circuits, which may exist in a network, given by the formula

A=a-n-1/(2n-5)

Where a is the number of arcs, and n is the number of nodes.

The Alpha index gives the range values possible from 0 to 1. The higher the index, the greater is the degree of connectivity in the network. Simple networks, such as trees, have nil values. A value of 1 is indicative of a highly integrated network in which every possible link exists between the various nodes.

The accessibility is derived by buffer zonation of the area. The roads are buffered with 0.5 km, 1km, 2km and 5km radius and an accessibility map has been prepared in GIS environment (Map: 4) Road network is related to relief and drainage of the study area by overlaying the layers in GIS. (Map: 5)

ANALYSIS AND RESULTS

The region shows backwardness in the case of road network. Even though the length of the road seems to be more, the road density is comparatively low in relation to the total area of each Panchayat. Only 6 Panchayats have a density above1.5 km per sq.km. Among these two Panchayats have a density above 2 km. Nine Panchayats have density below 1 km. Three Panchayats have a very low density below half km. These are Belloor (0.25), Bedadka (0.4) and Kuttikole (0.35) Panchayats. (Table:1)

The alpha and beta indices show a low level of connectivity in the region (Table.1). The low connectivity is mainly due to the drainage pattern with very few north south connections. This was mainly due to the non-availability of bridges. The roads are in east west direction and are parallel to the drainage. (Map 3) Bridges have been constructed recently for connecting north and south. Still at many places the streams are a hinderance to the movement of the people.

According to Taafe and Gauthier (1973), when the gamma index is close to 0, it indicates incomplete connectivity. The exercise carried out in this study clearly shows low connectivity.

The beta index signifies that out of 20 Panchayats 9 show minimum connectivity. Other Panchayats show very poor connectivity.

Sl no	Name of Panchayat	Area	Road Length	Density of roads	No of edges	No. of Nodes	Beta Index	Gamma Index	Alpha index
1	MADHUR	26.04	34.72	1.33	22	25	0.88	0.32	-0.09
2	CHENGALA	53.79	56.1	1.04	24	22	1.09	0.40	0.03
3	CHEMNAD	40.11	33.76	0.84	12	12	1.00	0.40	-0.05
4	MULIYAR	34.27	36.39	1.06	6	7	0.86	0.40	-0.22
5	KARADKA	41.17	38.6	0.94	8	9	0.89	0.38	-0.15
6	DELAMPADY	49.85	38.09	0.76	4	9	0.44	0.19	-0.46
7	BEDADKA	81.13	32.2	0.40	6	7	0.86	0.40	-0.22
8	KUTTIKOLE	70.36	23.74	0.34	2	3	0.67	0.67	-2.00
9	MOGRAL PUTHUR	14.24	28.5	2.00	32	27	1.19	0.43	0.08
10	MANJESWARAM	24.40	48.22	1.98	64	50	1.28	0.44	0.14
11	VORKADY	45.40	26.39	0.58	6	27	0.22	0.08	-0.45
12	MEENJA	44.91	73.87	1.64	54	51	1.06	0.37	0.02
13	MANGALAPADY	36.30	78.68	2.17	73	68	1.07	0.37	0.03
14	PAIVELIKI	72.51	84.7	1.17	43	41	1.05	0.37	0.01
15	KUMBLA	40.18	65.96	1.64	69	57	1.21	0.42	0.10
16	PUTHIGE	39.61	53.86	1.36	23	22	1.05	0.38	0.00
17	ENMAKAJE	78.23	77.48	0.99	21	23	0.91	0.33	-0.07
18	BADIYADKA	67.79	71.78	1.06	23	24	0.96	0.35	-0.05
19	KUMBADAJE	31.03	24.39	0.79	24	33	0.73	0.26	-0.16
20	BELLOOR	64.59	16.36	0.25	8	9	0.89	0.38	-0.15
21	KASARAGOD MUNICIPALITY	16.68	27.2	1.63	49	49	1.00	0.35	-0.01

Table - 1 Transport Network Analysis of Kasaragod Taluk

The alpha index in this study show some negative values and abnormal values. This is because of the poor connectivity of roads in the region.

The accessibility derived by buffer zonation is shown in table 2. According to the analysis 65% of area is within 0.5km accessibility, 21% of area is in 1km accessibility and 11% of the area is accessible within 2Km. The region falling under inaccessible area represents only 3% i.e. area beyond 5km distance from the road.

Buffer zone	Percentage area
500 m	64.83
1km	21.43
2km	10.80
5km	2.94
Total	100.00

Table - 2 Accessibility Area

Maps are prepared by overlaying roads with relief and drainage shows a very clear picture. The drainage in the taluk is the major controlling factor for the development of road network. (Map: 5) As stated earlier the roads are running parallel to the drainage in an east west direction. The roads are connected north - south in places where bridges are available. The roads run parallel to the stream to join the national highway No 16 running north - south through the western coastal areas.

(Map 2) The bridges in the national highway are the major north south connection other than some newly constructed bridges here and there. In many places the roads are abruptly ending near a stream or river.

CONCLUSION

The study reveals that the Kasaragod taluk is backward in transportation facilities. The major problem in the development of road network in the region is the absence of bridges. The people in the region have to travel many kilometres in circuitous route to reach a place. Importance should be given for the effective interconnection of roads. This will contribute to the overall development of the taluk as well as Panchayats in the region. This study also reveals the importance of GIS in the field of administration for the Local Governments especially the Panchayat Administration.

REFERENCE

Kansky, K. (1963). Structure of Transportation Network. University of Chicago Department of Geography, Research paper 84, p.1

Rajagopal B. (1976) Analytical Metropolitan Transportation Planning. The Indian Geographical Society, Golden Jubilee Volume, p. 161

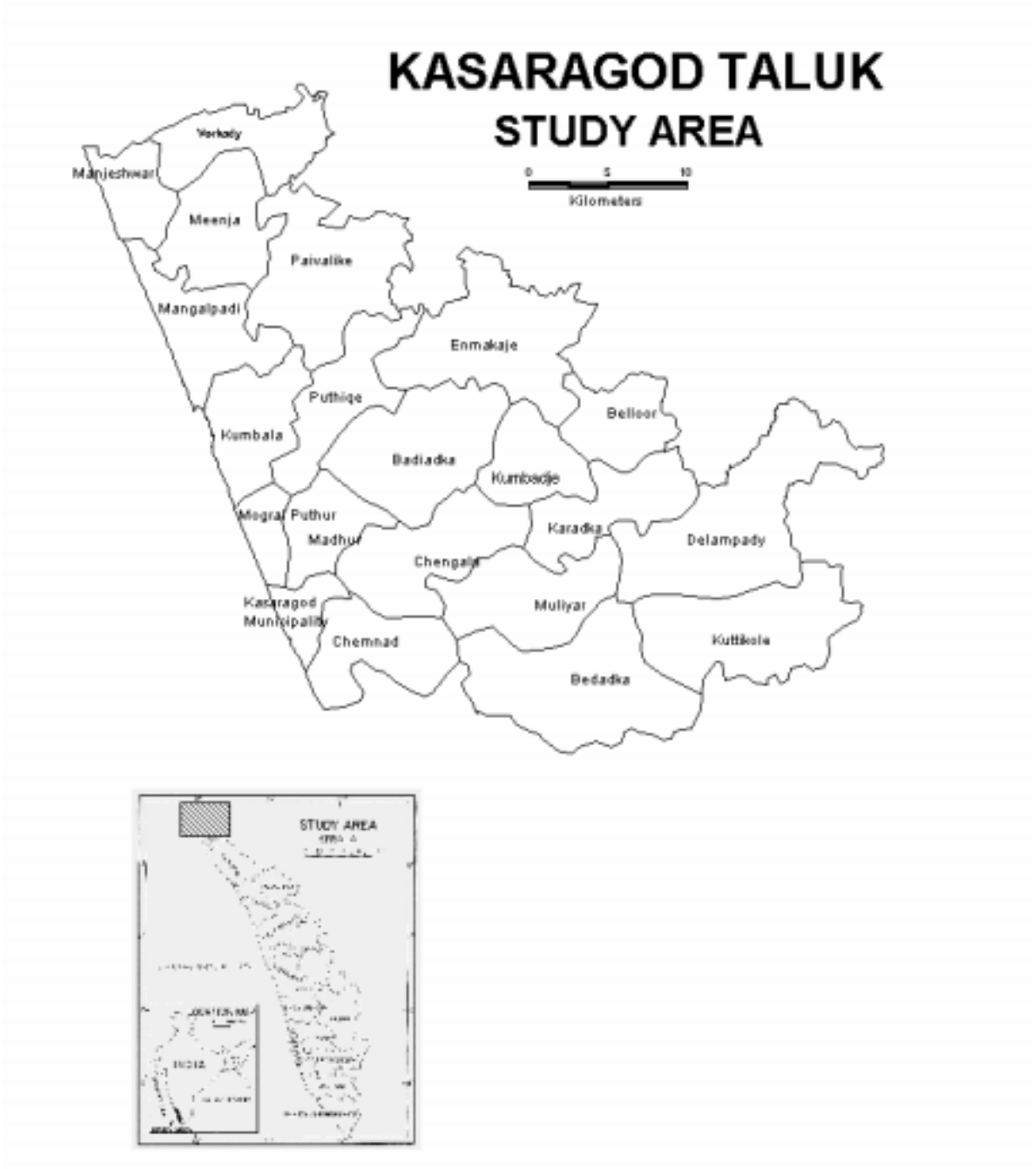
Ramaswami G. (1976) Road Network In Tiruchi-Thanjavur Planning Region The Indian Geographical Society, Golden Jubilee Volume, pp. 150-160

Robinson,H. Bamford, C.G. (1978) Geography Of Transport, MacDonald and Evans pub. London p.80

Robinson , Roger.(1977) Ways to move. Cambridge University Press, London

Taaffe, Edward,j and Howard L. Gauthier (1973), Geography of transportation pp107, 110-111

Ullman, E.L. (1956, Transportation Geography In American Geography: Inventory And Prospects (Ed) P.E. James and C.L. Jones, Syracuse University press


KASARAGOD TALUK
STUDY AREA
0 5 10
Kilometers
Manjeshwar
Meenja
Paivalike
Mangalpadi
Enmakaje
Puthige
Kumbala
Badiadka
Kumbadaje
Belloor
Mogral Puthur
Madhur
Karadka
Delampady
Chengala
Kasaragod Municipality
Muliyar
Chemnad
Kuttikola
Bedadka
STUDY AREA

MAP 1

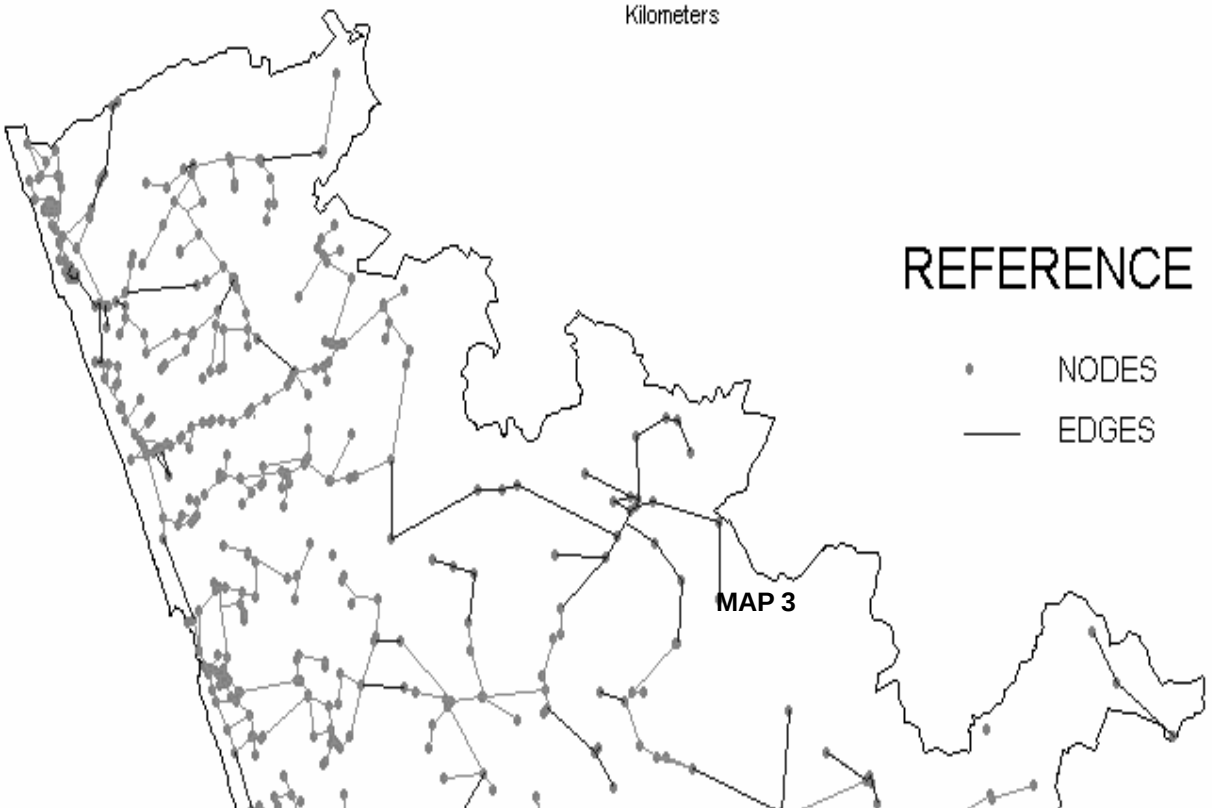
MAP 2

KASARAGOD TALUK

TOPOLOGY

0 5 10

Kilometers



REFERENCE

NODES

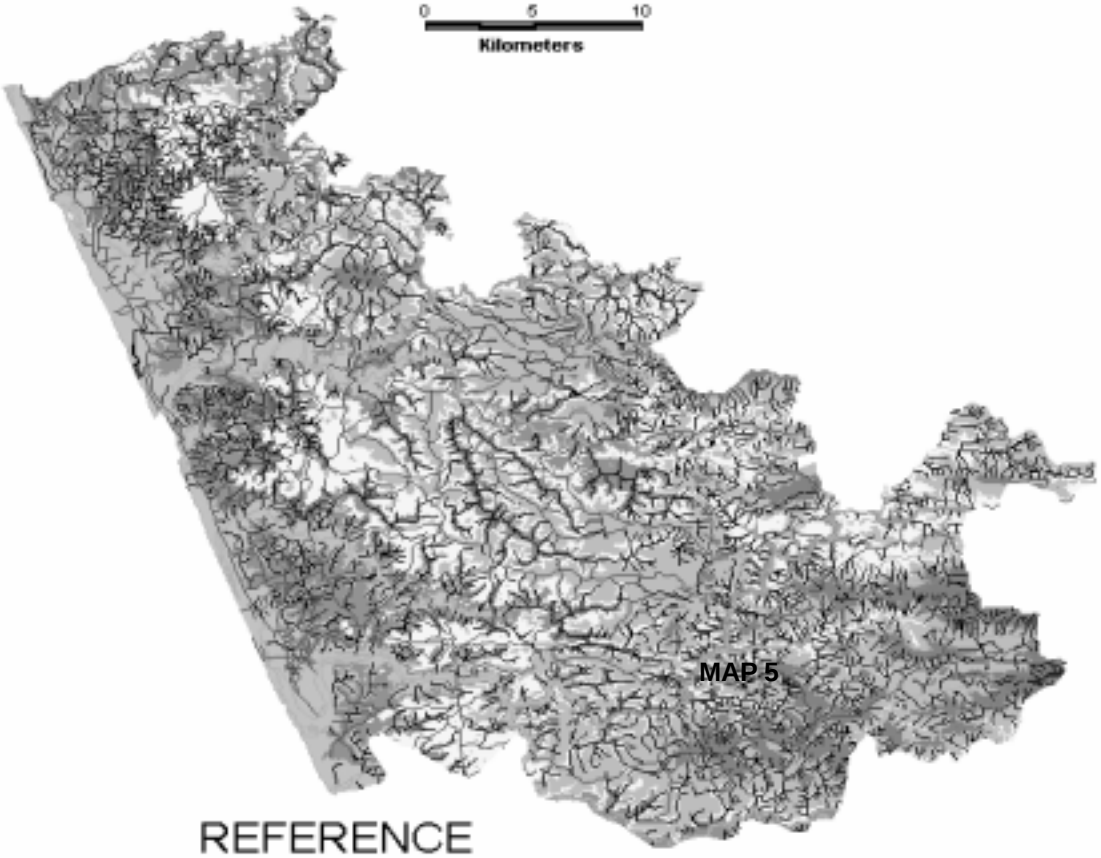
EDGES

MAP 3

MAP 4

KASARAGOD TALUK

RELIEF, DRAINAGE AND ROAD



MAP 5