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संशोधक

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अन्यायाचा सामर्थ्याने ! मग असा संहार केला
वाघाच्या वाघनखांनी ! शत्रूला ठार केला..

प्रकाशक : इतिहासाचार्य वि.का.राजवाडे संशोधन मंडळ,धुळे

इतिहासाचार्य वि. का. राजवाडे संशोधन मंडळ, धुळे

विद्यमान पदाधिकारी व कार्यकारी मंडळ

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।। संशोधक।।

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- प्रा. डॉ. मृदुला वर्मा
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Geographical Analysis of Road Transportation Network Using Gamma Indexing Method: Spatial Reference to Beed District

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Abstract:

Road transportation network refers to the system of roads, highways and other infrastructure that enables the movement of people and goods by land. Road network influenced the rural and urban population's mobility. Road transportation network plays a vital role in economic growth, social connectivity and access to service and opportunities. Its efficiency and capacity can impact traveling times, safety and environmental sustainability. The present research paper denotes the spatio-temporal network structure of road in Beed district. The study is based on primary and secondary data sources. Twenty years period 2001 to 2021 has been choose for analysis and result displayed through statistical and cartographical methods and aright result has been derive.

Key Wards: Road Transportation, Transportation Network, Connectivity, Vertices, Edges etc.

Introduction:

The term transportation network, we generally mean a set of geographical locations interconnected in a system by a number of routes. Whereas 'Transport Network' may be considered as referring to spatial pattern of transportation facilities in the given region, A number of techniques have been developed for the analysis of transport networks. The more elementary measures like the existence or non-existence of routes seems somewhat easier to interpret then the preparation of maps and tables listing distances, capacities, flows and such indices as networks densities and isochrones. With a view to provide a better basis for comparison and evaluation of different networks, a number of consistent measures describing the network characteristics have been developed during the past several years. Most of these measures are based on graph theory. Graph theory is used by geographers to describe the spatial structure of transportation networks. The network of transport happens to be a very real feature of the geography of an area from the point of view of human interaction and is an important indicator of the level of its development. Some elementary concepts of graph theory have been introduced to explain some basics structural properties of networks has been attempted in many studies beginning with ruler in 1736 and Koing in 1936. Graph theory is a branch of mathematics concerned with how network can be encoded and their properties are measured. The following elements are fundamental in understanding graph theory.

Graph:-A graph 'G' is a set of vertices (node) 'V' connected by edges (links) e.

Thus G = (v, e)

Vertices (node): A node 'v' is a terminal point or an intersection point of a graph. It is the abstraction of a location, such as a city, an administrative division, a road interaction or a transport terminal.

Edges (Link): An edge 'e' is a link between two nodes. The link (i,j) is between initial extremity 'i'

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and terminal extremity 'j'. A link is the abstraction of a transport infrastructure supporting movements between nodes. It has a direction that is commonly represented as an error.

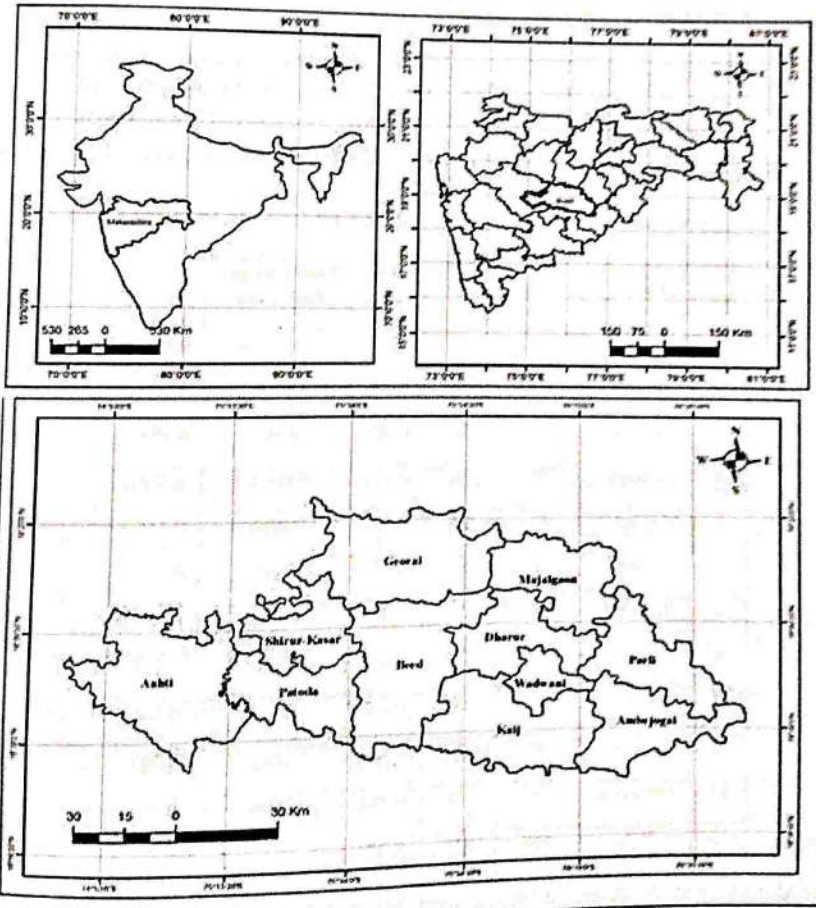
Objective:

1. To find out the Tahsil wise transportation connectivity through Gamma Index in Beed district.
2. To analyze the spatio-temporal changes in transportation connectivity in Beed district.

Study Region:

Beed district is situated in central part of Maharashtra. It is lies between 18° 27' to 19° 27' North latitude and 74° 49' to 76° 44' East longitude (fig. no.1) The East-West extension of Beed district is 268 kilometer and North-South trench is 127 kilometers. Geographical area of the district as per 2011 census is 10679 square kilometers, out of which 10445 square kilometer are rural and 234 square kilometers are urban. The Beed district is divided into eleven Tahsil for administrative setup. These Tahsil's are Ashti, Patoda, Shirur (Kasar), Gevrai, Majalgaon, Beed, Wadwani, Kaij, Dharur, Parali (Vaidyanath) and Ambajogai.

Figure 1: Location Map of Beed District



Data Sources and Methodology:

The present study is based on primary and secondary data sources. Secondary data collected from Road Development Plan of Beed District 2001-2021 and 2001-2021

The Gamma Index (Ã) is calculated using the following formula:

$\tilde{A} = (E / (3 * (N - 2)))$

Where:

- Ã (Gamma Index) is a dimensionless value between 0 and 1
- E = total number of edges (links) in the network
- N = total number of nodes (intersections or junctions) in the network

This formula was first introduced by Garrison and Marble in 1962.

Here's a step-by-step breakdown:

1. Count the number of nodes (N) in the network.
2. Count the number of edges (E) in the network.
3. Calculate the Gamma Index (Ã) using the formula above.

Discussion:

Gamma Index Analysis is a method used to evaluate the connectivity and efficiency of road networks. It's a mathematical approach that assesses the overall structure and performance of a transportation network.

Gamma Index 2001: Table no.1 reveals that the road network connectivity of Beed district through Gamma index measure during the period 2001. In this period out of eleven tahsils of Beed district highest Gamma index value 0.686 noticed in Ambajogai tahsils and lowest Gamma index value 0.373 found in Ashti tahsil. High Gamma index value above 0.700 are not found in the region during this period, it means there are no well-connected area in the Beed district. Moderate Gama index value 0.500 to 0.700 observed in Ambajogai (0.686) and Dharur (0.666) tahsil whereas low Gamma index

Table no. 1 : Road Network Connectivity in Beed District Gamma Index (Ã) 2001

Sr. No.	Tahsils	Vertex	Edges	Gama Index	Tahsils as per their rank	Score
1	Ashti	69	75	0.373	Ambajogai	0.686
2	Patoda	57	67	0.406	Dharur	0.666
3	Shirur Ka	51	62	0.421	Parali	0.464
4	Georai	78	96	0.421	Wadwani	0.458
5	Majalgaon	42	52	0.433	Majalgaon	0.433
6	Beed	48	59	0.427	Beed	0.427
7	Wadwani	18	22	0.458	Georai	0.421
8	Kaij	54	62	0.397	Shirur	0.421
9	Dharur	15	26	0.666	Patoda	0.406
10	Parli (V)	30	39	0.464	Kaij	0.397
11	Ambajogai	36	70	0.686	Ashti	0.373
12	R.A.	498	630	0.423	-	-

Source: Map of Road Development Plan of Beed District 1981-2001 compiled by Researcher.

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Value experienced in Parali (0.464), Wadwani (0.458) Majalgaon (0.433), Beed (0.427), Georai (0.421), Shirur Kasar (0.421) Patoda (0.406) Kaij (0.397) and Ashti (0.373) tahsils during year 2001. Majority part of Beed district comes low connectivity category measures by Gamma index value. average Gamma index value of Beed district is 0.423.

Gamma Index 2021: Table No 2 shows that the Gamma index network connectivity in Beed district for the period 2021. The highest Gamma index value 0.754 noticed in Parali tahsil and lowest Gamma index value 0.438 found in Patoda tahsil of Beed district. High Gamma index value above 0.700 experienced in Parali (0.754) and Dharur (0.719) tahsils, these are considered high connectivity region for the referred period. Moderate Gamma index 0.500 to 0.700 recorded in Majalgaon (0.689), Ambajogai (0.614), Beed (0.593), Wadwani (0.573), Georai (0.560), Shirur (0.552) and Kaij (0.513) tahsil. All these areas come under moderately connected group shows more than mean score of same periods. Low Gamma index value below 0.500 found in Ashti (0.439) and Patoda (0.438) tahsil it is shows low connectivity due to less branches of roads in comparison to present vertices in referred period. Average Gamma index value of entire Beed region is 0.542 and it is comes in moderate category and shows the scope of road development in Beed district.

Table no. 2 : Road Network Connectivity in Beed District Gamma Index (Ā) 2021

Sr. No.	Tahsils	Vertex	Edges	Gamma Index	Tahsils as per their rank	Score
1	Ashti	87	112	0.439	Parali	0.754
2	Patoda	78	100	0.438	Dharur	0.719
3	Shirur Ka	84	136	0.552	Majalgaon	0.689
4	Georai	99	163	0.560	Ambajogai	0.614
5	Majalgaon	60	120	0.689	Beed	0.593
6	Beed	57	98	0.593	Wadwani	0.573
7	Wadwani	27	43	0.573	Georai	0.560
8	Kaij	63	94	0.513	Shirur Ka	0.552
9	Dharur	21	41	0.719	Kaij	0.513
10	Parli (V)	36	77	0.754	Ashti	0.439
11	Ambajogai	66	118	0.614	Patoda	0.438
12	R.A.	678	1101	0.542	-	-

Source: Map of Road Development Plan of Beed District 2001-2021 compiled by Researcher.

Tahsil wise varied changes recorded in Gamma index value in all over the region during 2001 to 2021. Parali and Dharur tahsil improved the road connectivity position and uplift low to high and moderate to high respectively. Ambajogai costant on moderate position and about Beed, Georai, Wadwani,Majalgaon, Shirur Ka and Kaij tahsil uplift low to moderate category during the investigation period. Ashti and Patoda tahsil are on their low position during twenty year of observation. These regions entirely low connected as well as under developed in agricultural, industries and road transport. It is known as the region of "sugarcane cutter labors".

Conclusion:

Above discussion shows the spatio-temporal development of road transportation network connectivity in Beed district. It's very slightly developed during twenty years. Regional average was 0.423 in 2001 and grown up to 0.542 during 2021. Hence there is scope to road network development.

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