

Original Article**A Geographical Study of Patio-Temporal Transformation of Roadways in a Decade of 2011 to 2021 in Dhule District of Maharashtra****Dr. P. S. Chaudhari**

Assistant Professor, Department of Geography, Pratap College (Autonomous) Amalner.

Dist. Jalgaon

Email: pramodchaudhari82@gmail.com**Manuscript ID:**

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Submitted: 25 Jan. 2025**Revised:** 25 Mar. 2025**Accepted:** 20 Jun. 2026**Published:** 30 Jun. 2026**Abstract**

This research paper presents a comprehensive analysis of the evolution of road infrastructure in Dhule district over the decade from 2011 to 2021. Roads, more than just concrete and asphalt, serve as the lifeline of socio-economic development and human connectivity in this region. The study putting light on significant changes, including a 26% increase in the total length of roads, exemplifying the critical role of road networks in regional progress and accessibility. The objectives of this research are threefold: first, to analyze temporal trends in road length; second, to assess spatial variations in road density per 100 square kilometers; and third, to explore the relationship between population growth and road density per 1000 population. The analysis reveals that while the total length of roads grew substantially, disparities exist across tehsils. For instance, Sakri exhibited the largest road network, while Shindkheda recorded the smallest total length of roads. The study also examines the road density (roads per 100 sq. km) and road density (roads per 1000 population). Notably, the road density per 100 sq. km increased by 34.75% during the study period, with Shirpur tehsil showing remarkable development. Conversely, road density per 1000 population increased by 25.23%, revealing the intricate dynamics between population growth and road infrastructure. The research underscores the importance of enhancing road connectivity in semi-tribal dominant regions. Access to basic services and socio-economic opportunities must be on par with other areas, and this paper emphasizes the need for a holistic approach that considers not only the physical infrastructure but also socio-cultural and environmental factors when developing transportation systems in such regions.

Keywords: Roadways, Transformation, Infrastructure, Services etc.**Introduction**

The patio-temporal transformation of road infrastructure in a

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Address for correspondence:

Dr. P. S. Chaudhari, Assistant Professor, Department of Geography, Pratap College (Autonomous) Amalner. Dist. Jalgaon

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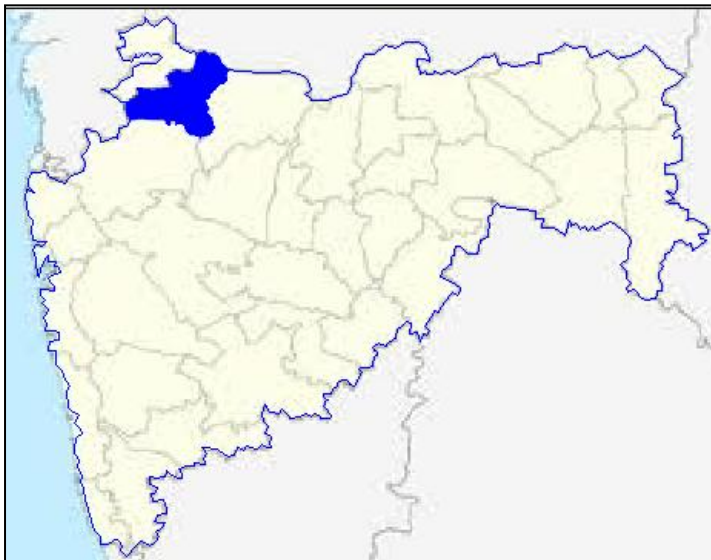
region extends beyond a mere network of concrete and blacktop; it intricately weaves together the fabric of socio-economic development and human connectivity. Over the course of a decade, from 2011 to 2021, the road network within the geographical boundaries of Dhule district has undergone significant transformations. These changes can be measured by total road length, road density per 100 square kilometers of land area and road density per 1000 population. These aspects serve as critical indicators for regional progress, accessibility and growth potential. In this research paper, conduct a comprehensive analysis of the changes observed in key road infrastructure metrics over the past decade, shedding light on variations in total road length and road density (per 100 sq. km and per 1000 population). This study underscores the crucial role of road infrastructure in fostering growth and prosperity within the region.

Objectives

The present study aims to achieve the following objectives:

- 1. Analyze Temporal Trends:** To examine the changes in the length of roads in Dhule district from 2011 to 2021, with a focus on identifying significant trends or fluctuations.
- 2. Assess Spatial Variation:** To investigate how road density (measured as roads per 100 sq. km) has evolved spatially across different regions within Dhule district.
- 3. Explore Population Dynamics:** To explore the relationship between population growth and changes in road density (measured as roads per 1000 population) during the study period.

Study Region



(Courtesy by Google)

Figure No. 1

Dhule district, located in the northern part of Maharashtra, holds a special place in the regional geography. Renowned for its unique topography, it is home to various local tribal communities. A significant portion of the district's population belongs to scheduled tribes. As an essential administrative division within Maharashtra, Dhule district has undergone notable changes in recent decades, particularly in its road infrastructure. Roads, the lifeblood of connectivity and development, have experienced

dynamic shifts concerning their length, density per square kilometer, and their interaction with the population in past few decades.

Methodology

This research paper undertakes a comprehensive analysis of the changes observed in the total length of roads, road density (measured as roads per 100 sq km), and road density (measured as roads per 1000 population) within Dhule district during the critical ten-year period from 2011 to 2021. Our study is based on secondary data sourced from the Indian Census and Socio-economic reviews of Dhule district. We have collected data at the tehsil level. The data has been tabulated, analyzed and presented graphically. To calculate road density per 100 sq km, the researchers utilized the ratio between the total road length and the area of the region. Similarly, for road density per 1000 population, we computed the ratio between the total population and the total length of roads in the regions, using the following formula:

Total Density of Roads = Total Population of the Tehsil / Total Length of Roads in the Tehsil

Total Length of Roads in Dhule District

Analyzing the data regarding the total length of roads in Dhule district for the years 2011 to 2021 allows us to gain insights into the changes and trends over this decade. This analysis provides a fundamental understanding of the growth in road infrastructure within Dhule district during this specified time frame.

Table No. 1

Sr. No.	Tehsil	Total Length of Roads (In k. m.)		Absolute changes in road length	Percentage changes
		2011	2021		
1	Dhule	1836	2024.69	188.69	10.28
2	Shirpur	1002.7	1546.08	543.38	54.19
3	Shindkheda	1340.52	1432.9	92.38	6.89
4	Sakri	1414.31	2071.02	656.71	46.43
Total Dhule District		5593.53	7074.69	1481.16	26.48

(Tabulated by researcher)

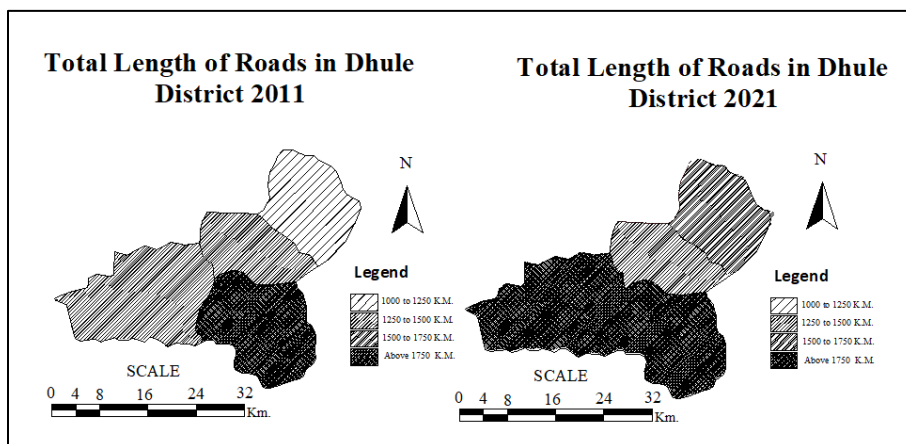


Figure No. 2

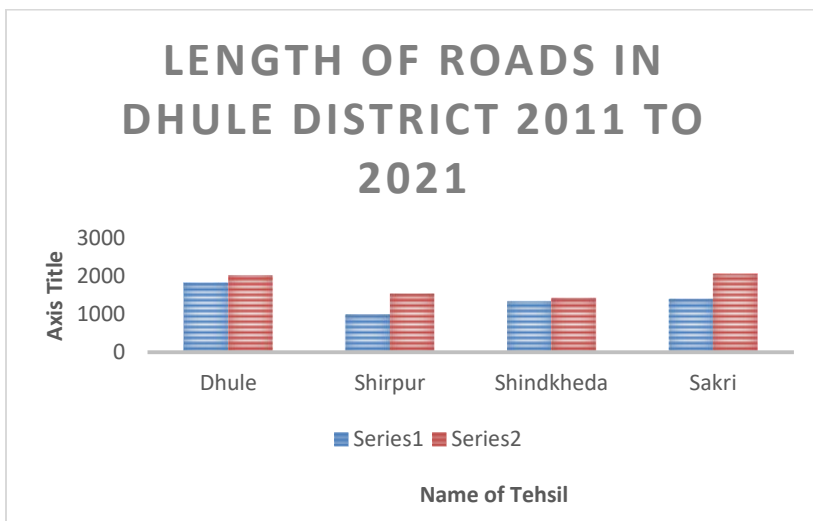


Figure No. 3

Changes in Total Road Length (2011-2021)

Over the span of a decade, from 2011 to 2021, the total length of roads in Dhule district expanded by approximately 1481.16 kilometers, representing a substantial 26.48% increase. Among the tehsils in the district, Dhule had the most extensive road network at 1836 kilometers, while Shirpur tehsil had the lowest total road length at 1002.70 kilometers. The remaining tehsils, namely Shindkheda and Sakri featured varying road lengths ranging from 1340.52 to 1414.31 kilometers. Notably, the year 2021 witnessed remarkable changes in the total road length, with an increase from 5593.53 kilometers in 2011 to 7074.69 kilometers in 2021, marking a significant 26.48% rise. Shirpur exhibited substantial development, with a remarkable 54.19% increase in road length. In contrast, Shindkheda demonstrated relatively limited progress, with only a 6.89% increase (from 1340.52 kilometers in 2011 to 1432.9 kilometers in 2021). Other two tehsils in Dhule district made marginal improvements in total road length during this decade. Enhancing road transportation in this semi-tribal dominant region is vital for socio-economic development, ensuring residents' access to essential services and opportunities on par with the broader region.

Dhule District Road Density (per 100 sq. km)

This metric allows for the standardized comparison of road networks in different regions, considering the area of each region.

Table No. 2

Sr. No.	Tehsil	Road Density (Per 100 sq. k. m.)		Absolute changes in road density	Percentage changes
		2011	2021		

1	Dhule	92.83	102.68	9.85	10.61
2	Shirpur	42.64	102.34	59.7	140.01
3	Shindkheda	103.54	110	6.46	6.24
4	Sakri	58.54	85.94	27.4	46.81
Total Dhule District		74.39	100.24	25.85	34.75

(Tabulated by researcher)

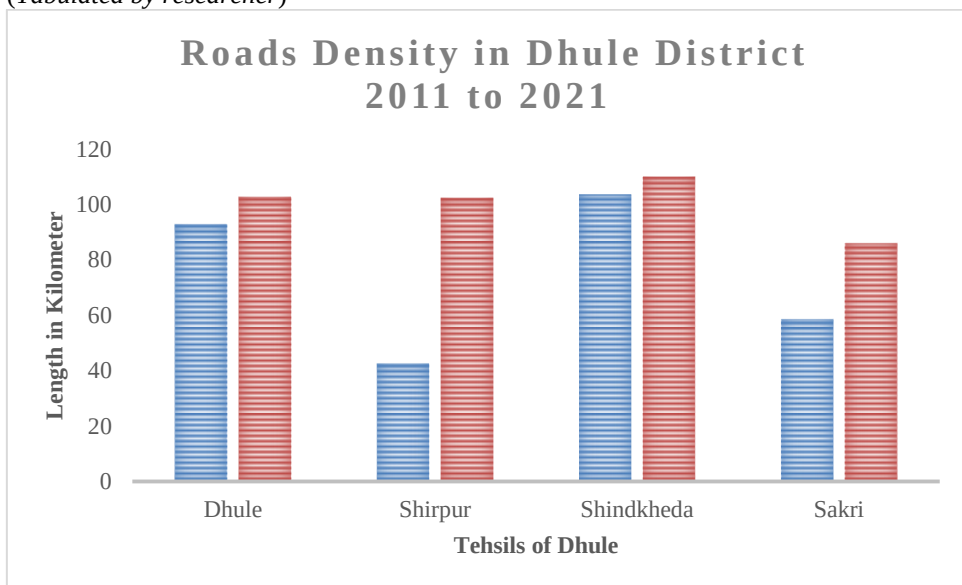


Figure No. 4

The table No. 2 presents data on the road density of Dhule district, highlighting changes in road density per 100 sq. km over the course of a decade. In 2011, the road density was 74.39, and it grew to 100.24 per 100 sq. km in 2021, reflecting a substantial improvement of 34.75%. Shirpur tehsil recorded a remarkable 140% increase in road density, while Shindkheda tehsil showed very low improvement during the same period. Additionally, tehsils like Dhule (10.61%) and Sakri (46.81%) demonstrated substantial progress in developing road density per 100 sq. km.

Dhule District Road Density (per 1000 Population)

This analysis provides insights into how road infrastructure caters to the population's transportation needs.

Table No. 3

Sr. No.	Tehsil	Road Density (Per 1000 population as per 2011 Census)		Absolute changes in road density	Percentage changes
		2011	2021		
1	Dhule	4.34	4.79	0.45	10.37
2	Shirpur	2.9	4.48	1.58	54.48
3	Shindkheda	4.85	5.18	0.33	6.80
4	Sakri	3.25	4.76	1.51	46.46
Total Dhule District		3.84	4.80	0.97	25.23

(Tabulated by researcher)

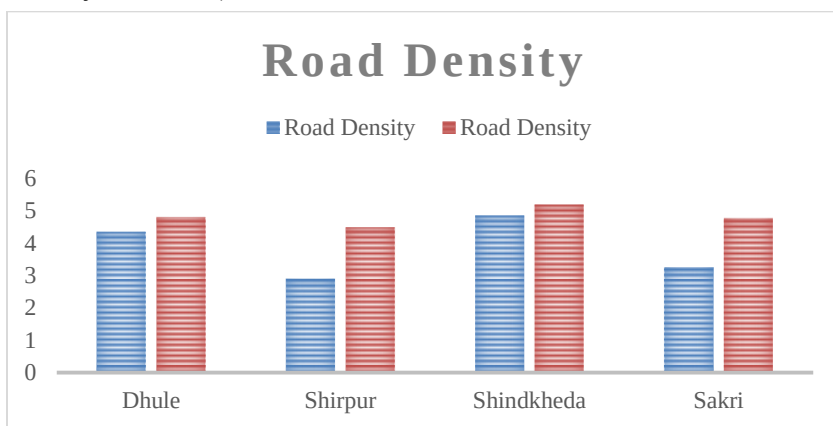


Figure No. 5

The table No. 3 illustrates the capacity of road infrastructure to serve the transportation needs of the population. In 2011, the road density per 1000 population in Dhule district was 3.84, which increased to 4.80 in 2021, signifying a substantial 25.23% improvement. Shirpur tehsil experienced significant progress, with a remarkable 54.48% growth in road density. However, it's noteworthy that despite a substantial increase in road length in Sakri tehsil (a remarkable 656.71 during the decade from 2011 to 2021), this tehsil registered a positive growth in road density per 1000 population, with of 46.46% (from 3.25 in 2011 to 4.76 in 2021). Other tehsils like Dhule (10.37) and Shindkheda (6.80) exhibited considerably low progress during this period. Conversely, comparatively developed tehsils like Dhule recorded a low growth rate, and Shindkheda showed limited progress in road density per 1000 population. These disparities raise concerns regarding the ratio of population and road density in the region.

Conclusion

Enhancing road infrastructure has a profound impact on connectivity between semi-tribal areas and the broader region, providing easier access to essential services, markets, and opportunities. However, developing road transportation in semi-tribal dominated regions presents unique challenges due to geographical constraints, land ownership issues, environmental considerations and limited financial resources. In a span of ten years, the total road length in Dhule district, with notable progress in tehsils like

Sakri. However, road density (per 1000 population) partially matches the rate of road length expansion. In summary, developing transportation in semi-tribal regions necessitates a holistic approach, considering not only physical infrastructure but also socio-cultural and environmental factors specific to these areas.

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