

Service Area Analysis of Road Transport and Regional Development in Solapur District

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Article Info	ABSTRACT
<p>Article History: Received: 18th Sep 2025 Accepted: 02st Oct 2025 Published: 17th Oct 2025</p> <p>Keywords: Road Transport, Service Area, Regional Development, GIS.</p>	<p>Road transport plays a crucial role in fostering regional development by enhancing accessibility, connectivity, and mobility of people and goods. This paper analyzes the service area of road transport in Solapur District of Maharashtra, India, using network analysis. Service areas within 0–25 km from tahsil headquarters were calculated and compared to understand the spatial accessibility patterns. The study highlights disparities in road transport accessibility across tahsils and its implications for balanced regional development.</p>

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1. Introduction:

Transport is both a driver and indicator of development. Efficient road networks link production centers with markets, people with services, and regions with opportunities. In developing economies, where industrialization and urbanization are unevenly spread, transport accessibility plays a decisive role in reducing regional disparities.

Solapur District in Maharashtra is known for its textile industry, sugar factories, religious centers, and agricultural hinterland. Despite its economic potential, accessibility gaps exist due to uneven road distribution and service areas. This paper undertakes a service area analysis of Tahsil headquarters in Solapur District to understand the impact of road transport accessibility on regional development.

2. Review of Literature

Accessibility plays a central role in regional development, as it determines the ease of movement for people, goods, and services. Rodrigue et al. (2020) emphasize that transport systems influence trade flows, market integration, and industrial location, thereby shaping regional economic geographies. Banerjee and Chakraborty (2016) note that in India, road infrastructure remains unevenly distributed, leading to spatial imbalances where urban centers progress rapidly while peripheral rural areas lag behind.

In Maharashtra, Deshpande (2018) showed that road density and connectivity are strongly linked with agricultural productivity, rural employment, and urban growth. Semi-arid regions like Solapur particularly depend on transport access for both farming and agro-industrial activities.

Methodological advances have further improved transport studies. Kumar and Singh (2015) highlighted the limitations of straight-line distance analysis, arguing that network analysis better reflects real travel conditions. Similarly, ESRI (2019) demonstrated how GIS-based tools can effectively map service areas, identify accessibility gaps, and guide infrastructure planning.

Supporting evidence comes from regional case studies. Patil (2017) found that many rural populations in western Maharashtra travel more than 20 km to reach essential services, while Jadhav and Pawar (2020) showed that poor accessibility in drought-prone districts contributes to socio-economic backwardness.

Collectively, these studies establish that service area mapping through GIS and network analysis offers a robust way to assess road transport accessibility, making it particularly relevant for regions like Solapur District where balanced regional development is closely tied to transport connectivity.

3. Objectives of Study:

The study aims to:

- Analyze the spatial distribution of road transport service areas in Solapur District.
- Assess accessibility within 0–25 km service zones from tahsil headquarters.

- Evaluate the relationship between transport accessibility and regional development.

4. Database and Methodology

This study is based on both primary and secondary data. Tahsil-level administrative boundaries were obtained from the Socio-Economic Review and District Statistical Abstract of Solapur District (2021), while road network data was collected from the Public Works Department (PWD), Government of Maharashtra, and updated through satellite imagery. Tahsil headquarters were taken as nodal points for accessibility analysis, and service areas were classified into six zones: 0–5 km, 5–10 km, 10–15 km, 15–20 km, 20–25 km, and beyond 25 km.

The methodology involved digitizing administrative maps and road networks in GIS and using the Network Analyst extension in ArcGIS to generate service areas at regular 5 km intervals. The land area within each zone was computed in square kilometers and tabulated tahsil-wise. Comparative analysis was then carried out to identify variations in accessibility, where larger service areas within shorter distances indicated better connectivity, and higher proportions in the >25 km category reflected weaker accessibility. The findings were finally interpreted in relation to the socio-economic development of Solapur District.

5. Results and Discussion

The analysis of road transport service areas in Solapur District provides valuable insights into the spatial patterns of accessibility and their implications for regional development. By categorizing service areas into six distance zones (0–5 km, 5–10 km, 10–15 km, 15–20 km, 20–25 km, and >25 km), the study highlights variations in connectivity both at the district and tahsil levels. These findings help to identify regions with strong transport linkages as well as those facing accessibility constraints. The results are presented in four parts: district-level findings, tahsil-level findings, key observations, and implications for regional development.

Table No. 1.1

Solapur District: Tahsil-wise Service Area of Solapur District (in sq. km)

Sr. No.	Tahsil	Service Area in Sq.km						Total
		0-5 sq.km	5-10 sq.km	10-15 sq.km	15-20 sq.km	20-25 sq.km	> 25 sq.km	
1	Karmala	55.22	149.41	165.81	143.8	107.31	950.2	1571.75
2	Madha	51.13	149.67	238.3	163.61	67.78	855.51	1526
3	Barshi	50.4	158.76	213.28	250.59	163.2	686.27	1522.5
4	North Solapur	43.26	106.95	127.58	102.8	37.59	264.85	683.03
5	Mohol	38.32	141.98	222.9	243.25	119.34	551.1	1316.89
6	Pandharpur	54.25	176.1	274.72	235.87	139.34	414.09	1294.37
7	Malshiras	55.82	149.38	199.04	221.03	123.03	859.72	1608.02
8	Sangola	55.53	142.67	208.62	174.66	83.97	928.86	1594.31
9	Mangalwedha	63.51	165.32	218.1	181.01	38.04	475.61	1141.59
10	South Solapur	31.84	73.46	93.22	129.3	136.97	729.84	1194.63
11	Akkalkot	56.66	169.84	220.12	182.11	94.02	678.55	1401.3
12	Total	555.94	1583.54	2181.69	2028.03	1110.59	7394.6	14854.39

Source: Computed using Network Analysis Methods, 2021.

6.1 District-Level Findings

The service area analysis of Solapur District covers a total of 14,854.39 sq. km, reflecting the extent of accessibility from Tahsil headquarters through the existing road network. The largest share of this area of 7,394.60 sq. km (nearly 50%)—falls within the >25 km zone, which indicates that almost half of the district remains relatively far from administrative and service centers. Such a concentration in the outermost zone highlights significant accessibility gaps across the district.

In contrast, the inner service zones are relatively small. The 0–5 km zone accounts for only 555.94 sq. km, while the 5–10 km zone covers 1,583.54 sq. km. Together, these two categories represent less than 15% of the total service area, suggesting that only a limited proportion of settlements enjoy proximity to tahsil headquarters. The intermediate zones (10–15 km, 15–20 km, and 20–25 km) cover 2,181.69 sq. km, 2,028.03 sq. km, and 1,110.59 sq. km respectively, forming a gradual transition between highly accessible cores and poorly connected peripheries.

This overall pattern shows that road transport in Solapur District provides moderate accessibility near tahsil centers, but vast stretches of rural and peripheral areas remain dependent on long-distance travel. Such uneven distribution of service areas has direct implications for socio-economic opportunities, particularly in agricultural marketing, access to healthcare, education, and administrative services.

6.2 Tahsil-Level Findings

At the tahsil level, accessibility patterns in Solapur District show considerable variation. The total service area differs from one tahsil to another, reflecting both geographical extent and road network efficiency.

Karmala, Madha, and Barshi each record service areas exceeding 1,500 sq. km. Karmala (1,571.75 sq. km) has the largest coverage, with significant portions in the 10–20 km range, but nearly 950 sq. km still lies beyond 25 km. Madha (1,526 sq. km) also shows similar trends, where accessibility near the tahsil headquarters is reasonable, but the periphery remains less connected. Barshi (1,522.5 sq. km), one of the most urbanized tahsils, has stronger accessibility within the 10–20 km belt, though more than 686 sq. km falls in the >25 km zone.

Malshiras (1,608.02 sq. km) and Sangola (1,594.31 sq. km) emerge as large tahsils with extensive service areas. However, both show high dependence on the >25 km zone—859.72 sq. km in Malshiras and 928.86 sq. km in Sangola—indicating that a majority of villages remain far from the tahsil headquarters. Despite their size, peripheral areas in these tahsils face limited accessibility, which restricts transport-driven development. Pandharpur (1,294.37 sq. km), Mohol (1,316.89 sq. km), and Akkalkot (1,401.3 sq. km) represent medium-level service areas. Pandharpur, as a major pilgrimage center, shows better coverage within the 0–15 km zones (over 500 sq. km), reflecting the influence of road improvements catering to religious tourism. Mohol

and Akkalkot display a balance between central accessibility and peripheral inaccessibility, with large shares of their service areas still lying beyond 25 km.

By contrast, North Solapur, South Solapur, and Mangalwedha reflect lower accessibility. North Solapur covers only 683.03 sq. km, the smallest in the district, largely due to its compact size, though proximity to Solapur city compensates for its limited service area. South Solapur (1,194.63 sq. km) and Mangalwedha (1,141.59 sq. km) both face challenges as more than one-third of their areas lie in the >25 km zone, restricting easy access for rural communities.

Overall, the tahsil-level findings indicate that while larger tahsils like Malshiras, Karmala, and Sangola dominate in total service area, they also suffer from widespread inaccessibility in peripheral villages. Smaller tahsils like North Solapur demonstrate concentrated accessibility but limited spatial reach. These disparities underscore the uneven nature of road transport services in the district.

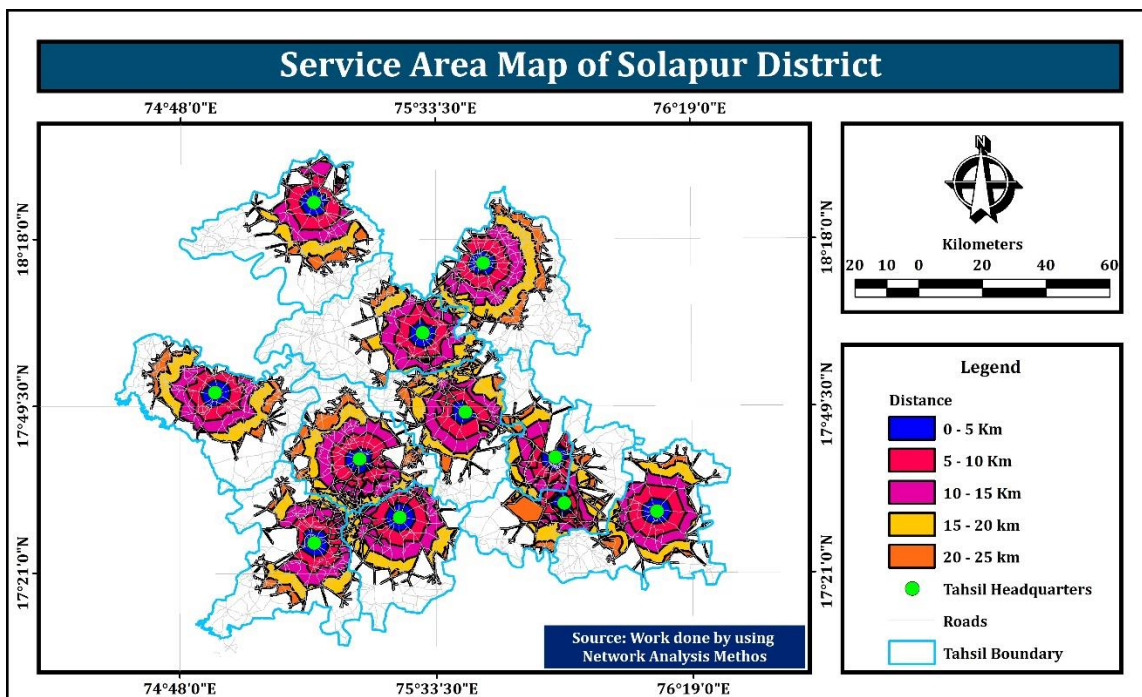


Fig. No. 1.1

6.3 Key Observations

Limited Accessibility: Nearly half of Solapur District falls in the >25 km service zone, reflecting that a large portion of the population has limited access to tahsil headquarters, which may affect administrative efficiency and service delivery.

Uneven Connectivity: While central tahsils such as Karmala, Madha, Barshi, Malshiras, and Sangola cover extensive areas, their outer zones remain poorly connected. Pandharpur, on the other hand, enjoys better short-range access due to its religious and economic importance, although its peripheries still face accessibility challenges.

Peripheral Challenges: Tahsils in the southern and southwestern parts, including South Solapur, Mangalwedha, and Sangola, have significant areas beyond 25 km from headquarters. This weak

connectivity limits rural development opportunities, affecting agriculture, trade, and social services.

Transport Development Linkage: Accessibility patterns strongly correlate with socio-economic conditions. Tahsils with better transport networks exhibit higher agricultural productivity, industrial activity, and trade, whereas poorly connected areas lag in development and economic growth.

6.4 Implications for Regional Development

Uneven Transport Accessibility: The district exhibits significant disparities in connectivity, which directly influence socio-economic development. Areas with good transport links benefit from easier agricultural marketing, trade, and access to services.

Disadvantaged Peripheral Regions: Remote villages, particularly in drought-prone and semi-arid tahsils like Mangalwedha and South Solapur, face limited access to markets and services, worsening their developmental challenges.

Need for Targeted Infrastructure Investments: Improving road networks, especially to connect peripheral regions with tahsil headquarters and major market centers, is crucial for fostering inclusive growth.

Enhancing Rural Linkages: Expanding rural roads and strengthening inter-tahsil connections can increase economic opportunities, reduce regional disparities, and support more equitable development across the district.

7. Conclusion

This study reveals that road transport plays a vital role in shaping regional development in Solapur District. Service area analysis using GIS reveals that nearly half of the district lies beyond 25 km from tahsil headquarters, underscoring serious accessibility challenges. While central and western tahsils such as Malshiras, Karmala, and Sangola enjoy relatively better connectivity, peripheral and semi-arid tahsils lag behind. The results make clear that improving road transport accessibility is essential for reducing regional inequalities, enhancing agricultural and industrial linkages, and ensuring balanced socio-economic development in Solapur District.

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