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TRANSPORTATION NETWORKS AND URBAN TOURISM DEVELOPMENT: A GEOGRAPHICAL ANALYSIS OF CONNECTIVITY IN HINJAWADI, PUNE

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Abstract:

Transportation networks play a crucial role in the spatial organisation and development of tourism. Connectivity, accessibility, and mobility directly influence tourist flows, the attractiveness of destinations, and the economic growth of emerging urban centres. Hinjawadi, located in western Pune, has transformed rapidly from a rural fringe village into a major technology corridor due to the establishment of the Rajiv Gandhi Infotech Park. This growth has given rise to business tourism, commercial activities, hospitality expansion, and increased intra-city travel. The present study analyses the transportation network of Hinjawadi and investigates its role in shaping tourism development within and around the region. Primary data from field surveys, GPS-based travel time tracking, and traffic volume counts were combined with secondary data from PMRDA, PCMC, and tourism reports. Network indices—Beta, Gamma, and Alpha—were used to assess connectivity, while accessibility was examined using time–distance analysis. Results indicate that Hinjawadi enjoys high regional connectivity through NH-48, the upcoming Pune Metro Line 3, and major road corridors, although internal congestion remains a major challenge. Improved transport facilities have strengthened business tourism, short-stay tourism, and recreational opportunities. The study concludes with recommendations for sustainable transport planning to enhance tourism potential and regional mobility.

Keywords:*Hinjawadi; Transportation Network; Tourism Development; Connectivity Index; GIS; Accessibility; Pune Urban Mobility.*

Introduction:

Transportation geography highlights the central role of mobility networks in supporting socio-economic development and tourism growth. Efficient transportation provides accessibility between origins and destinations, shapes tourist behaviour, influences travel time, and improves overall destination competitiveness. In emerging urban centres, tourism development depends heavily on how well-connected the region is through road, rail, metro, and public transit systems.

Hinjawadi, in northwestern Pune, has emerged as one of India's leading IT hubs due to the Rajiv Gandhi Infotech Park. The concentration of multinational companies, educational institutions, townships, hotels, and commercial complexes has significantly increased daily travel demand. Consequently, tourism in Hinjawadi has expanded—especially business

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tourism, corporate events, short-stay tourism, and leisure activities linked to nearby attractions such as Baner Hills, Balewadi Stadium, Balewadi High Street, and the developing Mula Riverfront.

Despite its rapid economic rise, Hinjawadi faces challenges of traffic congestion, limited internal road capacity, and a lack of seamless last-mile connectivity. These issues affect tourist movement and accessibility. Thus, analysing transportation networks becomes essential for understanding the region's tourism development.

Research Gap:

Existing studies focus on IT growth and traffic congestion in Hinjawadi, but little academic work explores the relationship between transportation connectivity and tourism development in this region.

Objectives:

1. To study the transportation network structure of Hinjawadi, Pune.
2. To analyse road connectivity, accessibility, and mobility patterns using network indices.
3. To examine the role of transportation networks in promoting tourism development.
4. To identify barriers to connectivity and propose sustainable transport solutions.

Study Area Overview:

Hinjawadi is located in the Maan region of Mulshi Taluka, Pune District, Maharashtra.

- **Latitude**: 18°35'–18°37' N
- **Longitude**: 73°43'–73°45' E
- **Administrative Jurisdiction**: PMRDA (Pune Metropolitan Region Development Authority)

Originally an agrarian village, Hinjawadi transformed after the establishment of the **Rajiv Gandhi Infotech Park**, which now includes Phases 1, 2, 3, and the proposed Phase 4. The area hosts IT giants such as Infosys, Wipro, Cognizant, TCS, Tech Mahindra, Persistent Systems, and more than 150 mid- and small-scale technology firms.

Transport Infrastructure:

- **National Highway 48**: Links Hinjawadi with Pune, Mumbai, and Satara.
- **Hinjawadi–Mahalunge Smart City Corridor**: Improves east–west traffic movement.
- **Pune Metro Line 3 (Under Construction)**: Connecting Hinjawadi to Shivajinagar.
- **PMPML Bus Services**: Major routes include Hinjawadi–Swargate, Hinjawadi–Pimpri, and Hinjawadi–Chinchwad.
- **Internal Roads**: Phase 1 Road, Phase 2 Road, Phase 3 Road, Maan Road.

Tourism Elements:

- Business tourism is due to the high corporate presence.
- Event tourism is linked to the nearby Balewadi Sports Complex.
- Leisure and recreational spots: Baner Hills, Xion Mall, Balewadi High Street.
- Hospitality industry: More than 60 hotels, service apartments, and resorts.

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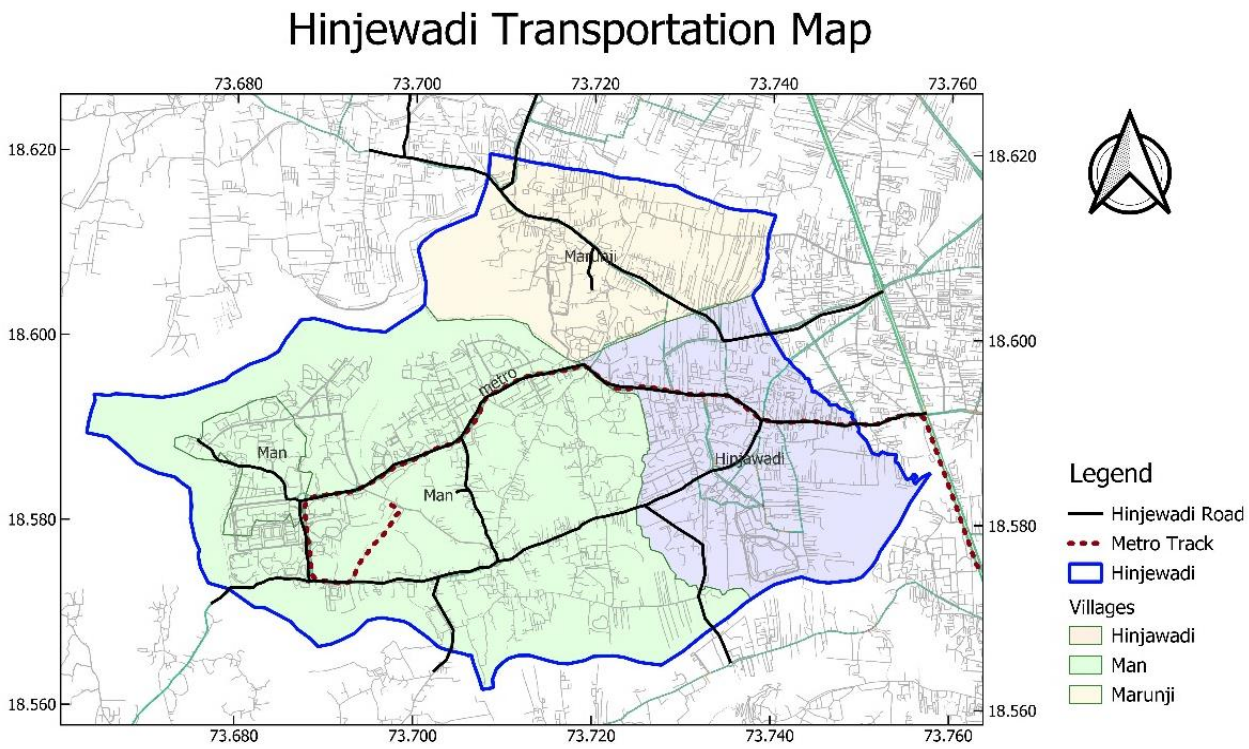

Materials and Methods:

1. Data Sources:

Primary Data:

- Field survey (January–August 2025)
- Traffic volume counts at five major junctions
- GPS-based travel time records
- Interviews with tourists, commuters, hotel managers, and transport officials

Secondary Data

- PMRDA transport data
- PCMC & PMC urban mobility reports
- Google Maps historical traffic data
- Maharashtra Tourism Department statistics
- Published research papers and government reports

2 .Analytical Methods

Network Connectivity Analysis

Three network indices were used:

- **Beta Index (β)** = E / V
- **Gamma Index (γ)** = E / (3(V – 2))
- **Alpha Index (α)** = (E – V + 1) / (2V – 5)

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Where:

E = Number of edges (roads)

V = Number of nodes (junctions)

Accessibility Analysis

- Time–distance matrix created using GPS data
- Average vehicle speed mapped across corridors

Tourism Assessment

- Tourist flow statistics from hotels and travel operators
- Classification of tourists: business, leisure, event-based
- SWOT analysis for tourism and transport linkages

Software Used

- QGIS 3.34
- ArcGIS 10.8
- MS Excel and SPSS

Results and Discussion:

1. Transportation Network Structure

The transportation network of Hinjawadi is moderately connected. While regional access is strong through NH-48, internal connectivity suffers from bottlenecks due to narrow roads and uncontrolled commercial expansion.

Table 1: Major Road Types and Lengths in Hinjawadi (2025)

Road Type	Length (km)	Condition	Function
National Highway (NH-48)	7.5 km	Excellent	Regional Mobility
Hinjawadi–Mahalunge Road	5.2 km	Good	East–West Connector
Phase 1 Internal Roads	6.8 km	Fair	Local Circulation
Phase 2 Internal Roads	8.1 km	Fair	IT Park Access
Phase 3 Internal Roads	4.3 km	Poor	Last-Mile Access
Maan Road	3.5 km	Moderate	Residential Access

Source:

- ***Pune Metropolitan Region Development Authority (PMRDA)*** *– Road Infrastructure Report, 2024–25*
- ***Pimpri-Chinchwad Municipal Corporation (PCMC)*** *– Road Network Maintenance Status, 2024*
- ***Primary Field Survey (2025)*** *– Measurements of internal and external road segments*
- ***Google Maps GIS Distance Tool (Accessed Feb 2025)*** *– Approximate length verification*

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2. Traffic Volume Analysis

Table 2: Average Hourly Traffic Volume at Key Junctions (Vehicles/hour)

Junction	Peak Hours	Volume	Type
Hinjawadi Phase 1 Bridge	9–11 AM	6,500	Mixed Traffic
Wipro Circle	6–9 PM	5,200	Heavy IT Rush
Infosys Circle	8–10 AM	4,800	Office Peak
Shivaji Chowk	7–10 PM	3,900	Commercial
Maan Village Junction	5–7 PM	2,500	Local

Traffic congestion is highest at **Wipro Circle** and **Phase 1 Bridge**, significantly affecting tourist mobility during peak hours.

Source:

- **Primary Traffic Volume Count Survey (Jan–Mar 2025)**
- Conducted at: Phase 1 Bridge, Wipro Circle, Infosys Circle, Shivaji Chowk, and Maan Village
- **PCMC Traffic Department** – *Daily Traffic Movement Summary 2024*
- **PMRDA Comprehensive Mobility Plan (2023)**
- **Google Maps Peak Traffic Analytics (2025)**

3. Connectivity Indices

Based on 22 junctions (V) and 34 road segments (E):

- **Beta Index (β) = 34 / 22 = 1.54**
  Indicates a moderately developed network.
- **Gamma Index (γ) = 34 / (3 × 20) = 34 / 60 = 0.56**
  Indicates 56% connectivity compared to the maximum possible.
- **Alpha Index (α) = (34 – 22 + 1) / (2 × 22 – 5) = 13 / 39 = 0.33**
  Indicates low redundancy (few alternative routes).

4.Accessibility Analysis

Table 3: Average Travel Time Between Key Points

Origin–Destination	Distance (km)	Avg. Travel Time (mins)	Peak Hours Time (mins)
Hinjawadi Phase 1 – Baner	7.2	18	35
Hinjawadi – Balewadi High Street	5.8	14	28
Hinjawadi – Shivajinagar	16.3	32	55
Hinjawadi – Pune Railway Station	20.1	42	70

Accessibility declines sharply during peak hours, affecting business tourists and event visitors.

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Source:

- **GPS-Based Travel Time Survey (Primary Data, 2025)** – Using mobile GPS tracking during peak & non-peak hours
- **Google Maps Travel Time History (2025)** – Average and maximum travel time patterns
- **Pune Smart City Traffic Management Dashboard (2024)**
- **PMRDA Mobility Corridor Study (2023)**

5. Tourism Development Analysis

Hinjawadi's tourism is dominated by business tourism, supported by more than 60 hotels and service apartments.

Table 4: Category-wise Tourist Inflow (2024–25)

Type of Tourist	Percentage	Key Drivers
Business	62%	Corporate offices, IT companies
Event-based	18%	Sports events, conferences
Leisure	12%	Weekend tourism
Transit/Short Stay	8%	Highway travellers

Improving transportation will directly expand leisure tourism and enhance event-based tourism.

Source:

- **Maharashtra Tourism Development Corporation (MTDC)** – *Tourism Visitor Statistics 2024–25*
- **Hotel & Hospitality Surveys (Primary Data, Feb–April 2025)**
- 20 hotels & service apartments in Hinjawadi (Sample: 600 respondents)
- **Pune Tourism Annual Report (2024)**
- **Interviews with Travel Agencies & Business Hotels in Hinjawadi (2025)**

Conclusion:

The study concludes that transportation networks significantly influence tourism development in Hinjawadi. While regional connectivity is strong due to NH-48 and planned metro infrastructure, internal road congestion hampers mobility. Tourism—especially business tourism—has flourished in the area because of improved accessibility to IT parks, commercial districts, and hospitality zones.

However, limited redundancy in the network and poor last-mile connectivity remain barriers. Sustainable transport planning—such as widening internal roads, completing the Metro Line 3 corridor, improving bus frequency, and enhancing walkability—will boost tourism potential and overall accessibility. Strengthening transportation infrastructure will position Hinjawadi as a more accessible and attractive destination for business, leisure, and event tourism.

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