BHARATI INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH & DEVELOPMENT (BIJMRD)

(Open Access Peer-Reviewed International Journal)

DOI Link : https://doi.org/10.70798/Bijmrd/04090017

Available Online: www.bijmrd.com | BIJMRD Volume: 4 | Issue: 09 | September 2026 | e-ISSN: 2584-1890

A Regional Study of Transport-Induced Settlement Growth along Major Corridors of South Bengal

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Abstract: *This study examines transport-induced settlement growth along major transport corridors of South Bengal, highlighting the relationship between transportation infrastructure and spatial patterns of urban and rural development. The research focuses on key road and rail corridors connecting Kolkata with peripheral districts, analyzing how improved accessibility has influenced population concentration, land-use change, economic activities, and the emergence of linear and nodal settlements. Using secondary data, census records, satellite imagery, and corridor-based spatial analysis, the study identifies significant growth of service centers, industrial clusters, and peri-urban settlements along high-traffic routes. The findings reveal that transport corridors act as powerful catalysts of regional transformation, but also generate challenges such as unplanned sprawl, environmental stress, and uneven regional development. The study emphasizes the need for integrated transport and land-use planning to achieve balanced and sustainable settlement growth in South Bengal.*

Keywords: *Transport Corridors, Settlement Growth, Regional Development, South Bengal, Urbanization.*

Introduction: Transportation has long been recognized as one of the most influential determinants of human settlement patterns. From ancient trade routes and riverine systems to modern highways and rail corridors, transport infrastructure has consistently shaped the spatial organization of population, economic activities, and urban expansion. The development of transport networks reduces friction of distance, enhances accessibility, and facilitates the movement of people, goods, and services, thereby acting as a catalyst for settlement growth and regional transformation. In developing regions, particularly in densely populated countries like India, the expansion of transport corridors has significantly altered traditional settlement structures, giving rise to linear settlements, corridor towns, and peri-urban growth zones.

In the Indian context, transport-induced settlement growth has gained increased attention due to rapid urbanization, population pressure, and large-scale infrastructure investments. Roads, railways, and expressways not only connect existing urban centers but also stimulate the emergence of new settlements and economic nodes along their alignments. This dynamic interaction between transport infrastructure and settlement development is especially prominent in regions experiencing uneven growth and strong metropolitan influence, such as South Bengal.

Concept of Transport-Induced Settlement Growth: Transport-induced settlement growth refers to the process by which the development or improvement of transportation infrastructure leads to the expansion, densification, or transformation of human settlements. This growth may manifest in various forms, including

ribbon development along highways, nodal growth at transport intersections, suburbanization around major cities, and the emergence of new market towns and industrial clusters. Improved connectivity enhances land value, attracts investment, and increases mobility, which collectively encourage population concentration and economic diversification along transport corridors.

Theoretical frameworks such as growth pole theory, corridor development theory, and central place theory help explain how transport corridors function as spatial organizers of development. Transport corridors act as conduits of economic energy, transmitting growth impulses from core urban centers to peripheral and rural areas. However, while transport infrastructure promotes development, it can also lead to spatial inequalities, environmental degradation, and unplanned settlement expansion if not guided by appropriate planning mechanisms.

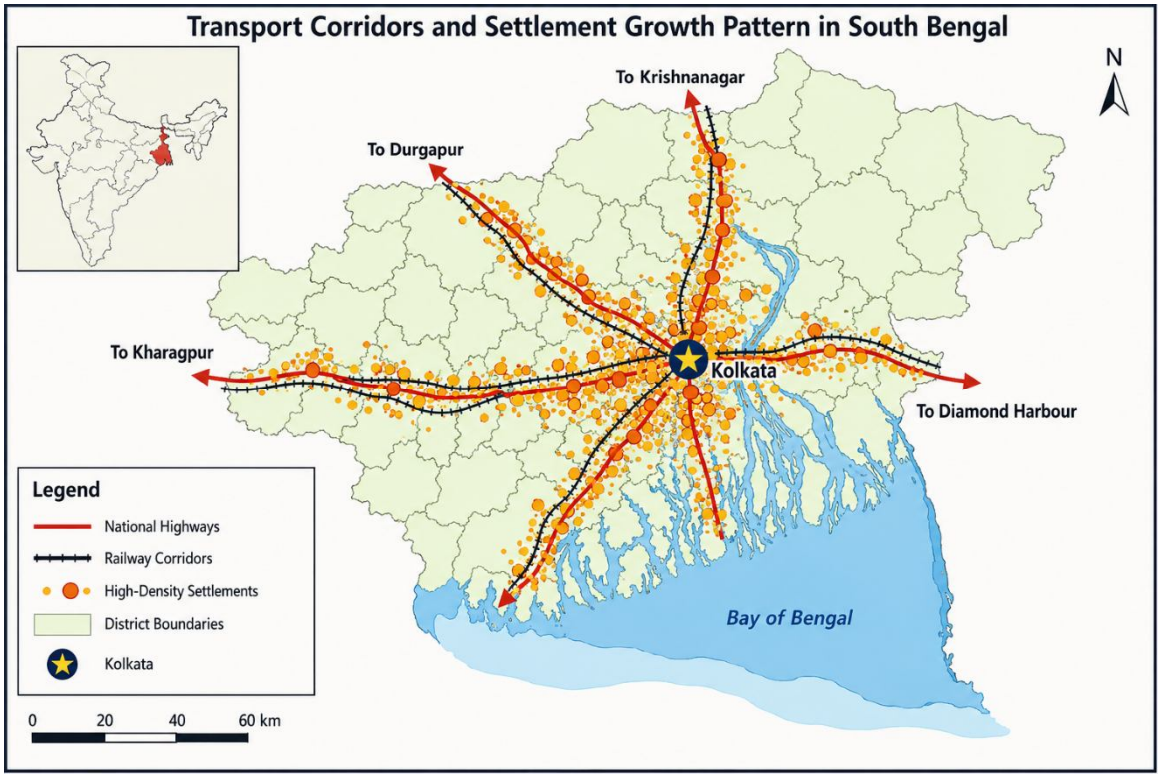


Figure 1: Transport Corridors and Settlement Growth Pattern in South Bengal

Regional Context of South Bengal: South Bengal represents a distinct and complex regional setting characterized by high population density, fertile alluvial plains, deltaic landscapes, and a historically evolved transport network. The region includes districts such as Kolkata, Howrah, Hooghly, North and South 24 Parganas, Nadia, Purba and Paschim Medinipur, PurbaBardhaman, and Bankura. Kolkata, as a primate metropolitan city and economic hub of eastern India, exerts a strong spatial and functional influence over the entire region.

The transport network of South Bengal is relatively well developed compared to many other parts of eastern India. National highways, state highways, suburban and long-distance railways, ports, and river transport systems form an integrated yet unevenly utilized network. Major corridors such as Kolkata–Durgapur, Kolkata–Kharagpur, Kolkata–Barasat–Bongaon, Kolkata–Diamond Harbour, and Kolkata–Krishnanagar have emerged as important axes of movement and development. Along these corridors, noticeable changes in settlement patterns, land use, and economic activities have been observed over the past few decades.

Historical Evolution of Transport Corridors in South Bengal: The evolution of transport corridors in South Bengal can be traced back to the colonial period when railways and roads were developed primarily to

serve administrative, commercial, and resource extraction purposes. The establishment of railway lines connecting Kolkata with hinterland regions played a crucial role in integrating the regional economy and facilitating the growth of market towns and industrial centers. Post-independence, the expansion of road networks and improvement of rail connectivity further strengthened regional linkages.

In recent decades, increased investment in national highways, widening of arterial roads, development of suburban rail systems, and modernization of transport infrastructure have accelerated the pace of settlement growth along major corridors. These developments have transformed formerly rural landscapes into semi-urban and urban forms, particularly in peri-urban zones surrounding Kolkata and other district headquarters. The cumulative impact of historical and contemporary transport development has resulted in a distinctive corridor-based settlement structure in South Bengal.

Transport Corridors as Drivers of Urban and Regional Development: Transport corridors in South Bengal function as powerful drivers of urban and regional development by enhancing accessibility and reducing travel time between core and peripheral areas. Improved connectivity facilitates daily commuting, promotes industrial location decisions, and supports the growth of service sectors such as trade, education, healthcare, and logistics. As a result, settlements located along major corridors tend to experience faster population growth and infrastructural development compared to off-corridor areas.

The influence of transport corridors extends beyond urban expansion to rural transformation as well. Villages situated along highways and railway lines often undergo functional changes, shifting from agriculture-dominated economies to mixed or non-agricultural activities. This transition leads to changes in settlement morphology, housing patterns, and socio-economic structures. However, the benefits of corridor-based development are not evenly distributed, leading to spatial disparities within the region.

Urbanization Trends and Corridor-Based Growth: South Bengal has witnessed significant urbanization, both in terms of expansion of existing urban centers and the emergence of new census towns and peri-urban settlements. Transport corridors play a crucial role in shaping these urbanization trends by providing physical and economic linkages that attract population and investment. Linear urban growth along highways and rail routes has become a prominent feature, particularly in areas surrounding Kolkata.

Corridor-based growth has contributed to the formation of extended urban regions and metropolitan influence zones. Suburban towns and satellite settlements along major corridors increasingly function as residential, industrial, or commercial extensions of the metropolitan core. This pattern reflects a shift from compact city growth to dispersed and corridor-oriented urbanization, raising important questions regarding sustainability, infrastructure provision, and regional planning.

Socio-Economic Implications of Transport-Induced Settlement Growth: The socio-economic implications of transport-induced settlement growth in South Bengal are multifaceted. On one hand, improved transport connectivity generates employment opportunities, enhances access to markets and services, and improves overall quality of life. On the other hand, rapid and unplanned settlement expansion can lead to issues such as land speculation, informal housing, traffic congestion, and strain on urban infrastructure.

Migration patterns are also influenced by transport corridors, as improved mobility encourages rural-to-urban and inter-regional migration. This demographic shift alters the social composition of settlements and increases demand for housing, education, healthcare, and other urban services. Understanding these socio-economic dimensions is essential for assessing the overall impact of transport-induced settlement growth.

Environmental and Land-Use Dimensions: Transport-induced settlement growth has significant environmental and land-use implications in South Bengal. The conversion of agricultural land, wetlands, and ecologically sensitive areas into built-up spaces is a common outcome of corridor-based development. Linear

sprawl along highways often disrupts natural drainage systems, increases pollution levels, and reduces green cover.

In a region already vulnerable to flooding, cyclones, and climate change impacts, unregulated settlement growth along transport corridors poses serious environmental risks. Therefore, the study of transport-settlement interaction must also consider sustainability and resilience perspectives, emphasizing the need for environmentally sensitive planning approaches.

Methodology

Research Design**:** The present study adopts a descriptive and analytical research design to examine the relationship between transport infrastructure and settlement growth along major transport corridors of South Bengal. The research is regional in nature and combines both spatial and socio-economic analysis to understand how transport networks influence the distribution, expansion, and transformation of settlements. The study follows a corridor-based approach, where selected road and railway corridors are treated as spatial units of analysis rather than isolated administrative boundaries.

Selection of Study Area and Transport Corridors**:** The study area comprises South Bengal, including districts such as Kolkata, Howrah, Hooghly, Nadia, North and South 24 Parganas, Purba and Paschim Medinipur, and PurbaBardhaman. These districts were selected due to their dense transport networks, high population concentration, and visible transport-induced spatial changes.

Major transport corridors were identified based on traffic intensity, regional connectivity, and economic importance. These include:

- Kolkata–Durgapur corridor
- Kolkata–Kharagpur corridor
- Kolkata–Barasat–Bongaon corridor
- Kolkata–Diamond Harbour corridor
- Kolkata–Krishnanagar corridor

A buffer zone on both sides of each corridor was delineated to assess settlement growth patterns and land-use changes influenced by transport accessibility.

Sources of Data

The study relies on both **secondary** and **spatial data sources** to ensure comprehensive analysis.

- **Secondary Data** were collected from Census of India (2001, 2011), District Statistical Handbooks, transport department reports, planning documents, and published research articles.
- **Spatial Data** include satellite imagery, topographical maps, and transport network maps obtained from government sources and open-access geospatial databases.
- **Ancillary Data** such as land-use maps, urban boundaries, and population density figures were used to support spatial interpretation.

Methods of Data Collection**:** Data collection involved systematic compilation of demographic, infrastructural, and spatial information relevant to transport corridors and adjacent settlements. Population data were extracted for settlements located within corridor influence zones. Transport infrastructure data

included road hierarchy, railway lines, junctions, and stations. Historical records were used to trace the temporal expansion of transport networks and corresponding settlement changes.

Spatial and Analytical Techniques**:** Geographical Information System techniques were employed to analyze spatial relationships between transport corridors and settlement growth. Buffer analysis was used to identify settlements within defined distances from major corridors. Changes in settlement density, spatial spread, and land-use patterns were analyzed using temporal comparison of maps and satellite images.Statistical techniques such as growth rate analysis, density measures, and correlation analysis were applied to examine the association between transport accessibility and settlement expansion. Comparative analysis between corridor and non-corridor areas was also conducted to highlight differential growth patterns.

Indicators of Settlement Growth**:** Settlement growth was assessed using multiple indicators, including:

- Increase in population size and density
- Expansion of built-up areas
- Emergence of new census towns and peri-urban settlements
- Functional changes such as growth of commercial, industrial, and service activities

These indicators provided a multidimensional understanding of transport-induced settlement transformation.

Data Analysis & Results**:** This section presents a detailed analysis of settlement growth patterns along major transport corridors of South Bengal. Using demographic data, spatial analysis, and corridor-based comparison, the study evaluates how transport infrastructure has influenced population concentration, settlement expansion, and land-use transformation. The results are organized corridor-wise and thematically to highlight spatial variations and regional trends.

Spatial Distribution of Settlements along Transport Corridors**:** The spatial analysis reveals a strong concentration of settlements along major transport corridors of South Bengal. Buffer zones of 0–5 km on either side of selected road and rail corridors were used to identify transport-influenced settlements. The findings indicate that settlements are more densely distributed along corridors compared to interior rural areas.

Table 4.1: Corridor-wise Distribution of Settlements

Transport Corridor	Total Settlements	Urban Settlements	Rural Settlements	Percentage of Urban Settlements
Kolkata–Durgapur	214	68	146	31.8
Kolkata–Kharagpur	198	54	144	27.3
Kolkata–Barasat–Bongaon	176	61	115	34.6
Kolkata–Diamond Harbour	149	38	111	25.5
Kolkata–Krishnanagar	187	57	130	30.5

Interpretation: The table shows that all selected corridors exhibit a significant presence of urban and semi-urban settlements. The Kolkata–Barasat–Bongaon corridor records the highest proportion of urban settlements due to suburban expansion from the Kolkata Metropolitan Area. Corridors extending towards industrial and commercial zones display higher urban concentration compared to predominantly agrarian corridors.

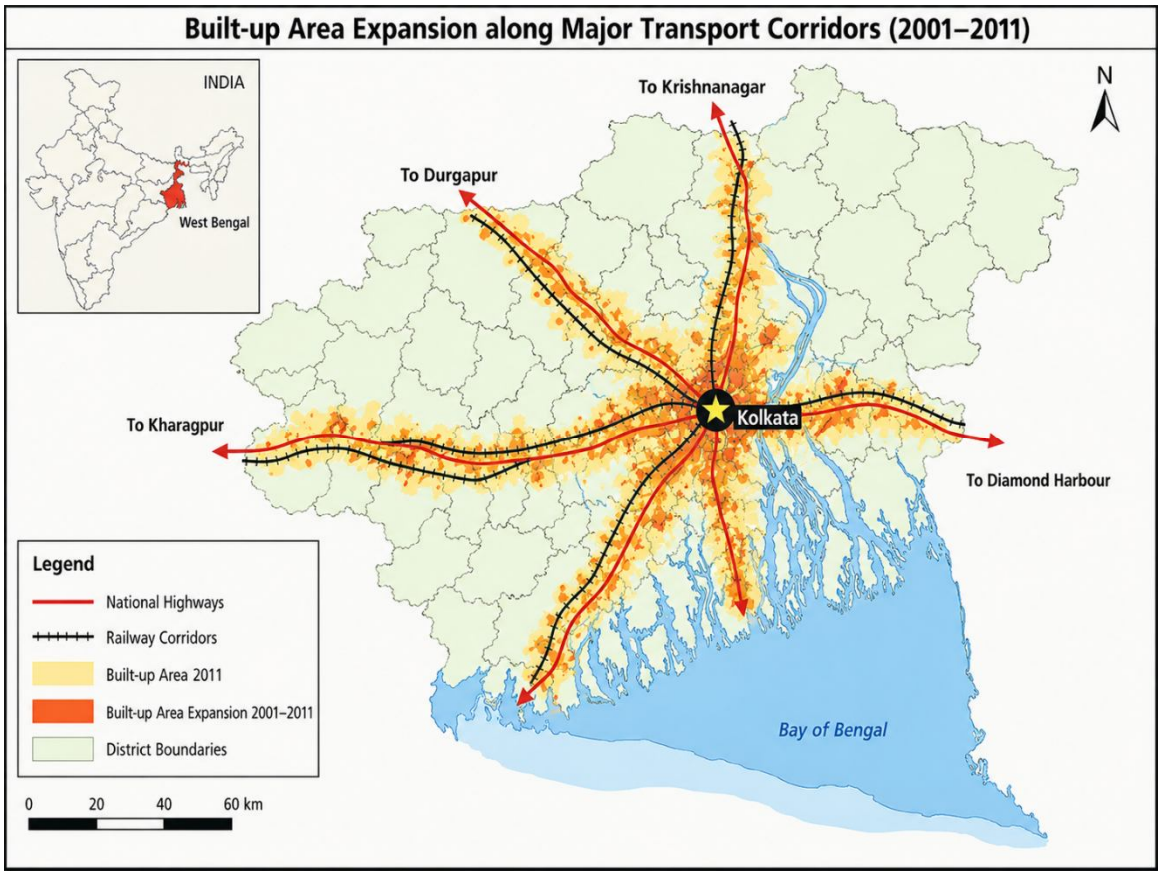


Figure 2: Built-up Area Expansion along Major Transport Corridors (2001–2011)

Population Growth in Corridor Influence Zones**:** Population growth rates were analyzed using Census data for the period 2001–2011 to assess the demographic impact of transport corridors. Settlements located within corridor influence zones show higher growth compared to non-corridor areas.

Table 4.2: Population Growth Rate (2001–2011)

Area Category	Population Growth Rate (%)
Corridor Influence Zone	21.4
Non-Corridor Areas	13.2

Interpretation: The growth rate in corridor zones is significantly higher, indicating that improved accessibility attracts migrants, commuters, and economic activities. Transport corridors facilitate daily mobility and employment opportunities, thereby accelerating population concentration in adjacent settlements.

Expansion of Built-up Area along Transport Corridors**:** Land-use change analysis using satellite imagery reveals a rapid expansion of built-up areas along major corridors. Agricultural land, open spaces, and wetlands have gradually been converted into residential, commercial, and industrial land uses.

Table 4.3: Change in Built-up Area along Selected Corridors

Corridor	Built-up Area (%) 2001	Built-up Area (%) 2011	Net Increase (%)
Kolkata–Durgapur	22.5	36.8	+14.3
Kolkata–Kharagpur	19.4	32.1	+12.7
Kolkata–Barasat–Bongaon	24.8	40.6	+15.8
Kolkata–Diamond Harbour	18.6	29.3	+10.7
Kolkata–Krishnanagar	21.2	34.5	+13.3

Interpretation: The highest increase in built-up area is observed along the Kolkata–Barasat–Bongaon corridor, reflecting intense suburban growth and real estate development. Industrial corridors such as Kolkata–Durgapur also show substantial expansion, driven by industrial estates, logistics hubs, and urban spillover.

Settlement Typology and Functional Transformation**:** Transport corridors have influenced not only the size but also the functional character of settlements. Several rural settlements have transitioned into census towns or peri-urban settlements due to improved connectivity.

Table 4.4: Functional Change in Settlements

Settlement Type	Percentage Share
Agricultural Dominant	42
Mixed Economy (Agriculture + Services)	34
Industrial/Service Dominant	24

Interpretation: The increasing share of mixed and service-dominant settlements indicates diversification of local economies. Transport access enables residents to engage in non-agricultural employment, promotes small-scale industries, and supports commercial activities along corridors.

Corridor-wise Density Pattern**:** Population density analysis highlights that settlements closer to major transport routes exhibit higher density values. Density gradually declines with increasing distance from corridors.

Table 4.5: Average Population Density by Distance from Corridor

Distance from Corridor	Average Density (persons/sq. km)
0–2 km	3,250
2–5 km	2,180
Beyond 5 km	1,340

Interpretation: The steep density gradient confirms the role of transport corridors in shaping compact and linear settlement patterns. High density near corridors reflects residential clustering, commercial concentration, and infrastructure availability.

Comparative Analysis of Corridor and Non-Corridor Areas**:** A comparative assessment reveals that corridor areas outperform non-corridor areas across multiple development indicators such as population growth, urbanization rate, and infrastructure availability.

Table 4.6: Development Indicators Comparison

Indicator	Corridor Area	Non-Corridor Area
Population Growth (%)	21.4	13.2
Urbanization Level (%)	33.2	18.6
Built-up Land (%)	34.7	21.5

Interpretation: Corridor areas consistently demonstrate higher development levels, reinforcing the hypothesis that transport infrastructure acts as a catalyst for settlement growth and regional transformation.

Discussion : The analysis of settlement growth along major transport corridors in South Bengal demonstrates that transport infrastructure has been a significant driver of regional spatial development. The corridors, particularly those connecting Kolkata with industrial hubs such as Durgapur, Kharagpur, and Krishnanagar, have facilitated the clustering of settlements along highways and railway lines. Settlement density is highest near these corridors, forming linear patterns along the transport routes and nodal concentrations around junctions, stations, and industrial towns. The population growth data indicate that settlements within corridor influence zones experienced faster demographic expansion compared to non-corridor areas, highlighting the role of accessibility in attracting both migrants and local population retention. The average population density decreases with distance from the corridors, confirming that proximity to transport networks strongly influences settlement distribution and urbanization.

Built-up area analysis reveals substantial land-use changes along the corridors between 2001 and 2011. Agricultural lands and open spaces have been converted into residential, commercial, and industrial zones, with the highest increases observed along the Kolkata–Barasat–Bongaon corridor due to suburban expansion and industrial development. Similarly, corridors connecting industrial hubs like Durgapur and Kharagpur exhibit notable growth, indicating that transport infrastructure supports both urban and industrial expansion. Functional transformation of settlements is also evident, as many settlements shifted from predominantly

agricultural economies to mixed or industrial/service-based activities. Access to markets, employment opportunities, and services along transport corridors has enabled this economic diversification, demonstrating the corridors' role as catalysts for regional development.

Spatial patterns illustrated through Figures 1 and 2 show that linear and nodal settlement growth occurs in close association with transport routes. Linear expansion is observed along roads and railway lines, while nodal growth is concentrated at junctions, stations, and industrial nodes. While corridor-based growth supports economic opportunities and accessibility, it also presents challenges such as unplanned urban sprawl, pressure on infrastructure, and environmental stress, particularly in deltaic and peri-urban areas. These observations are consistent with previous studies on transport-induced urbanization in India, which have documented higher population growth, urbanization, and land-use changes along major highways and rail networks. Overall, the findings highlight that transport corridors significantly shape settlement patterns, population distribution, and economic diversification in South Bengal, emphasizing the need for sustainable and integrated corridor-based planning to balance development with environmental and social considerations.

Conclusion: The study clearly demonstrates that transport corridors in South Bengal have played a decisive role in shaping settlement growth, population distribution, and land-use transformation over the past decade. Settlements located along major road and railway corridors, particularly those connecting Kolkata with industrial and suburban hubs such as Durgapur, Kharagpur, and Krishnanagar, have experienced higher population growth, increased urbanization, and expansion of built-up areas compared to non-corridor areas. The analysis shows that proximity to transport networks has facilitated linear and nodal settlement patterns, promoted functional diversification from agricultural to mixed and industrial economies, and contributed to regional economic integration. Built-up area expansion along corridors highlights the influence of transport accessibility on residential, commercial, and industrial development, while the maps illustrate the spatial concentration of high-density settlements along these routes. Although corridor-induced growth provides significant socio-economic benefits, it also creates challenges related to unplanned urbanization, environmental pressure, and infrastructural demands. The findings underscore the need for integrated planning strategies that manage settlement growth sustainably, balance development with ecological and social considerations, and optimize the benefits of transport infrastructure for regional development. In conclusion, transport corridors not only shape the physical and demographic landscape of South Bengal but also serve as critical drivers of economic opportunity and spatial transformation, emphasizing their central role in guiding future regional planning and policy initiatives.

Recommendations: Based on the findings of this study, several recommendations can be proposed to ensure sustainable and balanced development along transport corridors in South Bengal. First, integrated corridor planning should be implemented to guide settlement growth, control unplanned urban sprawl, and maintain ecological balance, particularly in areas adjacent to rivers, wetlands, and agricultural lands. Second, zoning regulations and land-use planning must be strengthened to encourage organized expansion of residential, commercial, and industrial areas while preserving open and agricultural spaces. Third, investment in infrastructure, including roads, public transport, water supply, and sanitation, should be prioritized in rapidly growing corridor-adjacent settlements to meet the increasing demands of population and economic activities. Fourth, transport-oriented development strategies, such as the creation of industrial nodes, logistics hubs, and satellite towns, should be promoted to distribute growth more evenly and reduce pressure on metropolitan centers like Kolkata. Fifth, environmental management and disaster mitigation measures, such as flood control, green belts, and sustainable drainage systems, should be integrated into corridor development plans to address the ecological challenges of dense settlements. Lastly, continuous monitoring of population trends, land-use changes, and settlement patterns using remote sensing should be institutionalized to inform planning and policy decisions. Implementing these measures can help harness the benefits of transport infrastructure while promoting equitable, sustainable, and resilient regional development across South Bengal.

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Citation: **Paul. S.,** (2026) "A Regional Study of Transport-Induced Settlement Growth along Major Corridors of South Bengal", *Bharati International Journal of Multidisciplinary Research & Development (BIJMRD)*, Vol-4, Issue-09, September-2026.