

Impact of Road Corridors On Urban Land Use Dynamics a Case Study of Navi Mumbai

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Abstract

Road corridors are instrumental in shaping urban development, particularly in fast-growing metropolitan regions. This study examines Navi Mumbai, a planned satellite city of Mumbai, to analyze the impact of main transportation corridors on urban land use patterns. The project employs spatial and temporal analysis via GIS and remote sensing technologies to monitor land use changes over the last twenty years. The findings indicate a significant correlation between the growth of road infrastructure and the proliferation of built-up regions, frequently supplanting agricultural land and open spaces with residential, commercial, and industrial developments. The findings also emphasize the dual impact of planned infrastructure: while it accelerates economic growth, it also threatens ecological stability, especially in environmentally sensitive zones like wetlands and mangroves. The study concludes by recommending integrated planning strategies that align infrastructure development with sustainable land use practices.

1. INTRODUCTION:

Urbanization in India has been accompanied by a surge in infrastructure development, particularly road corridors, which play a pivotal role in shaping land use patterns. These corridors influence the spatial distribution of urban growth, land value dynamics, and socio-economic structures. The influence of road corridors is especially pronounced in swiftly urbanizing areas such as Navi Mumbai and Delhi, which exemplify divergent models of urban planning and growth. Navi Mumbai, developed as a planned satellite city to alleviate congestion in Mumbai, exemplifies organized expansion under the “City and Industrial Development Corporation (CIDCO)”. The city's growth adheres to a clearly articulated master plan that prioritizes zoning, connection, and sustainability. The establishment of road corridors is a crucial component of urban infrastructure, significantly affecting land use patterns, urban sprawl, and socio-economic activity. As urban areas develop, the establishment of new road networks acts as a spur for expansion, influencing the spatial arrangement of residential, commercial, and industrial sectors. The correlation between transportation infrastructure and land usage becomes particularly apparent in swiftly urbanizing areas such as Navi Mumbai. Navi Mumbai, a carefully organized satellite city of Mumbai, exemplifies a strategic approach to infrastructure-led growth, with road corridors intentionally intended to facilitate balanced development. (3) This study explores the transformative impact of new road corridors on land use in these two urban contexts, focusing on shifts in land utilization, the emergence of new

economic zones, and changes in socio-economic dynamics. (3 this research seeks to uncover insights into sustainable urban planning practices and the long-term implications of transportation infrastructure on land use. This study seeks to improve understanding of the relationship between road corridors and urban development, offering insights for improved policy-making and planning in rapidly expanding cities. Three

Key Words: Urban Land Use, Road Corridors, Urban Planning, Land Use Dynamic, Infrastructure Development, Geospatial Analysis, Urban Growth Patterns, Mixed-Use, Development Sustainable, Urbanization, Land Resource Optimization, Urban Transformation, Spatial Dynamics, Environmental Impact, Policy Implications.

2. RESEARCH OBJECTIVE:

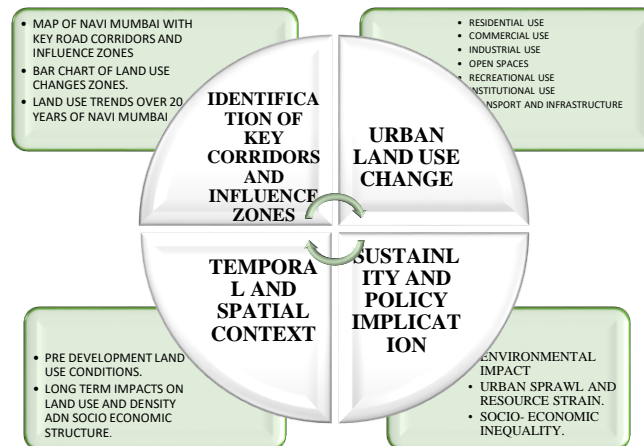
- To analyze the impact of major road corridors on the transformation of urban land use patterns in Navi Mumbai.
- To assess the socio-economic changes induced by the development of road corridors in the study area.
- To evaluate the role of planning policies and regulations in shaping land use dynamics along road corridors.
- To propose strategic recommendations for integrating road corridor planning with sustainable urban development (3)

{How road corridors in Navi Mumbai have influenced the allocation of land for residential, commercial, industrial, and green spaces. By using geospatial analysis, the research will map changes in land use over time, identifying trends such as densification near roads, urban sprawl, and the displacement of agricultural or open lands. It will assess how socio-economic benefits are distributed across different demographics, revealing potential inequalities and identifying opportunities for inclusive development. Urban sustainability demands a holistic approach that integrates infrastructure development with environmental stewardship, economic vitality, and social well-being. This focuses on formulating strategic recommendations for aligning road corridor planning with sustainable urban development goals. Drawing from the findings, the research will propose solutions such as mixed-use zoning, enhanced public transportation networks, and policies to preserve green spaces. These strategies aim to create a balanced urban landscape that maximizes the benefits of road corridors while minimizing adverse effects, ensuring long-term sustainability and livability in Navi Mumbai.}07-Rodrigue-Ch-07-Section-2.pdf

3. SCOPE OF WORK:

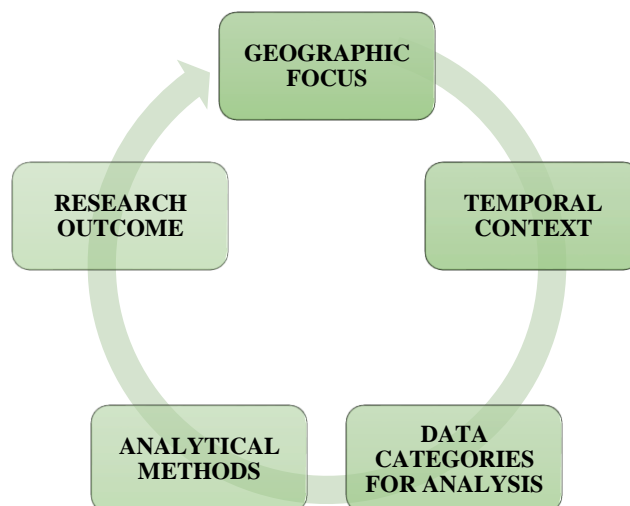
➤ The study focuses on examining the urban land use changes influenced by the development of major road corridors in Navi Mumbai.

1. Identification of key road corridors and their influence zones within Navi Mumbai.



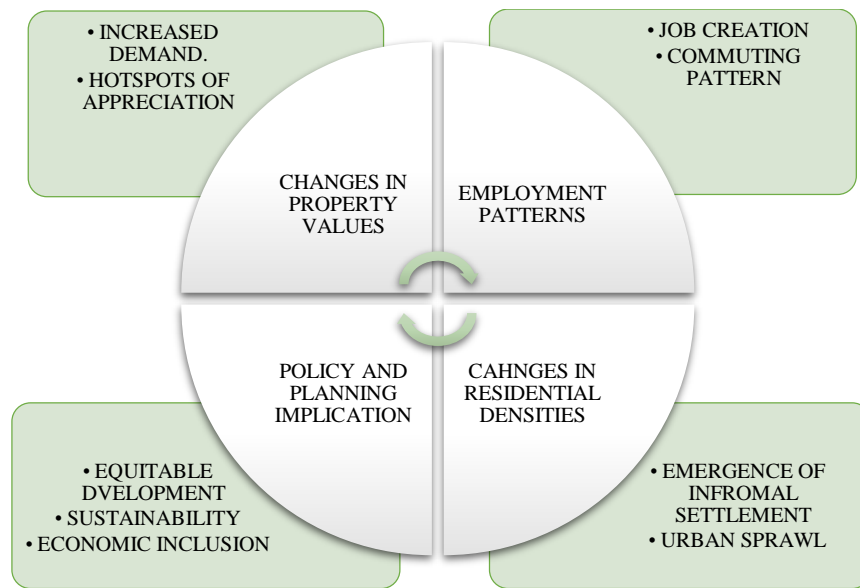
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2. Analysis of historical and contemporary land use data to understand transformation trends.

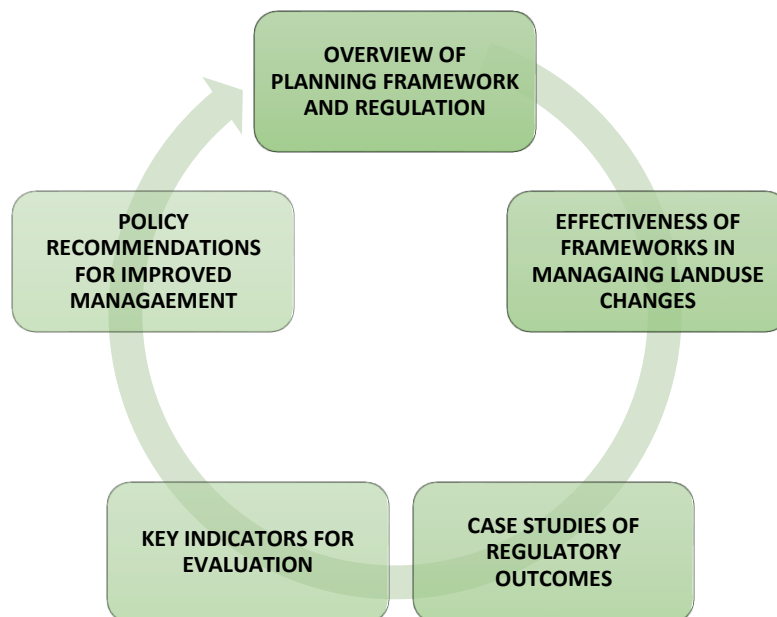


4. LAND USE CHANGE

3. Assessment of socio-economic impacts, including changes in property values, employment patterns, and residential densities.



4. Evaluation of planning frameworks, regulations, and their effectiveness in managing land use changes along road corridors.



Articles on land use impacts and accessibility improvements

5. Formulation of policy recommendations for sustainable integration of road corridor development with urban planning.



5. LITERATURE REVIEW SUMMARY:

➤ **Transportation and Land Use Dynamics** by Giuliano, G. (1995):

The study of Transportation and Land Use Dynamics explores the intricate and reciprocal relationship between transportation systems and land use patterns, emphasizing how these two factors shape urban development over time. Transportation infrastructure, such as roads, highways, and transit corridors, enhances accessibility, reducing travel costs and times, and effectively altering the spatial organization of cities. These changes catalyze land use transformations, including the densification of urban cores, the decentralization of economic activities, and the emergence of suburban and exurban developments. Improved connectivity driven by transportation projects often leads to increased property values, shifts in residential densities, and the reallocation of land for commercial, industrial, or recreational purposes. **Transportation and Land Use Dynamics** by Giuliano, G. (1995)

Transportation and Land Use Dynamics emphasizes the necessity for holistic and integrative methodologies in urban planning. Strategies that involve transit-oriented development (TOD), mixed-use zoning, and environmental impact assessments (EIA) are crucial for synchronizing transportation investments with sustainable urban growth goals. This discipline connects theoretical frameworks with empirical evidence, offering essential insights for policymakers and urban planners seeking to develop equitable, efficient, as well as resilient urban environments. **Transportation and Land Use Dynamics** by Giuliano, G. (1995)

➤ **Urban Sprawl and Transportation: Challenges for Sustainability** by Ewing, R. (1997):

Urban Sprawl and Transportation: Challenges for Sustainability explores the deep-seated relationship between urban sprawl and transportation systems, providing a critical analysis of the environmental, social, and economic impacts of these interconnected phenomena. Urban sprawl is defined by low-density, automobile-dependent expansion that radiates from urban centers, leading to disjointed and inefficient land utilization patterns. Ewing highlights that transportation infrastructure, particularly road networks, facilitates sprawl by enhancing accessibility to peripheral areas, thereby encouraging decentralization of population and economic activities.

It identifies several sustainability challenges associated with sprawl. Environmentally, it contributes to the loss of agricultural land, forests, and wetlands, exacerbating habitat destruction and biodiversity loss. Sprawl also increases vehicle miles travelled (VMT), leading to higher greenhouse gas

emissions, air pollution, and greater energy consumption. Socially, sprawl reinforces car dependency, marginalizing individuals without access to private vehicles and reducing opportunities for public transit development. Economically, the outward expansion of cities places a significant financial burden on governments to extend and maintain infrastructure such as roads, utilities, and public services. Urban Sprawl and Transportation: Challenges for Sustainability by Ewing, R. (1997)

Ewing argues for compact, mixed-use development as a sustainable alternative to sprawl. By promoting higher-density residential areas integrated with commercial and recreational facilities, cities can reduce travel distances and encourage non-motorized and public transportation. Policies like growth management, transit-oriented development (TOD), and urban growth boundaries are advocated to curtail sprawl and enhance sustainability. The research underscores the necessity of coordinating transportation and land use planning to develop resilient urban systems that harmonize environmental conservation, economic efficacy, and social equality. Urban Sprawl and Transportation: Challenges for Sustainability by Ewing, R. (1997)

This work has become a foundational text in urban planning and transportation studies, offering actionable insights for managing the adverse impacts of sprawl while fostering sustainable urban development. Its implications remain relevant for policymakers and planners seeking to address the challenges of urban expansion in rapidly growing regions. Urban Sprawl and Transportation: Challenges for Sustainability by Ewing, R. (1997)

➤ **Land Use Impacts of Transportation by Hanson, S., and Giuliano, G. (2004)**

The interplay between transportation infrastructure and land use patterns is intricately connected, with each exerting influence on the other in a dynamic feedback loop. Land Use Impacts of Transportation examines how transportation systems shape the spatial organization of cities and the allocation of land for various uses, including residential, commercial, industrial, and recreational purposes. Transportation infrastructure, such as road corridors, highways, and transit systems, enhances accessibility, reducing travel times and costs. This increased accessibility attracts development, altering land use patterns by concentrating high-density activities near transit hubs or along major transportation corridors. Land Use Impacts of Transportation by Hanson, S., and Giuliano, G. (2004)

The impacts of transportation on land use are multifaceted. Enhanced connection frequently propels urban growth into peripheral regions, leading to suburban sprawl and the transformation of agricultural or undeveloped land for urban purposes. Conversely, it can also promote densification in urban cores and around transit hubs, fostering mixed-use developments that reduce the need for vehicular travel. However, these transformations are not without challenges. Transportation projects can lead to socio-economic inequalities, such as displacement of marginalized communities or uneven distribution of accessibility benefits. They may contribute to habitat fragmentation, the reduction of green spaces, and elevated pollution levels. Land Use Impacts of Transportation by Hanson, S., and Giuliano, G. (2004)

The study underscores the necessity of amalgamating transportation planning with land use regulations to address these difficulties. Strategies include TOD, mixed-use zoning, and environmental impact assessments (EIA) are emphasized as mechanisms to guarantee that transportation investments foster sustainable and equitable urban development. By comprehending and regulating the land use effects of transportation, urban planners and policymakers may develop cities that are more accessible, efficient, and resilient. Land Use Impacts of Transportation by Hanson, S., and Giuliano, G. (2004)

➤ **Transit-Oriented Development (TOD): Theory and Practice** by Cervero, R. (2002):

TOD is a progressive urban planning approach that integrates land use and transportation systems to create high-density, mixed-use communities centered around transit hubs. The primary aim of TOD is to diminish reliance on automobiles by improving access to efficient public transit, promoting walkable communities, and supporting sustainable urban development. Typically located within a 400–800-meter radius of a transit station, TOD developments blend residential, commercial, and recreational spaces, enabling residents to live, work, and shop within a compact and interconnected area. **Transit-Oriented Development (TOD): Theory and Practice** by Cervero, R. (2002):

TOD offers significant environmental, social, and economic benefits. By prioritizing public transit over private vehicles, it reduces greenhouse gas emissions, traffic congestion, and energy consumption. Economically, TOD increases property values and attracts investments in transit-adjacent areas while promoting local businesses. Socially, it enhances quality of life by reducing commuting times, providing affordable housing options, and fostering vibrant, pedestrian-friendly communities. TOD faces challenges such as the need for zoning reforms, high initial investments, and potential gentrification that may displace low-income residents.

Effective implementation of TOD requires strong governance, community engagement, and innovative financing mechanisms such as public-private partnerships. Cities like Curitiba (Brazil), Copenhagen (Denmark), and Hong Kong exemplify successful TOD models, showcasing the potential of integrating transit systems with sustainable land use practices. TOD enables metropolitan regions to attain compact, sustainable, and equitable growth, addressing the issues associated with urban sprawl and environmental deterioration.

Transit-Oriented Development (TOD): Theory and Practice by Cervero, R. (2002)

It emphasizes the importance of strong governance frameworks to ensure equitable access to TOD benefits, including affordable housing provisions and the preservation of community spaces. It emphasizes that by integrating residential, commercial, and recreational spaces within a walkable radius of transit stations, TOD reduces the need for long-distance commuting and vehicular travel, thereby mitigating urban sprawl and its associated environmental and social costs. The book highlights the critical role of accessibility in shaping land use patterns, with transit hubs serving as anchors for economic and social activities. **Transit-Oriented Development (TOD): Theory and Practice** by Cervero, R. (2002).

➤ **Spatial Impacts of Expressways in India** by Kundu, D. (2020)

Expressways in India have profoundly reshaped the spatial organization of urban and rural regions, acting as key drivers of economic development, land use transformation, and regional connectivity. These high-speed corridors have facilitated rapid urban expansion, the creation of economic clusters, and suburbanization, often altering traditional land use patterns. For example, expressways such as the Mumbai-Pune Expressway, Yamuna Expressway, and Ahmedabad-Vadodara Expressway have significantly influenced urban growth by enhancing accessibility and reducing travel times. This increased connectivity has catalyzed the development of industrial parks, logistics hubs, and residential townships along their routes, transforming previously agricultural or undeveloped lands into vibrant economic and urban zones. **Spatial Impacts of Expressways in India** by Kundu, D. (2020)

The Mumbai-Pune Expressway, for instance, has fostered the emergence of satellite towns such as Panvel and Lonavala, while enabling industrial growth in Navi Mumbai. Similarly, the Yamuna Expressway has driven real estate booms in Greater Noida and Jewar, spurred by the proposed Noida International Airport, which has attracted substantial investments. However, these transformations are

often accompanied by challenges such as urban sprawl, unplanned development, and environmental degradation. Agricultural lands along expressways are frequently converted into urban uses, leading to habitat loss, deforestation, and increased emissions. Moreover, land speculation and rising property values can displace marginalized communities, exacerbating socio-economic inequities. Spatial Impacts of Expressways in India by Kundu, D. (2020)

Kundu's analysis (2020) highlights that while expressways enable regional economic growth and spatial reorganization, their benefits are often unevenly distributed. Development tends to concentrate in high-value zones along the corridors, leaving peripheral and rural areas underdeveloped. This uneven growth underscores the importance of integrated planning to align expressway development with sustainable and inclusive land use strategies. Policies that involve TOD, mixed-use zoning, and environmental impact assessments (EIA) are critical for mitigating negative impacts. Furthermore, integrating affordable housing and community services near expressway nodes can ensure equitable development.

In conclusion, the spatial impacts of expressways in India demonstrate their transformative potential but also highlight the need for careful planning to address unintended consequences. By fostering sustainable, equitable, and environmentally sensitive development, expressways can be harnessed as tools for balanced regional growth. Spatial Impacts of Expressways in India by Kundu, D. (2020).

➤ **Chattaraj's Impact of Infrastructure on Urban Development: A Case Study of Mumbai (2011)**

Impact of Infrastructure on Urban Development provides a comprehensive analysis of how transportation infrastructure has shaped the spatial, economic, and social fabric of Mumbai, one of the globe's most densely inhabited cities. The study highlights the transformative role of transportation networks, such as railways, highways, and metro systems, in driving urban expansion, influencing land use patterns, and fostering economic growth. Mumbai's complex transportation infrastructure, comprising the Mumbai Suburban Railway, Eastern Express Highway, Western Express Highway, and recent metro developments, has facilitated the city's expansion beyond its traditional limits, linking its core to peripheral areas such as Thane, Navi Mumbai, and Vasai-Virar.

The research emphasizes the dual nature of infrastructure's impact. On one hand, transportation projects have enhanced accessibility and mobility, spurring the development of satellite towns and economic hubs. Areas such as Bandra-Kurla Complex (BKC) and Powai have emerged as key commercial centers due to improved connectivity, attracting businesses, real estate investments, and a skilled workforce. Suburban regions like Navi Mumbai have benefited from strategic road and rail links, becoming self-sufficient urban nodes that reduce the pressure on Mumbai's overburdened core.

Environmental consequences are another significant theme in the study. Land reclamation for roads and railways has altered coastal ecosystems, while unplanned growth along transportation corridors has increased pollution and strained urban resources. For instance, the construction of major highways has resulted in habitat loss and fragmentation, while vehicular emissions contribute to deteriorating air quality.

Chattaraj advocates for a more integrated approach to urban planning, emphasizing the need to align transportation infrastructure development with sustainable land use policies. Recommendations include adopting TOD to promote high-density, mixed-use communities near transit hubs, prioritizing affordable housing in rapidly developing zones, and implementing environmental safeguards to mitigate ecological impacts. The study paper emphasizes the necessity of inclusive design that harmonizes economic development with social fairness and environmental conservation, framing infrastructure as a

mechanism for fostering sustainable and resilient urban ecosystems.

6. GOVERNMENT POLICIES:

The City and Industrial Development Corporation (CIDCO),

The CIDCO, the principal planning authority for Navi Mumbai, has played a critical role in shaping the city's land use patterns through the development of major road corridors. CIDCO's master plans integrate transportation infrastructure with urban development, emphasizing connectivity, economic growth, and sustainable land use. Key road corridors such as the Palm Beach Road, Sion-Panvel Expressway, and the Mumbai-Pune Highway have significantly influenced Navi Mumbai's spatial organization and land use dynamics.

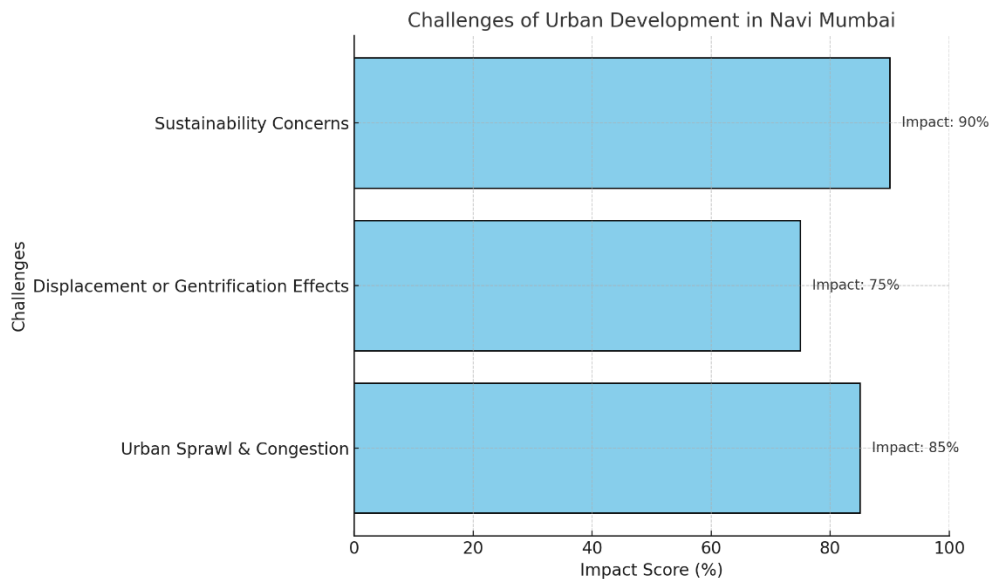
These road corridors have facilitated the transformation of previously undeveloped or underutilized land into thriving residential, commercial, and industrial zones. The Palm Beach Road, for instance, has become a premium residential and commercial belt, attracting high-density developments and increasing property values. Similarly, the Sion-Panvel Expressway has supported the growth of logistics hubs and industrial parks, fostering economic activity while connecting Navi Mumbai to Greater Mumbai and beyond. The improved accessibility provided by these corridors has catalyzed mixed-use developments, enabling a balanced integration of residential and commercial spaces near transit hubs. City and Industrial Development Corporation (CIDCO)

However, the expansion of road corridors has also led to challenges such as urban sprawl and environmental degradation. Peripheral areas along these corridors have experienced rapid but often unplanned development, leading to inefficient land use and loss of green spaces. Informal settlements have emerged in some zones due to the displacement of marginalized populations, highlighting socio-economic inequities associated with infrastructure-driven growth. City and Industrial Development Corporation (CIDCO)

CIDCO's planning framework aims to mitigate these issues by promoting TOD and mixed-use zoning, ensuring efficient land use and equitable access to transportation. Provisions for green buffers, affordable housing, and integrated public transit systems within CIDCO's plans demonstrate a commitment to sustainable urbanization. By aligning road corridor development with strategic land use policies, CIDCO has created a model for leveraging transportation infrastructure to foster both economic growth and sustainable urban development. City and Industrial Development Corporation (CIDCO)

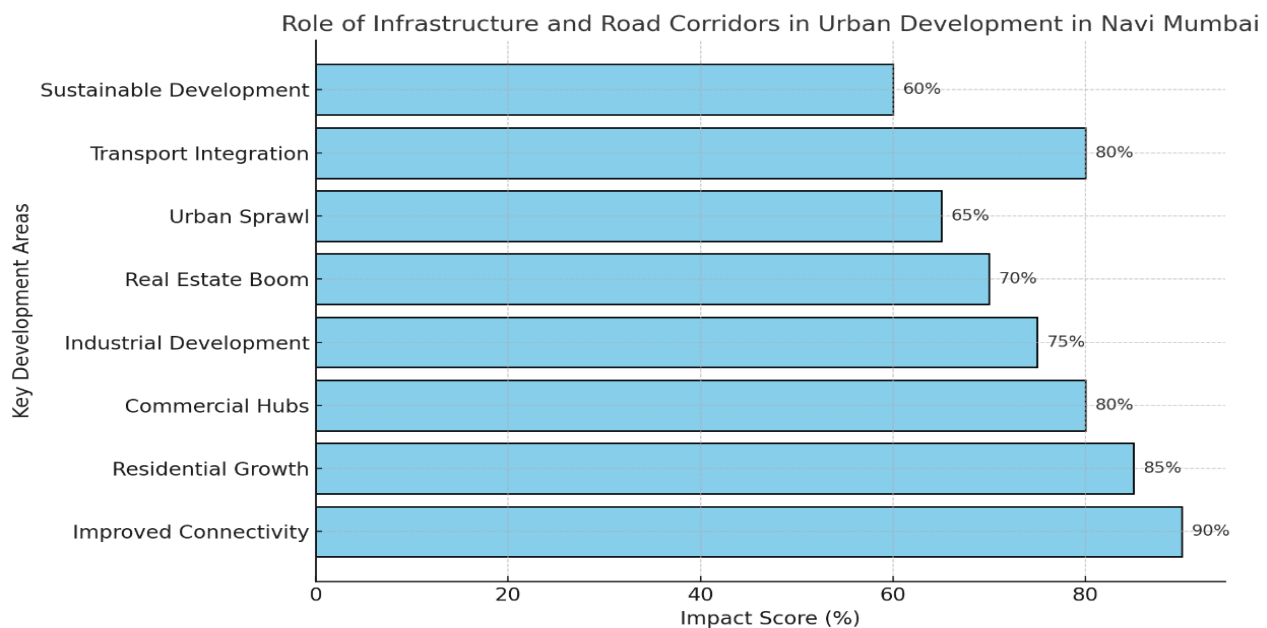
<https://cidco.maharashtra.gov.in>

Challenges of Urban Development in Navi Mumbai:



Source: City and Industrial Development Corporation (CIDCO)

Role of infrastructure and road corridors in urban development:



Source: <https://cidco.maharashtra.gov.in>

➤ National Urban Transport Policy (NUTP)

The NUTP, established by the “Ministry of Housing and Urban Affairs (MoHUA)” in 2006, provides a strategic framework for the integration of transport and land use planning to foster sustainable urban growth in India. Recognizing the growing challenges of urbanization, such as congestion, pollution, and unplanned growth, the policy emphasizes creating compact, accessible, and equitable urban environments. At its core, the NUTP seeks to align transport infrastructure development with land use strategies to foster balanced regional growth and ensure efficient resource utilization. National Urban Transport Policy (MoHUA, 2006)

The core principle of the NUTP is TOD, which promotes high-density, mixed-use developments adjacent to transit lines to minimize travel distances, improve accessibility, and decrease reliance on automobiles. This strategy encourages dense urban development, reduces urban sprawl, and supports pedestrian-friendly, walkable communities. The policy promotes the integration of housing and employment centers with public transit systems to ensure equal mobility and diminish socio-economic inequities. The NUTP seeks to foster inclusive cities by emphasizing public transport and non-motorized transport (NMT) over private vehicles, ensuring that all socio-economic groups have access to affordable and efficient transportation. National Urban Transport Policy (MoHUA, 2006)

The policy further emphasizes the environmental benefits of integrated planning, such as reducing greenhouse gas emissions, conserving green spaces, and encouraging the development of green infrastructure. It promotes simultaneous preparation of transport and land use plans to ensure cohesive urban development, with a focus on decentralized economic activities to reduce congestion in city centers and support growth in peripheral areas.

Despite its visionary framework, the NUTP faces implementation challenges, including inadequate coordination among municipal agencies, lack of enforcement mechanisms, and socio-economic inequities such as gentrification near transit hubs. To overcome these barriers, the policy calls for strengthening institutional frameworks, fostering public-private partnerships, and expanding funding mechanisms to support integrated transport and land use projects. National Urban Transport Policy (MoHUA, 2006)

The NUTP is fundamental to India's urban planning efforts, offering a framework for cities to attain sustainable, inclusive, and efficient urban development through the integration of transportation and land use planning. Its principles have informed major urban transport projects, including metro rail systems and transit-oriented developments across India, and continue to shape the discourse on urban sustainability. National Urban Transport Policy (MoHUA, 2006)

➤ **Smart Cities Mission (SCM)**

Launched in 2015 by the Government of India, the Smart Cities Mission (SCM) represents a transformative approach to urban development, aimed at addressing the challenges of rapid urbanization while promoting sustainability, efficiency, and inclusivity. The mission seeks to create 100 smart cities across the country by leveraging technology, data-driven solutions, and citizen-centric governance to enhance the quality of life, foster economic growth, and ensure environmental sustainability. The overarching vision of the SCM is to build cities that are resilient, efficient, and capable of supporting a growing urban population.

The mission emphasizes core infrastructure development, including efficient urban mobility, water and energy management, waste disposal, affordable housing, and robust IT connectivity. A hallmark of the SCM is its focus on area-based development (ABD) and pan-city initiatives. ABD involves upgrading existing urban spaces through retrofitting, redevelopment, or Greenfield development, transforming them into vibrant, economically productive, and environmentally sustainable areas. Pan-city solutions, on the other hand, employ smart technologies to address citywide challenges, such as traffic management, e-governance, and smart metering for utilities. <https://smartcities.gov.in/>

One of the defining features of the SCM is its integration of transport and land use planning, aligning urban mobility with sustainable land use strategies. This includes promoting transit-oriented development (TOD), creating walkable communities, and integrating public transport with digital solutions for real-time tracking and user convenience. Additionally, the mission advocates for the preservation of green spaces and adoption of renewable energy technologies, such as solar grids, to

minimize the environmental footprint of urbanization. <https://smartcities.gov.in/>

The Smart Cities Mission adopts a citizen-centric approach, encouraging public participation in the planning process through consultations and digital platforms. This participatory model ensures that projects are tailored to the needs and aspirations of local communities. Furthermore, the mission promotes public-private partnerships (PPPs) to mobilize resources and foster innovation in urban governance and infrastructure. <https://smartcities.gov.in/>

While the SCM has achieved notable successes, such as the implementation of smart traffic systems in Pune and the development of a sustainable waste management framework in Indore, it also faces challenges. These include delays in project execution, lack of institutional capacity, and disparities in resource allocation among cities. Addressing these challenges requires a stronger focus on capacity building, streamlined governance, and equitable resource distribution.

In conclusion, the Smart Cities Mission marks a paradigm shift in India's urban development strategy. By leveraging technology, sustainable practices, and participatory governance, the SCM aims to create cities that are not only smart but also inclusive and resilient. Its innovative frameworks and solutions serve as a blueprint for other rapidly urbanizing nations seeking to balance growth with sustainability. <https://smartcities.gov.in/>

➤ **Environmental Impact Assessment (EIA):**

Environmental Impact Assessment (EIA) frameworks are essential regulatory tools designed to evaluate the potential environmental consequences of proposed projects before they are implemented. Originating in the United States in the 1970s and now globally adopted, EIAs aim to balance developmental goals with environmental sustainability by ensuring that projects comply with ecological norms and mitigate adverse impacts on natural ecosystems. In India, EIA frameworks were institutionalized under the **Environment Protection Act, 1986**, and are overseen by the Ministry of Environment, Forest, and Climate Change (MoEFCC).

An EIA involves a systematic process of identifying, predicting, and evaluating the environmental effects of projects such as infrastructure developments, industrial facilities, or urbanization initiatives. Key components of an EIA framework include screening, to determine whether a project requires a full assessment; scoping, to identify significant environmental concerns; **impact** analysis, to predict effects on air, water, soil, and biodiversity; and mitigation planning, which proposes strategies to minimize or offset adverse impacts. The process concludes with a public consultation phase, enabling affected communities to voice their concerns, followed by the preparation of an Environmental Management Plan (EMP) to guide the project's execution with sustainability in mind. <https://www.environmental-mainstreaming.org>

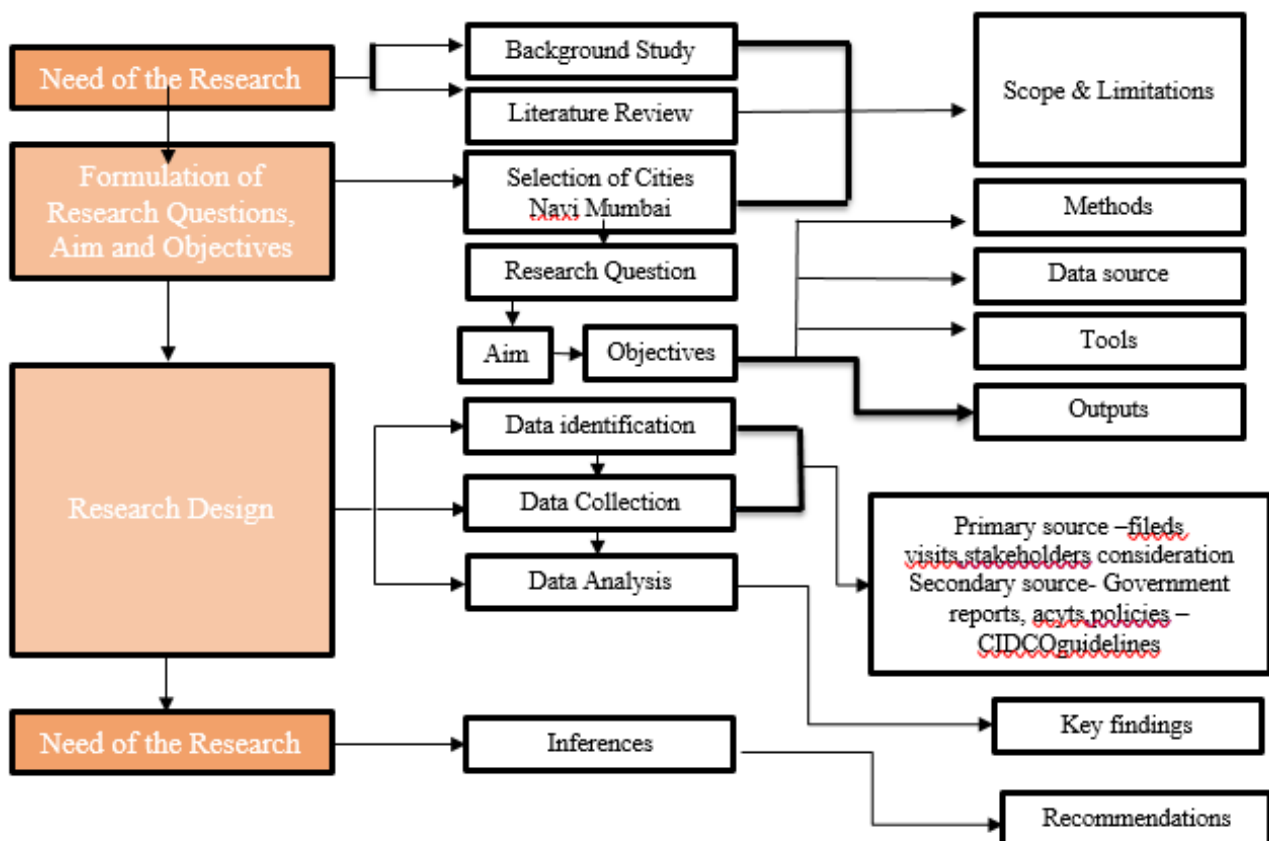
The EIA framework is particularly critical in infrastructure projects such as road corridors, expressways, and urban development. For example, road projects can lead to deforestation, habitat fragmentation, and increased pollution, making EIAs vital for proposing mitigation measures like green belts, eco-sensitive construction practices, and noise barriers. Similarly, urban expansion projects often involve land use changes and resource extraction, necessitating a thorough assessment of their ecological footprint. <https://www.environmental-mainstreaming.org>

Despite its significance, the EIA process in India faces challenges such as delays, a lack of transparency, and weak enforcement. Critics argue that rapid clearances, often under political or economic pressures, undermine the framework's effectiveness. Furthermore, inadequate public participation and insufficient baseline data can lead to poorly informed decisions that fail to account for cumulative or long-term impacts.

To strengthen EIA frameworks, there is a need for enhanced institutional capacity, adoption of digital tools like Geographic Information Systems (GIS) for better impact mapping, and stricter post-approval monitoring to ensure compliance with mitigation measures. Additionally, fostering greater stakeholder engagement and aligning EIAs with global standards like Strategic Environmental Assessments (SEAs) can improve their effectiveness in balancing development with ecological preservation. <https://www.environmental-mainstreaming.org>

EIA frameworks are indispensable for sustainable development, acting as safeguards against ecological degradation while enabling informed decision-making. By integrating robust assessment processes with accountability mechanisms, EIAs can ensure that economic growth aligns with environmental stewardship. <https://www.environmental-mainstreaming.org>

7. METHODOLOGY:

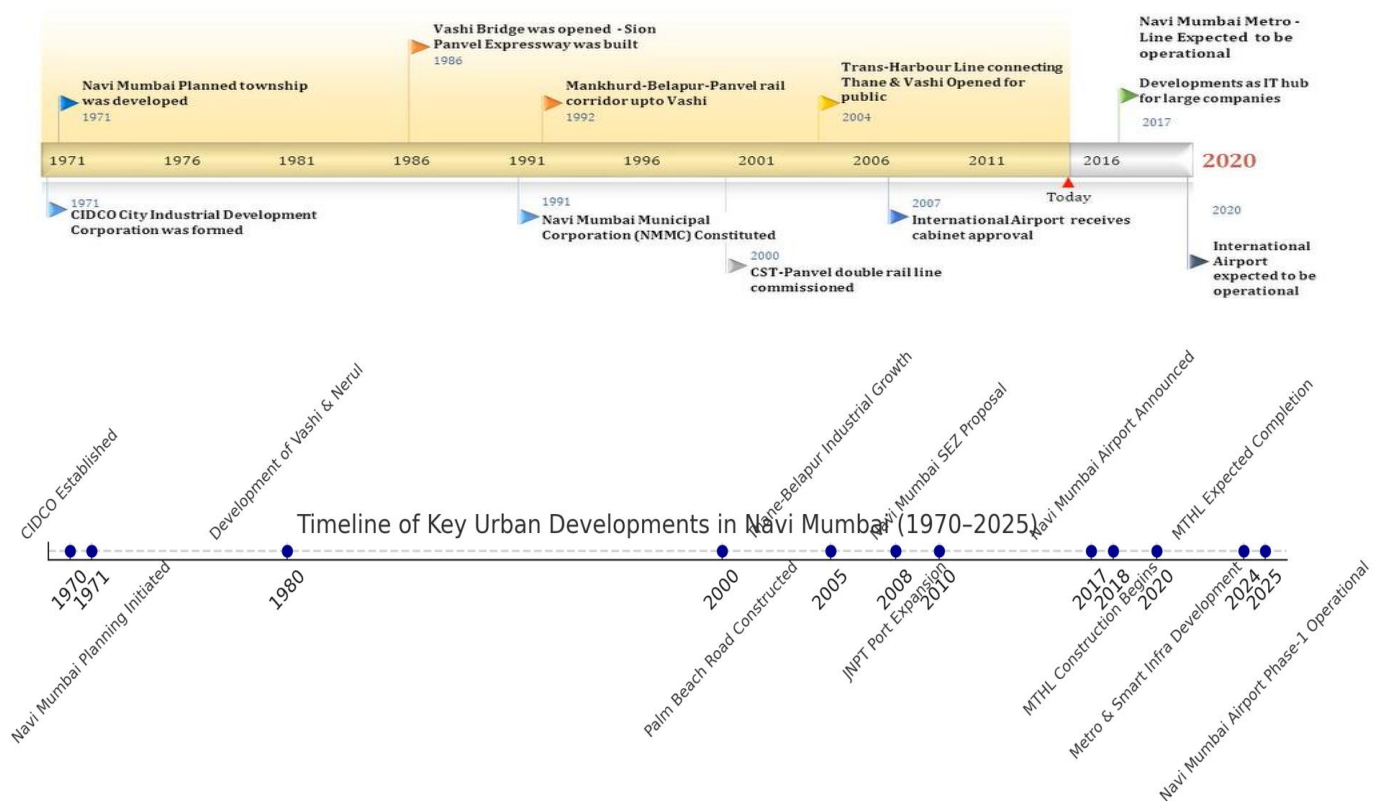


TIMELINE OF NAVI MUMBAI

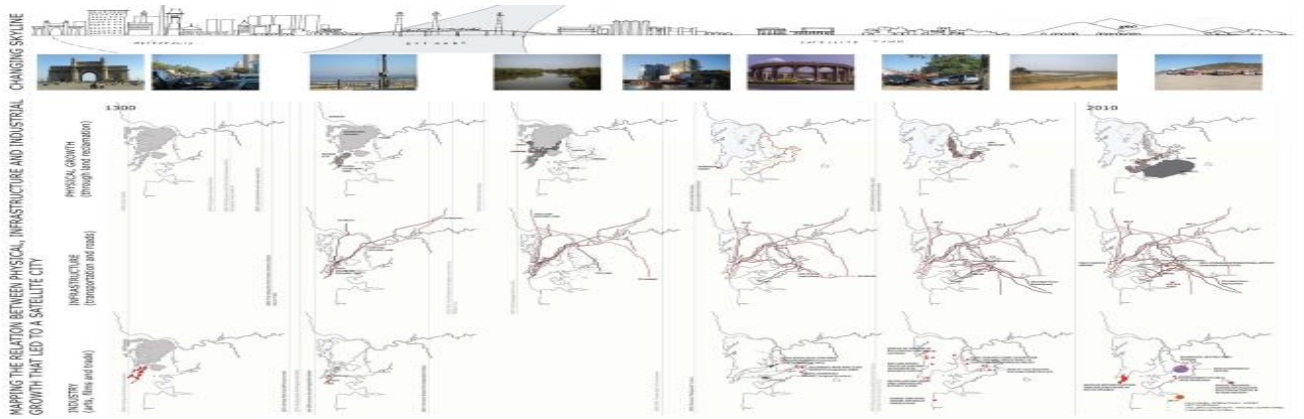
Navi Mumbai is a meticulously planned satellite city founded in 1971 to mitigate the demographic and commercial pressures on Mumbai and address the growing needs of the “Mumbai Metropolitan Region (MMR)”. Navi Mumbai, developed by the “City and Industrial Development Corporation (CIDCO)”, is situated along the eastern shoreline of Thane Creek, encompassing portions of Thane and Raigad districts. The concept was developed using a polycentric urban paradigm featuring autonomous nodes—namely Vashi, Nerul, Belapur, Kharghar, and Panvel—each intended to be self-sustaining, incorporating

residential, commercial, institutional, and recreational areas. Since the 1980s, Navi Mumbai has evolved rapidly, especially following the development of critical transport corridors like the Sion-Panvel Expressway and the Mumbai-Pune Highway. This transformation accelerated through the **1990s and 2000s**, aided by significant infrastructure investments in roads and suburban railways.

The construction of Palm Beach Road in the early 2000s further boosted intra-city connectivity and real estate development along its stretch. In recent years, upcoming mega projects that involve the Navi Mumbai International Airport and the “Mumbai Trans Harbour Link (MTHL)” have reinforced the city’s strategic importance as a major urban and economic center within the region. While Navi Mumbai's growth has brought considerable benefits, including increased investments in real estate, education, and service industries, it has also led to emerging challenges. This encompasses unanticipated densification, the expansion of informal settlements, as well as increased pressure on natural ecosystems. As the city continues to expand in the 2020s, the need for integrated, inclusive, and environmentally sustainable planning is more urgent than ever to ensure balanced urban development.



TIMELINE OF KEY URBAN DEVELOPMENTS IN NAVI MUMBAI 1970-2025



Time Period	Dominant Land Use	Key Developments	Land Use Share (%) (Approximate)
1970–1980	Agricultural, wetlands, mangroves	- CIDCO established - Initial planning of Vashi, Nerul, Belapur	Agricultural/Wetlands: 70% Residential: 10% Industrial: 5% Commercial: 5% Green/Open: 10%
1980–2000	Early residential & development	- MIDC along Thane-Belapur Road - Basic infrastructure - Vashi/Nerul populated	Agricultural/Wetlands: 50% Residential: 20% Industrial: 15% Commercial: 5% Green/Open: 10%
2000–2010	Residential and commercial expansion	- Palm Beach Road - JNPT port growth - SEZ and node expansions	Agricultural/Wetlands: 30% Residential: 30% Industrial: 20% Commercial: 10% Green/Open: 10%
2010–2020	Infrastructure-led densification	- Metro & MTHL construction - Ulwe & Taloja growth - Airport project announced	Agricultural/Wetlands: 15% Residential: 40% Industrial: 25% Commercial: 10% Green/Open: 10%
2020–2025	Transit-oriented & high-density development	- MTHL & Airport near completion - TOD & redevelopment - Logistics hubs expand	Agricultural/Wetlands: <5% Residential: 45% Industrial: 25% Commercial: 15% Green/Open: 10%

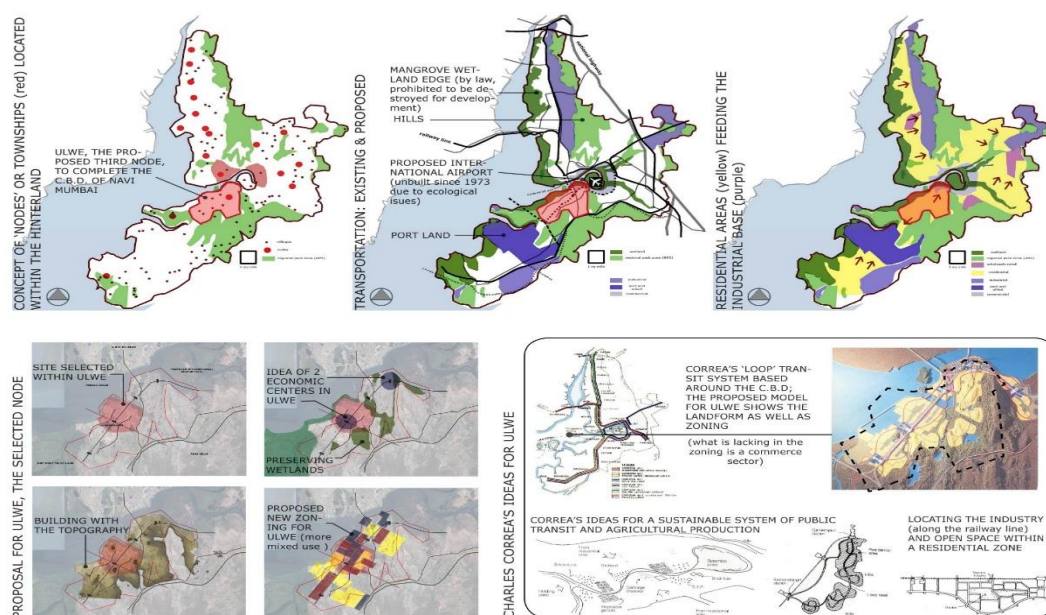


8. RESEARCH DESIGN:

This study aims to examine the impact of road corridors on urban land use dynamics in Navi Mumbai, highlighting how essential transportation routes have influenced spatial development and land use changes over time. Employing a mixed-method approach, the study will integrate both quantitative and qualitative data. The research will focus on major corridors such as the Ulve JNPT, Palm Beach Road, and the proposed MTHL influence zone. Sampling methods will include purposive selection of road corridors, stratified sampling of adjoining land use zones, and random household surveys. Additionally, stakeholder insights will help evaluate the socio-economic implications and planning challenges arising from these developments. This research approach seeks to elucidate the influence of road infrastructure on urban land use transformations, hence facilitating evidence-based planning and sustainable urban development initiatives in Navi Mumbai. <https://cidco.maharashtra.gov.in>

9. LOCATION:

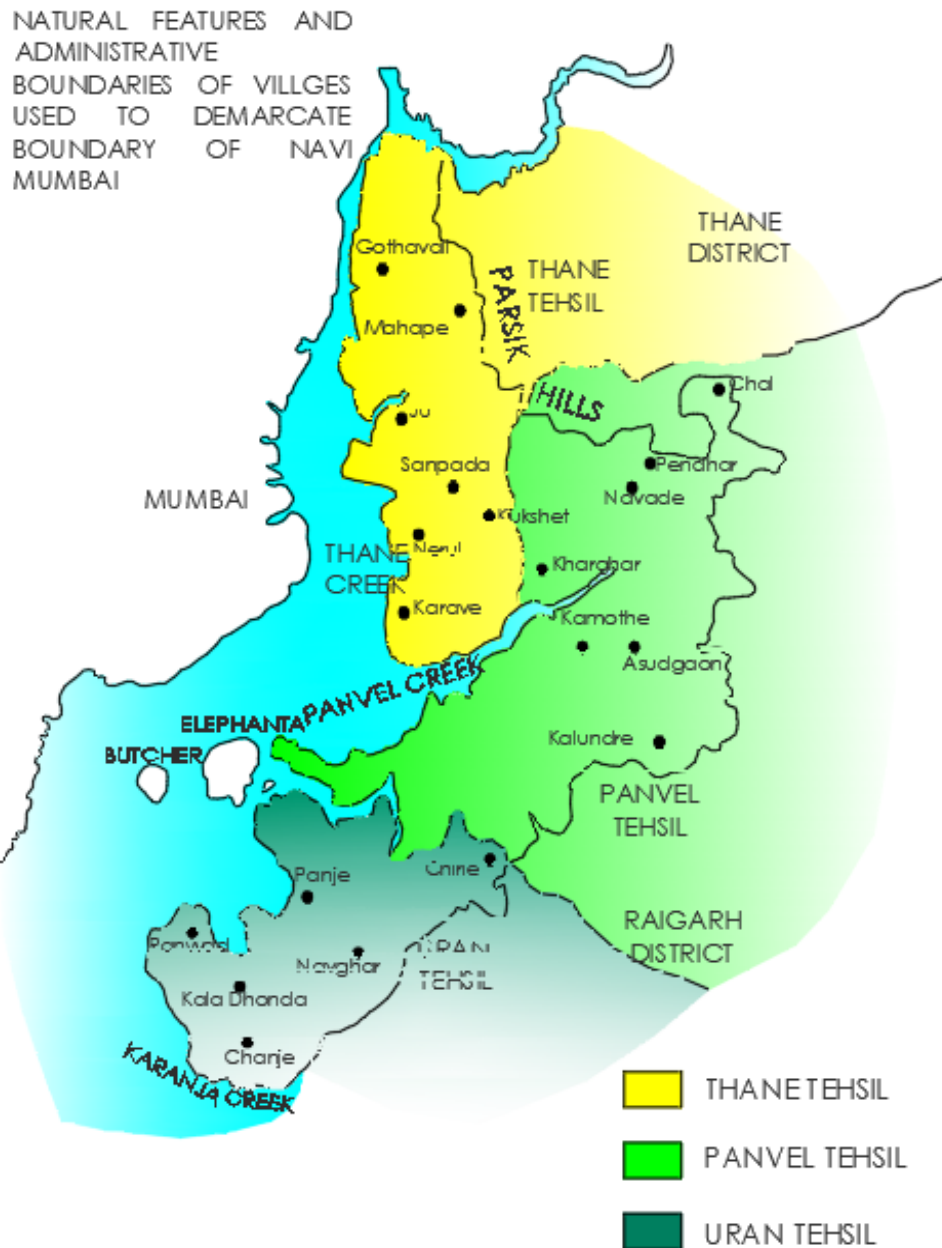
Navi Mumbai is located on India's western coast, in Maharashtra, along the eastern bank of Thane Creek, opposite Mumbai. It spans two districts—Thane and Raigad—and is situated within the “Mumbai Metropolitan Region (MMR)”. The city stretches from Airoli in the north to Uran and Panvel in the south, encompassing several urban nodes designed to function as self-contained townships. Navi Mumbai's strategic position along essential transport corridors that involve the Mumbai-Pune Expressway, the Sion-Panvel Expressway, and significant railway lines, has established it as a crucial connection between Mumbai and the interior areas of Maharashtra. The proximity to the JNPT and the proposed Navi Mumbai International Airport augments its connectivity and economic prospects, establishing it as a conduit for trade, logistics, and regional advancement. <https://cidco.maharashtra.gov.in>



City and Industrial Development Corporation (CIDCO)

- Navi Mumbai was established as a carefully developed satellite city to alleviate congestion in Mumbai and offer a well-organized alternative for urban expansion. In the 1960s, Mumbai experienced significant overpopulation, inadequate housing, and haphazard expansion, leading the Maharashtra government to suggest the creation of a twin city on the eastern mainland.
- Established in 1970, the CIDCO was tasked with the planning and development of Navi Mumbai, encompassing 344 square kilometers over the Thane and Raigad districts.
- The city was designed with 14 self-sustaining nodes, including Vashi, Nerul, Belapur, Kharghar, and Airoli, each with dedicated residential, commercial, and industrial zones. Initial development focused on infrastructure like roads, railways, and bridges, including the Vashi Bridge, which improved connectivity with Mumbai. City and Industrial Development Corporation (CIDCO)
- Over the decades, Navi Mumbai witnessed significant industrial and commercial growth, driven by the Thane-Belapur industrial belt, IT hubs, and the JNPT.
- The real estate boom in the 1990s and 2000s transformed it into a major urban center. Today, with projects like the MTHL, Navi Mumbai Metro, and the upcoming Navi Mumbai International Airport, the city is evolving into a global economic and residential hub while maintaining its planned urban character. City and Industrial Development Corporation (CIDCO)

10. NAVI MUMBAI FORMATION OF BOUNDARIES AND LOCATION OF VILLGAES:



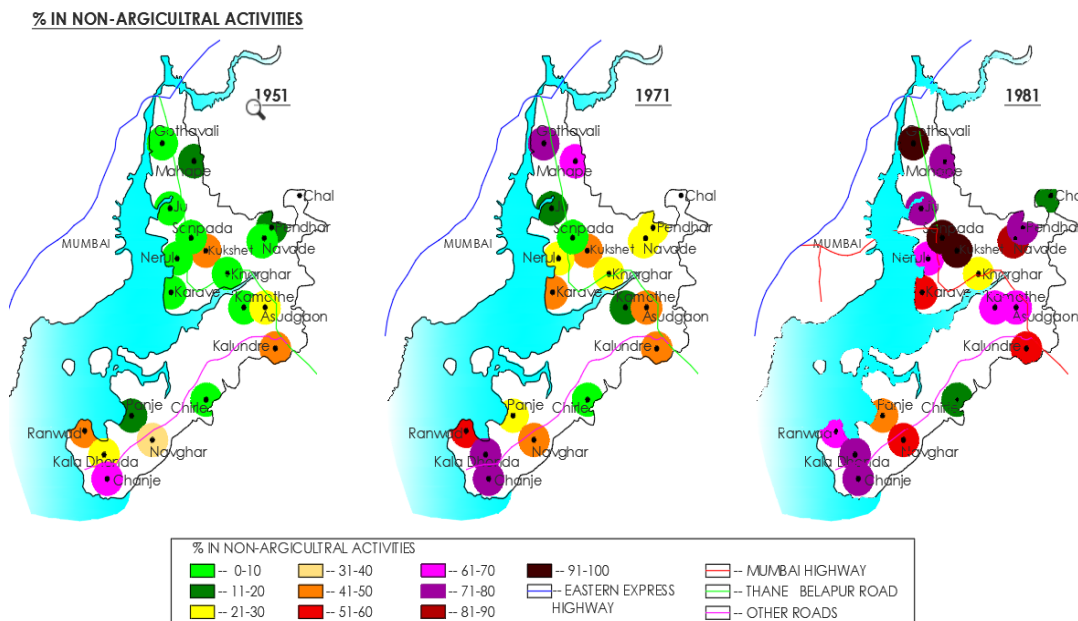
NAVI MUMBAI:FORMATION OF BOUNDARIES AND LOCATION OF VILLAGES

POPULATION DENSITY (PEOPLE/SQ.KM)

SPATIAL UNIT	1961	1971	1981
THANA TALUKA	610	1084	1794
PANVEL TALUKA	207	266	349
URAN TALUKA	290	366	463

(SOURCE VARIOUS DISTRICT CENSUS HANDBOOK www.censusindia.net)

<https://cidco.maharashtra.gov.in>



11. STUDY PROFILE

This investigation examines the effect of road corridors on urban land use dynamics in Navi Mumbai, a planned city developed by CIDCO in the Mumbai Metropolitan Region. Focusing on major road corridors such as the Palm Beach Road, Thane-Belapur Road, and Ulwe Jnpt road, the research aims to analyze how these transportation networks have influenced spatial patterns of residential, commercial, and industrial development from the early 2000s to 2025. Using satellite imagery, GIS mapping, and planning data, the study identifies correlations between improved connectivity and land use transformation. The findings are intended to inform future infrastructure planning and promote sustainable, transit-oriented urban development. <https://cidco.maharashtra.gov.in>

CASE STUDY -

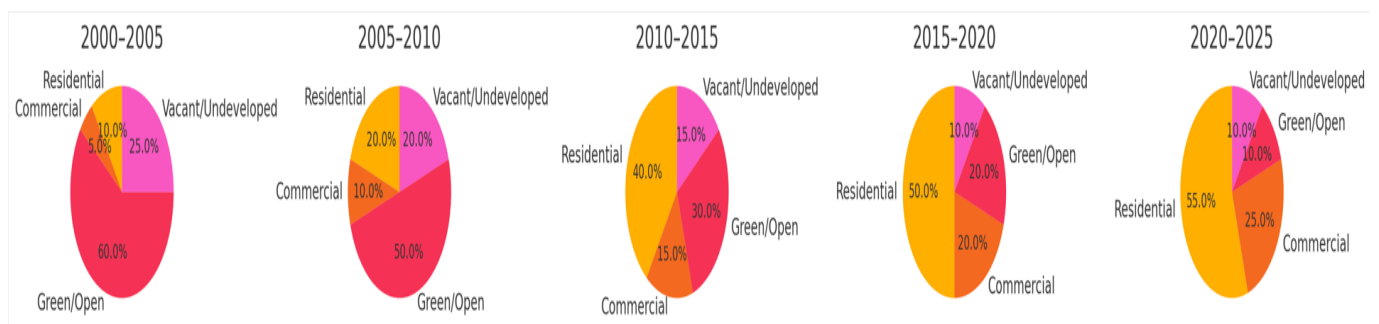
Navi Mumbai, Maharashtra – focusing on major road corridors including:

- **Palm Beach Road**
- **Thane-Belapur Road**
- **Ulwe JNPT Road**

PALM BEACH ROAD-VASHI

Time Period	Key Developments	Land Use Changes	Impact
2000–2005	<ul style="list-style-type: none"> - Road partially developed - Surrounding areas largely undeveloped 	<ul style="list-style-type: none"> - Dominated by mangroves, wetlands, and salt pans - Very low built-up area 	<ul style="list-style-type: none"> - Limited traffic - Real estate potential recognized
2005–2010	<ul style="list-style-type: none"> - Road extended and beautified (e.g., in Nerul, Sanpada) - CIDCO starts auctioning plots - Growth in high-end residential complexes 	<ul style="list-style-type: none"> - Rise in residential projects - Commercial use begins along the corridor - Conversion of open land to mixed-use development 	<ul style="list-style-type: none"> - Rising property prices - Improved connectivity to CBD Belapur
2010–2015	<ul style="list-style-type: none"> - Development of shopping complexes, educational institutions - Further real estate densification 	<ul style="list-style-type: none"> - Shrinking green cover in some pockets - Emergence of luxury towers & commercial hubs 	<ul style="list-style-type: none"> - Emergence of Palm Beach as an elite address - Increased traffic volume
2015–2020	<ul style="list-style-type: none"> - Road widening & street lighting enhancements - Integration with metro & MTHL connectivity 	<ul style="list-style-type: none"> - Limited vacant land remaining - Near-complete saturation of developable plots 	<ul style="list-style-type: none"> - Pressure on utilities & environment - Urban heat island effect
2020–2025	<ul style="list-style-type: none"> - Focus on smart infrastructure (EV charging, surveillance, landscaping) projects begin 	<ul style="list-style-type: none"> - Redevelopment & infill projects begin 	<ul style="list-style-type: none"> - Traffic congestion - Land values peak
https://cidco.maharashtra.gov.in			

12. LANDUSE TRANSITION PALM BEACH ROAD:



These show the transformation from predominantly green and undeveloped land to dense residential and commercial areas over time. City and Industrial Development Corporation (CIDCO)

- **2000–2005:**

The area was predominantly **green/open space (60%)** with significant **vacant/undeveloped land (25%)**. Residential and commercial use were minimal.

- **2005–2010:**

A shift begins with increased **residential (20%)** and **commercial (10%)** development, while green space reduces to 50%.

- **2010–2015:** City and Industrial Development Corporation (CIDCO)

A major transition phase – **residential use jumps to 40%**, and **green cover drops to 30%**, reflecting rapid urbanization.

- **2015–2020:**

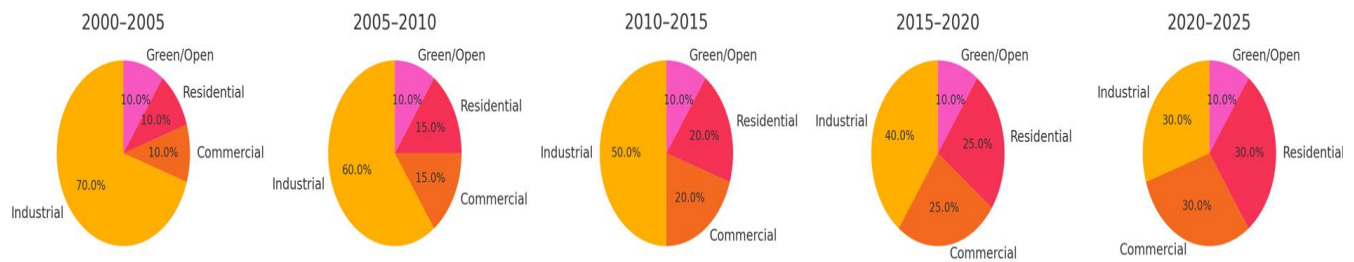
Residential areas grow to 50%, with **commercial land (20%)** catching up. Open and vacant lands shrink significantly.

- **2020–2025:**

Urban saturation is visible – **residential use dominates at 55%**, commercial at 25%, and both **green and vacant lands reduced to 10% each**, indicating high-density development. City and Industrial Development Corporation (CIDCO)

13. THANE-BELAPUR ROAD URBAN TRANSITION (2000–2025)

Phase	Key Developments	Land Use Changes	Impact
2000–2005	<ul style="list-style-type: none"> - Predominantly industrial corridor - Road in poor condition - Limited public transit 	<ul style="list-style-type: none"> - Dominated by MIDC industrial units - Scattered residential pockets - Vacant plots 	<ul style="list-style-type: none"> - Low real estate interest - Poor connectivity and infrastructure
2005–2010	<ul style="list-style-type: none"> - Road widening and surfacing - NMMT & BEST buses introduced - Rail connectivity improves 	<ul style="list-style-type: none"> - Initial commercial development near railway stations (Turbhe, Koparkhairane) 	<ul style="list-style-type: none"> - Improved connectivity - Beginning of mixed-use interest
2010–2015	<ul style="list-style-type: none"> - Rise of IT parks and corporate offices (e.g., Millennium Business Park, Mindspace) 	<ul style="list-style-type: none"> - Shift from pure industrial to IT and service-based use - Growth in employee housing 	<ul style="list-style-type: none"> - Rapid urbanization - Spike in land demand near Ghansoli, Airoli
2015–2020	<ul style="list-style-type: none"> - Metro Line 1 construction begins - Multimodal logistics integration 	<ul style="list-style-type: none"> - Decline in traditional industries - Warehousing, logistics & tech parks dominate 	<ul style="list-style-type: none"> - Employment hub status rises - Traffic volume and land prices increase
2020–2025	<ul style="list-style-type: none"> - Metro connectivity operational (expected) - Focus on green, smart infrastructure 	<ul style="list-style-type: none"> - High-density residential and commercial redevelopment - Infill & brownfield projects 	<ul style="list-style-type: none"> - Gentrification of older industrial areas - Urban sprawl into outskirts
https://cidco.maharashtra.gov.in			

LANDUSE TRANSITION- THANE BELAPUR ROAD:

A visual representation of land use changes along Thane-Belapur Road (2000–2025), shown through phase-wise pie charts, illustrates the gradual decline of industrial dominance and the steady rise of commercial and residential land uses over time, with green and open spaces remaining relatively constant throughout the period.

The land use pattern along Thane-Belapur Road has undergone a major transformation over the past two decades, shifting from an industrial-dominated corridor to a more diversified urban landscape:

- **2000–2005:**

The area was primarily industrial (70%), with minimal commercial and residential activity. Green/open spaces accounted for a small share, serving as buffer zones.

- **2005–2010:**

Early signs of diversification appeared with modest growth in residential (15%) and commercial (15%) land uses, spurred by improved road and rail connectivity.

- **2010–2015:**

Rapid development of IT parks and office spaces led to a surge in commercial and residential use, reducing the industrial share to 50%.

- **2015–2020:**

The corridor evolved into a mixed-use urban belt, with industrial use declining further as residential and commercial sectors each reached 25%.

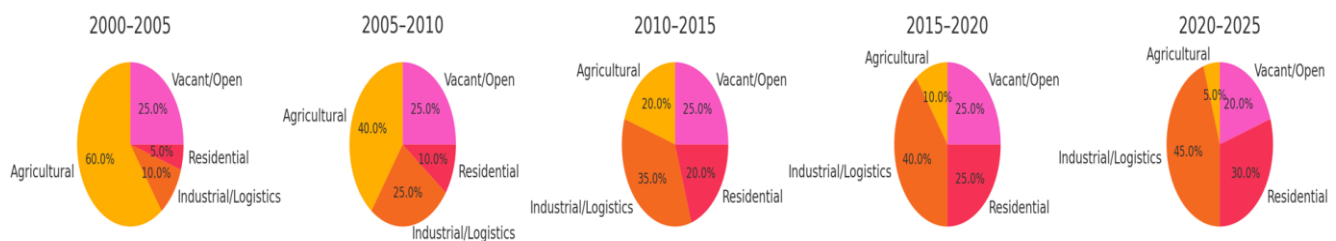
- **2020–2025:**

The transition culminated in a balanced land use profile with industrial, commercial, and residential zones each making up roughly 30%. This reflects growing demand for housing and business spaces, alongside declining traditional industrial activity. <https://cidco.maharashtra.gov.in>

ULWE JNPT ROAD URBAN TRANSITION

Phase	Key Developments	Land Use Changes	Impact
2000–2005	<ul style="list-style-type: none"> - Mostly underdeveloped rural belt - Road in nascent condition - Low activity 	<ul style="list-style-type: none"> - Agricultural land and mangroves dominate - Sparse settlements - Land earmarked for SEZs 	<ul style="list-style-type: none"> - Minimal infrastructure - Limited land value - Rise in speculative real estate interest
2005–2010	<ul style="list-style-type: none"> - Initial road upgrades by CIDCO - JNPT port expansion begins 	<ul style="list-style-type: none"> - Conversion to industrial and logistics use - Gradual loss of agricultural land 	<ul style="list-style-type: none"> - Early infrastructure push
2010–2015	<ul style="list-style-type: none"> - Navi Mumbai SEZ and airport project announcements - JNPT growth accelerates 	<ul style="list-style-type: none"> - Start of housing development in Ulwe 	<ul style="list-style-type: none"> - Surge in land prices - Shift in perception to emerging growth node
2015–2020	<ul style="list-style-type: none"> - Major road widening - MTHL construction impacts traffic planning 	<ul style="list-style-type: none"> - Warehousing, transport hubs, and residential areas expand - Infrastructure intensifies 	<ul style="list-style-type: none"> - Increased population inflow - Transit connectivity improves
2020–2025	<ul style="list-style-type: none"> - Navi Mumbai International Airport and MTHL (expected commissioning) - Logistics corridor focus 	<ul style="list-style-type: none"> - High urban pressure on Ulwe and Dronagiri - Port-led industrial expansion 	<ul style="list-style-type: none"> - Strategic trade and logistics role - Rapid urban transformation

City and Industrial Development Corporation (CIDCO)



City and Industrial Development Corporation (CIDCO)

The land use transition pie charts for Ulwe–JNPT Road (2000–2025) depict a substantial shift from primarily agricultural and wetland regions to a landscape increasingly characterized by industrial/logistics and residential development, largely driven by significant infrastructure initiatives that include the Navi Mumbai International Airport and the expansion of JNPT Port. City and Industrial Development Corporation (CIDCO) The Ulwe–JNPT Road corridor has experienced a dramatic land use transformation between 2000 and 2025, shaped by strategic infrastructure projects like the Navi MTHL, and JNPT port expansion:

- **2000–2005:**

The area was largely agricultural (60%) with vast tracts of vacant and open land (25%). Industrial and residential presence was minimal.

- **2005–2010:**

With early road upgrades and SEZ proposals, industrial/logistics use increased to 25%, while agriculture declined to 40%. Residential development remained limited.

- **2010–2015:**

A phase of rapid growth as industrial/logistics expanded to 35%, and residential areas began to emerge significantly (20%). Agricultural use dropped further.

- **2015–2020:**

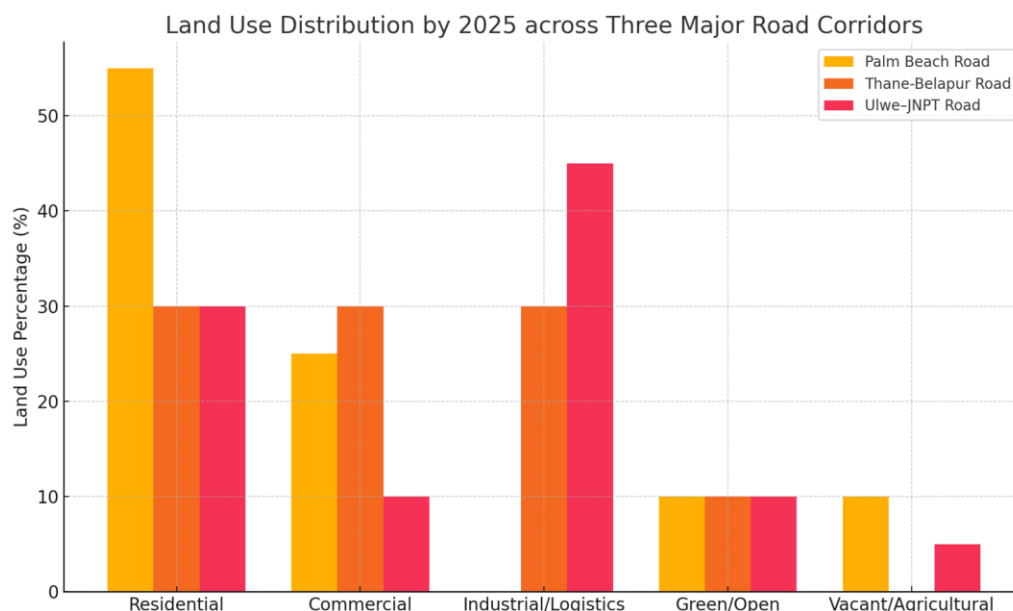
Urbanization intensified, with residential (25%) and industrial/logistics (40%) dominating. Agriculture became marginal.

- **2020–2025:**

The corridor now features a strong industrial/logistics base (45%) and growing residential development (30%), with agriculture reduced to just 5%. Vacant lands also declined due to land absorption. City and Industrial Development Corporation (CIDCO)

LANDUSE DISTRIBUTION BY 2025 OF 3 MAJOR ROAD CORRIDORS OF NAVI MUMBAI

City and Industrial Development Corporation (CIDCO)



STUDY AREA: ATAL SETU AREA NAVI MUMBAI

The Atal Setu land use study focuses on the areas directly and indirectly affected by the bridge, particularly along the corridor connecting Panaji and Porvorim in Goa. It encompasses a zone approximately 1–2 kilometres wide on either side of the bridge and its approach roads. This study area includes urban neighbourhoods, commercial and institutional spaces, key transportation nodes, and ecologically sensitive zones such as riverbanks and mangrove habitats. The analysis examines land use patterns before and after

the bridge's construction to assess its impact on urban development, connectivity, and environmental dynamics.

Period	Phase	Key Land Use	Infrastructure & Urbanization	Environmental Impact
1970s-1990s	Pre-Bridge Period	Agricultural land, plantations, open spaces, and sparse residential areas	Low connectivity, minimal urbanization, natural riverbanks	Mangroves and green cover are largely intact
1990s–2014	Transition Phase	Emerging residential and commercial areas, infrastructure stress begins	Increasing traffic, early urban sprawl, and land speculation	Initial stress on environment due to development
2014–2019	Construction Phase	Land acquisition, construction-related land use, logistics zones	Bridge construction activities dominate land use	Temporary disruption to ecosystems and riverbanks
2019–2025	Post-Construction Impact	High-density residential, commercial, institutional, and mixed-use development	Enhanced connectivity, real estate growth, rapid urbanization	Pressure on green zones, loss of some mangrove areas

City and Industrial Development Corporation (CIDCO)

1970s–1990s: Pre-Bridge Period

Dominant Land Use: Largely agricultural land, coconut plantations, low-density residential pockets, and large patches of open/undeveloped land.

Environmental Setting: Riverbanks remained largely untouched, with mangroves and natural vegetation thriving along the Mandovi River.

Infrastructure: Minimal urban sprawl with limited road connectivity; Porvorim was largely a quiet settlement.



1990s–2014: Transition Phase

Gradual Urban Expansion: Rise in residential and commercial development due to population growth and economic activity in Panaji.

Infrastructure Pressure: Increasing vehicular traffic over existing Mandovi bridges created demand for improved connectivity.

Emerging Land Value: Land in Porvorim began appreciating in anticipation of infrastructure upgrades.

2014–2019: Atal Setu Construction Phase

Land Acquisition: Land was acquired for approach roads, ramps, and support structures.

Shift in Land Use: Agricultural and open lands were repurposed for construction activities, logistics yards, and material storage.

Environmental Concerns: Temporary disturbance to river ecosystems and green cover in certain pockets.

2019–2025: Post-Construction Impact

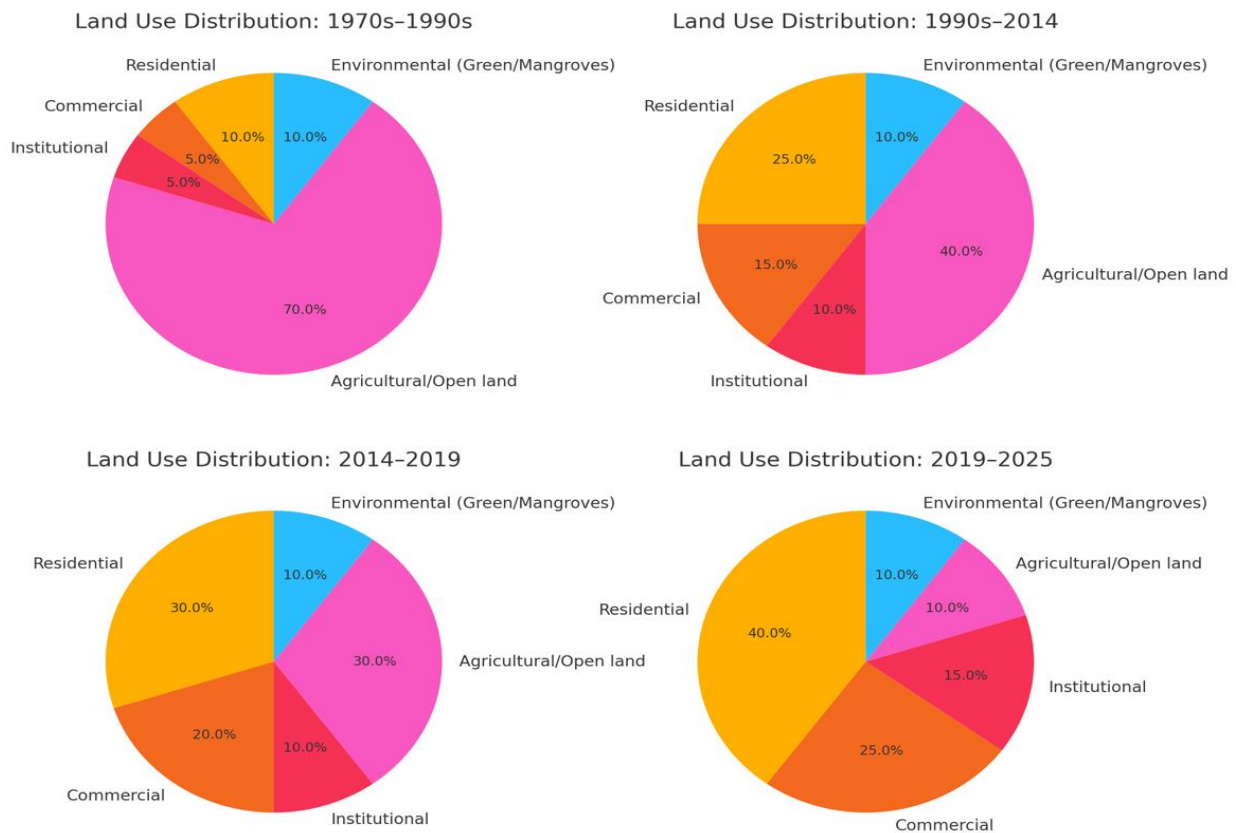
Rapid Urbanization: Boost in residential, commercial, and institutional land use, especially in Porvorim and approach areas.

Improved Accessibility: Enhanced north-south connectivity triggered real estate growth and redevelopment along NH-66.

Land Use Conversion: Significant shift from low-density residential and agricultural land to mixed-use and high-density development.

<https://cidco.maharashtra.gov.in>

LANDUSE TRANSITION OF ATAL SETU -1970-2025



<https://cidco.maharashtra.gov.in>

14. OBSERVATION:

It has been concluded that the Navi Mumbai has been planned as a satellite city for Mumbai to ease population density and has experienced considerable urban changes in the past twenty years. One such force includes the major transportation infrastructure especially the roads that have greatly contributed in the land use changes in the region. These stretches have been the growth centrals: The Sion-Panvel Expressway, Palm Beach Road, Thane Belapur Road besides the under constructions Mumbai Trans Harbour Link (MTHL) have not only helped in the connectivity but also helped in enlisting residential, commercial and industrial developments along the stretches. Metro construction and multimodal transport nodes are development corridor oriented and enhancing the physical transformation as well as the social and economic rearrangement of the city. This understands the ways in which these transport corridors have affected the land usage in Navi Mumbai between 2000 and 2025 concerning accessibility effects that led to urban densification, increase in land value, and changes in environment. From the GIS and remote sensing techniques, analysis of various land use changes around corridors with buffers of 0.5km to 2km was made. This paper reveals the multiple functions of the road corridors; these include the facilitation of access and the provision of economic benefits despite the social costs, for example; sprawl, informal development and degradation of the environment. The paper focuses on the importance of a comprehensive land use and transport planning for the implementation of sustainable transport systems, which, in return and with the use of policy instruments such as the Transit-Oriented Development (TOD),

ecological zoning, infrastructure provision, and value capture mechanisms. Therefore, the scenarios of road corridor development in Navi Mumbai could be explained with considerable aspects of sustainable and inclusive planning and spatial equity. The research therefore calls for a corridor sensitive strategic development of urban infrastructure to meet the sustainable social urban development policy goals of the country.

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