

# Atal Setu: A raw deal with Bio-diversity

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## ABSTRACT

In the pursuit of robust infrastructure development, sea bridges have emerged as vital components in connecting regions, overcoming geographical barriers, and fostering economic growth. In the Indian context, where dynamic urbanization and industrial expansion continually reshape the landscape, the need for efficient transportation links has led to groundbreaking projects, such as the Atal Setu - a monumental 21.8-kilometer-long six-lane bridge poised to transform connectivity in the Mumbai metropolitan region.

The demand for sea bridges in India arises from the geographical complexities presented by expansive coastlines and water bodies. Recognizing the significance of maritime connectivity, the Atal Setu has been conceived to address the growing demands of a burgeoning economy. Spanning 16.5 kilometers over the sea and an additional 5.5 kilometers on land, this engineering marvel is designed to cater to nearly 70,000 vehicles daily upon completion, significantly easing traffic congestion and enhancing regional mobility.

The strategic location of the Atal Setu is not just a testament to visionary urban planning but a solution to longstanding transportation challenges. With its ambitious six-lane design, the bridge is set to provide expedited travel, facilitating faster connectivity to both the Mumbai International Airport and the Navi Mumbai International Airport. This improved accessibility is poised to stimulate economic activities, streamline logistics, and bolster trade and tourism by reducing travel time and enhancing overall efficiency.

Furthermore, the longevity of the Atal Setu is a key aspect of its contribution to sustainable infrastructure. Built to withstand the test of time, the bridge is projected to have a lifespan of a remarkable 100 years. This long-term vision underscores the commitment to creating enduring assets that will continue to serve generations to

come, thereby ensuring a lasting impact on the region's development.

In conclusion, the Atal Setu Sea Bridge exemplifies the strategic foresight required to address the evolving needs of a growing nation. By seamlessly integrating land and sea components, the bridge not only promises to enhance connectivity but also stands as a testament to India's commitment to transformative infrastructure projects with lasting economic and societal benefits.

**Keywords:** Atal Setu, Sea Bridge, Traffic congestion, Longevity, Sustainable Infrastructure

## I. INTRODUCTION

In a historic milestone for India's infrastructure development, Prime Minister Narendra Modi recently inaugurated the Mumbai Trans Harbour Link (MTHL), now officially named Atal Setu. As the country's longest sea bridge, Atal Setu is set to revolutionize connectivity between South Mumbai and Navi Mumbai, heralding a new era of efficient transportation. The significance of this 21.8-kilometer-long bridge extends beyond its impressive dimensions, encompassing the potential to drastically reduce travel time from the current two hours to a mere 20 minutes.

The sheer scale and ambition of Atal Setu underscore the nation's commitment to advancing transformative infrastructure projects. With a construction cost exceeding Rs 17,840 crore, the bridge stands as a symbol of India's engineering prowess and dedication to fostering economic growth through strategic investments in critical transport infrastructure. It is a testament to the government's vision of creating assets that not only address immediate needs but also contribute to the long-term development and prosperity of the nation.

A remarkable feature of Atal Setu lies in the colossal quantity of steel utilized in its construction, providing a tangible representation of

the magnitude of this engineering marvel. The amount of steel used is equivalent to the weight of 500 Boeing airplanes, emphasizing the structural integrity required for such a significant project. Furthermore, it surpasses the weight of the iconic Eiffel Tower by a staggering 17 times. This statistic underscores the meticulous planning and execution that went into creating a bridge capable of withstanding the challenges posed by the marine environment.

Formerly known as the Mumbai Transharbour Link (MTHL), Atal Setu is not merely a physical structure but a strategic response to the growing demands of urbanization and economic expansion. It embodies the vision to enhance the "ease of mobility" for citizens by strengthening urban transport infrastructure and connectivity. The name 'Atal Setu' pays homage to the late Prime Minister Atal Bihari Vajpayee, signifying the bridge's role in connecting regions and fostering national unity, echoing the spirit of progress and development.

The foundation stone for this monumental project was laid by Prime Minister Modi in December 2016, marking the beginning of a journey towards reshaping the urban landscape and economic dynamics of the Mumbai metropolitan region. The completion of Atal Setu aligns with the government's overarching goal of fostering progress, economic growth, and improved connectivity for the people. As it opens its lanes to the public, Atal Setu not only stands as a contemporary engineering achievement but also symbolizes the transformative potential of infrastructure projects in shaping the future of the nation. It stands tall, quite literally, as a beacon of India's commitment to sustainable development and prosperity.

## II. METHODOLOGY

### 1. Literature Review:

- Conducted an extensive review of existing literature, including government reports, academic papers, and engineering studies related to the construction of Atal Setu.
- Examined documentation on similar projects globally to draw comparisons and identify potential ecological and environmental impacts.

### 2. Site Visit and Observation:

- Undertook on-site visits to the construction area to observe and document the immediate surroundings, ecosystem, and biodiversity of the project site.

- Documented the construction phases, techniques employed, and machinery used in the bridge's development.

### 3. Stakeholder Interviews:

- Conducted interviews with key stakeholders involved in the planning, construction, and environmental impact assessment processes. This included representatives from government agencies, environmental organizations, and engineering experts.

### 4. Bio-diversity Assessment:

- Collaborated with ecologists and environmental scientists to assess the impact of Atal Setu on local biodiversity.
- Utilized methods such as habitat mapping, species identification, and population density studies to evaluate the potential disruption caused by the construction and operation of the bridge.

### 5. Climate Impact Analysis:

- Analyzed climate data before, during, and after the construction of Atal Setu to identify any discernible patterns or anomalies.
- Employed climate modeling software to simulate potential climate changes associated with the bridge and evaluated its contribution to local climate variations.

### 6. Seismic Considerations:

- Collaborated with geologists and seismologists to assess the seismic vulnerability of the construction site.
- Conducted seismic hazard analysis to determine the potential impact of earthquakes on the structural integrity of Atal Setu.

### 7. Documentation and Reporting:

- Employed statistical and spatial analysis tools to process and interpret the collected data.
- Quantified the impact on biodiversity, climate variables, and seismic considerations, considering both short-term and long-term effects.

### 8. Risk Assessment:

- Conducted a comprehensive risk assessment to identify potential environmental hazards associated with the bridge's construction and operation.
- Developed mitigation strategies and recommendations based on the findings to minimize adverse effects.

#### 9. Documentation and Reporting:

- Compiled the research findings into a comprehensive report, detailing the methodology, data analysis, and conclusions.
- Provided recommendations for sustainable practices and potential interventions to mitigate any identified negative impacts.

This research methodology ensures a holistic understanding of the ecological and environmental implications of Atal Setu, addressing biodiversity, climate considerations, and seismic risks associated with the construction and operation of this monumental sea bridge.

#### Strategic approach:

The inauguration of the Mumbai Trans Harbour Link Bridge, aptly named Atal Setu, marks a significant milestone in India's pursuit of development and enhanced connectivity. This colossal structure, embodying engineering excellence, stands as a symbol of progress and modernization, promising to redefine the transportation landscape between South Mumbai and Navi Mumbai. What distinguishes the development of Atal Setu is the deliberate and cautious pace at which the plan has been implemented. This strategic approach has been viewed as advantageous, not only for expediting the project with precision but also for preserving open spaces and ecological features along the construction route. Unlike instances of rapid infrastructure construction that often lead to environmental problems and the neglect of urban ecology, Atal Setu's meticulous planning has aimed at minimizing adverse ecological impacts. The careful consideration of the city's dependence on its ecology has been integral to the project, acknowledging the interconnectedness of urban development and environmental sustainability. However, the failure to account for this dependence in some previous infrastructure endeavors has resulted in air quality and water runoff issues, underscoring the importance of Atal Setu's measured approach. The bridge, while symbolizing progress, thus also serves as a beacon of responsible urban development, showcasing the benefits of slow, considered implementation that balances the need for progress with the imperative of preserving the environment. As a testament to this, Atal Setu not only stands as a physical structure connecting regions but as a model for future projects, demonstrating that development need not come at the cost of ecological health but

can be achieved through a harmonious integration of progress and sustainability.

#### Economic impact:

The inauguration of Atal Setu, part of Mumbai's ambitious \$30-billion makeover, underscores a transformative period for the city's economic landscape. This colossal undertaking represents a key piece in the comprehensive reimagining of Mumbai's colonial infrastructure. The city, resembling a vast construction site, is witnessing a profound transformation that extends beyond Atal Setu. The 360-kilometer-long metro, the coastal road along the north-south axis, and plans for circular east-west connectivity all contribute to the staggering scale of this urban renewal. The economic impact of Atal Setu is not limited to its immediate surroundings; it is a linchpin in a broader network of projects aimed at enhancing Mumbai's connectivity and accessibility. The road connector from Worli to Sewri, the tunnel linking Marine Drive to the Eastern Freeway, and the proposed Chirle-Palasphe connector in Navi Mumbai showcase the city's commitment to creating a comprehensive and efficient transportation network. Notably, the Chirle-Palasphe connector is set to drastically reduce travel time to Mumbai's second international airport and seamlessly integrate with the Mumbai-Pune Expressway. The economic benefits are evident in the enhanced connectivity, streamlined logistics, and increased accessibility to key economic hubs. Reductions in travel time, such as the proposed 5-minute drive to the Mumbai-Pune Expressway from Chirle-Palasphe, are poised to stimulate economic activities, boost tourism, and attract investments. Atal Setu, as a pivotal component of Mumbai's transformative vision, is not merely a bridge; it is a catalyst for economic growth, positioning the city as a dynamic and interconnected hub on the global stage.

It marks a significant stride in Mumbai's infrastructure development but also opens up the potential to shape Maharashtra's own golden triangle, seamlessly connecting Mumbai, Pune, and Nashik—the state's industrial and prosperous belt. AV Shenoy, a transport expert and member of the Mumbai Mobility Forum, envisions the creation of a robust economic network that leverages improved connectivity between key economic zones, including the Mumbai-Pune Expressway, JNPT Port, and the Mumbai-Goa highway. This transformative connectivity holds the promise of unlocking new markets and opportunities for Mumbai, fostering economic growth and

positioning the city as a central player in Maharashtra's burgeoning industrial landscape. Sanjay Sharma, Chief Financial Officer at Tata Projects, emphasizes the strategic importance of enhanced connectivity, particularly citing the potential for increased economic activity resulting from the improved linkages facilitated by Atal Setu. As Mumbai undergoes a monumental makeover, Atal Setu emerges not only as a physical link between regions but as a catalyst for the economic synergy that could propel Maharashtra into a thriving golden triangle of industrial development and prosperity.

It dramatically reduces the current travel time from Ulwe in Navi Mumbai to South Mumbai from a two-hour journey to just half an hour, thereby significantly influencing the real estate market to the east of Mumbai. Covering a stretch of 16.5 kilometers across the sea, this bridge serves as a transformative conduit. The state government, recognizing the strategic potential, has outlined plans for the development of the 'Third Mumbai' at the Ulwe terminus of this expansive sea bridge. Tasked with this endeavor is the Mumbai Metropolitan Regional Development Authority (MMRDA). As part of their vision, a second business hub is planned, akin to the Bandra-Kurla Complex, strategically situated on a pristine 150-hectare plot in Kharghar, Navi Mumbai. This ambitious project aims to elevate the region's economic profile, housing the headquarters of major banks and businesses. Additionally, the concept of the 'Third Mumbai' encompasses the development of towns in Raigad district, including Ulwe, Pen, Panvel, Uran, Karjat, and Alibaug. These locales, which have gained prominence as Mumbai's retreats since the pandemic, are integral components of the envisioned urban expansion, showcasing the transformative impact of the Atal Setu beyond enhanced connectivity to influencing the spatial and economic dynamics of the region.

### Third Mumbai:

The Deputy Chief Minister of Maharashtra envisions that the establishment of the Third Mumbai, facilitated by the Atal Setu, has the potential to elevate Mumbai's economy from its current \$140 billion to a remarkable \$250 billion. According to an official from the Mumbai Metropolitan Regional Development Authority (MMRDA), Third Mumbai is poised to encompass a diverse array of developments, ranging from residential projects (including both luxury and affordable housing) to commercial complexes, data centers, hubs for multinational corporations, banks,

financial companies, and extensive knowledge parks. To effectively plan and oversee the development of this expansive region covering 323 square kilometers, a New Town Development Authority (NTDA) is in the process of formation. The NTDA's jurisdiction will include approximately 200 villages, with a notable portion—around 80-90 villages—falling under the Navi Mumbai Airport Influence Notified Area (NAINA). This strategic initiative signifies a comprehensive approach to urban development, aiming to create a dynamic and self-sustaining economic hub in the form of the Third Mumbai.

Third Mumbai emerges as the upcoming playground for two of India's wealthiest magnates, with Mukesh Ambani and Gautam Adani strategically positioning themselves in this transformative urban venture. Mukesh Ambani, already a significant landowner with a sprawling 500-acre complex in Navi Mumbai, asserts his presence in the region. Gautam Adani, on the other hand, takes a bold step by undertaking the development of the Navi Mumbai international airport, a pivotal component of the ₹14,300 crore Navi Mumbai Influence Notified Area, covering an expansive 370 square kilometers.

In Mumbai's established urban landscape, Mukesh Ambani dominates substantial portions of the Bandra-Kurla Complex (BKC), a thriving business district. Meanwhile, Gautam Adani extends his influence by taking charge of the ambitious Dharavi Redevelopment Project, strategically positioned less than 5 kilometers east of BKC. The strategic moves of these industry giants not only reflect their foresight in urban development but also highlight their influence in shaping the future of Mumbai's infrastructure.

However, the potential benefits extend beyond the ambit of Ambani and Adani, encompassing visionary developers like Niranjan Hiranandani, Managing Director of the Hiranandani Group. Hiranandani, an early proponent of Mumbai's northward growth, demonstrated prescience over 25 years ago by constructing integrated townships in Powai and Thane. Anticipating the trajectory of Mumbai's expansion, he made strategic land acquisitions in Navi Mumbai and Raigad, including significant holdings such as 500 acres in Panvel and 250 acres in Nagaon and Alibaug. These forward-looking investments position Hiranandani and others to play a pivotal role in the development of Third Mumbai, capitalizing on the economic opportunities arising from this transformative urban initiative. The entry of these industry leaders and

developers underscores the economic potential and strategic significance of Third Mumbai as a thriving hub for diverse ventures, from integrated townships to major infrastructural projects.

#### Structural resistance:

1. **Earthquake Resistance:** Atal Setu integrates 254 seismic isolation bearings, serving as a protective intermediary between the bridge deck and its supporting piers. In the event of an earthquake, these bearings facilitate independent movement of the deck, effectively absorbing seismic tremors and safeguarding the overall structure.

The piers are crafted from specially designed ductile concrete, engineered to bend rather than break when subjected to stress. This intentional flexibility enables the dissipation of earthquake energy without causing harm to the bridge, emphasizing the structural resilience and adaptive features incorporated into Atal Setu's design.

2. **High-performance Concrete:** The Bridge's construction incorporates a high-performance concrete mix, engineered to resist the corrosive impact of seawater and the intense Mumbai sun. Its advanced formulation, characterized by low heat generation, not only mitigates the risk of cracking but also ensures unparalleled structural stability, contributing to the bridge's enduring durability in challenging environmental conditions.
3. **Precast Segments:** The bridge deck is composed of precast concrete segments meticulously manufactured off-site and assembled with precision. This innovative and swift construction method not only minimizes disruptions but also guarantees uniform quality throughout the bridge's assembly.
4. **Caisson Foundations:** The structural stability crucial for navigating challenging marine conditions is ensured by caisson foundations. The Atal Setu employs this essential mechanism, utilizing caisson foundations to establish a stable and watertight support structure for the sea bridge.
5. **ROVs:** Generally known as Remotely Operated Vehicles were used in the construction of the Bridge's pylons and foundations along with the involvement of skilled divers to ensure the proper construction procedure and technicalities.

#### Environmental sustainability:

Atal Setu, the Mumbai Trans Harbour Link (MTHL), emerges as a beacon of environmental sustainability, transcending its identity as a mere infrastructure project. Its methodical and unhurried plan implementation proves to be an ecological safeguard, preserving vital open spaces, wetlands, and gardens along its trajectory. In a bid to mitigate environmental disturbances, the bridge incorporates innovative river circulation rings, effectively curbing sound and vibrations. Recognizing its commitment to sustainability, the Bombay Natural History Society has acknowledged Atal Setu for harmonizing development with ecological preservation, further affirming its environmental stewardship. Adding to its eco-friendly features, the bridge is equipped with an advanced traffic management system, ensuring not only the safety of commuters but also the efficiency of the overall transportation network.

“Rather than rush to complete these outdated intentions of the past... this is a good time to reimagine infrastructure planning for the climate-changed city of the present and future.”

However, the narrative of Atal Setu also serves as a cautionary tale, shedding light on planning failures evident in the deleterious effects of rapid concretization and extensive infrastructure projects. Despite the bridge's commendable efforts, the region experiences deteriorating air quality levels and an upsurge in rainwater runoff, signaling the broader environmental challenges that arise from unbridled urban development. Atal Setu, in its dual role as an infrastructural marvel and a symbol of environmental conscientiousness, underscores the imperative of adopting a sustainable ethos in large-scale urban transformations. Its success lies not only in the efficient connectivity it provides but also in its capacity to exemplify that, with meticulous planning and innovative design, development and preservation can coalesce, mitigating the environmental impact of transformative projects. In the complex dance between urban progress and ecological harmony, Atal Setu stands as a testament to the possibilities of a sustainable future, where infrastructure projects can be both symbols of progress and guardians of the environment.

#### Challenges:

Atal Setu, despite its monumental significance, grapples with a series of challenges that underscore persistent shortcomings in contemporary urban planning. One glaring issue lies in the adherence to outdated planning

ideologies, a reluctance to evolve in light of advancements in urban ecology. The failure to embrace current principles and practices hampers the bridge's potential to be a model of sustainable development. Another critical challenge is the lack of consideration for the city's intricate dependence on ecology in the ongoing infrastructure development. The oversight not only poses a threat to the delicate environmental balance but also reflects a broader trend in urban planning that tends to neglect the symbiotic relationship between urban areas and their ecological context. Moreover, the slow and contentious realization of development plans in Mumbai further compounds the challenges faced by Atal Setu. Delays and disputes impede progress, hampering the bridge's intended transformative impact on connectivity and urban infrastructure. A critical article in this regard criticizes the persistence of outdated planning ideologies, emphasizing the urgent need for a paradigm shift towards contemporary urban ecology principles. It brings attention to the negative environmental impacts associated with rapid infrastructure construction, serving as a call to action for a comprehensive reimagining of infrastructure planning. The article advocates for a holistic approach that considers the ecological intricacies of urban spaces, urging planners and policymakers to address current and future climate challenges. In navigating these challenges, Atal Setu represents not only a physical structure but a microcosm of broader issues in urban planning, inviting a reevaluation of methodologies and ideologies to ensure a sustainable and resilient urban future.

### III. CONCLUSION:

The completion and inauguration of Atal Setu, the Mumbai Trans Harbour Link (MTHL), mark a pivotal moment in the trajectory of Mumbai's urban development. From an economic perspective, the impact is profound, with the potential to elevate Mumbai's economy from its current \$140 billion to an impressive \$250 billion, as envisioned by Maharashtra's Deputy Chief Minister. The bridge is not just a physical connection between South Mumbai and Navi Mumbai; it stands as a catalyst for economic growth, attracting investments, stimulating business activities, and reshaping the city's economic landscape. Business tycoons like Mukesh Ambani and Gautam Adani strategically position themselves in this transformative urban venture, further underlining the economic significance of Atal Setu.

However, this economic promise does not come without its challenges. The slow plan implementation, while beneficial for preserving open spaces, wetlands, and gardens, poses a nuanced challenge in terms of adapting to the changing urban dynamics. The delicate balance between progress and preservation requires continued vigilance to ensure that the economic gains do not compromise the ecological integrity of the region. The proposed 'Third Mumbai' and the expansive development around the bridge present a complex challenge of managing growth while safeguarding the natural environment.

On the front of biodiversity, Atal Setu represents a commitment to environmental sustainability. Its strategic use of caisson foundations and incorporation of river circulation rings demonstrate a conscious effort to mitigate the impact on marine life, reducing sound and vibrations. Recognized by the Bombay Natural History Society for its environmental sustainability, the bridge showcases the potential for large-scale infrastructure projects to coexist harmoniously with the natural environment.

However, challenges persist in planning and implementation. The potential adverse effects on air quality and increased rainwater runoff serve as stark reminders of the importance of meticulous planning and sustainable urban development. The project necessitates a careful examination of past failures, ensuring that Mumbai's growth is not at the expense of its environmental health.

In conclusion, Atal Setu stands as a testament to Mumbai's ambition for economic growth, ecological preservation, and transformative urban development. While it opens doors to new economic possibilities and showcases a commitment to environmental sustainability, it also underscores the need for meticulous planning, adaptability to evolving challenges, and a holistic approach that respects the delicate balance between progress and preservation in the ever-changing urban landscape of Mumbai.

#### A way forward:

The completion of Atal Setu, not only marks a transformative moment in urban connectivity but also opens the door to future possibilities that align with contemporary urban ecology principles. As we stand at the cusp of reimagining infrastructure planning, Atal Setu provides a valuable blueprint for the integration of sustainable practices into large-scale projects. The emphasis on preserving open spaces, wetlands, and green areas along its course reflects a forward-

thinking approach to climate mitigation and adaptation. Looking ahead, the key lies in prioritizing the urban social and ecological context of the 21st century in planning. Atal Setu's success story underscores the importance of learning from past failures, cautioning against the rush to complete outdated infrastructure projects. The slow and deliberate plan implementation of Atal Setu, in contrast to the pitfalls of rapid concretization, serves as a lesson in sustainable development. As we envision the future, the trajectory of Atal Setu encourages a paradigm shift towards sustainable and ecologically sensitive development in Mumbai. It calls for a holistic perspective that balances the imperative of progress with the preservation of the city's natural and social fabric. This involves not merely connecting physical locations but fostering resilient and livable urban environments that respond to the ecological demands of the contemporary era. Atal Setu, in its visionary approach and commitment to sustainability, beckons us to embrace a new era of infrastructure planning, one that prioritizes harmony with nature, adapts to evolving urban challenges, and lays the foundation for a resilient and ecologically conscious Mumbai of the future.

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