



NATIONAL HIGHWAYS & OUTER RING ROADS AND THEIR IMPACT ON BOTH URBAN AND RURAL AREAS-A CASE STUDY IN TIRUPATI CITY

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Abstract : The expansion of national highways, in conjunction with the proposed outer ring road (ORR) and the finished Garuda Elevated Corridor in Tirupati, is collectively impacting both urban and rural regions by enhancing accessibility, stimulating economic development, and fostering substantial socio-economic transformations.

Index Terms : National Highways, Outer ring roads, Tirupati, Urban areas, rural areas etc.

I. INTRODUCTION

The initial circumferential routes were established around Berlin, Munich, and London during the 1930s. The development of ring roads in Europe was not aimed at alleviating congestion in the past, as traffic jams and congestion were virtually non-existent, and the volume of vehicles at that time differed significantly from the levels that would later lead to traffic issues [1]. The main purpose of these ring roads was to create remarkable structures and improve the existing spatial organization of urban areas [2]. Additionally, there was a substantial increase in automobile ownership following World War II, which spurred the construction of extensive highways in many affluent nations. Ring roads offer alternative pathways for vehicles heading to suburban areas or transporting goods to outlying suburbs without traversing the city center, thereby alleviating traffic congestion in urban centers by providing alternative routes and decentralizing vehicle flow from heavily congested main roads. By diverting vehicles away from urban centers, ring roads help mitigate traffic congestion.

Furthermore, they redirect undesirable traffic patterns, restricting the movement of transit goods and cross traffic into the city center, thus preventing congestion in the central district. Moreover, as a city expands and its urban planning extends towards the ring road or suburban regions, these ring roads significantly impact city organization and serve as a tangible constraint. The process of suburbanization, which involves transforming rural areas into municipalities that heavily depend on automobiles, exacerbates the reliance on vehicles in the absence of adequate public transportation options.

According to certain authors [3], the establishment of ring roads has a beneficial effect on local businesses as they serve as transport hubs and aid in the growth of companies, the creation of economic districts, and the transfer of jobs from urban centers to suburban regions. Ring roads enhance accessibility to suburban areas, elevate property values, and draw in more investors [4]. They enable the spread of activities while concurrently increasing traffic flow among various regions, which results in a gradual accumulation of congestion on these routes. The need for additional orbitals situated further from the city center is consistently on the rise [5]. Therefore, the growth of ring roads may not effectively resolve the issues associated with traffic congestion. Rather, it will encourage the use of new vehicles and cause a significant decline in environmental quality due to increased vehicle activity during peak hours, commonly referred to as "generated traffic." An outer ring road (ORR) constitutes a significant, high-capacity roadway system constructed around the outskirts of an urban region to enable traffic to circumvent the city center, mitigate congestion, and enhance regional connectivity.

Purpose and Benefits The fundamental objective of an outer ring road is to distinguish long-distance and heavy freight traffic from local urban traffic, resulting in numerous advantages:

Reduced Congestion: By offering an alternative pathway, ORRs diminish the strain on heavily trafficked inner-city streets. **Faster Travel Times:** They facilitate increased travel speeds (for instance, Hyderabad's ORR is engineered for speeds of up to 120 km/h) and incorporate grade separations (such as flyovers and underpasses) to guarantee uninterrupted travel.

Urban Planning & Economic Growth: The establishment of an ORR frequently stimulates the development of satellite townships, commercial centers, and industrial zones along its route, promoting decentralized urban growth and attracting investment.

Enhanced Connectivity: They link various national and state highways, in addition to major urban nodes such as airports, IT parks, and ports.

Significant Instances in India Numerous cities worldwide, including those in India, have either established or are in the process of constructing outer ring roads to address urban growth and traffic management.

Hyderabad (Nehru Outer Ring Road): This notable instance in India is a 158 km, 8-lane access-controlled expressway that completely surrounds the city, linking major IT centers, the international airport, and various national highways. Additionally, it includes a 23 km cycling track with a solar roof.

Bengaluru (Outer Ring Road): This roughly 60 km loop connects essential arterial routes and serves as a vital corridor for the city's IT and commercial industries. In light of the city's swift growth, it is currently experiencing considerable congestion, prompting plans for an additional Peripheral Ring Road and Satellite Towns Ring Road.

Chennai (Outer Ring Road): Designated as State Highway 234, this 62 km transport corridor traverses the outskirts of the Chennai Metropolitan Area, connecting multiple national highways and promoting the development of adjacent regions.

Delhi (Outer Ring Road): This 47.5 km six-lane roadway encircles the capital city and includes numerous flyovers and interchanges to facilitate improved traffic flow.

Alongside cities that already have ring roads, numerous other cities in India are either planning or constructing new ones. These initiatives aim to alleviate urban congestion and enhance connectivity.

Recently, the central government has designated more than twelve cities for the development of new access-controlled ring road projects, as announced in September 2025. The cities selected for this initiative are:

Kolkata
Amaravati
Nashik
Thiruvananthapuram
Ajmer
Warangal
Mangaluru
Udaipur
Tirunelveli
Rajahmundry.

Influence on both Urban and Rural areas

Ring roads play a crucial role in shaping urban development by altering a city's physical structure and economic landscape, resulting in a significant rise in property values in newly connected regions. This effect is primarily due to enhanced accessibility and the establishment of new growth corridors beyond the crowded city center.

Impact on Urban Development Decentralization and Expansion (Urban Sprawl): Ring roads enable the growth of urban areas by providing access to previously isolated or semi-urban lands. This accessibility fosters the emergence of satellite townships, new suburbs, and industrial zones along the outer corridor, thereby decentralizing the concentration of population and businesses from the city center.

Establishment of Economic Hubs: Enhanced connectivity draws the development of IT parks, logistics and warehousing centers, manufacturing facilities, and commercial hubs near interchanges. This interaction between industrial and residential expansion fosters self-sustaining micro-markets, diminishing dependence on the central business district.

Infrastructure Development: The enhancement of primary road infrastructure often catalyses the creation of supporting social infrastructure, including schools, hospitals, shopping centers, and entertainment venues, which further improves the liveability and appeal of these regions.

Traffic Decongestion (Initial Phase): By redirecting long-distance and heavy freight traffic, ring roads initially alleviate congestion in the central urban areas, enhancing overall traffic flow and the quality of life for residents.

Planned Urbanization: In certain instances, governments utilize ring roads to promote organized, regulated development in the outskirts, which aids in structuring city growth into a more systematic ring-radial configuration, as exemplified by the master plans of Hyderabad and Pune.

Impact on Real Estate Values Notable Growth

The closeness to a ring road serves as a key factor in the appreciation of property values. Regions adjacent to the Hyderabad Outer Ring Road and Pune Ring Road have experienced substantial increases in land prices, occasionally reaching 35% within a few weeks following project announcements, and even more over the course of several years.

Heightened Demand: Improved accessibility boosts the demand for both residential and commercial real estate in surrounding areas. This surge in demand is driven by homebuyers looking for better connectivity and a more pristine environment, alongside investors who are expecting significant returns.

Investment Opportunities: Certain areas near major interchanges and connection points transform into investment hotspots, offering the potential for greater returns compared to properties located in already crowded city centers.

Affordability Issues: Although ring roads provide more affordable housing alternatives in the outskirts compared to central locations, the swift rise in prices in these newly accessible areas may ultimately create affordability challenges for middle-income purchasers.

Enhancement of the Rental Market: The enhanced connectivity to job centers also elevates the demand for rental properties in nearby suburbs, drawing interest from co-living operators and individual landlords.

Nonetheless, the long-term effectiveness of ring roads in consistently alleviating traffic congestion remains a topic of discussion, as they can occasionally generate additional traffic and contribute to unplanned urban sprawl if not regulated with stringent land-use policies and integrated with efficient public transportation systems.

II. STUDY AREA

"Greater Tirupati" denotes the intended enlargement of the current Tirupati Municipal Corporation into a more extensive urban administrative entity, termed the Greater Tirupati Municipal Corporation (GTMC). The main objective is to oversee the swift and frequently unstructured urban growth taking place in the adjacent regions and to unify them for integrated development.

Tirupati is a prominent town located in the Tirupati District of Andhra Pradesh, India. It is best known as the spiritual capital of Andhra Pradesh, primarily because it is home to the Tirumala Venkateswara Temple, one of the most visited and wealthiest pilgrimage sites in the world.

The "Garuda" project in Tirupati is an elevated corridor (flyover) initiative, rather than a complete outer ring road, primarily designed to alleviate traffic congestion within the city for pilgrims traveling to Tirumala.

Garuda Varadhi (Elevated Corridor) Status: The project, officially referred to as the Garuda Varadhi (Garuda Elevated Corridor), is largely finished, with over 90% of the construction completed by late 2024. Some phases were temporarily closed for maintenance as recently as May 2025.

Purpose: This corridor offers a direct and convenient route for vehicles traveling from the city to the Tirumala hills, bypassing several congested intersections such as the Central bus station and Leela Mahal circle.

Funding: This initiative is a collaborative effort under the Tirupati Smart City project, with the Tirumala Tirupati Devasthanams (TTD) covering a substantial portion of the expenses (approximately 67%). **Design:** The architectural design of the flyover features elements that symbolize Lord Garuda, the vehicle of Lord Vishnu, with the structure's spine and wing shape paying tribute to the deity closely associated with Tirupati.

Outer Ring Road Plans Tirupati has been identified by the central government as one of the cities slated for a new access-controlled ring road project; however, this is distinct from the existing Garuda Varadhi flyover.

The larger outer ring road project is still in the planning phase (likely the Detailed Project Report submission stage) and aims to enhance overall regional connectivity for the growing urban area, as part of a broader initiative for infrastructure development throughout Andhra Pradesh.

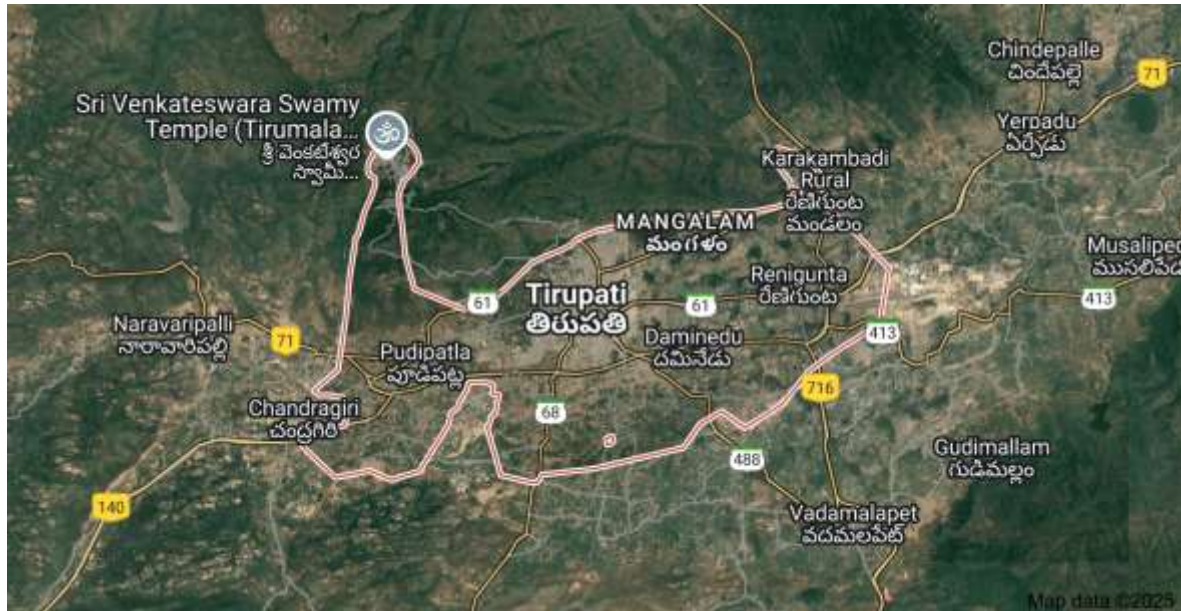


Figure : Satellite map of Tirupati

As of late 2025, the widening projects of national highways in the vicinity of Tirupati, particularly along NH 71 and NH 140, are either largely finished or in advanced phases. These enhancements have a substantial and predominantly beneficial effect on the city and its adjacent rural regions, mainly by enhancing connectivity, stimulating economic growth, and elevating property values.

Key Highway Widening Initiatives Several significant projects under the Bharatmala Pariyojana have either recently been completed or are currently underway:

NH 71 (Madanapalle to Naidupeta): The entire 190 km stretch is undergoing upgrades, with segments such as Madanapalle-Pileru and Pileru-Kalur already finished as four-lane corridors. The crucial Renigunta-Naidupeta segment is advancing rapidly towards a six-lane configuration.

NH 140 (Chittoor to Mallavaram): This segment, which links Chittoor to Tirupati via Kanipakam, was expanded to six lanes and became operational in May 2021, with remaining works completed subsequently.

NH 716 (Kadapa to Renigunta): This section is being developed to meet 4-lane standards. **Tirupati Bypass:** Bypasses around urban centers such as Tirupati and Naidupeta are included in the upgrade plans to redirect through-traffic away from congested city centers.

Impact on Tirupati City Decongestion: The bypasses and expanded roads assist in segregating long-distance and heavy commercial traffic from local urban traffic, leading to a significant reduction in congestion within the central city areas.

Improved Access to Key Facilities: The upgrades enable seamless connections to major economic and transit hubs, including the Tirupati International Airport (Renigunta Airport), railway junctions, and the Tirumala temple, thereby enhancing the city's status as a pivotal pilgrimage and logistics center.

Enhanced Safety: The transition to access-controlled 4/6 lane highways, equipped with flyovers, underpasses, and grade separators, is specifically aimed at eliminating accident-prone areas and railway crossings, thereby improving overall road safety.

Impact on Rural Areas Economic Transformation: The road network induces significant socio-economic changes in the adjacent rural and semi-urban regions by enhancing market access for agricultural products and other goods.

Industrial and Commercial Growth: The improved connectivity draws industrial and commercial investments along the corridors, fostering the creation of job opportunities in transportation, ancillary services, and new enterprises.

Tirupati urban areas

Enhanced urban connectivity: Initiatives such as the Garuda Varadhi and the expansion of key national highways (NH 71 and NH 140) have alleviated congestion and optimized traffic movement within the city, particularly benefiting pilgrims and tourists travelling to Tirumala. **Increased commercial activity:** Improved road infrastructure promotes more efficient logistics, drawing in commercial investments and broadening the economic landscape of the city. **Property value appreciation:** Regions adjacent to the highway corridors have experienced a significant rise in property values, attributed to enhanced accessibility and the prospects for both commercial and residential development.

Rural and semi-urban areas

Improved socio-economic access: Rural populations are afforded better access to urban amenities such as education, healthcare, and marketplaces, thereby promoting comprehensive social advancement.

Boosted agricultural trade: The expansion and efficiency of highways enable farmers to transport their agricultural products to markets more swiftly and cost-effectively, ensuring improved pricing and lower transportation expenses.

Job creation and non-farm employment: The road construction process itself creates job opportunities. Once completed, the improved connectivity attracts investments and stimulates non-agricultural job growth, offering new economic prospects for rural communities.

Increased land values: Land situated in semi-urban and rural locales along the highway corridors and the proposed ORR is witnessing a rise in value, reshaping the area and establishing new investment hubs.

III. POTENTIAL DRAWBACKS ENVIRONMENTAL IMPACT:

There may be adverse effects such as land acquisition that leads to displacement, environmental issues stemming from heightened pollution, and a reduction in scenic vistas due to increased traffic. **Social displacement:** Expansion projects can require land acquisition that results in the displacement of families and businesses, necessitating meticulous resettlement strategies to alleviate negative social repercussions.

Challenges

Environmental Concerns: The widening of roads can adversely affect local ecosystems through deforestation, construction-related pollution, increased traffic, and the destruction of natural habitats. The Garuda Varadhi, for instance, faced initial backlash due to its possible effects on the Alipiri forest trail.

Accident Risk: Although designed with safety in mind, the elevated speeds enabled by new expressways and flyovers can result in accidents if not properly managed with adequate safety measures. For example, additional safety features were implemented on the Garuda Varadhi following reports of fatal accidents.

Development Pressure: The rise in land values may trigger unregulated development and urban sprawl unless it is directed by effective urban planning and land-use policies. Overall

IV. CONCLUSION

The road infrastructure initiatives in and around Tirupati signify a deliberate attempt to address the rising population and pilgrim influx in the city while simultaneously promoting regional economic growth. The Garuda Elevated Corridor has already improved intra-city transportation, while the widening of national highways (including NH 71 and NH 140) is bolstering regional connectivity. In the future, a proposed outer ring road will further facilitate the city's growth and enhance regional connections. These advancements yield considerable socio-economic advantages, such as increased property values, heightened commercial and industrial activities, and better access to urban amenities for rural communities. Nevertheless, these transformations also pose challenges concerning environmental repercussions and potential social displacement that require careful management.

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