

A Review on Traffic Study for Proposed Thane Coastal Road (Kharegaon-Gaimukh) for Decongestion of Ghodbunder Road

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Abstract-Urban traffic congestion has become a paramount challenge in rapidly growing metropolitan agglomerations globally and across developing nations like India. Factors such as exponential urbanization, rising private vehicle ownership, heterogeneous mixed traffic streams, and constrained roadway capacities contribute to severe economic losses, extended passenger delays, environmental degradation, and reduced travel speeds. This comprehensive review paper synthesizes recent scholarly literature concerning urban traffic congestion root causes, advanced detection and monitoring technologies, Intelligent Transportation Systems (ITS), and the strategic implementation of macro-infrastructure alternatives such as bypasses, expressways, and coastal highways. Special emphasis is placed on evaluating high-density suburban corridors like Ghodbunder Road in Thane and the mitigating role of alternative megaprojects such as the proposed Thane Coastal Road. Findings synthesized from prior global and national studies indicate that integrated multimodal planning, real-time traffic diversion, and high-capacity coastal alignments successfully alleviate arterial congestion, enhance freight logistics, and foster sustainable urban mobility.

Key Words: Traffic Congestion, Urban Transportation, Coastal Corridors, Intelligent Transportation Systems, Traffic Diversion, Sustainable Mobility, Literature Synthesis.

1. INTRODUCTION

Transportation systems serve as the lifeblood of modern economies, enabling the efficient mobility of workforce populations, commercial goods, and raw materials. However, rapid population migration towards urban centres and accelerating motor vehicle registration have severely outpaced roadway infrastructure expansion. In metropolitan regions such as the Mumbai Metropolitan Region (MMR), arterial corridors frequently operate beyond design thresholds, precipitating severe bottlenecks, extended travel delays, heightened fuel wastage, and elevated atmospheric emissions.

To mitigate these pervasive urban challenges, transportation authorities increasingly rely on macro-infrastructure interventions, including ring roads, grade-separated flyovers, expressways, and coastal highways. This review paper consolidates contemporary research on urban congestion dynamics and examines the theoretical and

practical efficacy of alternative coastal corridors in redistributing heavy commercial and through traffic away from congested urban arteries.

1.1 Objectives and Scope

1. To review the underlying causes and impacts of urban congestion in major metropolitan regions.
2. To evaluate the role of Intelligent Transportation Systems (ITS) and physical infrastructure alternatives in traffic management.
3. To conduct a detailed review of traffic studies related to the proposed Thane Coastal Road (Kharegaon to Gaimukh) as a bypass solution for decongesting Ghodbunder Road.

2. CAUSES AND IMPACTS OF URBAN TRAFFIC CONGESTION

Extensive scholarly literature identifies rapid urbanization, surging vehicle ownership, and mixed traffic operating conditions as primary triggers for urban congestion. In Indian cities, heterogeneous traffic streams comprising two-wheelers, auto-rickshaws, passenger cars, buses, and heavy multi-axle freight trucks sharing identical right-of-way drastically suppress roadway capacity and operational efficiency. Furthermore, roadside encroachments, unmanaged parking, and frequent at-grade intersections compound travel delays.

The impacts of congestion extend far beyond direct economic losses driven by wasted fuel and delayed freight delivery. Environmental studies highlight significant elevations in particulate matter (PM2.5 and PM10), carbon monoxide, and greenhouse gas emissions. Consequently, sustainable urban planning mandates proactive infrastructure expansion coupled with advanced traffic management frameworks.

3. CONGESTION MANAGEMENT TECHNIQUES AND ITS INTEGRATION

Modern congestion mitigation strategies span both physical infrastructure development and advanced technological interventions. Intelligent Transportation Systems (ITS), AI-based traffic signal optimization, variable message signs (VMS), and probe vehicle data (PVD) monitoring have been

widely investigated by researchers. Studies demonstrate that real-time route guidance and automated incident detection successfully flatten peak demand spikes.

At the macro-infrastructure level, construction of bypasses and coastal corridors has proven highly effective. Research evaluating coastal highways in regions such as Kerala and Mumbai highlights that diverting through-traffic and heavy freight around congested urban cores restores acceptable Levels of Service (LOS) and enhances regional connectivity.

Table 1: Summary of Key Literature on Urban Traffic Congestion and Mitigation

Authors & Year	Study Focus / Region	Methodology Adopted	Key Findings & Recommendations
Rishabh & Rathee (2026)	Urban Transportation Systems	Literature Review	Highlighted ITS, AI optimization, and integrated management for sustainable urban traffic flow.
Jilani et al. (2025)	Congestion Prediction in ITS	PRISMA Systematic Review	Concluded that AI-based real-time prediction models effectively enhance urban congestion management.
Chandran et al. (2023)	Coastal Highway Demand, Kerala	Traffic Surveys & O-D Analysis	Demonstrated that coastal highways successfully divert regional traffic and remain operational up to design horizons.
Koukounaris et al. (2019)	Coastal Urban Traffic Diversion	Traffic Simulation & VMS	Real-time route diversion via coastal roads reduced travel times, fuel consumption, and delays.

4. ROLE OF ALTERNATIVE COASTAL CORRIDORS: A CASE STUDY PERSPECTIVE OF THANE

Corridors connecting major regional nodes, such as Ghodbunder Road in Thane, experience severe saturation due to dual local commuter and regional freight demands. Literature indicates that localized geometric improvements

and intersection widenings offer only temporary relief. Structural decongestion requires high-capacity alternative alignments.

Projects like the proposed Thane Coastal Road (Kharegaon–Gaimukh) exemplify this approach by utilizing stilts, tunnels, and dedicated multi-lane carriageways to bypass dense urban fabrics, thereby preserving ecological zones while accommodating high-volume freight traffic.

4.1. Key Benefits of the Kharegaon-Gaimukh Alignment:

1. Separation of Freight and Commuter Traffic: Directs JNPT and heavy regional cargo away from Thane's internal city routes.
2. Reduction in Travel Time: Bypasses congested intersections along Ghodbunder Road, boosting overall average travel speeds.
3. Environmental Improvement: Reduces localized emissions and noise pollution in residential neighborhoods along the existing arterial corridor.

5. CONCLUSIONS AND FUTURE SCOPE.

5.1 Conclusions

This literature review synthesized contemporary research on urban traffic congestion and infrastructure remedies. The literature overwhelmingly demonstrates that conventional road widening is insufficient in densely built metropolitan areas. Alternative corridors, particularly coastal highways and bypasses equipped with intelligent traffic systems, offer robust, sustainable solutions by diverting through traffic, reducing environmental emissions, and restoring optimal transport network efficiency.

5.2 Scope for Future Research

Future research may incorporate advanced microscopic traffic simulation software (such as VISSIM or SIDRA), GIS-based spatial modeling, and carbon emission assessment frameworks to evaluate the long-term environmental and operational benefits of coastal highway projects.

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