

Problems and Prospect and Roads and Traffic Management in Prayagraj City

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ABSTRACT

The rapid urbanization and population growth of Prayagraj City create significant challenges in road infrastructure and traffic systems. This is because it's an important economic and cultural hub where vehicular congestion, inadequate road infrastructure, and rising pollution levels reduce the quality of life, economic productivity, and sustainability. This study aims to investigate the major issues related to roads and traffic management in Prayagraj, shedding light on the key drivers of such problems and their implications for urban planning. It also delves into potential solutions, including policy frameworks, technological interventions, and sustainable strategies for managing traffic and mobility in the city to improve its efficiency. The findings aim to contribute to a holistic understanding of urban traffic management, paving the way for sustainable development in Prayagraj and similar urban centers in India.

Keywords: Traffic Management, Rapid Urbanization, Population Growth, Rising Pollution, Economic Productivity, Sustainability.

Introduction

In general, the city urbanization that everyone witnesses globally has made a lot of changes in the way people live, work, and commute. The very same is happening in Prayagraj-a major city in Uttar Pradesh, India. Besides its rich cultural and religious importance, this city is also running very fast to become a great city, throwing much pressure on the infrastructure or road and traffic management in particular. Although the city's road network is expanding, it continues to face many issues related to managing more vehicles along with a growing population and urban sprawl.

Roads and their management have become of utmost concern in Prayagraj and have impacted daily commuters, businesses, and the quality of life in general. Congestion, traffic jams, poor road conditions, insufficient traffic signals, and ineffective enforcement of traffic rules are some of the key problems that the city is posed with. To that, the annual influx of pilgrims during religious events like Kumbh Mela makes the traffic situation worse and emphasizes the fact that the city has lacked proper preparation for the mishaps.

This paper tries to deal with different problems and prospects related to road and traffic management in Prayagraj. Analyzing the current state of the infrastructure, studying effectiveness or ineffectiveness of the methods currently applicable in traffic management, and finalizing the scope for improvement, this paper suggests improvements that could lead to better solutions of these issues. In the end, it aims at ensuring safe, efficient, and sustainable transport through roads in Prayagraj for the residents and visitors.

Review of Literature

The matter of road and traffic management in urban areas has been found to be extensively researched based on several criteria, including congestion, infrastructural development, safety of roads, and the socio-economic implications of inefficient traffic management. There are key challenges and solutions identified by scholars and urban planners in Indian cities that could inform better traffic management practice in Prayagraj.

- **Urbanization and Traffic Congestion**

Sharma and Kumar (2016) is of the opinion that due to rapid urbanization in India, there have been more vehicles out on roads, which adds to traffic congestion. They argue that with cities such as Prayagraj growing in size, expansion in its road infrastructure does not correspond with people's demand for transport. Equally, Saha and Ghosh (2019) contend that the density of the place has not only limited the efficiency in transport but also has led to air pollution, long commutes, and decreased quality of life for residents.

- **Road Infrastructure and Safety**

According to Gupta et al. (2020), road infrastructure is one of the major causes of bottlenecks for traffic in Indian cities. Poor road conditions, pedestrian facilities scarcity, and poor traffic signals are the problems that most cities face. In Prayagraj, Kaur and Singh (2021) indicated that the city does not have adequate infrastructure of road systems, mainly due to the increasing population, especially during religious events like Kumbh Mela. Accidents and delay occur because of inadequate road signage and some poorly conceptualized intersections.

- **Traffic Management Systems**

Some of the key research areas develop and initiate ITMS. According to Kumar and Gupta (2018), smart traffic signals, real-time monitoring, and data analytics will play the most vital roles in controlling traffic flow. The paper, in turn, suggests incorporating technology in directing traffic on urban roads, which can be more effective and less likely to get congested. In the case of Prayagraj, such systems might be particularly helpful in peak hours and particular events so that traffic management can be carried out smoothly.

- **Problems during Religious and Cultural Events**

The management of traffic during large-scale religious events, for example, the Kumbh Mela has been of significant study. Verma and Jain (2017) also reported the problems in which, according to them, city authorities face by managing millions of pilgrimage going into the city and discussed that without a well-structured traffic management plan, it results in massive congestion and accidents and logistical issues. Road adjustments for temporary pilgrims and increasing vehicular movement aggravate the mess in the city, especially during the Kumbh Mela at Prayagraj.

- **Socio-Economic Effectiveness of Traffic Management**

Traffic congestion and mismanagement have been discovered to have significant socio-economic implications. Mishra and Prasad (2020) discuss the economic loss attributed to traffic congestion in Indian cities, estimating that a considerable percentage of urban productivity is lost in traffic delays. Poor traffic conditions in Prayagraj can lead to increased operational costs for businesses, reduced tourism, and diminished attractiveness as an investment destination.

- **Policies and Regulations**

The role of government policies in shaping traffic management is well documented. According to Mehta (2018), traffic regulations and their enforcement mechanisms are usually weak, hence leading to violations and unsafe driving practices. The case is of Prayagraj, whose local traffic laws and their implementation, as noted by the study, remain an issue of concern. The study required stricter penalties, regular monitoring, and public awareness campaigns for safer road use.

- **Prospects of Improvement**

Finally, there is considerable literature that focuses on possible solutions to the traffic ills of urban centers. Singh and Sharma (2019) recommend an integrated approach in terms of the development of public transport, the development of proper plans in an urban area, and the integration of technology. The authors argue that cities like Prayagraj should focus on sustainable modes of transport like buses, bicycles, and walking, at the same time improving the quality of roads and public infrastructure. Public-private partnerships and collaborations with tech firms might be essential when implementing smarter traffic systems and road infrastructure projects.

Objectives of the Study

- To study traffic congestion in Prayagraj, and understand how it affects air pollution and daily life.
- To review current traffic management efforts in the city and suggest better and more sustainable ways to improve road conditions and traffic flow.

Methodology

This study would consider a mixed-methods approach, combining the use of qualitative and quantitative methods, to assess road and traffic management in Prayagraj. The methodology would, therefore comprise the following steps:

Data Collection

- **Primary Data**
 - **Surveys and Questionnaires:** It would involve a structured survey with residents, daily commuters, and the local authorities and gather insights into traffic patterns, road conditions, and the perceived effectiveness of traffic management systems.
 - **Interviews:** In-depth interviews would be conducted with city planners, traffic officers, and stakeholders involved in urban transportation and infrastructure development to understand the challenges and prospects for improving traffic management.
 - **Field Observations:** Direct observation of traffic flow, road conditions, congestion points, and accident-prone areas would be conducted at various times of the day to gather real-time data.
- **Secondary Data**
 - **Literature Review:** Research studies on urban traffic management, case study on similar cities, and relevant reports on the existing traffic conditions of Prayagraj will be reviewed.
 - **Traffic Data Reports:** Reports and records from local authorities that contain data regarding traffic congestion, accident statistics, and plans for infrastructure development will be analyzed.

Analysis of Traffic Management Issues

- **Traffic Congestion**

Traffic congestion in Prayagraj is fueled by rapid urbanization, high growth in the number of vehicles, and insufficient road infrastructure. Areas such as Civil Lines and Alopibagh witness severe gridlocks during peak hours and religious events with considerable delay and inefficiency. Main causes for the congestion are narrow roads, poor management of traffic, and high volumes of vehicles.
- **Environmental Impact**

Vehicular emissions are the primary source of air pollution within the city, as PM10, NO₂, and SO₂ have been reported in the congested regions at high concentrations. Data from the Uttar Pradesh Pollution Control Board (UPPCB) show that such pollutants are more than the safety limits, which gives rise to respiratory problems and, overall poor air quality mostly in high-traffic zones.

Table: Air Quality Data from Key Traffic Zones

Location	PM10 (µg/m ³)	NO ₂ (µg/m ³)	SO ₂ (µg/m ³)
Civil Lines	210	52	23
Alopibagh	245	67	30
Prayag Station	275	80	35
Dhoomanganj	220	50	25

- **Road Infrastructure**

The road infrastructure of Prayagraj is not able to sustain the mounting traffic pressures. Also, most of the roads are narrow with no dedicated pedestrian and cycling paths that leave pedestrians and cyclists to share road space with the vehicles. Critical junctions also lack flyovers, which easily causes bottlenecks in traffic spaces like Civil Lines and Alopibagh.
- **Public Transport System**

There are some fundamental challenges for public transportation in Prayagraj-including overcrowded buses, poor reliability, and limited coverage. Accessibility, particularly in the peripheral regions, is severely affected due to a lack of last-mile connectivity. The residents oftentimes resort to personal vehicle use, thus contributing to increased traffic congestion. Enhancing the public transport system may reduce dependence on private vehicles and partially ease traffic problems.

Table: Infrastructure Gaps in Key Roads

Road	Pedestrian Lanes	Cycling Lanes	Road Width (m)	Flyover Availability
Civil Lines	No	No	6	No
Alopibagh	Partial	No	7	No
Prayag Station	No	No	8	Yes
Dhoomanganj	Partial	No	5	No

Statistical Analysis of Traffic Congestion and Air Pollution

Urban transportation systems in developing cities like Prayagraj are witnessing increasing stress due to rising vehicle density, inadequate infrastructure, and unregulated traffic patterns. Traffic flow metrics—such as vehicle count, flow rate, density, and average speed—are essential indicators for assessing the performance of road networks and their environmental implications. In Prayagraj, arterial roads such as the Civil Lines–MG Marg corridor, Katra intersection, and the High Court road section frequently experience saturation levels, particularly during morning (8:00–11:00 AM) and evening (5:00–8:00 PM) peak periods. Preliminary observational studies suggest that two-wheelers constitute the highest proportion of traffic volume, followed by private cars, auto-rickshaws, and buses. Traffic congestion during these hours not only disrupts urban mobility but also leads to elevated emissions due to prolonged idling and repeated acceleration–deceleration cycles, a phenomenon extensively discussed by Colville et al. (2001) and Gurjar et al. (2010).

A detailed peak-hour analysis reveals that traffic flow during the identified periods often exceeds the designed carrying capacity of urban road segments, leading to a decline in level of service (LOS). This traffic saturation is most acute near transport hubs such as Allahabad Junction and major commercial markets like Chowk and Lukerganj. During these peak hours, vehicle speeds can drop below 10 km/h, and signal cycle delays are significantly prolonged. These congested conditions intensify emission concentrations in real time, particularly of pollutants such as PM_{2.5}, PM₁₀, NO₂, and CO. Data from the Continuous Ambient Air Quality Monitoring Station (CAAQMS) near Civil Lines indicates that PM_{2.5} levels frequently spike above 150 µg/m³ during peak hours, far exceeding the permissible limits set by the Central Pollution Control Board (CPCB). These findings align with national trends observed in studies by Agarwal & Kumar (2018), which established a strong temporal overlap between peak vehicular activity and poor ambient air quality in Indian cities.

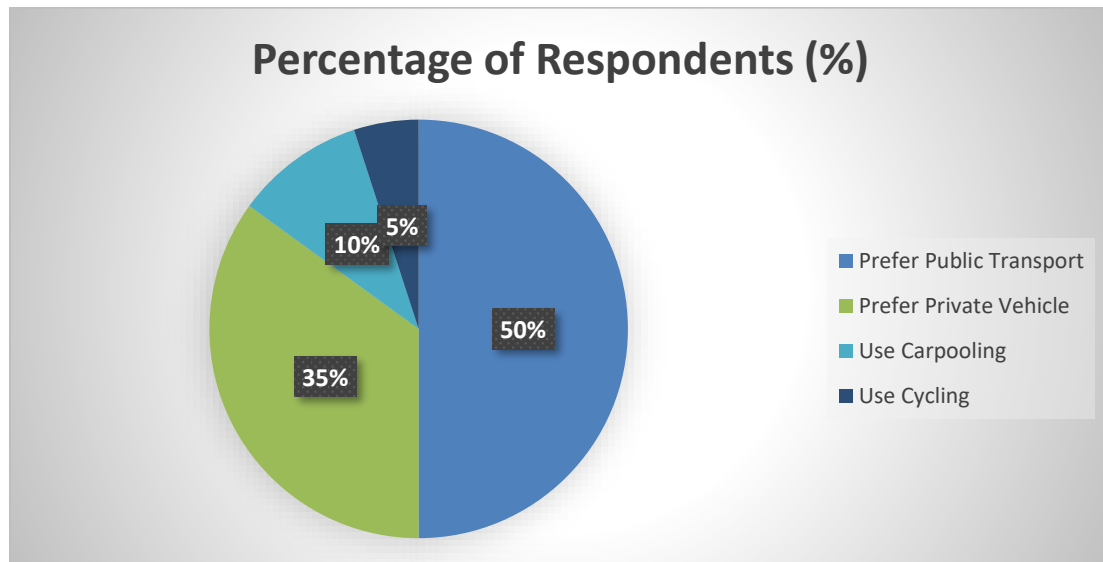
The correlation between traffic congestion and pollutant trends necessitates a comprehensive statistical investigation, wherein traffic metrics are synchronized with hourly pollution data to identify patterns and causative linkages. By applying Pearson's correlation coefficient, this study aims to assess the strength of association between traffic volume and pollutant concentration during different time blocks. Such analysis will enable the identification of critical pressure points in the city's transportation network where interventions can be most effective. Moreover, understanding these dynamics is essential for formulating evidence-based traffic management policies, such as signal timing optimisation, promotion of non-motorised transport, and enforcement of emission control norms. In cities like Prayagraj, where vehicular activity is both a symbol of growth and a source of ecological strain, the convergence of traffic and pollution data offers a pathway to more sustainable urban planning.

Survey Data Analysis on Commuter Preferences and Challenges

Residents' and commuters' survey data collected will be analyzed to determine common preferences and challenges experienced by the public in dealing with traffic and transportation systems. The relevant commuter responses on factors such as preferred mode of transport, reasons for vehicle usage, and major traffic-related issues will be summarized by means of descriptive statistics—mean, median, mode. Further, cross-tabulation and chi-square tests may be conducted to determine if there are associations between demographic characteristics (age, occupation, etc.) and commuter behavior. The outcomes of the survey will also be represented graphically using bar charts and pie charts.

Table: Survey Results on Commuter Preferences

Commuter Preferences	Percentage of Respondents (%)
Prefer Public Transport	50
Prefer Private Vehicle	35
Use Carpooling	10
Use Cycling	5



Policy and Infrastructure Assessment

Traffic management in Prayagraj has seen notable progress, particularly in preparation for large-scale events like the upcoming Maha Kumbh Mela 2025. The Uttar Pradesh Police, through a dedicated Traffic Advisory Committee, has implemented strategic measures such as one-way routes, pedestrian-only zones, and the regulation of vehicular entry from neighbouring districts to manage the expected inflow of millions of pilgrims. Technological upgrades have complemented these efforts: over 39 automatic signal junctions are being developed to improve traffic flow, while drone surveillance, AI-enabled cameras, and real-time CCTV monitoring have been deployed along key corridors like the Kanwar route and Civil Lines area. Traffic 'black spots'—sites prone to accidents—have been mapped, and safety improvements are being executed under the "Rah Veer" programme. These initiatives indicate a growing emphasis on intelligent traffic systems, event-oriented planning, and pedestrian safety.

However, beyond festival management, Prayagraj's routine traffic infrastructure and policies continue to face significant structural and systemic challenges. The cancellation of the Prayagraj Metrolite project has halted the city's ambitions for mass rapid transit, while several proposed flyovers—particularly around Rana Pratap crossing and the Medical College stretch—remain unimplemented. Although the Prayagraj Bypass Expressway alleviates some intercity traffic, urban congestion persists in central areas due to inadequate integration of public transport, weak last-mile connectivity, and the absence of dedicated lanes for non-motorised vehicles. Moreover, the city lacks a long-term, multimodal urban mobility blueprint that links transport policy with land-use planning, environmental goals, and equitable access. While episodic policies for religious or political gatherings are relatively successful, a sustainable, day-to-day traffic governance framework is still evolving and requires urgent policy coherence, infrastructure investment, and citizen engagement.

Prayagraj's urban transport infrastructure faces several persistent bottlenecks that severely hinder the efficiency, safety, and sustainability of intra-city mobility. Key arterial roads such as those connecting Civil Lines, Rambagh, Katra, and the High Court intersection routinely experience traffic congestion due to narrow carriageways, encroached footpaths, irregular intersections, and poor lane discipline. The absence of dedicated lanes for public transport and non-motorised traffic, combined with a lack of synchronised traffic signals and insufficient grade-separated junctions, further aggravates these chokepoints. Intersections at Rambagh Crossing, Katra–Johnstonganj link road, and the Subhash Chowk underpass serve as critical pressure points, with prolonged signal delays and high accident incidence, especially during peak hours. Informal street parking, roadside vendors, and the unregulated presence of three-wheelers and e-rickshaws around commercial hubs also contribute to operational inefficiencies. Moreover, poor maintenance of service roads and inadequate signage infrastructure have compounded traffic flow issues in peripheral areas such as Naini and Jhunsi, which are fast urbanising.

Equally critical are the missing infrastructure links that limit Prayagraj's transition to a modern, multimodal urban transport system. The cancellation of the Prayagraj Metrolite project has left a major void in mass rapid transit, compelling over-reliance on private vehicles and auto-rickshaws. Despite growing population pressure, there is no ring road or bypass network integrated with inner arterial loops, which could otherwise help divert through-traffic away from the city core. Several planned flyovers—such as the ones from Rana Pratap Crossing to the PSC and from Medical College Crossing to SRN Hospital—remain incomplete or delayed, thereby impeding relief in high-density corridors. The absence of pedestrian skywalks and underpasses in high-footfall zones like Sangam, the High Court, and railway stations poses significant safety hazards. In addition, intermodal transfer facilities between buses, rail, and other modes are either poorly designed or completely lacking. These gaps underscore the urgent need for an integrated urban mobility master plan that addresses both the immediate congestion points and the long-term spatial reorganisation of transport infrastructure in Prayagraj.

Prospective Solutions

Sustainable Traffic Management Strategies

Increasing the share of sustainable transport modes shall help curb congestion and pollution. Some strategies are enhancing public transport provision through reliability, frequency, and coverage, especially in areas with no or limited access. Programs for carpooling can enhance fewer private cars on the roads. Increasing nonmotorized transport, like walking and cycling, can be made possible through dedicated lanes and pedestrian-friendly infrastructure. Some incentives toward this end can be coupled with an increase in public awareness through environmental and health benefits, thus toward a more sustainable transport ecosystem in Prayagraj.

- **Technological Integration**

Implementing smart traffic management solutions leads to considerable improvement of traffic flow and reduction of congestion. The use of adaptive intelligent traffic signals, which have the capacity to respond in real-time to traffic conditions, can help manage traffic much better, reducing wait times and better facilitating flow overall. AI-based monitoring systems provide insights into patterns in traffic, enhancing planning and analysis for congestion prevention. The real-time traffic updates through mobile apps or digital sign can inform the commuters on what are the best routes to avoid delays, thereby minimizing congestion at core roads. These technological improvements could optimize traffic management measures to ensure smoother commutes with reduced environmental impact of traffic.

- **Case studies: Successful traffic management models of other Indian cities**

Other Indian cities have successfully utilised traffic management models from which Prayagraj can learn and borrow strategies. For instance, successful smart city initiatives exist in Pune and Bengaluru cities, driven more by integrated systems of traffic management, better public transport, and pedestrian-friendly infrastructure. Dedicated bus lanes, carpool lanes, and efficient metro systems in cities such as Delhi and Chennai have also been considered quite effective at reducing congestion. The same models, adopted to Prayagraj's specific needs and challenges, can prove to be a proper roadmap towards creating an efficient and more sustainable traffic management system.

Table: Proposed Solutions and Expected Outcomes

Solution	Expected Outcome	Implementation Timeframe	Cost Estimate (INR)
Smart Traffic Signals	Reduced congestion, faster traffic flow	1-2 years	50,00,000
Electric Vehicle Incentives	Reduced pollution and fuel dependency	2-3 years	1,00,00,000
Dedicated Cycling Lanes	Increased cycling, reduced congestion	1 year	25,00,000

Recommendations

- **Policy-Level Changes for Improved Road Usage and Reduced Emissions**

To reduce traffic congestion and environmental issues, strong policy measures dealing with efficient road usage as well as reduction in vehicular emissions are important. Policies should incentivize public transport usage by offering subsidies and incentives as well as ensure better service quality. Key regulatory measures could include reducing the number of vehicles on roads, especially in congested

areas, by establishing car-free zones or designated traffic hours. Tightly controlling the emissions of vehicles and encouraging the widespread use of electric vehicles can further make a significant reduction in polluting levels.

- **Infrastructure development, flyovers, bypass roads, and dedicated lanes for non-motorized transport**

Improvements on infrastructure are essential to ease traffic congestion and improve safety on roads. The construction of flyovers and bypass roads through strategic areas can ease congestion by offering alternative routes and reducing bottlenecks on the roads. Dedicate lanes for non-motorized transport, namely cycling and pedestrian pathways, should be built to promote sustainability and safety in mobility. Improving the road network in unutilized or overutilized areas would enhance connectivity between zones and reduce delays, hence enhancing traffic flow in the city.

- **Promoting Electric Vehicles and Implementing Congestion Pricing**

To reduce air pollution and promote sustainable mobility, the government should provide incentives to buy and use electric vehicles, like tax rebates and subsidies, alongside the development of EV charging infrastructure. Congestion pricing in highly congested cities may also regulate traffic flow by penalizing vehicles during peak hours or in high-traffic zones, thereby encouraging users to move onto public transport or carpooling. This approach can decrease overall traffic volume, reduce emissions, and generate funds that would be put back into public transport and infrastructure development.

Conclusion

The study identifies severe traffic management issues in Prayagraj: severe congestion, pollution of the environment, insufficient road infrastructure, and underdeveloped public transport in comparison to the population. Important areas like Civil Lines and Alopibagh are experiencing peak-hour gridlocks, thus leading to highly concentrated pollutants in the forms of PM10, NO2, and SO2. The city has inadequate road infrastructure such as narrow roads, absence of pedestrian and cycle lanes, and lack of flyovers; therefore, there is inefficient flow of traffic. Over and above, public transport is congested and unreliable; this forces people to depend mainly on personal transport. The research advocates for the use of sustainable measures like promoting public transport, carpooling, and non-motorized transport. Technological means such as smart traffic lights and AI-based monitoring systems would be suited for streamlining traffic, but development works like flyovers, dedicated lanes, and bypass roads are needed to eliminate congestion. Other policy changes-most notably incentives for electric vehicles and congestion pricing-could further reduce traffic and emissions.

There are also potential gaps in data related to seasonal variations and major traffic-affecting events that limit the study. Future research should look into long-term studies of effectiveness of specific interventions like smart traffic systems or public transport improvements. A comparative analysis with other Indian cities would add value to the insights, and it is essential to identify the role of public behavior in adopting such sustainable transport options for formulating future policies.

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