CHAPTER 130

Study of Traffic Roadway and Environmental Problems Associated with Urban Arterial Road Construction Projects

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ABSTRACT

Urban road and expressway development projects are critical to improving transportation efficiency and regional economic growth. However, they also present significant socio-economic, environmental, and traffic-related challenges, particularly during the construction phase. This study analyses the impacts of three major road infrastructure projects in Pune, Maharashtra-Gahunje Village near the Pune-Mumbai Expressway, the Vadgaon-Katraj Six-Lane Expansion, and the F.C. Road Maintenance Project. A mixed-method research approach was adopted, integrating primary data from surveys, stakeholder interviews, and field observations, along with secondary data from literature reviews and government reports. The findings reveal a complex interplay between development and disruption. While road expansion improves connectivity, reduces travel time, and fosters commercial growth, it also leads to severe traffic congestion, noise and air pollution, displacement of local businesses, and environmental degradation. Business owners along construction corridors report reduced customer footfall and revenue losses, while residents face deteriorating air quality and increased land costs. The research further highlights that inadequate planning and poor traffic management during construction exacerbate public dissatisfaction. To mitigate these adverse effects, the study recommends strategic interventions such as efficient traffic diversion plans, noise and dust control measures, enhanced pedestrian safety infrastructure, and financial support mechanisms for small businesses affected by road expansion. Sustainable urban planning approaches, incorporating environmental impact assessments and community engagement, are essential to balancing infrastructure growth with long-term urban resilience.

Keywords: Urban road infrastructure; Traffic congestion analysis; Environmental impact assessment; Socio-economic effects; Sustainable urban planning.

1.0 Introduction

Road infrastructure development plays a crucial role in enhancing regional connectivity, economic growth, and urban mobility.

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However, the construction and expansion of roads and expressways also bring significant socio-economic, environmental, and traffic-related challenges. Rapid urbanization and increasing vehicle density in metropolitan cities, such as Pune, India, necessitate large-scale infrastructure projects to manage traffic congestion and improve accessibility. However, these projects often result in unintended consequences, such as increased pollution, business disruptions, social displacement, and altered land-use patterns.

This study examines the impact of urban road construction through the analysis of three major infrastructure projects in Pune: The Gahunje Village expansion near the Pune-Mumbai Expressway, the Vadgaon-Katraj Six-Lane Road Widening Project, and the F.C. Road Maintenance Project. These locations were chosen due to their high traffic volumes, economic significance, and the scale of infrastructural modifications. The research adopts a mixed-method approach, incorporating surveys, stakeholder interviews, field observations, and secondary data analysis to assess the short-term and long-term effects of these projects on businesses, commuters, and local communities.

The key challenges identified in this study include increased travel time during construction, adverse effects on small and medium-sized enterprises, environmental degradation due to vehicular emissions and dust pollution, and changes in land use that impact real estate prices and community dynamics. While road expansion projects aim to enhance urban mobility and economic opportunities, poor planning and execution often lead to negative externalities that outweigh the benefits. Given these concerns, this research highlights the importance of sustainable infrastructure planning. By evaluating the impact of road construction on local businesses, traffic patterns, and environmental conditions, the study aims to propose strategic interventions for minimizing disruptions and maximizing long-term benefits**.** The findings of this research can assist policymakers, urban planners, and transportation authorities in developing more sustainable, inclusive, and efficient road infrastructure projects.

2.0 Objectives of the Study

The primary objective of this study is to evaluate the multifaceted impacts of urban arterial road construction projects on local stakeholders. Specifically, this study aims to:

- Analyse the effects on daily life and commuting patterns of residents.
- Examine the consequences for business operations along the construction corridor.
- Investigate environmental concerns, particularly air and noise pollution.
- Understand public perception and satisfaction levels related to road infrastructure changes.

3.0 Literature Review

Impact of Road Construction on Traffic Congestion: This study examines how road construction projects in Wuhan, China, contribute to urban traffic congestion. Using a regression

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model, the research highlights that prolonged construction leads to increased congestion, delays, and accident risks, emphasizing the need for improved traffic planning.

Highway Runoff Quality and Environmental Impacts: The paper investigates the impact of highway runoff on local ecosystems, highlighting the presence of heavy metals, suspended solids, and pollutants in water bodies. It recommends implementing green infrastructure solutions such as vegetative swales and retention ponds to mitigate pollution.

The Effects of Highway Improvement Projects on Nearby Business Activity: This study explores the economic impact of highway improvement projects on local businesses in urban and suburban areas. Findings indicate that while infrastructure upgrades can enhance commercial growth, prolonged construction disrupts business operations, leading to temporary revenue losses.

Do Highway Widenings Reduce Congestion? This research evaluates the short-term effects of highway widening in the Netherlands, concluding that widening projects initially reduce congestion but can lead to induced demand over time. The study suggests a balanced approach that includes alternative transportation planning.

Environmental Impact of Road Construction Based on Remote Sensing Monitoring: Using remote sensing techniques, this paper assesses the environmental effects of road construction on soil moisture, vegetation loss, and erosion risks. The study highlights the importance of integrating environmental impact assessments into infrastructure planning.

Retrospective Analysis of Highway Bypass and Widening Projects: The paper assesses the long-term economic and traffic impacts of bypass and road-widening projects, particularly in smaller cities. Findings suggest that while bypasses reduce congestion and improve road safety, they may negatively affect local businesses by diverting traffic away.

Environmental Impacts of Forest Road Construction on Mountainous Terrain: This study investigates the ecological consequences of road construction in steep terrains, finding that bulldozers cause more environmental damage than hydraulic excavators. It recommends using eco-friendly construction methods to minimize soil erosion and forest degradation.

The Economic Impact of Upgrading Roads: Using hedonic pricing models, this paper examines how road expansion projects affect nearby property values. Results indicate that residential property values tend to decline near highways due to noise and pollution, while commercial properties benefit from improved accessibility.

4.0 Methodology

This study employs a mixed-method research approach, integrating both quantitative and qualitative methods to analyse the socio-economic, environmental, and traffic-related impacts of urban road construction projects. The research focuses on three key locations in Pune, Maharashtra: Gahunje Village near Pune-Mumbai Expressway, where economic transformation, environmental concerns, and local business impacts due to expressway

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expansion are examined; Vadgaon (Navale Bridge) to Katraj Junction Six-Lane Road Expansion, which is analysed for traffic congestion, safety challenges, and economic disruptions faced by businesses and commuters; and F.C. Road, Pune (Four-Lane Road Maintenance Project), which assesses urban mobility issues, business disruptions, and pedestrian accessibility during road maintenance.

The study collects primary data through structured surveys, field observations, and stakeholder interviews. Surveys are conducted both online and in person, targeting local residents, business owners, commuters, and government officials. The study follows stratified random sampling to ensure representation from different affected groups. The key variables considered in the survey include business revenue trends, commuter travel times, environmental concerns, pedestrian safety, and economic impact. Field observations are conducted at each site to monitor real-time traffic conditions, accessibility issues, construction-related disruptions, air and noise pollution levels, and their overall impact on the surrounding areas. Additionally, semi-structured interviews with business owners, government officials, urban planners, and environmental experts provide insights into the planning, execution, and consequences of road construction projects.

The study also relies on secondary data collection, which includes a review of government reports, academic studies, and environmental impact assessments related to urban road development. Past traffic congestion trends, land-use changes, and socio-economic shifts due to infrastructure expansion are analysed to support the findings.

Trend analysis compares historical data to understand long-term socio-economic and environmental impacts, with findings represented through pie charts, bar graphs, and histograms for better visualization. Thematic analysis is used to identify key themes emerging from interviews and open-ended survey responses, while comparative analysis contrasts different stakeholder perspectives. Additionally, content analysis is performed on secondary data sources such as government reports and newspaper articles to supplement primary findings.

To ensure reliability and validity, pilot testing of the survey is conducted to refine questions and improve clarity. The research follows a triangulation approach, cross-verifying findings through multiple data sources, including surveys, interviews, literature reviews, and field observations. Statistical consistency checks are applied to minimize errors in data processing and ensure accuracy in the analysis.

The study follows ethical research guidelines, ensuring that all participants provide informed consent before data collection. The confidentiality of respondents is maintained, with personal data used strictly for research purposes. Furthermore, the research follows a non-biased approach, ensuring an objective interpretation of findings without external influence. This methodological framework ensures a comprehensive and systematic approach to evaluating the impacts of road infrastructure projects. By integrating quantitative survey analysis, qualitative stakeholder interviews, and direct field observations, the study provides a holistic understanding of how road construction affects urban mobility, businesses, and environmental sustainability.

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5.0 Data Collection and Analysis

This study follows a mixed-method approach, integrating qualitative and quantitative data collection techniques to provide an in-depth understanding of the impacts of urban road construction projects. The primary data was collected through structured surveys, field observations, and stakeholder interviews, while secondary data was gathered from literature reviews, government reports, and past research studies. The research focuses on three key locations in Pune, Maharashtra: Gahunje Village near Pune-Mumbai Expressway, Vadgaon (Navale Bridge) to Katraj Junction Six-Lane Road Expansion, and F.C. Road Four-Lane Maintenance Project.

5.1 Primary data collection

A structured survey questionnaire was designed to collect responses from various stakeholders, including local residents, business owners, commuters, and government officials. The survey aimed to capture key aspects such as the impact of road construction on daily life, business operations, traffic congestion, mobility patterns, environmental concerns related to air and noise pollution, and overall public perception. Both closed-ended and open-ended questions were used to allow for statistical analysis and thematic evaluation. Additionally, field visits and direct observations were conducted at all three sites to assess the real-time impact of the construction activities.

Researchers monitored traffic flow, business disruptions, and environmental conditions, documenting the changes with photographs and field notes. These site visits helped validate survey responses and provided firsthand insights into the challenges faced by different stakeholder groups.

Stakeholder interviews were also an essential part of primary data collection. Semi-structured interviews were conducted with business owners, urban planners, project managers, local government officials, and environmental experts.

- *Gahunje Village near Pune-Mumbai Expressway:* Surveys focused on changes in land use, business growth, and environmental impact due to the expressway expansion. Field visits covered commercial and residential developments, traffic flow, and air pollution levels.
- *Vadgaon (Navale Bridge) to Katraj Junction Six-Lane Expansion:* The study analysed increased congestion, safety concerns, and business disruptions due to road widening. Interviews with commuters and business owners provided insights into accessibility issues and traffic delays.
- *F.C. Road, Pune (Four-Lane Road Maintenance Project):* Surveys assessed the impact of road maintenance on commercial activities, pedestrian movement, and urban traffic. Observations included monitoring congestion at peak hours and evaluating temporary traffic diversions.

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5.2 Secondary data collection

The study reviewed government reports, policy documents, and past research papers to supplement primary data findings. A literature review was conducted to analyse existing studies on traffic congestion, environmental sustainability, and socio-economic changes due to road infrastructure development.

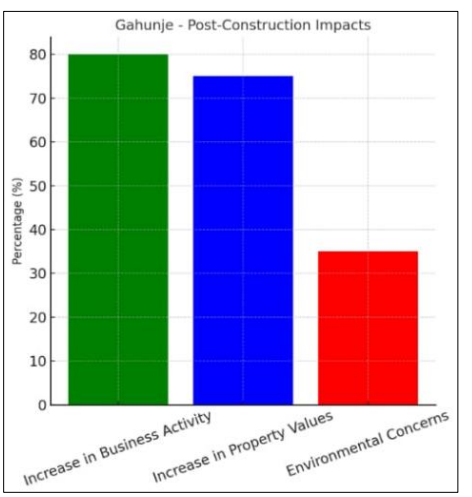
5.3 Data analysis

5.3.1 Key findings from field observations

In addition to surveys, field observations and stakeholder interviews were conducted to gather qualitative insights. These findings helped validate the survey data and provided contextual depth to the study. The collected data was analysed using both quantitative and qualitative techniques. Descriptive statistical analysis was applied to survey responses using Microsoft Excel. Mean, percentages, and frequency distributions were calculated to identify trends in public perception, business impact, and environmental concerns. Cross-tabulation was used to examine relationships between different variables, such as the correlation between traffic congestion and business losses.

Gahunje (Post-Construction Impacts): At Gahunje, post-construction analysis revealed significant economic growth, increased land values, and improved connectivity due to expressway expansion. Business owners reported enhanced customer footfall, with 80% acknowledging economic growth. However, 35% of respondents expressed concerns about rising air and noise pollution levels. While commercial establishments flourished, small businesses struggled with rising property costs, affecting affordability.

Figure 1: Study 1 Analysis



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Vadgaon-Katraj Junction (During Construction Impacts): The analysis of the Vadgaon-Katraj Junction during the construction phase highlighted major traffic congestion, business disruptions, and safety concerns. Peak-hour delays were reported by 52.3% of commuters, while 40% of local businesses experienced revenue losses due to restricted access. Pedestrian and vehicular safety concerns were prominent, with 47% feeling safe only "sometimes" and 17% feeling rarely safe due to construction-related road diversions and incomplete pedestrian pathways.

F.C. Road (During Construction Impacts): The ongoing road construction at F.C. Road had a mixed impact on businesses and pedestrians. While 42% of business owners saw long-term potential in road development, 44% expressed dissatisfaction due to ongoing disruptions. The key concerns included traffic congestion (28%), business losses (24%), and environmental impacts such as dust pollution (35%). Despite the challenges, 22% of respondents anticipated long-term economic benefits post-completion.

Figure 2: Study 2 Analysis

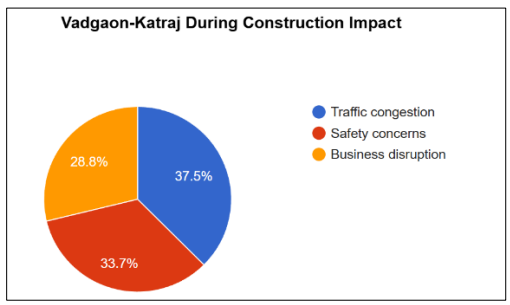
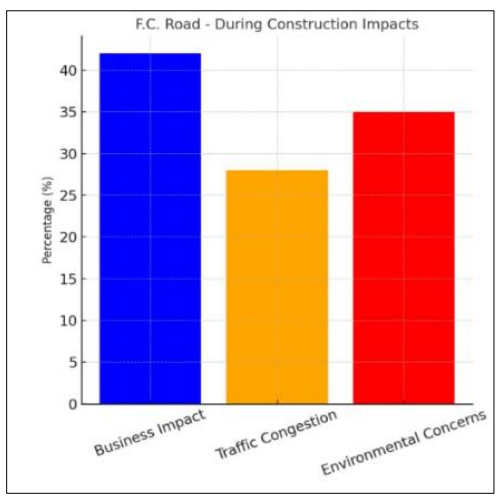


Figure 3: Study 3 Analysis



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The study aimed to understand the major impacts of urban arterial road construction, with a focus on three core aspects—effects on daily life, environmental concerns, and traffic-related issues. While other aspects such as business operations, mobility, and perception were considered, insufficient or inconsistent data limited their quantitative analysis in this paper.

6.0 Summary and Conclusion

6.1 Summary

The development of expressways and arterial roads plays a vital role in urban infrastructure growth, enhancing connectivity, mobility, and economic progress. However, these projects also bring socio-economic and environmental challenges, particularly before and during the construction phase. This study examines the impact of road construction on traffic congestion, local businesses, environmental conditions, and social displacement through surveys conducted at key sites such as Gahunje Village, the Vadgaon-Katraj Junction, and F.C. Road in Pune. Before construction, uncertainty over land acquisition and compensation creates distress among local businesses and residents. Lower-income groups face displacement risks due to anticipated property value hikes, and reduced investments occur in affected areas due to fears of disruption. During construction, businesses suffer revenue losses due to restricted access and road closures, while economic disparities emerge as large commercial developments benefit more than smaller enterprises. Job creation is temporary and does not always guarantee long-term employment. Traffic congestion worsens due to lane closures, diversions, and increased fuel consumption, causing delays for daily commuters and transport operators. Pedestrian safety is also compromised due to incomplete footpaths and lack of designated crossings.

Environmental impacts before construction include deforestation, biodiversity loss, and concerns over air and noise pollution. Excavation activities pose risks to the water table. During construction, air quality deteriorates due to dust and particulate matter, while noise pollution disrupts residential and commercial areas. Drainage systems are affected, increasing flood risks, and waste generation from construction activities becomes a disposal challenge. The Vadgaon-Katraj Junction and F.C. Road, which are currently undergoing road-widening and construction activities, experience severe congestion, business losses, and environmental disturbances. These areas face increased travel times, higher transportation costs, and disruptions in commercial activities due to blocked access and shifting traffic patterns. Land use changes before construction lead to speculative real estate investments, conversion of agricultural land into commercial zones, and legal disputes over land acquisition. During construction, property values temporarily decline due to dust and noise, while zoning changes displace informal settlements and low-income communities. In Gahunje Village, where expressway construction has been completed, post-construction impacts include increased land values, business growth, and improved connectivity. However, this progress has come with rising property prices, making housing less affordable for local communities, and ecological changes due to extensive land modification.

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6.2 Conclusion

The study highlights that while road infrastructure projects contribute to urban development and economic growth, they also bring significant short-term and long-term challenges. Before construction, uncertainty, financial losses, and displacement risks affect landowners, businesses, and residents. During construction, disruptions to local economies, increased pollution, and severe traffic congestion impact commuters, businesses, and the environment. Although post-construction benefits include improved infrastructure, higher property values, and business expansion, these advantages often come at the cost of environmental degradation and social displacement. The contrasting conditions of Gahunje, where post-construction impacts are evident, and the Vadgaon-Katraj Junction and F.C. Road, which are still undergoing construction, highlight the different phases of challenges faced by communities. The success of such projects depends on careful planning, stakeholder engagement, and sustainable implementation.

Field Observations: At Vadgaon-Katraj Junction, peak-hour traffic congestion was visibly severe. Incomplete pedestrian walkways and poor signage led to safety hazards. At F.C. Road, dust and noise levels were consistently high due to heavy machinery. Business entrances were partially blocked, affecting customer accessibility. Gahunje showed significantly improved road conditions post-construction, but rapid commercial development was observed to be pushing out smaller vendors.

Overall, stakeholders expressed a mix of concerns, frustrations, and cautious optimism regarding the urban arterial road construction projects. Small business owners were among the most affected, reporting revenue losses due to restricted access, dust pollution, and declining footfall during construction. Residents, particularly elderly individuals and families, voiced discomfort related to noise, air quality, and the lack of pedestrian safety. Commuters faced daily challenges due to unclear diversions, longer travel times, and congestion, although some acknowledged the potential long-term improvements in road quality.

Despite these issues, many stakeholders believed that the projects, once completed, would lead to improved connectivity, economic growth, and better transportation infrastructure — though they emphasized the need for more inclusive planning and mitigation strategies during the construction phase.

7.0 Recommendations

To minimize negative impacts before and during construction, sustainable construction practices should be adopted, including low-emission machinery, dust control measures, green corridors, and effective waste management. Traffic management strategies such as intelligent traffic systems, dedicated pedestrian pathways, and construction time restrictions can help reduce congestion. Socio-economic support should be provided to affected businesses and residents through financial compensation, tax incentives, and fair land acquisition policies.

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Community engagement is essential, requiring early consultations, transparent resettlement programs, and public awareness campaigns to keep stakeholders informed about construction timelines and commuting alternatives.

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