

Abstract

Title: Urban Transport and Associated Vehicular Emissions in Siliguri City

The phenomenon of rapid urbanization in contemporary developing nations brings with it a spectrum of challenges and opportunities. Siliguri, a burgeoning metropolitan hub nestled in the foothills of the Himalayas in West Bengal, India, exemplifies this dynamic. Siliguri has risen from a mere village to a significant commercial city. It is a nexus of trade and transportation, holding a strategic geographical and economic position in the region. Its strategic location as a gateway to the northeastern states and neighbouring countries has fuelled its growth, attracted a diverse population, and fostered a bustling economy.

However, this rapid growth has not been without its challenges. The city's infrastructure, particularly its road network, has struggled to keep pace with its expanding population, which has grown from 4.72 lakhs in 2001 to 5.13 lakhs in 2011. The roads, characterized by a tangled web of interlinking nodes, serve both the city's internal traffic and intercity movements. Notable roads such as Hill Cart Road, Sevoke Road, and Burdwan Road, while vital, have become synonymous with congestion and environmental stress. The motivation behind this study stems from the pressing need to address the environmental repercussions of urban expansion. The relevance of this research lies in its potential to influence urban planning and policy, ensuring that cities like Siliguri can grow sustainably without compromising environmental integrity or public health. By focusing on the interplay between urban transport systems and associated vehicular emissions, this thesis seeks to unravel the complexities of urbanization and its implications for air quality and urban liveability.

The primary objectives of this research encompass a comprehensive analysis of automobile pollution in Siliguri, focusing on quantifying pollutant variations and examining the spatial dynamics of traffic volumes at major intersections. The study aims to explore seasonal fluctuations in pollutant concentrations and investigate the relationship between these pollutants and climatic variables such as temperature and relative humidity. It also seeks to identify the principal causes of traffic congestion in Siliguri and assess the impact of vehicular emissions on human health within the city. Ultimately, the research intends to recommend transport action strategies and legislative measures to effectively reduce the pollution burden in Siliguri, thereby contributing to the development of sustainable urban mobility solutions.

To achieve these objectives, a comprehensive database was constructed, encompassing both primary as well as secondary data. A range of methodological approaches was employed across different chapters of the thesis. Spatial analysis techniques, such as Univariate Local Indicators of Spatial Association (LISA) maps and Moran's I statistics, were used to decipher the distribution of pollutants. Structural Equation Modeling (SEM) provided a framework for understanding the health impacts of pollution. Time series models, including ARIMA and TBATS, were applied to forecast the Air Quality Index (AQI) and to predict future trends. The findings of the research are revealing. An in-depth analysis of air pollutants over two years highlighted that the levels of PM_{2.5} and PM₁₀ were alarmingly high, surpassing national standards and pinpointing traffic volume at key intersections as a significant source. Seasonal variations in pollution were found to be intricately linked with climatic variables, and traffic congestion emerged as a pressing problem, with spatial and temporal disparities across the city. Logistic regression analyses from perception surveys underscored vehicle growth and road space encroachment as primary factors behind peak-hour congestion. The health impact assessments indicated a stark connection between vehicular pollution exposure and adverse health outcomes among residents. This thesis concludes with a clarion call for the implementation of sustainable urban transport and environmental strategies. It underscores the urgency of transitioning research into actionable policies, with a focus on achieving Sustainable Development Goal 11. The study contributes a substantial framework for urban stakeholders, guiding interventions that can reduce pollution levels and enhance quality of life. Through its detailed exploration of Siliguri's urban challenges, the thesis offers an extensive blueprint for other cities grappling with similar issues of urbanization and environmental impact.

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