Chapter 8
Addressing Environmental Consequences of Congestion:
Using Intelligent Transportation Systems (ITS)

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ABSTRACT

The emergence of Intelligent Transportation Systems (ITS) offers innovative solutions through advanced technologies, including real-time traffic management, vehicle monitoring, and connected vehicle communications. These systems enhance traffic flow, improve safety, and reduce environmental impacts, presenting a promising avenue for sustainable urban mobility. This chapter investigates the causes of traffic congestion, its environmental repercussions, and the effectiveness of both traditional and intelligent management strategies, ultimately highlighting the need for integrated approaches to enhance transportation efficiency and sustainability. Additionally, the

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study considers two case studies, such as Intelligent Transport Systems in Singapore and Smart Waste Management in Barcelona to illustrate the practical applications and impacts of these strategies in real-world urban environments.

1. INTRODUCTION

The implementation of digital systems across various sectors become a necessary for sustainability and environmental protection (Hlali and Gafsi 2024). These digital solutions enable organizations to optimize resource usage, reduce waste, and lower emissions. The integration of real-time data collection, automated control systems, and predictive analytics, sectors such as transportation, energy, manufacturing, and waste management can make more informed decisions that align with sustainable development goals. The shift toward digital transformation not only enhances operational efficiency but also supports logistics and supply chain management. In this context, (Frikha and Hlali 2023) explain that logistics management changed by the use of digital technologies such as automation, artificial intelligence, and the Internet of Things (IoT). These tools help companies to work more efficiently and reduce their impact on the environment.

When it comes to mobility, road transport is the primary choice of people mobility as it provides vital connections across vast distances. It has significant role in driving economic growth and fostering societal cohesion by facilitating the movement of goods and people. However, road traffic congestion is the most challenging aspect of the transport system today (metz, 2018). In recent years, vehicular traffic has significantly increased which can be attributed especially to rapid urbanization, city population growth, and expansion of cities. Densely populated cities frequently experience unbearable levels of traffic congestion on urban roads due to high traffic volumes. Traffic congestion essentially occurs when the demand for roadways surpasses the capacity of the existing infrastructure (Harrou et al. 2022 and Aftabuzzaman, 2007). Traffic congestion can be divided into two categories based on its causes: recurring and non-recurring. Recurring congestion basically occurs when there is high demand and inadequate infrastructure. Whereas, non-recurring congestion primarily arises from incidents, adverse weather conditions, and construction areas (Falcocchio & Levinson, 2015; Wang, Zhu, Li, & Wu, 2013). Traffic congestion is a major issue worldwide with increasingly adverse impacts. Its consequences are far reaching, the impacts include more accidents, unreliable travel times, increased fuel use, air pollution, noise pollution, and negative effects on public health (Shaygan, Meese, Li, Zhao, & Nejad, 2022).

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