

TRAFFIC MANAGEMENT SYSTEM: A SYSTEMATIC REVIEW OF LITERATURE**Ryan James R. Tuco****Orcid Id -** <https://orcid.org/0009-0000-8773-8451>

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ABSTRACT

This systematic review evaluates literature on urban traffic management systems with a focus on mid-sized cities, contextualized by the case of Digos City, Philippines. Using the PRISMA framework, 15 studies published between 2015 and 2025 were selected from an initial pool of 412 records. Key themes identified include ordinance effectiveness, enforcement capacity, public engagement, infrastructure quality, and technological integration. Findings highlight the need for updated policies, stronger institutional coordination, and smart mobility solutions. The review offers evidence-based policy recommendations for improved traffic outcomes in similar urban contexts.

Keywords:

Traffic management, urban mobility, policy reform, urban mobility, Digos City

INTRODUCTION

Urban traffic congestion continues to be a pressing issue for many developing cities, disrupting economic productivity, straining environmental sustainability, and diminishing overall quality of life. Digos City—a growing mid-sized urban area in Davao del Sur, Philippines—is no exception. The city faces recurring traffic problems due to outdated ordinances, weak enforcement, and insufficient infrastructure. While measures such as the installation of traffic lights and the passage of Ordinance No. 18-10 (Comprehensive Transport and Traffic Code of Digos City) have been implemented, these efforts have had limited success. Policy gaps, vague regulations, and enforcement challenges have hindered the effectiveness of the city's traffic management system.

Globally, urban traffic management has advanced into a multidisciplinary field involving policy reform, infrastructure development, enforcement systems, and the integration of smart technologies. Cities like Singapore and Tokyo have demonstrated how intelligent transport systems (ITS), supported by real-time data and automation, can significantly ease congestion and enhance mobility (Kumar, 2024; Elassy et al., 2024). In contrast, many Philippine cities—including Metro Manila and Davao City—continue to struggle with worsening congestion due to rapid urbanization, increased vehicle ownership, and limited enforcement capabilities (Flores, 2025; Statista, 2024). National efforts such as the Unified Vehicular Volume Reduction Program (UVVRP) offer partial solutions but suffer from inconsistent implementation and lack of local adaptation.

In Digos City, traffic congestion is further exacerbated by outdated traffic codes and the absence of modern enforcement and monitoring tools. As commercial activity and vehicle numbers rise, key intersections and road corridors frequently become choke points (Metz, 2018). Despite growing academic interest in traffic governance, much of the research is centered on large metropolitan areas, leaving mid-sized cities underrepresented in both scholarship and policy innovation. These cities often operate under different administrative, financial, and spatial constraints that require tailored approaches.

This study addresses that research gap by systematically reviewing the literature on urban traffic management in mid-sized cities, with Digos City as a contextual reference. By examining studies published between 2015 and 2025, the review seeks to identify prevailing strategies, recurring challenges, and promising interventions in traffic governance. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)

framework guides the review process, ensuring methodological transparency and relevance. Through this synthesis, the study aims to inform more responsive, inclusive, and sustainable traffic management strategies for Digos City and similarly situated urban areas.

OBJECTIVES

This study conducts a systematic review of existing literature on traffic management systems, using Digos City, as a contextual reference. It aims to identify prevailing traffic management strategies employed, examine the challenges and limitations commonly encountered, and highlight successful interventions that improve urban mobility. It further seeks to assess the relevance and applicability of these findings to the local context of Digos City and provide evidence-based recommendations to improve the city's traffic management. Achieving these objectives contributes to the formulation of more responsive, inclusive, and sustainable traffic solutions tailored for growing urban centers.

METHODOLOGY

This study employed a systematic review to examine urban traffic management systems in mid-sized cities, with Digos City, Philippines, serving as the contextual reference point. The review was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework to ensure transparency, structure, and methodological rigor throughout the process.

A comprehensive literature search was conducted across multiple academic databases, including Scopus, ScienceDirect, JSTOR, and Google Scholar. Supplementary sources, such as government reports and publications from key institutions like the International Transport Forum (ITF), Japan International Cooperation Agency (JICA), and the Transportation Science Society of the Philippines, were also reviewed to enrich the contextual relevance. The search focused on studies published between 2015 and 2025 that addressed traffic policies, enforcement mechanisms, infrastructure development, and the use of technology in urban traffic systems.

Clear inclusion and exclusion criteria were established to ensure the relevance and quality of selected studies. Only English-language peer-reviewed articles or credible institutional reports that specifically addressed traffic management in mid-sized cities, particularly in Southeast Asia or comparable regions, were included. These studies needed to offer empirical data, case examples, or practical insights. Excluded materials included non-peer-reviewed publications, theoretical papers without real-world applications, duplicates, and studies unrelated to urban traffic systems.

Following the PRISMA process, 412 initial records were identified. After removing 63 duplicates, 349 titles and abstracts were screened, with 295 found irrelevant. In the eligibility phase, 54 full-text articles were assessed, and 39 were excluded for lacking sufficient data or contextual alignment. Ultimately, 15 studies met the criteria and were included in the final synthesis.

A data extraction form was used to capture essential information from the selected studies, which were then organized into five thematic categories: policy and ordinance content, infrastructure quality, enforcement practices, public participation, and technology integration.

The review adopted a thematic analysis approach to identify recurring patterns, challenges, and effective strategies across the studies. To assess the quality and reliability of the included research, each study was evaluated using the Critical Appraisal Skills Programme (CASP) checklist.

Despite efforts trying to be thorough, the review still faced some limitations. Few studies focused specifically on Digos City, limiting the depth of localized insights. Additionally, the exclusion of non-English sources may have omitted relevant regional literature. While government documents and non-academic materials offered valuable context, inconsistencies in format and detail posed challenges for synthesis. Nonetheless, this systematic review offers a robust foundation for understanding key issues and policy directions in urban traffic governance for mid-sized cities like Digos.

Table 1: Distribution of Studies in Peer-Reviewed Journals and Databases

Source/Database	Number of Studies	Key Themes
ScienceDirect	3	Traffic policy, smart enforcement, infrastructure development
Google Scholar	5	Public transport, ordinance effectiveness, community participation

JSTOR	1	Urban mobility, governance models
Scopus	4	Traffic enforcement, urban mobility, smart transport systems
JICA/ITF Reports	1	Global best practices, sustainable traffic governance, Southeast Asian traffic management strategies
Transportation Science Society of the Philippines Report	1	Philippine traffic challenges, urban policy interventions
Total	15	

This table summarizes the studies reviewed for the systematic analysis by the source journal or database, the number of studies, and key themes. Google Scholar contributed the highest number of studies (5), capturing a broad scope of themes such as public transport, ordinance effectiveness, and community participation—key concerns for mid-sized cities like Digos. Scopus and ScienceDirect followed with 4 and 3 studies respectively, emphasizing topics like traffic enforcement, infrastructure development, and the integration of smart systems in urban mobility. One study from JSTOR provided insights into governance models relevant to traffic planning, while international sources such as the Japan International Cooperation Agency (JICA) and the International Transport Forum (ITF) offered perspectives on sustainable traffic strategies and Southeast Asian urban mobility challenges. Additionally, the Transportation Science Society of the Philippines contributed localized insights on traffic issues and policy responses within the Philippine context. Together, this distribution ensures a balanced understanding of both global best practices and local realities in traffic management.

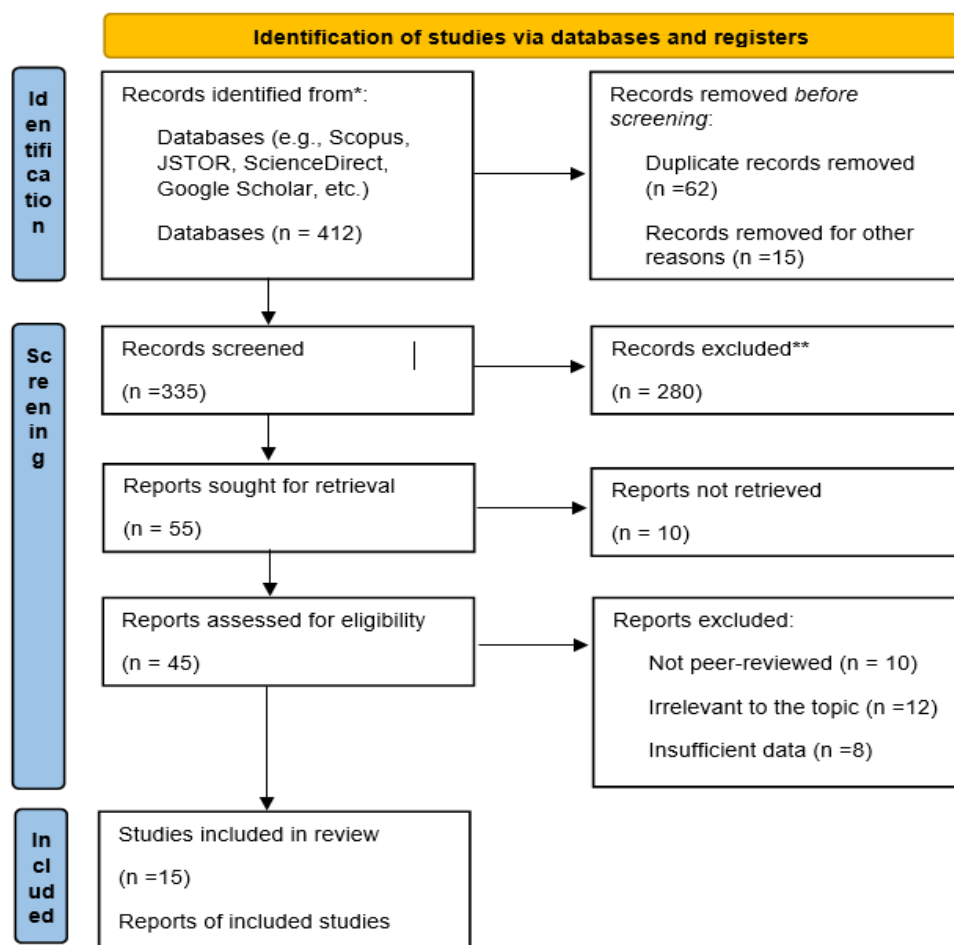


Figure 1. Contextualized PRISMA Model Used in the Study

RESULTS AND DISCUSSION

Following the PRISMA-guided review process, 15 peer-reviewed studies and institutional reports were identified and analyzed to evaluate traffic management strategies relevant to mid-sized urban centers. The analysis revealed five major themes that encapsulate the prevailing strategies, challenges, and successful interventions in urban traffic governance. These themes also serve as a framework for assessing the applicability of findings to Digos City's local context.

Policy and Ordinance Effectiveness. The review showed that many mid-sized cities struggle with outdated or fragmented traffic ordinances that no longer reflect current urban dynamics. Studies from Southeast Asia and Latin America emphasized the importance of continuous policy review to keep pace with changes in vehicle volume, population growth, and urban development (Bakker et al., 2017; Coq-Huelva & Asián-Chaves, 2019). This finding aligns with Valerio (2024), who highlighted that cities with regularly updated ordinances — particularly those that include public consultations, tend to achieve greater compliance and improved road discipline. In contrast, Digos City still relies on a decades-old traffic ordinance that lacks the clarity, adaptability, and responsiveness to manage today's complex traffic conditions. This result underscores the urgent need for legislative reform that is responsive to current urban dynamics and informed by participatory governance.

Enforcement Mechanisms and Institutional Capacity. Weak enforcement emerged as a major problem in many developing cities, and this finding found the same pattern across reviewed studies. The problem often caused by a lack of trained personnel, unclear institutional mandates, and poor coordination between traffic enforcement units and local government agencies. These enforcement challenges lead to low compliance rates, erratic traffic behavior and inefficient traffic flow. However, cities that proactively addressed these issues — by investing in capacity-building programs, hiring additional personnel, and clearly defining institutional roles demonstrated significant improvements in road discipline and traffic management (Castillo-Manzano et al., 2018; Alobaidallah et al., 2025). This supports the insights Paredes (2024), who emphasized that effective traffic systems require an integrated approach that combines strategic planning, modern technology, and strong enforcement mechanisms to optimize traffic flow and reduce delays. Likewise, Abdelhalim et al. (2021) validated this idea by claiming that outcomes improve significantly when enforcement agencies operate under clear mandates and utilize performance metrics for monitoring traffic behavior. Also, these studies highlight the importance of “human element”—the quantity and quality of traffic enforcers, as it can be the deciding factor whether a traffic management system succeeds or fails (Goetsch & Lobaton, 2023). In the context of Digos City, strengthening institutional capacity is essential. This can be achieved through organizational audits, increased staffing of traffic enforcers, and the implementation of data-driven tools such as GPS-based traffic monitoring and dashboard systems to improve real-time coordination and accountability.

Infrastructure and Urban Design. Most of the studies reviewed agree that poor road design, insufficient traffic signals, and lack of pedestrian infrastructure are major contributors to urban congestion. Common Infrastructure-related problems such as narrow roads, unregulated parking, and limited public transport terminals—were common in cities with high traffic volume but underdeveloped transport systems (Lagumbay et al., 2018). A key reason why many urban centers suffer from severe infrastructure bottlenecks is due to chronic underinvestment and planning that has failed to keep pace with rising populations (El-Bouayady et al., 2024). It is important to note that infrastructure quality remains a critical factor in determining traffic flow and road safety. Poorly maintained, inadequately designed, or insufficient infrastructure often leads to congestion, extended travel times, and higher accident risks—especially in fast-growing cities.

This corroborates to the findings of Chavan et al. (2022), who observed that cities implementing modern traffic solutions—such as adaptive signals, congestion pricing, and strict enforcement—consistently experience smoother traffic conditions compared to those relying on outdated manual systems. In the Philippines, Metro Manila stands out as a stark example, where narrow roadways, overlapping construction, and inconsistent planning intensify traffic gridlock (Presidential Communications Office, 2024). For Digos City, where commercial activities are concentrated in a few key areas, these spatial pressures highlight the urgent need for infrastructural upgrades. Improvements such as redesigned intersections, properly designated loading and unloading zones, and safer pedestrian walkways are essential to easing congestion and supporting sustainable urban growth.

Public Engagement and Behavioral Compliance. Across the reviewed literature, public participation consistently emerged as a key factor in traffic management outcomes. Factor (2018) found that cities with consistent public engagement—through traffic education campaigns, stakeholder consultations, and

participatory planning—tended to achieve greater policy acceptance and behavioral compliance. Ohmer et al. (2022) further stressed that sustainable public policies rely not just on top-down regulations but on meaningful, ongoing dialogue with the people affected by them. Conversely, the lack of public awareness and civic participation often led to weak implementation and resistance to change.

Zhang et al. (2025) reinforced this perspective, arguing the need to place people at the heart of urban transformation. In cities like Digos, creating opportunities for citizens to take part in traffic planning—not just as beneficiaries but as active contributors—can build a stronger sense of shared responsibility and encourage long-term compliance with traffic rules. This shift toward a participatory approach may be key to shaping more inclusive and responsive mobility systems.

Technological Integration and Smart Mobility Solutions. One of the recurring themes identified in this systematic review is the increasing role of technology in modern traffic management, especially in smart cities. This is in coherence with Soni et al. (2020), who claimed that tools such as the Internet of Things (IoT), real-time sensors, and AI-powered systems—has been widely recognized as a game-changer in improving urban mobility. These innovations enable cities to monitor traffic conditions in real-time, predict congestion patterns, and adjust traffic flow dynamically. The result is often a significant reduction in traffic delays, improved road safety, and more efficient transport systems.

Despite these benefits, many cities in developing countries continue to face major obstacles in adopting smart technologies. Common barriers include limited funding, outdated infrastructure, and a shortage of trained personnel to manage advanced systems (Nguyen & Mogaji, 2022; Yanocha et al., 2020). While highly developed cities like Singapore and Tokyo have successfully implemented intelligent traffic systems—such as adaptive traffic lights, smart monitoring platforms and automated enforcement tools (Kumar, 2024; Elassy et al., 2024)—others still rely heavily on manual operations.

While full-scale implementation may not yet be practical for cities with limited resources, such as Digos, low-cost options—like GPS-enabled public transport, CCTV monitoring, and mobile reporting apps—can serve as important first steps toward smarter traffic management. These scalable interventions make technology adoption more realistic for smaller cities aiming to improve road efficiency and safety.

CONCLUSION

The results of this review emphasize that traffic management in mid-sized urban centers like Digos City is an urgent concern. Outdated ordinances, limited infrastructure, weak enforcement, and low public engagement continue to hinder the effectiveness of existing traffic systems. Although policy frameworks are in place, their impact is diminished by inconsistent implementation, under-resourced traffic units, and a lack of integrated technological solutions. To address these issues, a multi-dimensional approach is necessary—one that involves updating traffic regulations, investing in road infrastructure and digital systems, and fostering community involvement in urban mobility initiatives. Sustainable and effective traffic management requires not only government funding and political will but also active partnerships among local authorities, private stakeholders, and the commuting public. These measures can pave the way for safer, more organized, and inclusive urban mobility systems that improve quality of life and economic efficiency in Digos City and similarly situated cities.

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