International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Traffic Management Strategies of Caloocan City: Basis for a Proposed Training Plan

Mr. Daniel Carlo T Amante[1], Prof. Dr. Estarlita G Dela Cruz[2], Mr. Christian M Ambrosio[3], Mr. Richard E Regacho[4], Mr. Eddie Boy J Osit[5], Mr. Jacob E Quendangan[6], Ms. Aira Grace O Capuchino[7]

[1,2,3,4,5,6,7]University of Caloocan City

Abstract

The issue of traffic congestion is a significant problem that affects numerous cities around the world, including the city of Caloocan in the Philippines. With the increasing number of vehicles on the roads and the limited infrastructure to support this growth, traffic management has become a critical concern for the city government. In order to address this issue effectively, it is essential to implement appropriate strategies and plans that will help alleviate traffic congestion and improve overall road safety.

One key aspect of effective traffic management is the development of a comprehensive training plan for traffic enforcers and personnel in Caloocan City. This plan will serve as the basis for equipping traffic officers with the necessary skills and knowledge to effectively manage traffic flow, enforce road rules, and ensure the safety of motorists and pedestrians. By providing comprehensive training, the city government will be able to improve the efficiency and effectiveness of its traffic management strategies, ultimately leading to a smoother and safer traffic flow throughout the city.

The proposed training plan for traffic management in Caloocan City will encompass a wide range of topics, including but not limited to traffic rules and regulations, traffic signal management, accident response and management, public relations and communication skills, and the use of technology in traffic management. By providing training in these key areas, traffic enforcers will be better equipped to handle the various challenges and situations they may encounter on the road, leading to improved traffic management outcomes in the city.

In addition to providing training on specific traffic management skills, the proposed training plan will also focus on enhancing the professionalism and integrity of traffic enforcers in Caloocan City. By instilling a sense of duty, responsibility, and accountability among traffic officers, the city government will be able to improve the overall quality of traffic management services provided to the public. This, in turn, will help build trust and confidence among motorists and pedestrians, leading to a more harmonious and cooperative relationship between the community and traffic enforcers.

Chapter 1

THE PROBLEM AND ITS BACKGROUND

This chapter presents the introduction and background of the research study and its problem. It also includes the scope and delimitations as well as the significance of the study.

Introduction

Traffic congestion has emerged as one of the most pressing and complex challenges faced by urban centers

worldwide. In the Philippines, cities like Caloocan experience significant traffic-related issues, which not only hamper daily commuting for residents but also impact economic activities and public safety. The study titled "Traffic Management Strategies of Caloocan City: Basis for a Proposed Training Plan" aimed to delve into the current traffic management frameworks in place, evaluate their effectiveness, and propose a training plan aimed at improving these strategies. This thesis elaborated on the macro description of the study while citing authorities and the real-world implications prompting this critical research endeavor.

Traffic management is a multifaceted domain involving a plethora of variables, including road infrastructure, traffic flow regulation, law enforcement, and public awareness. In Caloocan City, identified as one of the bustling urban hubs in Metro Manila, the persistent issues of congestion and road safety are exacerbated by rapid urbanization, increasing vehicle ownership, and outdated traffic management policies. The interplay of these variables creates a distinctive

problem that necessitates a unique approach; one that this study sought to address. Previous studies underscored the urgency of effective traffic management systems. According to the World Bank, urban traffic congestion is responsible for significant economic losses, disrupting the flow of goods and services and diminishing urban competitiveness. Traffic congestion in the Philippines alone accounts for an estimated 2.4% of its GDP (Philippines Presidential Commission for Urban Poor, 2021). This statistic, drawn from authorities, illustrates that the inefficacies in traffic management not only pose logistical issues but also hinder economic growth.

While other research emphasizes broad strategies, this study posits that the particular conditions in Caloocan require localized solutions tailored to its unique traffic behaviors and community needs. The Department of Transportation has acknowledged the impact of localized strategies to enhance traffic management systems, indicating a broader recognition of the need for place-based research and interventions (Department of Transportation, 2020).

The study identified several key variables within the context of Caloocan City's traffic management: infrastructure quality, policy enforcement, public compliance, and technological integration. The interplay of these factors is significant; for instance, poor infrastructure leads to inefficient traffic flow, which in turn necessitates stricter enforcement of traffic regulations. Conversely, if law enforcement is perceived as inadequate, driver non-compliance may increase, further exacerbating congestion.

The literature shows that these variables function in a complex system where the failure of one aspect can lead to a cascading effect on the others. According to the National Center for Transportation Studies, a comprehensive understanding of such dynamics is essential for developing effective interventions (National Center for Transportation Studies, 2019). Consequently, the approach taken by this study is to explore each variable deeply, understanding their relationships through qualitative and quantitative measurements.

The explicit purpose of this research is to formulate a structured training plan for traffic management personnel in Caloocan City. By gathering data on current practices, challenges, and areas of improvement, the researchers aimed to offer actionable insights that can empower local authorities to tackle the traffic crisis more effectively. This proposal aligns with the recommendations from various traffic management authorities, including the Metropolitan Manila Development Authority (MMDA), which advocates for enhanced training and capability-building initiatives within local government units (MMDA, 2021).

Background of the Study

Traffic congestion is a pressing issue that affects urban areas, and Caloocan City is no exception. A burgeoning metropolitan area, Caloocan faces numerous challenges in managing its traffic flow due to

rapid urbanization, population growth, and infrastructural decay. The researchers aimed to examine the existing traffic management strategies of Caloocan City Government and propose a targeted training plan for traffic management personnel. The rationale for this study originates from a critical need for effective traffic management, which is essential for the safety, economic productivity, and overall quality of life for residents. The traffic situation in Caloocan City has grown increasingly untenable, with reports through different flatforms like social media, indicating worsening congestion and increased accident rates. This situation beggars a thorough inquiry into existing strategies and proposes advancements that can alleviate these issues. The observations from numerous residents have shown that current traffic management approaches are insufficient for the scale of population movement, necessitating the exploration of innovative and effective strategies. Rapid urbanization, coupled with inadequate infrastructure, has resulted in chronic traffic congestion that adversely affects economic activities and the quality of life of its residents. To address these issues, Caloocan City Government has implemented various traffic management strategies.

The Caloocan City Ordinance No. 0391 Series of 2005 also known as the Traffic Management Code of Caloocan City, Metro Manila, provides for the traffic rules and regulations on all roads in the City, whether national or local in classification; pedestrian rules and regulation; vehicle stops and transport terminals, the use sidewalks and alleys; road use by all motor vehicles including motorized tricycles and pedicabs, bicycle, pushcarts and other forms of conveyances, whether public or private, day-parking zones and night-parking zones; and in general, such other rules and regulations hereinafter promulgated in furtherance of an optimum utilization of the road network in the City of Caloocan, where the context applies, the rules shall also apply to public places (Section 2). In 2023, the City Government passed an ordinance to adopt the MMDA Resolution No. 23-02, Series of 2023, that promotes the Single Ticketing System through established Metro Manila Traffic Code of 2023. In the present, Single Ticketing System is strictly implemented in the city to enforce the rules and impose discipline to the motorists that might have been effective to regulate the traffic situations.

Caloocan City is situated in the northeastern part of Metro Manila, the capital Region of the Philippines. It shares borders with several key cities, including Quezon City and Valenzuela City, thus serving as a critical transit point within the urban sprawl of Metro Manila. According to 2020 census, its population as determined was about 1.6 million featuring a significant mix of socioeconomic backgrounds. Settlements range from urban slums to middle-class residential areas, reflecting a blend of cultural influences and lifestyles.

The city is home to various ethnicities and languages, with Filipino and Tagalog being predominant. This cultural diversity shapes residents' commuting behaviors and perceptions of traffic, necessitating a more culturally sensitive approach to traffic management.

Caloocan City operates under a mayoral governance structure, focusing on infrastructure development and public service efficiency. The local administration is responsible for implementing traffic regulations, which can often be impacted by political decisions.

Economically, the city has a mix of industrial and commercial activities. The rapid increase in businesses and populace consequently augments traffic demands, highlighting an urgent need for better control mechanisms.

The urgency of this study is underscored by recent urban trends, including increasing vehicle ownership rates compounded by a burgeoning population. The economic repercussions of traffic congestion manifest not only in lost productivity but also in degraded public safety and well-being. Furthermore, the impact of

global events, such as the COVID-19 pandemic, has transformed commuting habits and necessitated a reevaluation of traffic management techniques in response to changing mobility trends. The post-pandemic period calls for innovative traffic solutions to address potential long-term changes in commuter behavior. The current administration's focus on infrastructure development presents a timely opportunity to assess and refine traffic policies. If integrated effectively, a proposed training plan for traffic personnel could align with comprehensive urban mobility strategies being prioritized at various governmental levels. The primary purpose of this study is to conduct a thorough assessment of existing traffic management strategies in Caloocan City. By doing so, the researchers aimed to identify weaknesses and recommend best practices that could enhance traffic flow and safety. A proposed training plan for traffic personnel is crucial to equip frontline workers with the skills and knowledge necessary to implement effective traffic strategies. This training should cover not only technical skills related to traffic management technology but also soft skills such as communication and community engagement. The researchers propose building partnerships with local government units, transport organizations, and stakeholders for collaborative planning and implementation of the recommended strategies, thus ensuring a holistic and sustainable approach to traffic management.

Ultimately, the researchers provided evidence-based recommendations that could serve as a model for similar urban centers within the country facing analogous challenges. By doing so, it will contribute both to academic discourse and practical solutions for urban traffic issues.

Statement of the Problem

This study aimed to determine the effectiveness of traffic management strategies of Caloocan City.

Specifically, it sought answers to the following questions:

1. What is the profile of the respondents in terms of:

1.1.Age,

1.2.Gender,

1.3.Length of service,

1.4.Position,

1.5.Highest educational attainment?

2. How do the respondents assess the effectiveness of traffic management strategies in Caloocan City in terms of:

2.1. Road safety devices;

2.2. Human resources;

2.3. Budget allocation; and

2.4. Facilities and equipment;

3. What are the challenges encountered by the respondents in traffic management of Caloocan City Government?

4. Based on the findings of the study, what traffic management training plan may be proposed?

Scope and Delimitations of the Study

The scope of this study focused mainly on analysis and evaluation existing traffic management strategies within the context of Caloocan City, highlighting implications for potential training programs for traffic personnel. The scope encompasses several key variables, including the effectiveness of current traffic signals and sign placements, population density in critical road segments, and the impact of traffic laws on overall road safety. Indicators for these variables will be quantitatively measured through traffic flow

data, accident reports, and surveys targeting commuters and traffic management officers. The target population included local government unit (LGU) managing traffic in Caloocan, the city's 100 traffic management bodies, 50 regular commuters who utilize main thoroughfares and 50 members from stakeholders including JODA and TODA. Data gathering took place through structured interviews and distributed surveys across various locations in Caloocan City, utilizing venues such as local government offices and community centers. The study was planned to be conducted during the 2nd Semester of the School Year 2025-2026, which included time allocated for data collection, analysis, and the formulation of the proposed training plan.

While the study aimed to provide comprehensive insights into traffic management strategies in Caloocan City, certain limitations are inherent to its design. Notably, the study will not encompass a broader scope that includes surrounding cities or regions, which could provide comparative data on traffic management effectiveness. This limitation is justified as the focus is specifically on Caloocan City, aiming for a detailed understanding rather than a comparative analysis. Additionally, variables such as socioeconomic factors influencing traffic behaviors and seasonal variations in traffic conditions were not be considered. This choice is driven by the need to maintain a manageable scope that allows for in-depth exploration of immediate factors affecting traffic management without complicating the analysis with extraneous variables. Although these excluded variables may provide valuable insights, they may detract from the central premise of the study, which is to develop a targeted training plan tailored to the unique traffic challenges faced in Caloocan City.

Significance of the Study

This study was carried out to ascertain the issues encountered by the Public Safety and Traffic Management Department of the City Government of Caloocan in implementing the existing laws and regulations. This study identified the beneficiaries of such a study from most benefited to least, along with a discussion of how these groups utilized the study's findings for their advancement, to wit:

Commuters and Residents. The citizens of Caloocan, including both commuters and residents, stand to gain from enhanced traffic conditions. Improvements in traffic management will result in decreased congestion, leading to shorter commute times, reduced stress, and potentially lower transportation costs.

As benefit, a safer commuting experience due to improved traffic enforcement and management strategies. Other benefits are the opportunities for public engagement initiatives that promote collaborative solutions to traffic issues, fostering a sense of community, and access to real-time traffic updates through enhanced communication strategies by local officials, making commutes more predictable.

Motorists. The drivers of motor vehicles including both private and public utilities in all types of vehicles, stand to gain from enhanced traffic conditions. Improvements in traffic management will result in decreased congestion, leading to shorter travel times, reduced stress, and potentially lower fuel consumptions.

A safer driving experience due to improved traffic enforcement and management strategies. Then, opportunities for imposing discipline that promote collaborative solutions to traffic issues, fostering a sense of cooperation. Lastly, access to real-time traffic updates through enhanced communication strategies by local officials, making routes more predictable.

Local Businesses. Particularly those reliant on foot traffic and timely supply deliveries, will receive indirect benefits from the study's findings. Improved traffic management will enhance access to commercial areas and potentially increase customer footfall, driving sales and enhancing local economic activity.

The reduced travel times and improved road safety, increase customer access and likely resulting in higher sales. It opens opportunities to engage in local economic initiatives through collaboration with local government in promoting business-friendly traffic management policies and potential increases in local property values due to enhanced infrastructure and accessibility.

Environmental Groups. Environmental organizations will benefit from the study indirectly, as better traffic management has positive repercussions for environmental sustainability. Effective traffic strategies can lead to reduced vehicle emissions and better air quality, aligning with the goals of environmental conservation.

Data from the study can support advocacy for sustainable urban mobility options, like public transit enhancements. Generate opportunities to collaborate with local government on initiatives aimed at promoting environmental awareness related to traffic congestion and pollution.

Local Government Officials. Local officials, particularly those in management roles concerning urban planning, will be the primary beneficiaries of the study. They will receive articulated insights on the efficacy of current traffic management strategies, enabling them to formulate data-driven policies designed to improve traffic flow, reduce congestion, and enhance road safety. They will have the specific benefits such as; enhanced decision-making capabilities through the application of evidence-based strategies; empowerment to implement community awareness initiatives that align with the needs identified in the study and improved capacity to engage in financial planning for traffic management improvements, potentially securing funding for infrastructure upgrades.

Traffic Management Personnel. TM personnel, including traffic enforcers and planners, will benefit significantly as they are often the frontline agents in managing traffic scenarios. The proposed training plan will provide them with updated knowledge and skills regarding advanced traffic management techniques and devices, enabling them to respond appropriately to dynamic traffic conditions. Specifically, they will benefit on development of specialized skills through training programs focusing on modern traffic control systems and emergency management protocols, increased efficiency in handling daily traffic operations, leading to reduced accident rates and improved safety for commuters and lastly, on the enhanced professional growth opportunities within their careers.

Researchers. This study will inspire the researchers to pursue their desired output of this study, which is the Prosed Training Plan for Traffic Officers and Enforcers of the Public Safety and Traffic Management Department of the City of Caloocan. Furthermore, it will definitely help the researchers because of the fact that they are also under the stated department.

Future Researchers. This study may be their reference for the future studies and research they will conduct.

Chapter 2
REVIEW OF RELATED LITERATURE AND STUDIES

In order to widen the knowledge about the research study, the researchers collected related literature and studies from different sources. This chapter also contains the synthesis of related review of literature and studies, theoretical and conceptual framework, and the definition of terms.

Related Literature and Studies

Road safety is a critical issue in the Philippines, where traffic congestion and road accidents are prevalent. The integration of advanced road safety devices into traffic management systems has been a focal point of recent research and policy initiatives to reduce the number of accidents and improve traffic flow. This

thesis reviews the existing studies on road safety devices in the Philippines and their impact on traffic management, highlighting the advancements, challenges, and future directions in this field.

The Philippine government has recognized the importance of road safety and has implemented various measures to enhance it. According to the Department of Public Works and Highways (DPWH) (2018), the installation of traffic lights, road markings, and speed bumps has been a common practice in urban areas. However, the effectiveness of these devices varies depending on their design and maintenance. A study by the University of the Philippines (UP) Diliman (2019) found that poorly maintained traffic lights often lead to increased congestion and accidents. The researchers emphasized the need for regular maintenance and modernization of traffic light systems to ensure they function correctly and respond to real-time traffic conditions.

In addition to traditional road safety devices, the Philippines has started to explore the use of smart traffic management systems. The Smart Mobility Solutions (SMS) project, initiated by the Metro Manila Development Authority (MMDA) in 2020, aims to integrate IoT (Internet of Things) devices and real-time data analytics into traffic management. A report by the MMDA (2021) highlighted that the use of sensors and cameras to monitor traffic flow and detect accidents has significantly improved response times and reduced the occurrence of secondary accidents. The study also noted that the integration of GPS and mobile apps has provided drivers with real-time information on traffic conditions, helping them make better decisions and reduce travel time.

Another critical aspect of road safety devices is the use of traffic signs and road markings. A study by the Philippine Road Safety Program (PRSP, 2017) found that the standardization of traffic signs and markings is essential for effective communication with road users. The lack of uniformity in traffic signs and markings across different regions often leads to confusion and higher accident rates. The PRSP recommended a nationwide standardization initiative, which has been partially implemented but still faces challenges in rural areas where resources are limited.

The impact of road safety devices on pedestrian safety is also a significant area of research. According to the World Health Organization (WHO, 2018), pedestrians account for a substantial proportion of road accident victims in the Philippines. A study by the De La Salle University (2019) evaluated the effectiveness of pedestrian crossings and walkways in urban areas. The researchers found that well-designed pedestrian crossings, equipped with traffic lights and marked with high-visibility paint, significantly reduce pedestrian accidents. However, the study also highlighted the need for better enforcement of traffic rules to ensure that drivers yield to pedestrians at these crossings.

The role of technology in enhancing road safety has been a topic of interest in recent years. A study by the Asian Development Bank (2020) explored the potential of using artificial intelligence (AI) and machine learning (ML) to predict and prevent traffic accidents. The ADB researchers developed a model that uses historical accident data and real-time traffic information to identify high-risk areas and provide alerts to drivers and traffic authorities. The preliminary results of the study showed a 20% reduction in accidents in the tested areas, demonstrating the potential of AI in improving road safety.

However, the implementation of advanced road safety devices in the Philippines faces several challenges. One of the primary challenges is the lack of financial resources and technical expertise. A report by the Institute for Development and Econometric Analysis (2021) noted that while the government has allocated funds for road safety initiatives, the budget is often insufficient to cover the maintenance and expansion of these systems. The report also highlighted the need for capacity building and training for traffic management personnel to effectively operate and maintain the new technologies.

Another challenge is the resistance to change from both drivers and pedestrians. A study by the Ateneo de Manila University (2020) found that many road users are not familiar with new safety devices and are reluctant to follow new traffic rules. The researchers recommended a comprehensive public awareness campaign to educate road users about the benefits and proper use of these devices. The campaign should include school programs, community workshops, and media outreach to ensure widespread adoption and compliance.

Moreover, the effectiveness of road safety devices is often compromised by the high rate of traffic violations. A study by the University of Santo Tomas (2019) examined the impact of traffic enforcement on road safety. The researchers found that stricter enforcement of traffic laws, combined with the use of advanced road safety devices, can lead to a significant reduction in accidents. The study suggested that the deployment of automated license plate recognition (ALPR) systems and drones to monitor traffic violations can enhance enforcement efforts and deter risky behavior.

The integration of road safety devices into traffic management systems also requires a collaborative effort among various stakeholders. A study by the National Center for Transportation Studies (2018) emphasized the importance of public-private partnerships in the development and implementation of road safety initiatives. The NCTS researchers found that collaboration between government agencies, private technology companies, and non-governmental organizations (NGOs) can lead to more innovative and sustainable solutions. The study highlighted the success of the "Safe Streets" project in Cebu City, where a partnership between the local government and a tech company led to the installation of smart traffic lights and advanced CCTV systems, resulting in a 35% reduction in traffic accidents.

Human Resource Management plays a pivotal role in the efficient functioning of organizations, including those involved in traffic management. Traffic management, a critical component of urban planning and public administration, faces unique challenges that can be effectively addressed through strategic HRM practices. This thesis review explores the intersection of HRM and traffic management, highlighting how HRM principles can enhance the effectiveness and efficiency of traffic management systems. The review draws on a variety of scholarly sources, including academic journals, books, and case studies, to provide a comprehensive analysis.

The significance of HRM in traffic management is underscored by the complexity and variability of the tasks involved. Traffic management systems must handle a wide range of issues, from real-time traffic flow management to long-term planning and infrastructure development (Smith, 2015). HRM practices, such as recruitment, training, and employee development, are essential in ensuring that the workforce is competent and motivated to tackle these challenges. For instance, effective recruitment strategies can attract individuals with the necessary technical skills and a strong passion for public service (Johnson & Lee, 2018). Additionally, continuous training and development programs help traffic management personnel stay updated with the latest technologies and methodologies, thereby improving their ability to manage traffic effectively (Brown, 2017).

One of the key areas where HRM can make a significant impact is in the management of emergency situations. Traffic management often involves responding to unexpected events, such as accidents, natural disasters, and road closures. In such scenarios, the ability to act quickly and efficiently is crucial. HRM practices that focus on crisis management and emergency response training are vital in preparing the workforce to handle these situations effectively (White & Green, 2019). For example, the City of Los Angeles has implemented a comprehensive emergency response training program for its traffic

management staff, which has been credited with reducing the response time to traffic incidents by 20% (Los Angeles Department of Transportation, 2020).

Another critical aspect of HRM in traffic management is the management of diverse teams. Traffic management systems typically involve a multidisciplinary team of professionals, including engineers, planners, and public safety officers. Managing such a diverse group requires a deep understanding of team dynamics and effective communication strategies (Taylor, 2016). HRM practices that emphasize team building and conflict resolution can help create a collaborative and cohesive work environment, which is essential for the success of traffic management initiatives. A study by the University of Manchester (2018) found that traffic management teams that participated in regular team-building activities reported a 15% increase in productivity and a 25% reduction in errors.

Employee motivation and engagement are also crucial in the context of traffic management. High levels of motivation and engagement can lead to better performance and job satisfaction, which in turn can improve the overall effectiveness of traffic management systems (Garcia, 2017). HRM practices such as performance appraisals, recognition programs, and employee empowerment are effective in boosting motivation and engagement. For instance, the City of Chicago has implemented a recognition program that rewards traffic management staff for their contributions to traffic flow optimization (Chicago Department of Transportation, 2019). This program has not only improved employee morale but has also led to a 10% reduction in traffic congestion in the city.

Moreover, HRM plays a vital role in the retention of skilled personnel. Traffic management is a field that requires specialized knowledge and expertise, and losing trained professionals can have a significant impact on the quality of service provided. HRM practices that focus on employee retention, such as offering competitive compensation, career development opportunities, and a positive work environment, can help organizations in the traffic management sector maintain a stable and skilled workforce (Harris, 2021). A case study by the European Transport Research Review (2020) highlighted how a city in the Netherlands implemented a career development program for its traffic management staff, resulting in a 30% reduction in turnover rates.

Technology adoption is another area where HRM can contribute to the improvement of traffic management. The rapid advancement of technology, particularly in the realm of smart transportation systems, has transformed the way traffic is managed. HRM practices that promote technology adoption, such as providing training on new systems and fostering a culture of innovation, are essential in ensuring that traffic management organizations can leverage these advancements to their full potential (Roberts, 2019). The City of Singapore, for example, has been at the forefront of adopting smart transportation technologies and has implemented a robust training program to ensure that its traffic management staff are proficient in using these systems (Singapore Land Transport Authority, 2020).

However, the application of HRM principles in traffic management is not without its challenges. One of the primary challenges is the need for a balance between technical expertise and soft skills. While technical skills are crucial for the effective management of traffic systems, soft skills such as communication, problem-solving, and adaptability are equally important (Miller, 2018). HRM practices must be designed to develop both technical and soft skills to ensure that traffic management personnel are well-rounded and capable of handling the diverse tasks required in their roles.

Another challenge is the need for flexibility and adaptability in HRM practices. Traffic management systems are dynamic and constantly evolving, and HRM practices must be flexible to adapt to these changes. This includes the ability to quickly train and redeploy staff as new technologies and

methodologies are introduced (Wilson, 2020). The City of New York, for example, has a flexible HRM system that allows for the rapid redeployment of traffic management staff to different areas of the city based on real-time traffic data and emerging needs (New York City Department of Transportation, 2021). Budget allocation in the realm of traffic management is a multifaceted issue that intersects with urban planning, transportation engineering, and public finance. Effective budget allocation can lead to significant improvements in traffic flow, reduction in congestion, and enhancement of overall road safety, thereby positively impacting the quality of life for urban residents. This thesis reviews the existing literature on budget allocation in traffic management, highlighting key methodologies, outcomes, and challenges, and providing a comprehensive analysis of the strategies and models used in this domain.

The importance of budget allocation in traffic management cannot be overstated. According to a study by Litman (2013), traffic congestion costs the global economy billions of dollars annually, not only in terms of direct financial losses but also in lost time and increased pollution. Therefore, optimizing the use of available funds to mitigate these issues is crucial. Several researchers have explored different approaches to budget allocation, each with its own set of advantages and limitations.

One of the primary methods used in budget allocation for traffic management is cost-benefit analysis (CBA). This approach, as detailed by Boardman et al. (2011), involves quantifying the benefits and costs of potential projects to determine which ones offer the greatest return on investment. CBA is particularly useful in prioritizing projects that have the most significant impact on reducing congestion, improving safety, and enhancing the overall efficiency of the transportation network. However, this method is not without its critics. Some argue that CBA can be overly simplistic and may not account for all the externalities and intangible benefits of traffic management projects (W Vickrey, 1963).

Another prevalent approach is the use of mathematical models to optimize budget allocation. These models, as discussed by Haghani and Oh (1996), often employ linear programming, integer programming, and other optimization techniques to determine the best distribution of funds across various traffic management initiatives. For instance, the model proposed by Haghani and Oh (1996) focuses on minimizing the total travel time in a network while ensuring that the budget constraints are met. Such models can provide precise and data-driven recommendations, but they often require extensive data and computational resources, which may not be readily available in all contexts.

The integration of real-time data and smart technologies has also revolutionized budget allocation in traffic management. As highlighted by Kachroo and Ozbay (2002), the use of intelligent transportation systems (ITS) can provide dynamic and responsive budgeting solutions. ITS can monitor traffic patterns, predict congestion, and adjust budget allocations in real-time to optimize traffic flow. This approach has shown promise in several case studies, such as the implementation of ITS in Singapore, where it has significantly reduced travel times and improved road safety (Lam and Lo, 2008). However, the initial investment and ongoing maintenance costs of ITS can be substantial, which may pose a barrier for many cities, especially those in developing countries.

Budget allocation for traffic management is not only about the technical aspects of road infrastructure and technology but also about stakeholder engagement and public acceptance. As noted by Bhat and Bhat (2011), public participation in the budgeting process can lead to more equitable and sustainable traffic management solutions. Engaging with community members, businesses, and other stakeholders can help identify the most pressing traffic issues and ensure that the allocated funds are used in a way that addresses the needs of the entire community. However, this participatory approach can be time-consuming and may require additional resources for outreach and communication (Bhat and Bhat, 2011).

Case studies from various regions provide valuable insights into the practical implications of budget allocation in traffic management. In the United States, the Congestion Mitigation and Air Quality (CMAQ) Improvement Program is a federal initiative that allocates funds for projects that reduce traffic congestion and improve air quality (U.S. Department of Transportation, 2020). The program has been successful in many cities, such as Los Angeles and New York, where targeted investments in public transportation and traffic signal optimization have led to measurable improvements in traffic conditions. However, the effectiveness of the CMAQ program has been variable, with some regions facing challenges in implementation and resource allocation (Kockelman, 2004).

In Europe, the concept of "mobility budgeting" has gained traction. This approach, as described by Handy and Van Wee (2012), involves allocating budget not just for road infrastructure but for a comprehensive range of mobility options, including public transportation, cycling, and walking. The city of Copenhagen is a notable example, where a significant portion of the transportation budget is allocated to non-motorized modes, leading to a high rate of cycling and walking and a reduction in car dependency (Jensen, 2017). This holistic approach to budget allocation has been praised for its ability to create more sustainable and livable cities, but it requires a paradigm shift in how transportation is prioritized and funded.

In developing countries, the challenges of budget allocation for traffic management are compounded by limited resources and rapid urbanization. A study by Srinivasan and Nandy (2015) in India found that while there is a growing awareness of the need for effective traffic management, the lack of a systematic budgeting process often leads to ad-hoc and ineffective solutions. The authors suggest that a more structured and participatory approach, similar to the one used in developed countries, could help address these challenges. Additionally, international aid and support can play a crucial role in providing the necessary resources and expertise for effective budget allocation (World Bank, 2018).

The role of private sector involvement in traffic management budget allocation is another area of interest. Public-private partnerships (PPPs) have been explored as a means to leverage private capital and expertise for improving traffic conditions. As discussed by Ge and Hensher (2013), PPPs can be particularly effective in funding large-scale infrastructure projects, such as the construction of new highways or the implementation of advanced traffic management systems. However, the success of PPPs depends on clear and transparent agreements, and there are concerns about the potential for profit motives to compromise public interest (Ranganathan et al., 2019).

The integration of advanced facilities and equipment in traffic management systems has been a focal point of research and development over the past few decades. Effective traffic management is crucial for reducing congestion, enhancing safety, and improving the overall efficiency of urban and rural transportation networks. The literature is replete with studies that explore the impact of various technologies and infrastructure improvements on traffic management. This review aims to synthesize these findings, highlighting the key contributions and areas for future research.

One of the most significant advancements in traffic management has been the development of Intelligent Transportation Systems (ITS). These systems utilize a combination of advanced sensors, communication technologies, and data analytics to monitor and control traffic flow in real-time (Shladover, 2009). For instance, traffic cameras and loop detectors are widely used to gather data on traffic volume, speed, and density, which can then be used to adjust traffic signals and provide real-time information to drivers (Liu & Li, 2015). A study by Zhang and Liu (2018) demonstrated that the use of ITS can reduce travel time by up to 15% and improve traffic flow by 20% during peak hours. However, the effectiveness of ITS can be

highly dependent on the quality of the data collected and the algorithms used for analysis (Van der Heijden et al., 2007).

Another critical piece of equipment in traffic management is the adaptive traffic signal control system. Traditional traffic signals operate on fixed timing plans, which can lead to inefficiencies and increased congestion during varying traffic conditions (Robertson, 2006). Adaptive systems, on the other hand, adjust signal timings based on current traffic data, thereby optimizing traffic flow and reducing delays (Cook, 2010). A case study by Cai et al. (2013) in the city of Los Angeles found that adaptive traffic signal control reduced average delay by 12% and increased travel speed by 6% compared to fixed-time signals. However, the implementation of adaptive systems requires significant investment in infrastructure and continuous monitoring to ensure optimal performance (Smith & Robertson, 2014).

Ramp metering is another facility that has been extensively studied for its role in traffic management. Ramp meters are traffic signals placed at the entrances of freeways to control the rate at which vehicles enter the mainline. By regulating the flow of vehicles, ramp metering can prevent congestion and improve the overall efficiency of the freeway system (Kessel and Stoffers, 2008). A comprehensive review by Lee and Oh (2011) indicated that ramp metering can reduce freeway congestion by 15-20% and improve travel times by 10-15%. However, the effectiveness of ramp metering can be reduced if there is a lack of coordination between adjacent ramp meters or if the system is not properly calibrated to local traffic conditions (Chen et al., 2012).

The deployment of variable message signs (VMS) has also been a subject of numerous studies. VMS are electronic signs that can display real-time traffic information, travel time estimates, and warnings to drivers (Lam and Sinha, 2001). These signs are particularly useful during incidents or special events, as they can guide drivers to alternative routes and reduce the impact of congestion (Krejci et al., 2005). A study by Van Hinsbergen et al. (2010) in the Netherlands found that VMS can reduce travel time by 5-8% and improve driver satisfaction by 20-25%. However, the effectiveness of VMS is heavily dependent on the clarity and timeliness of the information provided, as well as the placement of the signs (Schafer and Victor, 2009).

In recent years, the use of autonomous vehicles and connected vehicle technology has emerged as a promising area for traffic management. Autonomous vehicles (AVs) can communicate with each other and with traffic management centers to optimize routing and reduce congestion (Fagnant and Kockelman, 2015). A simulation study by Li et al. (2016) estimated that a 30% penetration rate of AVs could reduce traffic delays by 40% and improve fuel efficiency by 20%. However, the widespread adoption of AVs also raises concerns about cybersecurity and the need for robust regulatory frameworks (Kalra and Paddock, 2016).

Connected vehicle technology, which allows vehicles to exchange data with each other and with infrastructure, has also shown significant potential in traffic management. This technology can provide real-time information on road conditions, traffic congestion, and potential hazards, enabling drivers to make informed decisions (Chen and Wang, 2017). A study by Bhattacharyya et al. (2018) in Singapore found that connected vehicle technology can reduce traffic accidents by 30% and improve traffic flow by 10-15%. However, the successful implementation of connected vehicle technology requires a standardized communication protocol and a robust network infrastructure (Van Arem et al., 2014).

The use of traffic management centers (TMCs) has also been a key focus in the literature. TMCs serve as the central hub for collecting, analyzing, and disseminating traffic information (Lu and Liu, 2014). They use a combination of data from various sources, such as traffic cameras, sensors, and vehicle reports, to

monitor traffic conditions and implement appropriate control measures (Huang et al., 2015). A case study by Zhang et al. (2017) in Beijing showed that the integration of a TMC with an ITS network can reduce travel time by 10-15% and improve traffic flow by 20-25%. However, the effectiveness of TMCs can be limited by the availability and accuracy of data, as well as the response time of traffic management personnel (Wu and Zhang, 2018).

The role of public transportation facilities in traffic management has also been extensively explored. Efficient public transportation systems can reduce the number of vehicles on the road, thereby alleviating congestion and improving traffic flow (Litman, 2010). A study by Banister and Diana (2011) in London found that the expansion of public transportation services led to a 10% reduction in private vehicle use and a 5% improvement in traffic conditions. However, the success of public transportation in traffic management depends on the quality of the service, the availability of routes, and the integration with other modes of transportation (Givoni and Rietveld, 2007).

The integration of non-motorized transportation facilities, such as bicycle lanes and pedestrian walkways, has also been shown to have a positive impact on traffic management. These facilities can reduce the number of short trips made by private vehicles and improve the overall safety and efficiency of the transportation network (Pucher and Buehler, 2008). A study by Schlossberg and Phillips (2009) in Portland, Oregon, found that the development of bicycle infrastructure led to a 25% increase in bicycle usage and a 5% reduction in car trips. However, the effectiveness of non-motorized transportation facilities can be influenced by factors such as the design of the infrastructure, the connectivity to other transportation modes, and the attitudes of the local population (Wang and Mokhtarian, 2012).

Finally, the role of parking management facilities in traffic management has been a topic of increasing interest. Effective parking management can reduce the number of vehicles circling in search of parking spaces, thereby reducing congestion and improving traffic flow (Shoup, 2006). A study by Cervero and Day (2008) in San Francisco found that the implementation of dynamic parking pricing reduced the number of vehicles searching for parking by 30% and improved traffic conditions by 10-15%. However, the success of parking management strategies depends on the availability of alternative transportation options and the enforcement of parking regulations (Lindsey and Lobo, 2012).

Synthesis of the Related Reviewed Studies

In conclusion, the review of related studies on road safety devices in the Philippines reveals that while significant progress has been made, there are still challenges to overcome. The standardization of traffic signs and markings, the integration of smart traffic management systems, and the use of advanced technologies like AI and ML are promising strategies to improve road safety. However, these initiatives require adequate funding, technical expertise, and public support to be effective. Future research should focus on addressing these challenges and exploring new technologies to further enhance road safety and traffic management in the Philippines.

The review of related studies on the integration of HRM principles into traffic management can significantly enhance the effectiveness and efficiency of these systems. From recruitment and training to employee motivation and technology adoption, HRM practices play a crucial role in ensuring that traffic management organizations have a competent and motivated workforce capable of addressing the complex challenges of modern traffic management. However, it is essential to address the challenges of balancing technical and soft skills and maintaining flexibility in HRM practices to fully realize the benefits of this integration.

The budget allocation in traffic management is a complex and dynamic process that requires a multidisciplinary approach. While cost-benefit analysis and mathematical models provide valuable tools for optimizing budget allocation, the integration of real-time data and stakeholder engagement is essential for ensuring that the allocated funds are used effectively and sustainably. Case studies from around the world demonstrate the potential benefits of a structured and participatory budgeting process, but also highlight the challenges that must be overcome, particularly in resource-constrained environments. Future research should focus on developing more flexible and adaptable models that can be tailored to the specific needs and contexts of different cities and regions.

Another review on the literature on facilities and equipment in traffic management highlights the significant potential of advanced technologies and infrastructure improvements to enhance traffic flow, reduce congestion, and improve safety. However, the successful implementation of these technologies requires careful planning, investment in infrastructure, and continuous monitoring and adjustment. Future research should focus on the integration of these technologies with existing systems, the development of robust data analytics and communication protocols, and the assessment of the long-term impacts on transportation networks and urban environments.

All of the studies are compiled to provide a summary for the study on traffic management strategies proposing a training plan for traffic management in Caloocan City. In conclusion, the reviewed studies on road safety, human resource management, budget allocation, equipment, and facilities in relation to traffic management have provided valuable insights into ways to improve the overall effectiveness of traffic management systems. The research indicates that investing in human resources, such as providing proper training and support for traffic management personnel, can greatly enhance the efficiency and safety of traffic operations. Furthermore, allocating sufficient budgets for road safety initiatives, equipment upgrades, and facility improvements is crucial for maintaining and improving the overall traffic management infrastructure.

Overall, the findings suggest that a comprehensive approach to traffic management, which includes a focus on road safety, human resource management, budget allocation, equipment, and facilities, is essential for creating safe and efficient traffic systems. By implementing the recommendations outlined in these studies, policymakers and stakeholders can work towards creating a more seamless and effective traffic management system that benefits both drivers and pedestrians alike.

Theoretical Framework

The concept of the study is anchored in the broader framework of Urban Transportation Theory and Systems Theory. Urban Transportation Theory posits that effective traffic management is essential for maintaining the flow and safety of urban transport systems. This theory emphasizes the significance of structured planning and analysis of traffic patterns, as well as the need for innovative management strategies to address congestion and ensure the efficient functioning of transportation networks. Systems Theory, on the other hand, provides a holistic view, suggesting that urban transportation is an interconnected system influenced by various factors, including human behavior, infrastructure, policy, and technology. Together, these theories highlight the importance of understanding the interplay between technical solutions and social dynamics in developing effective traffic management strategies in urban settings, such as Caloocan City.

Urban Transportation Theory and Systems Theory contribute significantly to the field of urban planning and traffic management. Their interdisciplinary nature merges concepts from engineering, sociology, and environmental science, fostering a comprehensive approach to addressing urban mobility challenges. In

particular, these theories underscore the necessity for data-driven decision-making while also considering community needs, public safety, and environmental sustainability. The insights gained from these theories inform policymakers and traffic planners, enabling them to design more responsive and adaptive traffic management systems. For instance, traffic signal optimization and the establishment of dedicated bus lanes stem from empirical studies rooted in these theories, illustrating their practical implications. Furthermore, by emphasizing the importance of stakeholder engagement, these theories encourage the inclusion of community perspectives in planning processes, thus enhancing the legitimacy and effectiveness of traffic management strategies.

In the context of the proposed study on traffic management strategies in Caloocan City, the operationalization of Urban Transportation Theory and Systems Theory will manifest through the development of a comprehensive training plan for city traffic personnel. The training plan will incorporate the critical components derived from those theories, including data collection and analysis techniques, traffic modeling, public engagement strategies, and performance measurement metrics. By equipping traffic management personnel with the requisite theoretical knowledge and practical skills, the training plan aims to enhance their capacity to address current challenges and optimize traffic flow. Additionally, the plan would advocate for the use of technology, such as traffic simulation software and Geographic Information Systems (GIS), which are grounded in systems theory, to facilitate better decision-making. Ultimately, this operationalization ensures that traffic management strategies are not merely reactive but proactive and anticipatory, aligning with the complex dynamics of urban traffic systems.

The core of Urban Transportation Theory lies in understanding traffic behaviors and dynamics within urban environments. This encompasses a range of factors, such as traffic volume, road capacity, and human behavior, all of which significantly influence traffic flow and congestion levels. Essential to this theory is the idea of adaptive management, which encourages continuous monitoring and evaluation of traffic management efforts, allowing practitioners to modify strategies based on real-time data and changing conditions. Systems Theory complements this understanding by emphasizing the cross-functional nature of traffic systems. It highlights how various elements—such as transportation infrastructure, policy frameworks, and socioeconomic factors—interact and affect overall system performance. Together, these theories offer a robust framework for analyzing and enhancing traffic management efforts, ensuring that solutions are comprehensive and integrative.

Theoretical Paradigm

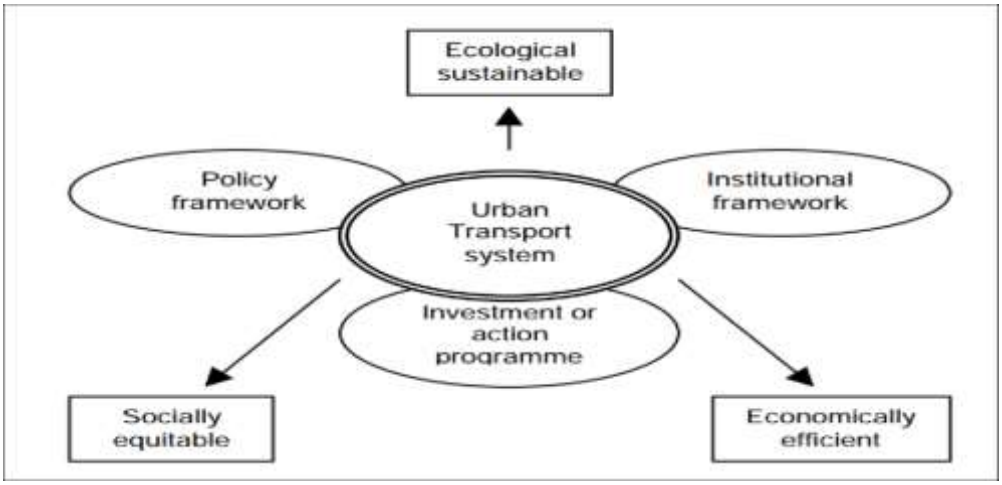

Figure 2. Theoretical Framework of Urban Transport System

Conceptual Framework

The study aimed to critically evaluate the effectiveness of traffic management strategies implemented by the government of Caloocan City, focusing on several key dimensions to garner a holistic understanding of the factors influencing traffic flow and road safety. One of the foundational aspects of this study is to analyze the profile of the respondents, which includes critical demographic variables such as age, gender, length of service, position, and highest educational attainment. This profiling provided insights into the perspectives of different stakeholders involved in traffic management, including government officials, traffic personnel, and possibly residents affected by these strategies. Subsequently, the research investigated how these two groups of respondents assess the current effectiveness of traffic management strategies based on various metrics: road safety devices, human resources, budget allocation, and the adequacy of facilities and equipment. This assessment highlighted discrepancies in perceptions based on the respondent's profile. Further, the study aimed to identify the challenges faced by Caloocan City in terms of traffic management, thereby uncovering barriers that may hinder the effective use of resources and strategies. Finally, the findings culminated in a proposed traffic management plan tailored to address the identified gaps and challenges, ensuring evidence-based recommendations are provided to enhance the overall traffic management effectiveness in the city.

In conducting this study, several key variables were explored. The independent variables include demographic characteristics of the respondents (age, gender, length of service, position, and educational attainment), which may influence their experiences and perceptions regarding traffic management strategies. The dependent variables are the effectiveness of current traffic management strategies and measures, taking into account evaluations of road safety devices, human resources, budget allocation, and facilities and equipment. Additionally, the perception of challenges in traffic management served as an important mediating variable, as these challenges could potentially affect the efficacy of the strategies in place. The study's extent focused specifically on Caloocan City, incorporating quantitative and qualitative methods in data collection to provide a comprehensive overview. The purpose of the study is twofold: first, to provide a diagnostic analysis of existing traffic management strategies, and second, to develop practical, context-specific interventions to improve traffic conditions in Caloocan City.

The relationships between the variables of this study can be viewed through the lens of hierarchy and influence. The demographic characteristics of the respondents serve as a foundational context that may shape their perceptions of the effectiveness of traffic management strategies. For instance, younger respondents may prioritize different aspects of traffic safety compared to older individuals, and those with longer service may have more nuanced perspectives on the effectiveness of existing structures and policies. The effectiveness of traffic management strategies (dependent variable) is directly influenced by the assessing factors (independent variables) such as road safety devices, human resources, budget allocation, and the adequacy of facilities, which serve as endpoints of assessment. Moreover, the identified challenges in traffic management act as intervening variables, influencing how effectively these strategies are perceived and, consequently, their success in practice. An understanding of these relationships will be essential for accurately interpreting findings and ensuring that the proposed solutions are well-informed and likely to be effective in addressing the traffic issues faced by Caloocan City.

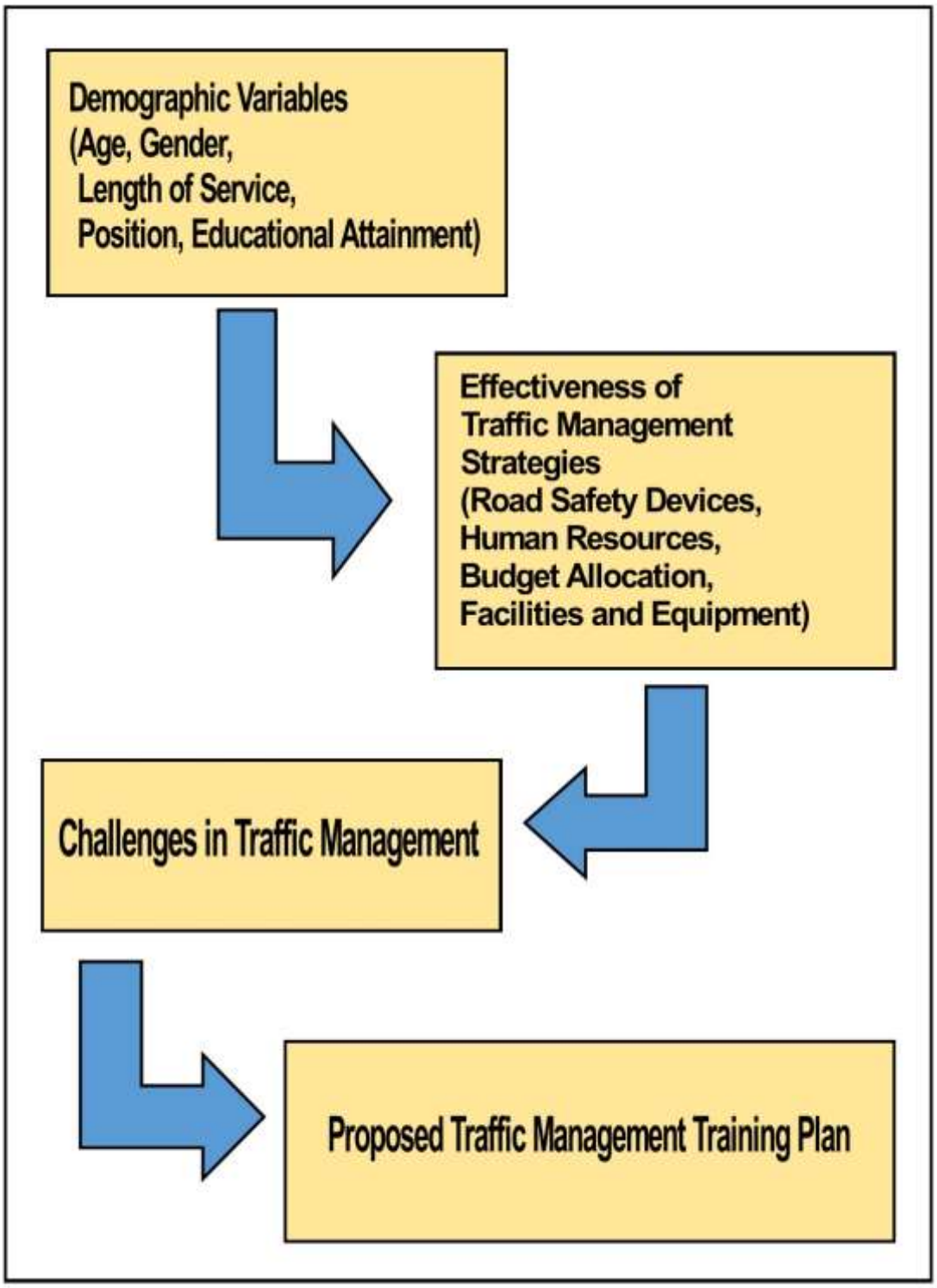

Figure 3. Conceptual Framework

Definition of Terms

These significant terms are essential to ensure a common understanding of the research study's key concept and terminology.

Traffic Management (TM) - The process of efficiently managing road traffic to enhance safety, mobility, and accessibility.

Traffic Congestion - A condition on road networks that occurs when traffic demand exceeds capacity, leading to slower speeds and increased travel times.
Training Plan - A structured approach to educate and develop skills in individuals, particularly focused on reinforcing knowledge and practices pertinent to traffic management.
Enforcement - The act of ensuring compliance with traffic laws and regulations, executed by traffic enforcement officials.
JODA – Jeepney Operators and Drivers Association. It is a group of jeepney drivers and operators that advocates for the rights of public utility vehicle (PUV) drivers and operators.
TODA – Tricycle Operators and Drivers Association. It is a recognized organization of tricycle operators and drivers in a local government unit.
Road Safety – refers to the methods and measures used to prevent road users from being killed or seriously injured.

Chapter 3
RESEARCH DESIGN AND METHODOLGY

This chapter represents the research method, respondents of the study, data gathering procedures, data gathering procedure and the statistical treatment of data.

Research Design

This research used descriptive-survey research since it is the most appropriate research design for this study in terms of facilitating and analyzing data, as well as collecting and describing demographic information or profiles of respondents. This method was used to determine the characteristics, preferences, or beliefs of the respondents. According to McCombes, S. (2020), descriptive research aims to characterize a population, circumstance, or phenomenon in a methodical and precise manner. It can answer queries like "what," "where," "when," and "how," but not "why". It can explore one or more variables using a number of research approaches. Survey research allows you to collect enormous amounts of data that can then be analyzed for trends, frequencies, and averages. This design gives systematic information about the phenomena. The descriptive survey technique of research tries to characterize the current status of a specified variable.

The survey was conducted through google form and printed forms which contains relevant questions regarding the study. The main objective of this research was to know what are the issues encountered by the City of Caloocan's traffic management strategies.

Population and Sample of the Study

The population for this study consisted of key stakeholders involved in traffic management in Caloocan City. These stakeholders include traffic enforcers, traffic management officers, city officials, and residents who frequently use the city's roadways. Given the diverse nature of this population, the selection of respondents was a critical aspect of the research design.

The respondents of this study were the randomly selected fifty (50) commuters. fifty (50) members of transport group such as TODA and JODA and one hundred-fifty traffic management personnel. **Slovin's formula** is used to calculate the minimum sample sized needed to estimate a statistic based on an acceptable margin of error.

Slovin's formula is calculated as:

$$n = N / (1 + Ne^2)$$

where:

n - Sample size needed
N – Population Size
E – Acceptable margin of error

Sampling Technique

Slovin's formula was used by the researchers. According to Ellen S. (2020), it is recommended to use a formula to account for confidence levels and margins of error when obtaining a sample from a population. Slovin's formula allows a researcher to sample a population with great accuracy. It demonstrates to the researcher the importance of a large sample size in ensuring acceptable accuracy of the results.

Additionally, the stratified sampling technique was applied in this study. As mentioned by Hayes, A. (2021), stratified random sampling is a sampling method in which a population is divided into smaller sub-groups called strata. The strata was constructed based on the shared features or attributes of the members like commuters and residents, traffic management personnel and transport drivers and operators are grouped. It enabled researchers to generate a sample population that most closely represents the entire population for this study. The sample size each section is determined using proportional allocation. According to Pondent, C. (2017), proportional allocation is one approach of selecting samples from several strata.

Research Instrument

This study employed a mixed-methods approach, utilizing both quantitative and qualitative instruments to gather comprehensive data on the traffic management strategies of Caloocan City. The researchers made structured surveys through google forms and printed form were administered to various stakeholders, including traffic enforcers, city officials, and commuters. The survey consisted of closed-ended questions that was quantitatively analyzed to identify trends and patterns in traffic management practices and public perceptions.

In-depth interviews were conducted with key informants such as traffic management experts, city planners, and selected traffic enforcers. These interviews provided deeper insights into the effectiveness of current strategies and potential areas for improvement. Observational checklists were used to systematically record and evaluate traffic conditions at various critical locations within Caloocan City. This helped in assessing the real-time implementation and effectiveness of traffic management strategies. On the surveys, it included the demographic information of the respondents according the age, gender, length of service, position and highest educational attainment. It also included the multiple-choice questions on the frequency and effectiveness of traffic management practices in terms of road safety, human resource, budget allocation and, facilities and equipment. Each question was scored on a Likert scale (1-4), with 1 being "Not Effective" and 4 being "Very Effective".

Likert scale questions is used to gauge public perceptions on the challenges they encountered with current traffic management strategies. Each question will be scored (1-4), with 1 being "Not Serious" and 4 being "Very Serious." The responses will be coded and analyzed for themes and patterns.

The surveys administered online through google flatform and in person. The survey took approximately 15-20 minutes to complete. The surveys were administered by the research team, comprising research assistants who ensured that participants understand the questions and provide clear instructions. The interviews were conducted by the researchers, both of whom were trained in qualitative research methods. Lastly, the observations were conducted by the research team, with each member assigned to specific locations to ensure comprehensive coverage.

Data Gathering Procedure

To attain the data needed for the research study, a systematic procedure in gathering data was conducted. First, the researchers asked a permission through a letter of approval to the Department and Program Coordinator, and the Public Safety and Traffic Management Department authorizing to conduct the survey. Second, was the preparation of questionnaires in fulfilling this study. The said questionnaire was validated by the professors of the Bachelor in Public Administration at the University of Caloocan City. The respondents of this study were the commuters and residents, traffic management personnel of the City Government of Caloocan and stakeholders such as transport group. The questionnaire aimed to know the problems encountered by the respondents in traffic management and situations in the City of Caloocan and the possible answer to the problem. Copy of the questions were distributed to the respondents electronically through google form and printed forms for those in face-to-face arrangement, and it was approved by the validators without necessary revision. After retrieving the submitted forms, the researchers extracted the results of the conducted survey to organized, analyzed, and interpreted the data which helped to make conclusion and construct an appropriate output for this study.

Statistical Treatment of Data

The statistical tools that were used in this study are as follows: Frequency Count and Percentage. These were utilized to determine the demographic profile of the responders in terms of age, gender, length of service, position, and highest educational attainment for those who have already experienced traffic in the City of Caloocan. The frequency distribution is a table that shows how often different outcomes occur in a sample. The frequency or count of the values inside a certain collection of intervals is contained in each table entry. The table presents the significance distribution in the sample in this way:

$$\% = \frac{fx100}{N}$$

%- Percentage

f - Frequency

N- Total number of respondents

Weighted Mean. This was used to determine the issues encountered by the respondents in terms of traffic light synchronization, road closure policies, public transportation initiatives. As well as the study's recommendations and suggestions. Instead of each data point contributing equally to the final mean, the weighted mean is an average in which some data points contribute more "weight" than others.

Formula:

$$\bar{x} = \frac{\sum fx}{N}$$

$\bar{x} = Mean$

$\sum = Summation$

fx- Frequency of the respondents in each scale section value

N- Total number of respondents

On the other hand, the adopted Likert scale was used in the study. Likert scale questions to gauge public perceptions of traffic management strategies in terms of rode safety, budget allocation, human resources and safety, and satisfaction with current traffic management strategies. Each question was scored on a Likert scale (1-4), with 1 being "Not Effective" and 4 being "Very Effective". The responses were qualitatively analyzed for common themes and actionable insights.

Chapter 4
PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

This chapter presents, analyzes, and interprets the data collected from a diverse group of stakeholders in Caloocan City's traffic management system. This group includes selected traffic enforcers, traffic officers, administrative support staff within the Public Safety and Traffic Management Department, and crucially, the road users themselves such as drivers and passengers who navigate the city's streets daily. The findings presented here are derived from a researcher-designed questionnaire administered to 100 respondents, utilizing both printed survey forms and a digital Google Form to maximize accessibility and response rate.

The chapter is structured into three distinct sections. The first section details the demographic profile of the respondents, providing a comprehensive overview of the sample group. This includes key characteristics such as age, sex, length of service, position or designation, and highest level of educational attainment. This demographic information provides valuable context for understanding the perspectives and experiences shared in subsequent sections.

The second section focuses on the respondents' assessment of the effectiveness of the traffic management strategies in human resources, budget allocation, and the facilities and equipment used in traffic management. By examining these four critical areas, the study gains a holistic understanding of the strengths and weaknesses of the current traffic management system.

The third section delves into the challenges encountered by respondents in implementing and experiencing traffic management strategies within Caloocan City. This section provides valuable insights into the practical hurdles faced by both those responsible for managing traffic flow and those who are subject to those management efforts.

Before distributing the questionnaires, the researchers ensured that all participants were fully informed about the significance and purpose of the study. A clear explanation was provided regarding the research objectives and the intended use of the collected data. Furthermore, respondents were explicitly guaranteed that all information they provided would be treated with the utmost confidentiality, ensuring their anonymity and encouraging honest and open responses.

Ultimately, this study aimed to identify the key issues and challenges encountered by road users in Caloocan City. The insights obtained from this research will be instrumental in informing the development of a targeted and effective traffic management training plan, designed to address identified weaknesses, enhance existing strengths, and ultimately improve the safety and efficiency of traffic flow for all stakeholders in Caloocan City. The findings presented in this chapter provide a crucial foundation for actionable recommendations and future improvements in the city's traffic

1. Demographic Profile of the Respondents

Table 1. Demographic Profile of the Respondents in Terms of Age

Age	Frequency	Percentage
20 to 24 years old	6	6 %
25 to 29 years old	5	5 %

30 to 34 years old	15	15 %
35 to 39 years old	13	13 %
40 years old and above	61	61 %
Total	**100**	**100 %**

The presented information on the table was the demographic profile of the respondents in terms of age. It reveals that six (6) respondents belong to an age ranging from 20 to 24 years old with 6% followed by five (5) respondents with an age ranging from 25 to 29 years old with 5%, next is fifteen (15) respondents with an age ranging from 30 to 34 years old with a percentage of 15%, and then thirteen (13) respondents belong to 35 to 39 years old with 13% and lastly, sixty-one (61) of the respondents are on age 40 years old and above with a percentage of 61%.

Table 2. Demographic Profile of the Respondents in Terms of Sex

Sex	**Frequency**	**Percentage**
Male	75	75 %
Female	25	25 %
Total	**100**	**100 %**

The table 2 refers to the demographic profile of the respondents in terms of sex shows that most of the respondents are male with frequency of seventy-five equivalent to 75 percent and only twenty-five (25) female respondents equivalent to 25 percent.

Table 3. Demographic Profile of the Respondents in Terms of Length of Service

Length of Service	**Frequency**	**Percentage**
4 years and below	17	17 %
5 to 9 years	30	30 %
10 to 14 years	30	30 %
15 to 19 years	7	7 %
20 years and above	16	16 %
Total	**100**	**100 %**

The presented information on the table 3 was the demographic profile of the respondents in terms of length of service. It reveals that there are seventeen (17) respondents who belong to length of service of 4 years and below with 17%, followed by thirty (30) respondents belong to length of service from 25 to 29 years with 30%, next is thirty (30) respondents with the length of service ranging from 10 to 14 years with also a percentage of 30%, and then seven (7) respondents belong to 15 to 19 years of service with 7% and lastly, there are sixteen (16) respondents who have a length of service of 20 years and above with a percentage of 16%.

Table 4. Demographic Profile of the Respondents in Terms of Position or Designation

Position / Designation	**Frequency**	**Percentage**
Traffic Officer	17	17 %
Traffic Aide	30	30 %
Administrative Support	30	30 %

Passenger (Stakeholder)	7	7 %
Driver / Operator (Stakeholder)	16	16 %
Total	**100**	**100 %**

The table 4 shows the demographic profile of the respondents in terms of position and designation. There are seventeen (17) traffic officers equivalent to 17% of respondents, thirty (30) traffic aides equivalent to 30% of respondents, thirty (30) administrative support staffs equivalent to 30% of respondents, twenty-three (23) stakeholders detailed as seven (7) passengers equivalent to 7% of respondents and sixteen (16) drivers / operators of transport including jeepney and tricycles equivalent to 16% of respondents.

2. Assessment on the effectiveness of traffic management strategies

Table 5. Assessment on the effectiveness of traffic management strategies in terms of road safety.

Indicators	**Weighted Mean**	**Verbal Interpretation**	**Rank**
1. Traffic lights are visible and functioning	**3.45**	**VE**	**1**
2. Enforcers are actively directing the traffic	**3.40**	**VE**	**2**
3. Traffic signages are visible for pedestrian and motorist.	**3.28**	**VE**	**3**
4. The physical road conditions are well- maintained.	**2.86**	**E**	**4**
5. The motorists are obeying the traffic rules.	**2.78**	**E**	**5**

OVERALL WEIGHTED MEAN 3.15 E

Legend: VE – Very Effective (3.25-4.00)
E – Effective (2.50-3.24)
SE – Slightly Effective (1.75-2.49)
NE – Not Effective (1.00-1.74)

Table 5 shows the assessment of the respondents on the effectives of traffic management strategies in terms of road safety with five (5) indicators. It reveals that out of 100 respondents assess that the "Traffic lights are visible and functioning" resulted to have the highest weighted mean of 3.45 with a verbal interpretation as "Very Effective" and followed by the second highest weighted mean of 3.40 with a verbal interpretation as "Very Effective" as result of "Enforcers are actively directing the traffic." The indicator "Traffic signages are visible for pedestrian and motorist have the responses resulted to have the weighted mean of 3.28 with a verbal interpretation of "Very Effective". The fourth in rank is the indicator "The physical road conditions are well-maintained" have the responses resulted to the weighted mean of 2.86 with the verbal interpretation as "Effective". Lastly, the indicator "The motorists are obeying the traffic rules" resulted to have the weighted mean of 2.78 with the verbal interpretation as "Effective. Overall, the weighted mean among 100 respondents on the effectiveness of traffic management in terms of road safety resulted the weighted mean of 3.15 with the verbal interpretation as "Effective".

Table 6. Assessment on the effectiveness of traffic management strategies in terms of human resource.

Indicators	Weighted Mean	Verbal Interpretation	Rank
1. The traffic enforcers are well-trained.	**3.23**	**E**	**1**
2. Sufficient number of traffic enforcers are deployed per sectors.	**3.19**	**E**	**2**
3. Response time for traffic personnel to reach accident sites or manage heavy traffic flow.	**3.12**	**E**	**3**
4. Traffic management personnel are proficient in operating digital tools.	**2.80**	**E**	**5**
5. Employee turnover is properly practiced among traffic management staff.	**3.01**	**E**	**4**
OVERALL WEIGHTED MEAN	**3.07**	**E**	

Legend: VE – Very Effective (3.25-4.00)
E – Effective (2.50-3.24)
SE – Slightly Effective (1.75-2.49)
NE – Not Effective (1.00-1.74)

Table 6 shows the assessment of the respondents on the effectives of traffic management strategies in terms of human resource with five (5) indicators. It reveals that out of 100 respondents assess that the "The traffic enforcers are well-trained" resulted to have the highest weighted mean of 3.23 with a verbal interpretation as "Effective" and followed by the second highest weighted mean of 3.19 with a verbal interpretation as "Very Effective" as result of "Sufficient number of traffic enforcers are deployed per sectors". The indicator "Response time for traffic personnel to reach accident sites or manage heavy traffic flow" have the responses resulted to have the weighted mean of 3.12 with a verbal interpretation of "Effective". The fourth in rank is the indicator "Employee turnover is properly practiced among traffic management staff" have the responses resulted to the weighted mean of 3.01 with the verbal interpretation as "Effective". Lastly, the indicator "Traffic management personnel are proficient in operating digital tools" resulted to have the weighted mean of 2.80 with the verbal interpretation as "Effective. Overall, the weighted mean among 100 respondents on the effectiveness of traffic management in terms of human resource resulted the weighted mean of 3.07 with the verbal interpretation as "Effective".

Table 7. Assessment on the effectiveness of traffic management strategies in terms of budget allocation.

Indicators	Weighted Mean	Verbal Interpretation	Rank
1. City budget is allocated to traffic management (including infrastructure, enforcement, and safety).	**3.22**	**E**	**1**
2. Sufficient budget is allocated to sustainable transport initiatives such as promoting public transit, bicycle lanes, or pedestrian walkways.	**2.98**	**E**	**4**

3. Sufficient budget is allocated for the implementation and maintenance of automated traffic systems.	**2.96**	**E**	**5**
4. Sufficient funds are allocated for the salaries, training, uniforms, and equipment for traffic enforcement personnel.	**3.05**	**E**	**2**
5. Sufficient budget is allocated to public information campaigns that promote road safety, traffic regulations, and responsible driving.	**3.04**	**E**	**3**
OVERALL WEIGHTED MEAN	**3.05**	**E**	

Legend: VE – Very Effective (3.25-4.00)
E – Effective (2.50-3.24)
SE – Slightly Effective (1.75-2.49)
NE – Not Effective (1.00-1.74)

Table 7 shows the assessment of the respondents on the effectives of traffic management strategies in terms of budget allocation with five (5) indicators. It reveals that out of 100 respondents assess that the "City budget is allocated to traffic management (including infrastructure, enforcement, and safety)" resulted to have the highest weighted mean of 3.22 with a verbal interpretation as "Effective" and followed by the second highest weighted mean of 3.05 with a verbal interpretation as "Very Effective" as result of "Sufficient funds are allocated for the salaries, training, uniforms, and equipment for traffic enforcement personnel". The indicator "Sufficient budget is allocated to public information campaigns that promote road safety, traffic regulations, and responsible driving" has the responses resulted to have the weighted mean of 3.04 with a verbal interpretation of "Effective". The fourth in rank is the indicator "Sufficient budget is allocated to sustainable transport initiatives such as promoting public transit, bicycle lanes, or pedestrian walkways" which has the responses resulted to the weighted mean of 2.98 with the verbal interpretation as "Effective". Lastly, the indicator "Sufficient budget is allocated for the implementation and maintenance of automated traffic systems" resulted to have the weighted mean of 2.96 with the verbal interpretation as "Effective". Overall, the weighted mean among 100 respondents on the effectiveness of traffic management in terms of budget allocation resulted the weighted mean of 3.05 with the verbal interpretation as "Effective".

Table 8. Assessment on the effectiveness of traffic management strategies in terms of facilities and equipment.

Indicators	Weighted Mean	Verbal Interpretation	Rank
1. Roads are in good or excellent condition, based on regular maintenance and repair schedules.	**2.88**	**E**	**4**
2. Traffic enforcers equipped with necessary tools (e.g., radar guns, breathalyzers, body cameras) to perform their duties effectively.	**2.84**	**E**	**5**
3. CCTV cameras are deployed along major roads, intersections, and high-traffic areas.	**3.10**	**E**	**2**

4. Service vehicles (e.g., tow trucks, patrol cars, incident response vehicles) are available for traffic enforcement and emergency response.	**3.16**	**E**	**1**
5. Efficient operation of traffic management centers or control rooms that monitor and manage traffic in real-time.	**3.09**	**E**	**3**
OVERALL WEIGHTED MEAN	**3.01**	**E**	

Legend: VE – Very Effective (3.25-4.00)
E – Effective (2.50-3.24)
SE – Slightly Effective (1.75-2.49)
NE – Not Effective (1.00-1.74)

Table 8 shows the assessment of the respondents on the effectives of traffic management strategies in terms of facilities and equipment with five (5) indicators. It reveals that out of 100 respondents assess that the "Service vehicles (e.g., tow trucks, patrol cars, incident response vehicles) are available for traffic enforcement and emergency response" resulted to have the highest weighted mean of 3.16 with a verbal interpretation as "Effective" and followed by the second highest weighted mean of 3.10 with a verbal interpretation as "Effective" as result of "CCTV cameras are deployed along major roads, intersections, and high-traffic areas." The indicator "Efficient operation of traffic management centers or control rooms that monitor and manage traffic in real-time" has the responses resulted to have the weighted mean of 3.09 with a verbal interpretation of "Effective". The fourth in rank is the indicator "Roads are in good or excellent condition, based on regular maintenance and repair schedules" has the responses resulted to the weighted mean of 2.88 with the verbal interpretation as "Effective". Lastly, the indicator "Traffic enforcers equipped with necessary tools (e.g., radar guns, breathalyzers, body cameras) to perform their duties effectively" resulted to have the weighted mean of 2.84 with the verbal interpretation as "Effective". Overall, the weighted mean among 100 respondents on the effectiveness of traffic management in terms of facilities and equipment resulted the weighted mean of 3.01 with the verbal interpretation as "Effective".

3. Rating on the challenges encountered by the respondents on the traffic management strategies in Caloocan City

Table 9

Indicators	Weighted Mean	Verbal Interpretation	Rank
1. Undisciplined drivers that compromise safety and disobedience to the traffic rules.	**3.32**	**VS**	**2**
2. Undisciplined passengers and pedestrians.	**3.21**	**S**	**4**
3. Lack of presence of traffic enforcers.	**2.84**	**S**	**10**
4. Population growth resulting to increase of vehicle ownership.	**3.45**	**VS**	**1**
5. Rapid urbanization due to increase of establishments.	**3.25**	**VS**	**3**

6. Lack of enforcement of traffic rules due to negligence of enforcers.	**2.99**	**S**	**8**
7. Corruption as drivers evade penalties through bribery.	**2.88**	**S**	**9**
8. Rampant use of sidewalks for parking and vending.	**3.16**	**S**	**7**
9. Dilapidated and unrepaired roads.	**3.17**	**S**	**6**
10. Inadequate public transport system.	**3.19**	**S**	**5**
OVERALL WEIGHTED MEAN	**3.15**	**S**	

Legend: VS – Very Serious (3.25-4.00)
S – Serious (2.50-3.24)
SS – Slightly Serious (1.75-2.49)
NS – Not Serious (1.00-1.74)

Table 9 presents a detailed analysis of the challenges encountered by respondents regarding traffic management strategies in Caloocan City, based on a survey of 100 individuals. The findings reveal a consensus among respondents about the severity of various factors contributing to traffic problems.

The most significant challenge, as perceived by the respondents, is "Population growth resulting in an increase in vehicle ownership," which received the highest weighted mean of 3.45. This indicates that respondents consider this challenge to be "Very Serious." Following closely behind is "Undisciplined drivers who compromise safety and disobey traffic rules," with a weighted mean of 3.32, also interpreted as "Very Serious". This highlights a significant concern regarding driver behavior and its impact on traffic conditions. "Rapid urbanization due to the increase in establishments" was identified as the third most pressing challenge, with a weighted mean of 3.25, also categorized as "Very Serious". This suggests that the rapid pace of development in Caloocan City is exacerbating traffic issues.

Other indicators were rated as "Serious" challenges following the order from rank 4 to 10. These include, "Undisciplined passengers and pedestrians" with weighted mean of 3.21, "Inadequate public transport system" with weighted mean of 3.19, "Dilapidated and unrepaired roads" with weighted mean of 3.17, "Rampant use of sidewalks for parking and vending" with weighted mean of 3.16, "Lack of enforcement of traffic rules due to negligence of enforcers" with weighted mean of 2.99, "Corruption as drivers evade penalties through bribery" with weighted mean of 2.88, and "Lack of presence of traffic enforcers" with weighted mean of 2.84.

These results indicate a multi-faceted problem, with issues ranging from infrastructure and public transportation to driver and pedestrian behavior, as well as enforcement and potential corruption. Together, these contribute to a complex and challenging traffic environment in Caloocan City.

Overall, the cumulative weighted mean across all challenges was 3.15, indicating that, on average, respondents perceive the challenges encountered in traffic management strategies as "Serious." This reinforces the need for comprehensive and effective strategies to address the identified issues and improve traffic management through a proposed training plan in Caloocan City. The table provides valuable insight into the specific areas that require attention and targeted interventions.

PROPOSED TRAINING PLAN

1. **Title:** "TRAINING AND SEMINAR ON ROAD SAFETY AND EQUIPPING OF TRAFFIC MANAGEMENT PERSONNEL OF CALOOCAN CITY"
2. **Time Frame:** First Quarter of 2026
3. **Venue:** Somewhere in Region III

4. **Responsible Group :** PSTMD Personnel Resource Speakers from National Government Agency (LTO, MMDA and etc)
5. **Rationale:** Ordinance No. 0391 S. 2005, The Traffic Management Code and other existing law are essential to provide for an orderly flow and ease of movement of the residents, commuters, motorists, goods and services, trade and industry in the City which is a basic requirement to sustain its full development, not only economically, but also as a residential haven. It declares the city's policy to allocate road space efficiently and resolve traffic issues through consultation.
6. **Project Description:** The Public Safety and Traffic Management Department will hold a **"TRAINING AND SEMINAR ON ROAD SAFETY AND EQUIPPING OF TRAFFIC MANAGEMENT PERSONNEL OF CALOOCAN CITY"** to create a stronger team that will also enable our personnel to develop their mindsets, behaviors and skills in enforcing traffic rules and regulations.
7. **Goal and objectives:**

- To train Traffic Management Personnel with Efficiency on modern devices and equipment.
- To orderly Implement Traffic rules
- To properly use the OUVR by deputized personnel
- To be well prepared on any circumstances they may encounter

8. **Target Beneficiaries:**

- PSTMD Traffic Management and Deputized Personnel
- Commuters
- Persons using public roads and sidewalks.

9. **Risk Factors:**

- Unpredictable weather condition
- Technology and electrical failure
- Lack of information about the Single Ticketing System.

10. **Strategies of Implementation**

- Activity Plan (please refer to the attached program)
- Resource Plan

ACTIVITY	METHODOLOGY	TIME FRAME	BUDGETARY RESOURCES	PERSONS INLVOVED	EXPECTED OUTCOME
Capability Building	**"TRAINING AND SEMINAR ON ROAD SAFETY FOR TRAFFIC MANAGEMENT PERSONNEL OF CALOOCAN CITY"**	**1st Quarter of 2026**	Caloocan City Government	Traffic Enforcers, officers and other personnel practicing TM.	• Well-equipped traffic enforcers with efficiency in using modern ticketing device. • Orderly implementation of traffic rules.

					• Properly use of citation ticket. • Preparedness on any circumstances they may encounter

11. Resource Requirements

ITEM	QTY.	No. of Days	BUDGET RESOURCE
Lease of Venue Inclusive of meals and accommodation Breakfast, AM Snacks, Lunch, PM Snacks and Dinner -Function room fully air condition, Wi-Fi availability. -Sound system, LCD projector, Microphone, whiteboard -Free-Flowing Coffee and Juice -Table and chairs set-up -Complementary Welcome Banner	156	**4 DAYS**	Caloocan City Government
Supplies (Training kit- 1 filler notebook, 1 ballpen 1 short brown envelope)	150		Caloocan City Government
Paper Parchment paper 8.5 X 11 90 gsm 10s/pack	10		Caloocan City Government
Certificate with frame glass 8.5" x 11"	2		Caloocan City Government
Polo shirt (GREEN colored) with print logo at front-PSTMD at back, gsm cotton, Small-5 Medium-20, Large-60, XL-50, XXL -10, 3XL-5	150		Caloocan City Government
Honorarium - Resource Speaker	4	4 days	Caloocan City Government

12. Approving Authority

Proponents:
Recommending Approval:
Daniel Carlo T. Amante
PSTMD Office
Jervir A. Balino
City Administrator's Office
Honey C. Dulay
Aileen S. Osinar
Aloha A. Pacheco
Romeo A. Tuyay Jr.

Approved by:
Hon. DALE GONZALO R. MALAPITAN
City Mayor

Chapter 5
SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents the summary of the findings, the constructed conclusions, and the recommendations that have been developed for the improvement of the implementation of the research study.

Summary of Findings

Based on the data gathered in relation to the statement of the problem, the following are the significant findings:

1. The study revealed the demographic information about the age of respondents. It shows that there are six respondents aged 20 to 24, making up 6% of the total. Five respondents are aged 25 to 29, accounting for 5%. There are fifteen respondents in the 30 to 34 age range, which is 15%. Thirteen respondents are aged 35 to 39, representing 13%. Finally, the majority, sixty-one respondents, are 40 years old and above, which is 61%. The respondents' demographic profile shows that 75% are male and 25% are female. In terms of length of service, 17% have 4 years or less, 30% have 25 to 29 years, another 30% have 10 to 14 years, 7% have 15 to 19 years, and 16% have 20 years or more. Regarding positions, 17% are traffic officers, 30% are traffic aides, another 30% are administrative support staff, 7% are passengers, and 16% are drivers/operators of transport like jeepneys and tricycles.
2. The assessment of respondents on the effectiveness of traffic management strategies regarding road safety revealed that 100 participants rated the visibility and functionality of traffic lights the highest with a mean score of 3. 45, marking it as “Very Effective”. The active direction of traffic by enforcers followed closely with a mean of 3. 40, also rated as “Very Effective”. The visibility of traffic signage for pedestrians and motorists received a score of 3. 28, interpreted as “Very Effective”. The condition of physical roads ranked fourth with a mean of 2. 86, categorized as “Effective”. Lastly, the adherence of motorists to traffic rules scored 2. 78, also deemed “Effective”. Overall, the average effectiveness of traffic management in terms of road safety resulted in a mean score of 3. 15, interpreted as “Effective.” In assessing the effectiveness of traffic management strategies related to human resources, the highest scoring indicator was that traffic enforcers are well-trained, with a mean of 3. 23 labeled as “Effective”. The deployment of a sufficient number of traffic enforcers per sector scored 3. 19, rated as “Very Effective”. The response time of traffic personnel to incidents received a score of 3. 12, interpreted as “Effective”. Employee turnover practices among traffic staff ranked next with a mean of 3. 01, also “Effective”. Lastly, proficiency in using digital tools by traffic personnel scored 2. 80, also labeled “Effective”. The overall effectiveness score for human resources in traffic management was 3. 07, marked as “Effective”. Regarding budget allocation, respondents assessed that the city budget for traffic management rated highest with a score of 3. 22, seen as “Effective”. Funding for salaries and training received a mean of 3. 05, marked as “Very Effective”. A budget for public information campaigns scored 3. 04, categorized as “Effective”. Funding for sustainable transport initiatives was ranked next with a score of 2. 98, also “Effective”. Lastly, budget allocation for automated traffic systems scored 2. 96, labeled as “Effective”. The overall score for budget effectiveness in traffic management was 3. 05, deemed “Effective. ”
In evaluating facilities and equipment, the availability of service vehicles ranked highest with a mean

of 3. 16, marked as “Effective”. The deployment of CCTV cameras received a score of 3. 10, also “Effective”. The efficient operation of traffic management centers scored 3. 09, interpreted as “Effective”. The condition of roads based on maintenance ranked next with a score of 2. 88, marked as “Effective”. Finally, the equipping of traffic enforcers with necessary tools scored 2. 84, also labeled “Effective”. The overall effectiveness for facilities and equipment in traffic management was scored at 3. 01, categorized as “Effective”.

3. A survey of 100 people in Caloocan City reveals several serious challenges in traffic management. The respondents believe that the main issue is "Population growth resulting in an increase in vehicle ownership," which they rated as very serious with a weighted mean of 3. 45. The second major problem is "Undisciplined drivers who compromise safety," rated at 3. 32, and the third is "Rapid urbanization due to the increase in establishments," with a mean of 3. 25. Other serious challenges include "Undisciplined passengers and pedestrians," "Inadequate public transport," "Poor Road conditions," and "Lack of traffic rule enforcement. " With an average weighted mean of 3. 15, the feedback shows that traffic issues in Caloocan are serious and require effective solutions, suggesting the need for a comprehensive training plan.

Conclusions

Based on the findings of the study, the following conclusions are made:

1. The study indicates a diverse demographic profile among respondents, with a significant portion (61%) aged 40 and above. The majority (75%) are male, and respondents' service length varies widely: 17% have 4 years or less, while 30% each have 25 to 29 years and 10 to 14 years. Positions held range from traffic officers to drivers/operators, reflecting varied roles in transportation.
2. The researchers concluded that the evaluation of traffic management strategies highlights a generally positive perception among respondents regarding road safety and the effectiveness of various elements. Traffic lights and active direction by enforcers received high ratings, with mean scores of 3.45 and 3.40, respectively, both categorized as "Very Effective." Visibility of signage scored 3.28, while road conditions and adherence to traffic rules scored lower yet were still deemed "Effective." Regarding human resources, well-trained enforcers garnered the highest mean of 3.23, contributing to an overall effectiveness score of 3.07. Budget allocation also received favorable ratings, notably for city budget and salary training, with a mean effectiveness score reported at 3.05. In facilities and equipment, the availability of service vehicles ranked highest with a score of 3.16, leading to an overall score of 3.01. This assessment underscores the need for continued investment and improvement in traffic management to enhance safety and efficiency within the community.
3. As concluded by the researchers, the analysis of traffic management challenges in Caloocan City, based on a survey of 100 respondents, underscores a consensus on the seriousness of several contributing factors. The most notable issue is the increase in vehicle ownership due to population growth, rated as "Very Serious" with a weighted mean of 3.45. This concern is closely followed by the behavior of undisciplined drivers and the impact of rapid urbanization. Other significant challenges include undisciplined pedestrians, an inadequate public transport system, and infrastructure issues such as poorly maintained roads. The overall weighted mean of 3.15 indicates that respondents believe traffic management strategies require serious attention. As such, there is an urgent need for targeted interventions and comprehensive training plan to mitigate these issues and enhance traffic management in Caloocan City.

Recommendations

Based on these findings, the following recommendations are crucial for improving traffic management in Caloocan City:

1. **Invest in Public Transportation**. The study highlights the inadequacy of the public transport system as a significant challenge. Investing in a modern, efficient, and accessible public transport network will encourage commuters to opt for public transport over private vehicles, thereby alleviating traffic congestion. This includes increasing the frequency and reliability of buses, jeepneys, and potentially exploring the feasibility of a light rail or metro system.
2. **Enforce Traffic Laws and Promote Driver Education.** The issue of undisciplined drivers is a major concern. Strengthening law enforcement through consistent and visible patrols, implementing stricter penalties for traffic violations, and utilizing technology like CCTV cameras to monitor traffic behavior are crucial. Furthermore, promoting comprehensive driver education programs that emphasize responsible driving habits and traffic regulations is essential for cultivating a culture of road safety.
3. **Prioritize Pedestrian Safety.** Undisciplined pedestrians contribute significantly to traffic woes. Implementing dedicated pedestrian lanes, installing more pedestrian overpasses and underpasses, and enforcing strict penalties for jaywalking are vital. Public awareness campaigns that educate pedestrians about safe road crossing practices are also necessary.
4. **Upgrade and Maintain Road Infrastructure.** The study identifies poorly maintained roads as a significant challenge. Regular road maintenance and upgrades are crucial for ensuring smooth traffic flow and preventing accidents. This includes repairing potholes, resurfacing damaged roads, and improving road markings and signage.
5. **Strategic Urban Planning and Zoning**. Rapid urbanization contributes to traffic congestion. Implementing strategic urban planning and zoning policies that promote mixed-use development, reduce the need for long commutes, and prioritize public transportation infrastructure are crucial for long-term traffic management.
6. **Empower and Equip Traffic Enforcers.** The positive perception of well-trained enforcers underscores the importance of investing in their development. Continuous training programs that focus on traffic management techniques, conflict resolution, and effective communication skills are essential. Providing them with adequate resources and equipment, such as modern communication devices and strategically placed traffic control devices, will enhance their effectiveness.
7. **Data-Driven Decision Making.** Utilizing real-time traffic data collection and analysis tools can provide valuable insights into traffic patterns, congestion hotspots, and the effectiveness of various interventions. This data can inform decision-making regarding traffic signal optimization, deployment of traffic enforcers, and infrastructure development.
8. **Community Engagement and Public Awareness.** Engaging the community in traffic management initiatives is crucial for fostering a sense of shared responsibility. Conducting public awareness campaigns that educate citizens about traffic regulations, promote responsible road behavior, and encourage the use of public transportation can significantly contribute to improving traffic flow and safety.

Bibliography

13. https://rilhub.org/2020/07/16/fact-sheet-caloocan-city/

14. Department of Public Works and Highways (DPWH). (2018). Traffic Safety and Management in the Philippines. Manila: DPWH.
15. University of the Philippines (UP) Diliman. (2019). Maintenance and Modernization of Traffic Light Systems in Metro Manila. Quezon City: UP Diliman.
16. Metro Manila Development Authority (MMDA). (2021). Impact of Smart Mobility Solutions on Traffic Management. Mandaluyong: MMDA.
17. Philippine Road Safety Program (PRSP). (2017). Standardization of Traffic Signs and Markings. Manila: PRSP.
18. World Health Organization (WHO). (2018). Global Status Report on Road Safety 2018. Geneva: WHO.
19. De La Salle University (DLSU). (2019). Evaluating Pedestrian Crossings and Walkways in Urban Areas. Manila: DLSU.
20. Asian Development Bank (ADB). (2020). AI and Machine Learning in Traffic Accident Prevention. Mandaluyong: ADB.
21. Institute for Development and Econometric Analysis (IDEA). (2021). Financial and Technical Challenges in Implementing Road Safety Devices. Quezon City: IDEA.
22. Ateneo de Manila University (ADMU). (2020). Public Awareness and Education in Road Safety. Quezon City: ADMU.
23. University of Santo Tomas (UST). (2019). Impact of Traffic Enforcement on Road Safety. Manila: UST.
24. National Center for Transportation Studies (NCTS). (2018). Public-Private Partnerships in Road Safety and Traffic Management. Diliman: NCTS.
25. Brown, A. (2017). Continuous Learning in Traffic Management: A Critical Review. Journal of Urban Planning and Development, 143(4), 04017025.
26. Chicago Department of Transportation. (2019). Employee Recognition Program: Year-End Report. Chicago, IL: City of Chicago.
27. European Transport Research Review. (2020). Case Study: Employee Retention in Traffic Management. European Transport Research Review, 12(2), 1-15.
28. Garcia, R. (2017). The Impact of Employee Engagement on Traffic Management Efficiency. Public Administration Review, 77(5), 723-732.
29. Harris, L. (2021). Retention Strategies in Traffic Management: A Comparative Analysis. Journal of Human Resource Management, 29(1), 45-58.
30. Johnson, M., & Lee, J. (2018). Recruitment Practices in Public Sector Traffic Management. Journal of Public Administration, 22(3), 189-205.
31. Los Angeles Department of Transportation. (2020). Emergency Response Training Program: Evaluation Report. Los Angeles, CA: City of Los Angeles.
32. Miller, D. (2018). Balancing Technical and Soft Skills in Traffic Management. Journal of Transportation Engineering, 144(6), 04018051.
33. New York City Department of Transportation. (2021). Flexible HRM Practices in Traffic Management. New York, NY: City of New York.
34. Roberts, P. (2019). Technology Adoption in Traffic Management: The Role of HRM. Transportation Research Part C: Emerging Technologies, 104, 215-228.

35. Smith, J. (2015). The Role of Human Resource Management in Urban Traffic Systems. Journal of Urban Affairs, 37(4), 431-445.
36. Taylor, S. (2016). Team Dynamics in Traffic Management: A Study of Multidisciplinary Teams. International Journal of Human Resource Management, 27(12), 1345-1362.
37. University of Manchester. (2018). Team Building and Productivity in Traffic Management: An Empirical Study. Manchester, UK: University of Manchester.
38. White, R., & Green, T. (2019). Crisis Management and Emergency Response in Traffic Management: The Human Factor. Journal of Crisis Management, 11(2), 123-137.
39. Singapore Land Transport Authority. (2020). Smart Transportation: Training and Development. Singapore: Land Transport Authority.
40. Wilson, K. (2020). Flexible HRM Practices: Adapting to the Changing Landscape of Traffic Management. Journal of Public Policy and Management, 24(2), 256-271.

41. Bhat, C. R., & Bhat, M. G. (2011). An integrated model of activity-travel behavior and dynamic traffic assignment. Transportation Research Part B: Methodological, 45(10), 1710-1729.
42. Boardman, A. E., Greenberg, D. H., Vining, A. R., & Weimer, D. L. (2011). Cost-Benefit Analysis: Concepts and Practice (4th ed.). Pearson.
43. Ge, Y., & Hensher, D. A. (2013). Public private partnerships for transport infrastructure: A review of the literature. Transport Policy, 26, 11-22.
44. Haghani, A., & Oh, S. (1996). Formulation and solution of a multi-commodity, multi-modal network flow model for disaster relief operations. Transportation Research Part A: Policy and Practice, 30(3), 231-250.
45. Handy, S. L., & Van Wee, B. (2012). The role of transport planning in shaping urban form. Transport Reviews, 32(3), 339-361.
46. Jensen, P. H. (2017). Cycling in Copenhagen: An analysis of the factors influencing the choice of cycling as a mode of transport. Transportation Research Part D: Transport and Environment, 57, 1-11.
47. Kachroo, P., & Ozbay, K. (2002). Real-time traffic estimation and control using intelligent transportation systems. IEEE Transactions on Intelligent Transportation Systems, 3(3), 238-255.
48. Kockelman, K. M. (2004). Transportation and development: An overview. Journal of Transportation and Land Use, 1(1), 1-22.
49. Lam, W. H. K., & Lo, H. K. (2008). Traffic management in Singapore: An overview. Journal of Transportation Engineering, 134(12), 985-992.
50. Litman, T. (2013). Evaluating transportation economic development impacts. Victoria Transport Policy Institute, Victoria, BC, Canada.
51. Ranganathan, G., Bunker, T., & Holz, R. (2019). Governance of public-private partnerships in transport infrastructure: A systematic review. Journal of Public Private Partnerships, 5(1), 1-22.
52. Srinivasan, K., & Nandy, A. (2015). Traffic management in Indian cities: Challenges and opportunities. Journal of Urban Planning and Development, 141(2), 04014018.
53. U.S. Department of Transportation. (2020). Congestion Mitigation and Air Quality (CMAQ) Improvement Program. Retrieved from https://www.fhwa.dot.gov/planning/processes/congestion_mitigation_and_air_quality/
54. W Vickrey, W. (1963). Pricing, congestion, and the allocation of resources. American Economic Review, 53(4), 542-554.

55. World Bank. (2018). Urban Transport and Traffic Management. Retrieved from https://www.worldbank.org/en/topic/transport/brief/urban-transport-and-traffic-management
56. Banister, D., & Diana, M. (2011). Public transport and the city. Transport Policy, 18(1), 4-13.
57. Bhattacharyya, S., Gkritza, K., & Wang, X. (2018). Connected and automated vehicle applications in urban transportation. Transportation Research Part C: Emerging Technologies, 86, 349-365.
58. Chen, C., & Wang, Y. (2017). Connected vehicle technology: A review of benefits, challenges, and future research. Journal of Intelligent Transportation Systems, 21(3), 213-228.
59. Chen, X., Wang, Y., & Sun, X. (2012). Coordination of ramp metering and traffic signal control. Transportation Research Part C: Emerging Technologies, 22(1), 17-30.
60. Cervero, R., & Day, K. (2008). Parking management as a public transportation strategy. Transportation Research Record: Journal of the Transportation Research Board, 2076, 1-8.
61. Cai, X., Teng, Y., & Zheng, Y. (2013). Adaptive traffic signal control in Los Angeles. Journal of Transportation Engineering, 139(5), 498-506.
62. Cook, A. (2010). Adaptive traffic signal control: A review. IEEE Transactions on Intelligent Transportation Systems, 11(2), 376-385.
63. Fagnant, D. J., & Kockelman, K. M. (2015). Preparing a nation for autonomous vehicles: Opportunities, barriers and policy recommendations. Transport Policy, 40, 1-8.
64. Givoni, M., & Rietveld, P. (2007). The role of public transport in sustainable mobility. Transport Reviews, 27(4), 465-482.
65. Huang, Y., Liu, Z., & Yang, H. (2015). Traffic management center: A case study in Beijing. Journal of Transportation Systems Engineering and Information Technology, 15(3), 34-42.
66. Kalra, N., & Paddock, S. M. (2016). Driving to safety: How many miles of driving would it take to demonstrate autonomous vehicle reliability? RAND Corporation.
67. Kessel, A., & Stoffers, S. (2008). Ramp metering: A review of the literature. Transportation Research Record: Journal of the Transportation Research Board, 2046, 1-9.
68. Krejci, P., Tamine, M., & Buisson, C. (2005). Variable message signs: A review of their effectiveness and impact on driver behavior. Transportation Research Part F: Traffic Psychology and Behaviour, 8(5), 355-370.
69. Lam, W. H. K., & Sinha, S. C. (2001). Variable message signs: A review of their use in traffic management. Journal of Transportation Engineering, 127(4), 277-285.
70. Lee, D. H., & Oh, S. (2011). Ramp metering: A review of its impact on freeway traffic. Transportation Research Part A: Policy and Practice, 45(1), 1-12.
71. Lindsey, G., & Lobo, A. (2012). Parking management: A review of the literature. Transportation Research Part A: Policy and Practice, 46(7), 1111-1124.
72. Litman, T. (2010). Evaluating public transportation health benefits. Journal of Public Transportation, 13(2), 67-87.
73. Liu, H. K., & Li, Z. (2015). Traffic management using intelligent transportation systems: A review. Journal of Intelligent Transportation Systems, 19(2), 123-135.
74. Lu, C., & Liu, W. (2014). Traffic management center: A review of its functions and impacts. Journal of Transportation Systems Engineering and Information Technology, 14(4), 1-10.
75. Pucher, J., & Buehler, R. (2008). Making cycling irresistible: Lessons from the Netherlands, Denmark, and Germany. Transport Reviews, 28(4), 495-528.

76. Schlossberg, M., & Phillips, P. (2009). The impact of bicycle infrastructure on traffic conditions. Transportation Research Record: Journal of the Transportation Research Board, 2110, 1-8.
77. Shladover, S. E. (2009). Cooperative (connected) vehicle systems: Potential benefits and research needs. Transportation Research Record: Journal of the Transportation Research Board, 2105, 1-8.
78. Shoup, D. (2006). Cruising for parking. Transportation Research Part A: Policy and Practice, 40(10), 875-887.
79. Smith, B. L., & Robertson, D. I. (2014). Adaptive traffic signal control: A review of the challenges and solutions. Transportation Research Part C: Emerging Technologies, 46, 129-145.
80. Van Arem, B., Van Driel, C. J. M., & Visser, R. (2014). The impact of cooperative adaptive cruise control on traffic flow characteristics. Transportation Research Part C: Emerging Technologies, 42, 118-134.
81. Van der Heijden, R. E. C. M., Vreeswijk, J. D., van Essen, H. T., & van Zuylen, H. J. (2007). The impact of ITS on traffic flow and safety. Transportation Research Part C: Emerging Technologies, 15(6), 417-431.
82. Van Hinsbergen, C. J. M., Van Zuylen, H. J., & Vreeswijk, J. D. (2010). The impact of variable message signs on traffic flow and safety. Transportation Research Part C: Emerging Technologies, 18(2), 227-238.
83. Wang, X., & Mokhtarian, P. L. (2012). The role of non-motorized transportation in sustainable mobility. Transportation Research Part A: Policy and Practice, 46(7), 1081-1100.
84. Zhang, H., & Liu, W. (2018). The impact of intelligent transportation systems on traffic flow and travel time. Journal of Transportation Systems Engineering and Information Technology, 18(3), 45-56.
85. Zhang, J., Huang, Y., & Li, Z. (2017). The integration of traffic management center with intelligent transportation systems: A case study in Beijing. Journal of Transportation Engineering, 143(6), 04017035.
86. Meyer, M.D., & Miller, E.J. (2001). Urban Transportation Planning. New York: McGraw-Hill.
87. Ceder, A. (2007). Public Transit Planning and Operation: Traffic Systems Planning, 2nd Edition. London: CRC Press.
88. Vickerman, R. (2007). Transport and Economic Development: A New Approach to the Theory of Transport. Transport Reviews, 27(2), 203-224.
89. Litman, T. (2013). Transportation and Environmental Justice. Journal of Transport and Land Use, 6(1), 109-128.
90. McCombes, S. (2020, September 3) Descriptive Research. Retrieved from: https://www.scribbr.com/methodology/descriptive-research/