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Contributory Factors in Traffic Congestions in the 2nd District of Albay, Philippines: Basis for Traffic Management Framework

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ABSTRACT

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The global concern over traffic safety conditions has escalated due to the growing number of vehicles and pedestrians. Governments are putting significant efforts into implementing systems to alleviate and reduce traffic congestion. This study aimed to identify the factors contributing to traffic congestion in the 2nd district of Albay through quantitative research. It examined traffic congestion status in terms of Data Traffic Volume, Rush Hour, Classification of Vehicles, and Road Users. The research pinpointed key contributors to congestion, including insufficient road infrastructure, high vehicle density, rapid population growth, poor public transport, and road quality. A survey questionnaire was administered to personnel from Camalig MPS,

Daraga MPS, and Legazpi City Police Station, as well as Public Safety Officers from the mentioned areas. The community, representing riders and commuters in the Poblacion area, also participated. The findings revealed that traffic congestion is prevalent in the 2nd district of Albay, primarily driven by traffic volume, rush hour, vehicles, and road users. As a result, the study emphasizes the need for a standardized traffic management framework to be implemented. This framework aims to coordinate stakeholders' perceptions regarding the factors contributing to traffic congestion, serving as a guide for effective traffic management in the region.

INTRODUCTION

The global issue of traffic congestion is a major concern, intensified by insufficient infrastructure to meet increasing demand. Limited space and external factors further contribute to the problem. In countries like India, diverse and undisciplined traffic adds complexity for researchers. The resulting loss of significant productive time due to congestion harms the economy (Samal et al., 2020).

Several papers have delved into theories regarding traffic congestion in the Philippines. One of these papers explores the varied aspects of congestion, encompassing both public and private vehicles. It proposes creating a system utilizing a Convolutional Neural Network to count, detect, recognize, and classify these vehicles (Ambata et al., 2019). Another paper focuses on the factors contributing to congestion, such as population growth, urbanization, and industrialization. To alleviate the issue, it recommends adopting environmentally sustainable transportation alternatives, like diesel-electric vehicles (Estacio et al., 2019).

In the Bicol region, despite the implementation of a Traffic Management System in the 2nd district of Albay, ongoing traffic issues persist in key areas such as the community areas of Camalig and Daraga Albay, as well as in Legazpi City along Barangay Rawis, Cabangan, Gogon, and Bonot. Challenges include inadequate lighting, the absence of traffic signals and unclear signage, a high volume of vehicles per hour in specific directions, population growth leading to increased transportation demand, rising private vehicles affecting public transport, and complications from road widening or construction.

The current infrastructure is insufficient to cope with growing traffic demands, exacerbated by space restrictions and outside activities contributing to congestion. Recognizing the need to comprehensively understand and analyze various traffic issues, this study aims to identify effective solutions. The study's

significance extends to the community, Philippine National Police, Local Government Unit, Land Transportation Office, Public Safety Officers, External and Internal Stakeholders, students, and researchers.

FRAMEWORK

This research draws on multiple theoretical frameworks: the Theory of Traffic Flow and Congestion, Induced Demand Theory, Human Behavior Theory by Lyons (2008), and Human-kinetic multiclass traffic flow theory by Tampère (2004). The Theory of Traffic Flow and Congestion delves into the intricate interactions among transportation elements, revealing insights into how insufficient road infrastructure, high vehicle density, and inadequate public transport contribute to congestion.

The Induced Demand Theory, proposed by Lee, posits that a specific situation results from another condition, particularly in traffic volumes. This theory originated from the observation that enhancements to a highway, especially capacity improvements, attract more traffic, leading to increased road usage compared to scenarios where the highway remains undeveloped.

Lyons' Human Behavior Theory (2008) centers on human behavior, emphasizing the significant influence of conditioning. Finally, the research is anchored in Tampère's Human-kinetic multiclass traffic flow theory (2004), which aims to predict future traffic flows involving a blend of traditional and technologically advanced vehicles. This theory utilizes innovative driver assistance systems and models to explore and comprehend the dynamics of upcoming traffic scenarios.

OBJECTIVES OF THE STUDY

This study primarily focused on traffic congestion in the 2nd district of Albay. Specifically, it determined traffic congestion status along Data Traffic Volume, Rush Hour, Classification of Vehicles, and Road Users. It also identified the contributory factors in traffic congestion in terms of insufficient road infrastructure, high vehicle density, rapid population growth, poor public transport, and road quality. Moreover, it determined the significant agreement between the above-mentioned contributory factors in traffic congestion and proposed a traffic management framework to prevent traffic congestion in the 2nd District of Albay.

METHODOLOGY

Research Design

This study is a descriptive quantitative research design. The descriptive research design determines and describes a phenomenon or sample group of a population. The quantitative approach was employed to determine the framework for preventing traffic congestion. Using a descriptive quantitative approach in a study on contributory factors in traffic congestion provides a structured and numerical analysis of various aspects of the problem. It offers a systematic, objective, and efficient means of collecting, analyzing, and interpreting numerical data. It enables researchers and policymakers to gain insights into the quantitative relationships among various factors and aids in the development of evidence-based strategies for congestion management.

Research Site

This research was conducted in the second congressional district of Albay, one of the three districts in Albay, Philippines. It has been in the Philippines House of Representatives since 1916, with earlier representation in the Philippine Assembly from 1907 to 1916. Primarily, this research was conducted in three police stations in the second district of Albay. As of January 2024, Camalig MPS has 53 personnel, 136 in Daraga MPS and 222 in Legazpi City. Along with the number of personnel in Public Safety, there are 12 in Camalig, 76 in Daraga, and 80 in Legazpi City. In terms of the population ratio, according to the 2020 census, there are 72, 042 in Camalig, 133,893 in Daraga, and 209,533 in Legazpi City.

Participants

The participants in this study include 71 personnel from Camalig MPS, Daraga MPS, and Legazpi City Police Station, 24 Public Safety Officers from the municipalities of Camalig, Daraga, and Legazpi City, and 60 members of the community representing riders and commuters in the Poblacion area. These participants were selected using purposive and simple random sampling. Purposive sampling was used for PNP and PSO personnel, while random sampling was used for the community respondents. These respondents were chosen to glean knowledge from individuals with particular expertise in the study. These specific barangays were selected because they are the areas where most traffic congestion is observed. Similarly, the chosen personnel from the three police stations and public safety officers were selected due to their roles as law and traffic enforcers, possessing knowledge of the issue and being responsible for directing drivers

and managing traffic. The researcher clearly communicates to participants the measures taken to safeguard their confidentiality during the informed consent process and protect their identity and sensitive information throughout the research process.

Instrumentation

To address the study's objectives, the survey questionnaire primarily focused on identifying factors contributing to traffic congestion, including insufficient road infrastructure, high vehicle density, rapid population growth, poor public transport, and road quality. The researcher adopts a detailed and systematic approach by considering five (5) items within each major component. This approach allows a more nuanced understanding of the various elements contributing to congestion.

The questionnaire was designed to collect relevant data from the respondents. To ensure the questionnaire covered the study's intended themes and areas, the items underwent validation by personnel from Camalig MPS, Daraga MPS, and Legaspi CPS for both face and content validation. The study employed a Likert-type questionnaire, offering respondents four answers regarding the contributory factors in traffic congestion: 4 4-Highly Agree, 3-Agree, 2-Moderately Agree, and 1-Not Agree.

Data Collection

In gathering the data, the researcher sought permission from the adviser to research the implementation of the Human Rights Development Program in Tabaco City. Right after, the researcher also sought permission from the Chief of Police of Tabaco CPS and the Barangay Captain to conduct the research. The researcher personally approached and distributed the questionnaires to the respondents. Each participant was formally introduced to the purposes of the study, and strict confidentiality of the data gathered was ensured. The data-gathering procedure lasted for five weeks. The researcher ensures ethical considerations, ultimately recording, validating, and preparing the data for analysis. The frequency of data collection used is the one-time data collection, which provides a snapshot of a specific period.

Research Ethics Protocol

To guarantee ethical considerations in this study, participation is entirely voluntary, and the researcher has supplied a consent letter to allow respondents to respond freely to the questionnaire. Additionally, respondent anonymity has been preserved. Preserving the dignity of the participants through meticulous

wording of the questions was a paramount concern in this research. Ultimately, the researcher is committed to maintaining the study's independence and impartiality in presenting all the collected data.

RESULTS AND DISCUSSION

This part of the study presents the analysis and interpretation of the data gathered on the contributory factors contributing to traffic congestion in the 2nd district of Albay. They were analyzed and interpreted in the light of the insights from reading and statistical outputs for the relationship.

Status of Traffic Congestion. Traffic congestion is a transportation condition marked by reduced speeds, prolonged travel times, and heightened vehicular queues. It occurs when the traffic demand is sufficiently high, causing a slowdown in the speed of the traffic flow due to vehicle interactions. Although congestion can affect various modes of transportation, this study concentrates explicitly on congestion related to automobiles on public roads. The assessment of traffic congestion in this study encompasses considerations such as Data Traffic Volume, Rush Hour, and the Classification of Vehicles and Road Users.

Data Traffic Volume. In the 2nd district of Albay, based on the data gathered from the respondents, the data traffic volume was measured during school hours or school days, during activities like fiestas, festivals, processions during Holy Week, and other activities initiated by the LGU or provincial government of Albay, ongoing road construction, vehicular or traffic accident that causes traffic. This implies that understanding the factors that add to traffic volume will support in framing local analysis questions, governing current measures, distinguishing important intervention points, and choosing suitable responses to the problem of school traffic congestion during activities like fiestas, festivals, processions during Holy Week, and other activities initiated by the LGU or provincial government.

Sardar (2018) emphasized that the safe and timely movement of people and goods relies on traffic flow, closely connected to speed, volume, and density in traffic characteristics. Additionally, Chakravorty notes that traffic volume studies, conducted to analyze movements, quantity, and classifications of vehicles on specific road segments, play a crucial role in identifying flow patterns, evaluating the impact of large vehicles or pedestrians on traffic, and documenting volume trends.

School Hour or School Days. Increased traffic volume, especially during peak hours, has resulted in significant challenges during regular school hours. The drivers' behavior is often identified as the primary cause of the

heightened traffic around schools, particularly during rush hours. From the municipality of Camalig going to Legazpi City, there are an estimated nine primary and tertiary schools with many pupils and students, which causes traffic congestion. These schools are Camalig Elementary School, Daraga Community College, Daraga National High School, Bicol University Daraga Campus, Bicol College, Bicol University-Main Campus, Divine Word College of Legazpi, Cabangan Elementary School, and STI College.

School traffic congestion is just one part of a larger set of issues related to school traffic. It can lead to increased speed and recklessness in the surrounding area as frustrated parents and commuters try to make up for lost time. Speeding, reckless driving, and traffic violations are often associated with high school students driving themselves to and from school.

According to Paypa (2017), congestion significantly affects workers and employees, causing tardiness, commuting difficulties, frustration, stress, longer work commutes, extended travel times, and a loss of personal time.

Activities like Fiestas/Festival and Holy Week. Special events such as festivals and Holy Week cause significant spikes in traffic volume, leading to congestion on low-traffic roads. Despite their temporary or seasonal nature, these events contribute to traffic congestion, posing challenges in managing traffic due to the limited infrastructure and the large number of participants. The adverse effects on traffic flow and safety during these events are noteworthy.

Various special events are celebrated annually in Camalig, Albay, Daraga, Albay, and Legazpi City, including the Pinangat Festival, Cagsawa Festival, Ibalong Festival, Magayon Festival, and Holy Week. These events contribute to social problems like traffic congestion, parking challenges, overcrowding, and, in severe cases, social dislocation. The occurrence of festivals and Holy Week results in significant traffic volume, causing congestion, particularly on smaller or inadequate roads. Understanding the traffic characteristics of these events becomes crucial for predicting their impact, planning effective traffic management, and anticipating parking needs.

Fernando's (2019) study highlights the variability of Planned Special Events (PSEs) based on features like location, type, duration, time of occurrence, market area, estimated audience size, and audience accommodation. Evaluating these characteristics is a gap in existing research to understand their impact on urban traffic congestion. Planned special events encompass diverse activities such as concerts, festivals, sporting events, and conventions at stable and temporary venues, including fireworks displays, motorcycle rallies, bicycle races, sporting games, parades, and seasonal festivals.

Moreover, Eck and Montag (2003) emphasize that special events like

historical reenactments, concerts, sporting events, fairs, and festivals can generate substantial traffic volumes, leading to congestion and related problems on low-traffic roads.

Road construction. The expansion of road construction projects is occurring rapidly to accommodate the growing traffic volume. A thorough examination and investigation of planned road construction within the road network system can significantly enhance traffic conditions, addressing congestion and road safety issues. This suggests that the ongoing road construction projects substantially impact the surrounding road network, resulting in traffic problems. These road construction initiatives strongly influence the operational performance of roads, leading to heightened congestion and delays during the construction phase. Consequently, the design and construction of road infrastructures, as a contributing factor to traffic congestion, should prioritize comprehensive considerations to minimize the risk of congestion for users.

Vehicular and traffic accidents. The concept of traffic volume is widely employed in analyzing traffic accidents today. However, it is crucial to recognize that identical traffic volumes on different road sections lead to distinct operational conditions and varying accident possibilities. The recorded vehicular and traffic accidents in the three locations indicate that these incidents also contribute to traffic congestion. This suggests that a counterintuitive relationship between accidents and congestion would imply a potential safety advantage in congested conditions, posing a challenging scenario for traffic management. According to Wang and Chen's study in 2016, when evaluating the impact of road construction on traffic, it is possible to assess traffic conditions and the operational level of the construction site. Proposed development procedures can be recommended by analyzing existing issues, road conditions, and the overall traffic environment. Additionally, Ji's findings in 2020 suggest that while road construction is proposed as a solution to severe congestion, it may result in increased commuting time and decreased traffic speed due to poor management or suspension decisions.

Rush Hour. The congestion experienced during rush hours stands out as a major concern for traffic engineers, constituting a significant factor contributing to road congestion alongside incidents like accidents, malfunctioning traffic signals, and ongoing construction works. Various policies and strategies have been implemented, leveraging cutting-edge technology and traffic management tools to alleviate rush hour traffic congestion. It is emphasized that the reliability and advance awareness of travel variations, leading to a more dependable transportation system, hold greater significance for travelers compared to factors like a reduction in travel time. During rush hours, a substantial portion of

the road network operates close to its maximum capacity, making even minor increases in traffic flow severely exacerbate congestion.

In Albay's 2nd district, rush hours span from 7:00 to 9:00 AM and 4:00 to 6:30 PM. During these peak periods, major roads experience congestion due to the high concentration of commuters and activities related to schools, commerce, and businesses. The disruption of traffic flow during rush hours challenges the community and their daily activities, exacerbated by the diverse classification of vehicles, leading to traffic issues and occasional vehicle queues. The situation worsens when vehicles are parked haphazardly, with road shoulders often used as makeshift parking spaces, neglecting the designated parking areas.

Hintural et al. (2016) argued that while the primary goal of traffic operation is to facilitate traffic flow, the prevalent congestion during peak hours negatively affects the economic well-being of commuters. The continuous increase in global oil prices contributes to economic challenges. Urgent implementation of initiatives to alleviate the adverse effects of rising prices on essential goods is crucial. Furthermore, traffic congestion prolongs travel time and impedes individual productivity.

Classification of Vehicles

Road Users. The term "road user" encompasses individuals utilizing various modes of transportation, including public transportation motorcyclists, operators, passengers, motorists, bicyclists, truck drivers, and pedestrians. This study classified road users into private and public vehicle users and bikers. The data reveals that 2020 witnessed the lowest number of road users in Albay's 2nd district, primarily due to the unprecedented disruptions caused by the COVID-19 pandemic. As a response, the government implemented and enforced a minimum level of transport connectivity, reserving travel bans as a last resort.

To curb the spread of COVID-19, Albay imposed restrictions on domestic transit and occasionally closed border crossings for road freight transport services. Although cargo transportation is widely recognized as an essential activity, numerous cargo-handling companies ceased operations during the outbreak, decreasing traffic flow. Consequently, the transport network played a significant role in influencing the spread of infectious diseases.

Furthermore, this indicates that various activities and road incidents contribute to traffic congestion, negatively impacting the surrounding areas. A comprehensive understanding of potential impacts on traffic flow forms the basis for strategic traffic planning during such activities and incidents. Traffic volume around schools tends to be inherently higher than in other public spaces, making it challenging to control. The current demand for mobility and accessibility is often perceived as parallel to urban growth rates, influencing road efficiency (Abd

Rahman et al., 2018).

Contributory Factors in Traffic Congestions. Traffic congestion is a common occurrence on urban roadways, particularly at specific critical traffic points, and is influenced by various factors on the roads. Many studies have utilized travel time indices to identify congested segments within road networks. However, indices based on travel time delays have limited application in assessing and quantifying congestion levels across road networks.

Insufficient Road Infrastructure. Transportation is vital for economic and social development, but many local communities lack the infrastructure for efficient distribution. Challenges such as irregular or nonexistent roads, limited public transport, worn-out equipment, service inconsistency, and high costs hinder the satisfactory delivery and accessibility of essential goods and services, restricting overall growth.

Table 1
Insufficient Road Infrastructure

Indicators	PNP		C		PSO		WM	AI
1. There is no roadway and intersection design/ making and control	2.04	A	2.17	A	2.63	MA	2.63	MA
2. Inadequate Street Capacity (crowded to capacity).	2.28	A	2.55	MA	3.04	MA	2.62	MA
3. Inadequate lighting, failure to install traffic signals, and confusing traffic signs and markings.	1.93	A	2.64	MA	3.33	HA	2.63	MA
4. There is no dedicated designation for the loading and unloading area.	2.28	A	2.30	A	2.63	MA	2.40	A

5. No alternative transportation options (transit, walking, cycling, etc.)	1.79	A	2.52	MA	2.88	MA	2.39	A
		AWM					2.46	A

Legend: 4-Highly Agree, 3- Agree, 2- Moderately Agree, 1-Not Agree

Data analysis revealed that factors like the absence of roadway and intersection design, inadequate lighting, failure to install traffic signals, and confusing traffic signs and markings received the highest weighted mean of 2.63 or "Moderately Agree." Conversely, the lack of alternative transportation options (transit, walking, cycling, etc.) received the lowest weighted mean of 2.39 or "Agree." Overall, insufficient road infrastructure had an average weighted mean of 2.46, interpreted as "Agree," based on consolidated results from three respondent groups.

Proper roadway and intersection design and control are crucial for providing convenience, ease of use, and comfort to people navigating intersections, facilitating efficient vehicle and pedestrian movement. Traffic signals are vital in controlling traffic, assigning movement priorities, and enhancing intersection traffic-handling capacity. The importance of traffic signs as visual aids to convey information about traffic laws and regulations was emphasized. Well-designed traffic signs serve as reminders, directions, or warnings, aiding drivers in understanding information quickly to avoid congestion or violations and contributing to road safety.

Robielos and Lin (2022) recommended using pictorial symbols in traffic signs to convey complex information effectively. Wiseman et al. (1985) also found that combining symbols and text enhances memory quality, improving understanding. Shinar and Vogelzang (2013) concluded that adding text to symbols improves driver understanding and reduces the time needed to comprehend traffic signs in their context.

High Vehicle Density

The increasing number of vehicles on the roads leads to significant issues, including heightened accident risks and traffic congestion. The elevated vehicular density contributes to longer travel times, increased frustration, and challenges finding appropriate parking spaces, leading to potential obstacles for emergency vehicles and endangering pedestrians. Moreover, the surge in vehicles amplifies the likelihood of accidents, posing threats to people and property and

straining the healthcare system with potential financial losses.

Table 2
High Vehicle Density

Indicators	PNP		C		PSO		WM	AI
1. There is a high number of vehicles moving in a specific direction (per hour).	3.02	MA	2.92	MA	3.67	HA	3.20	MA
2. High number of vehicles moving in a specific direction (per lane per hour).	2.90	MA	2.73	MA	3.41	HA	3.01	MA
3. There is a maximum number of vehicles passing a given point (in one hour).	2.52	MA	2.67	MA	2.96	MA	2.72	MA
4. A traffic or vehicular accident always causes a road blockage or slows down traffic flow.	2.36	A	2.30	A	2.79	MA	2.48	A
5. There is a high number or presence of heavy transport or cargo vehicles.	2.59	MA	2.70	MA	2.96	MA	2.75	MA
	AWM						2.83	MA

Legend: 4-Highly Agree, 3- Agree, 2- Moderately Agree, 1-Not Agree

Analyzing the data results, many vehicles moving in a specific direction (per hour) received the highest weighted mean of 3.20 or "Moderately Agree." Conversely, the presence of traffic or vehicular accidents causing road blockages or traffic flow slowdown had the lowest weighted mean of 2.48 or "Agree." Overall, the contributory factor of high vehicle density had an average weighted mean of 2.83, interpreted as "Moderately Agree," based on consolidated results from three respondent groups.

This suggests that traffic volume significantly contributes to congestion, involving numerous vehicles moving in a specified direction on a lane or roadway during a given time. Additionally, accidents tend to increase in frequency and severity during traffic congestion, aligning with Karl N. Vergel and Tetsuo Yai's study in 2018. Their research highlights the connection between high-density urban development, increased traffic demand, and congestion on major arterials,

especially at critical conflict points.

Rapid Population Growth. Overpopulation and urban growth present significant challenges, and daily traffic congestion manifests this ongoing problem. The demand for transportation services surges as people strive to move simultaneously each day, particularly during peak hours when individuals commute to school, work, and run errands. The synchronized patterns of activity are crucial for the efficient operation of the economy and educational systems, contributing to regular traffic congestion. As the population continues to expand, the problem of traffic congestion is exacerbated.

Table 3
Rapid Population Growth

Indicators	PNP		C		PSO		WM	AI
1. The population in the 2nd district of Albay grows, and more people are on the roads, leading to increased congestion.	2.98	MA	2.70	MA	3.13	MA	2.94	MA
2. Population growth can lead to urban spread, where people live further away from the city/ municipal proper and must commute longer distances.	2.56	MA	2.73	MA	3.13	MA	2.81	MA
3. Population growth can lead to a lack of infrastructure, such as public transportation and highways, which can also lead to traffic jams.	2.45	A	2.60	MA	3.30	MA	2.78	MA
4. Population growth increases the demand for transportation services.	3.00	MA	2.93	MA	3.33	MA	3.09	MA
5. Population growth leads to the increased use of vehicles, thus increasing the demand for roads.	2.96	MA	2.75	MA	3.25	MA	2.99	MA
	AWM						2.92	MA

Legend: 4-Highly Agree, 3- Agree, 2- Moderately Agree, 1-Not Agree

According to the study, the factor of population growth increasing the demand for transportation services received the highest weighted mean of 3.09

or "Moderately Agree," while the impact of population growth on infrastructure, leading to traffic jams due to a lack of public transportation and highways, had the lowest weighted mean of 2.78, also interpreted as "Moderately Agree." Overall, the contributory factors in traffic congestion due to rapid population growth had an average weighted mean of 2.92, indicating a "Moderately Agree" interpretation based on consolidated results from three respondent groups.

This implies that the ongoing population growth directly influences overall transportation demand. The nature and distribution of transportation demand are closely linked to where and how the population is growing and changing. The increase in population, coupled with the movement of people to a locality, directly results in more cars on the roads during peak hours.

The World Economic Forum's book, "Migrations and Its Impact on Cities," highlights that the growing population intensifies transportation needs and increases road congestion. In Davao, according to Colina (2017), the construction industry boom is a central cause of traffic congestion, closely connected to population growth. Another study by Babu (2017) conducted in India, titled "Study of Urban Cities Traffic Problems due to Delay and Overcrowding," reveals that as a city expands, transportation challenges become more intricate, particularly as areas take on diverse and multifaceted functions, attracting more individuals to commute for work.

Poor Public Transport

Public transportation systems are crucial in urban and rural settings, catering to people's daily travel needs. In the current context, the importance of public transportation is viewed through the lens of sustainability, contributing to the well-being of individuals, the economy, and the environment. Public transport is expected to simplify urban and rural tasks, alleviate traffic volume, and enhance mobility within the traffic system and economy.

According to the study, the increase in private vehicle ownership, leading to reduced demand for public transport and a consequent decline in funding for public transport systems, received the highest weighted mean of 3.05, interpreted as "Moderately Agree." Conversely, the factor of poor or lacking modern mobility systems or networks had the lowest weighted mean of 2.72, also interpreted as "Moderately Agree." Overall, the contributory factors in traffic congestion due to poor public transport had an average weighted mean of 2.87, indicating a "Moderately Agree" interpretation based on consolidated results from three respondent groups.

This suggests that the surge in private vehicle ownership has diminished the demand for public transport, leading to reduced financial support for public

transport systems. Private vehicles have become increasingly popular for daily travel, and the limited accessibility and inefficiency of public transport contribute to a rise in traffic congestion. Addressing these challenges is crucial for achieving a sustainable and efficient public transport infrastructure.

The case of Lagos exemplifies the importance of investing in sustainable public transport infrastructure. Recognizing the environmental challenges posed by climate change, traffic congestion, and emissions from fossil fuel vehicles, the city emphasizes the need for sustainable infrastructure. Lagos aims to collaborate on climate action, endorsing public transport and securing networks to address these challenges (International Association of Public Transport, 2018).

Table 4
Poor Public Transport

Indicators	PNP		C		PSO		WM	AI
1. Lack of funding, inadequate infrastructure, proper planning and coordination, and political will to invest in public transport systems.	2.65	MA	2.73	MA	3.05	MA	2.81	MA
2. There is population growth, urbanization, and changing transportation patterns.	2.82	MA	2.78	MA	3.20	MA	2.93	MA
3. Poor or lack of modern mobility systems or networks.	2.51	MA	2.69	MA	2.96	MA	2.72	MA
4. Outdated technology and equipment, lack of maintenance and repair, and a lack of focus on customer service.	2.73	MA	2.67	MA	3.09	MA	2.83	MA
5. Private vehicle ownership is increasing, which can lead to decreased demand for public transport and a corresponding decrease in funding for public transport systems.	2.68	MA	2.97	MA	3.50	HA	3.05	MA
	AWM						2.87	MA

Legend: 4-Highly Agree, 3- Agree, 2- Moderately Agree, 1-Not Agree

In Dhaka, studies by Quddus et al. (2019) and Sajib (2020) highlight public dissatisfaction with current public transport facilities, citing unreliability,

danger, and inefficiency. The inadequacy of transport vehicles in Dhaka creates challenging conditions, particularly for low and middle-income communities, leading to safety concerns, traffic hazards, reduced mobility, and various socio-cultural issues. Addressing these challenges is crucial to avoid severe consequences for the residents of Dhaka in the future.

Road Quality

Road serviceability represents a crucial aspect of meeting the diverse needs of modern society. The maintenance and enhancement of existing road networks, a primary function of the government, are widely recognized as a public good investment, contributing to economic activity and job creation. Significant public expenditures are allocated to the upkeep and improvement of existing roads.

As per the study, the perception that road widening or construction leads to additional problems and traffic congestion has the highest weighted mean of 2.84, indicating a "Moderately Agree" interpretation. Conversely, the notion that road design and traffic flow were not adequately planned received the lowest weighted mean of 2.49, also interpreted as "Moderately Agree." Overall, the contributory factors to traffic congestion related to road quality had an average weighted mean of 2.67, signifying a "Moderately Agree" interpretation based on the consolidated results from three respondent groups.

Table 5
Road Quality

Indicators	PNP		C		PSO		WM	AI
1. Road design and traffic flow were not planned properly.	2.08	A	2.50	A	2.88	MA	2.49	A
2. Roads do not have markings, faded centerlines, or a lack of reflective markers.	2.47	A	2.44	A	3.12	MA	2.68	MA
3. Road widths are irregular, too many bottlenecks.	2.24	A	2.57	MA	2.96	MA	2.59	MA
4. Road widening or construction creates other problems and traffic congestion instead.	2.52	MA	3.03	MA	2.86	MA	2.84	MA

5. The supervision and maintenance of the application of traffic control devices such as traffic light signals, pavement markings, and traffic signs is low.	2.33	A	2.89	MA	3.08	MA	2.77	MA
		AWM					2.67	MA

Legend: 4-Highly Agree, 3-Moderately Agree, 2-Agree, 1-Not Agree

This suggests that one of the significant road challenges stems from the absence of reliable and standardized designs. Roadway design plays a crucial role in influencing driving behavior and perceived safety. In the era of increasing globalization, roads have evolved into essential infrastructure for the efficient transportation of goods and people, underscoring the importance of well-planned and functional road development to prevent traffic congestion.

This aligns with WSP's (n.d.) perspective that traffic engineering plays a key role in addressing obstacles to the transportation process. Traffic engineering encompasses deliberate aspects of road geometry, including traffic signals, intersection management, traffic signs, and road surface markings, alongside the design and construction of transportation infrastructures. Similarly, Nelson (2018) emphasizes that engineering is crucial in resolving transportation issues. Forman (2007) underscores the importance of a transportation and society vision in providing cost-effective solutions across the road network.

Significance of Agreement among Contributory Factors on Traffic Congestions

The indicators evaluated were insufficient Road Infrastructure, High Vehicle Density, Rapid Population Growth, Poor Public Transport, and Road Quality. The Summation of Squared Deviation from the Mean Difference, which is used to compute the Coefficient of Concordance W. The Coefficient of Concordance W measures the degree of agreement among the ranks of the indicators. The Degree of Freedom is determined by the number of groups and activities. The Computed X2 is a statistical test used to determine if there is a significant difference between the observed and expected frequencies. The Tab. X2 Value provides the critical values of X2 for a given level of significance (0.05, 0.025, 0.01, and 0.005). The Significance of Agreement indicates whether there is a significant agreement among the ranks of the indicators. The Decision on H1 indicates whether the null hypothesis (H0) that there is no significant agreement among the ranks of the indicators is accepted or rejected.

Propose a Traffic Management Framework

The global traffic safety situation faces challenges due to driver and pedestrian compliance with laws, vehicle types, traffic flow, and infrastructure. Effective traffic regulations are crucial for societal development, but poor enforcement can lead to undesirable consequences. The proposed traffic management framework aims to reduce congestion while ensuring safety and order. Adherence to traffic laws is essential for preventing congestion, violations, and accidents.

The framework fosters community discipline, reduces negative behaviors, and collaborates with local enforcement. It includes infrastructure improvements, educational activities, and training personnel. Implementing these strategies involves promoting education and awareness through collaborative initiatives among government agencies, traffic police, and private organizations. The goal is to enhance awareness of traffic rules, encourage appropriate behavior, and create a safer and more orderly traffic environment in daily life.

The proposed strategy for traffic management encompasses a multifaceted approach to ensure safety and efficiency on the roadways. By prioritizing the regular update and modernization of traffic ordinances, authorities aim to align regulations with current traffic conditions. Simultaneously, they plan to enhance awareness among drivers through the distribution of informative materials such as pamphlets and posters, presenting statistical reports of road accidents to discourage future violations. Collaborative efforts with various institutions will integrate road safety education into broader civic initiatives, while the extensive use of media channels will maximize the dissemination of real-time traffic information. Vigilance is maintained by continuously studying evolving traffic problems and periodically assessing accident-prone locations, parking conditions, pedestrian challenges, and congestion indicators. To ensure the effectiveness of traffic control measures, the plan includes regular schedules for the inspection, reconditioning, and maintenance of signs and signals. Street improvement plans undergo expert scrutiny for capacity and safety considerations, and an inventory of traffic signs, signals, and pavement markings is maintained to ensure citizens' compliance with Uniform Standards mandated by state law. The comprehensive strategy includes providing standard signs and initiating a program to modernize traffic control signals, reflecting a commitment to evolving and enhancing the overall traffic management framework.

In the proposed Traffic Management Framework, several key entities, namely the Philippine National Police (PNP), Land Transportation Office (LTO), Local Government Units (LGU), and academic institutions, assume pivotal roles in ensuring the successful implementation of traffic management

strategies. The PNP is integral in enforcing traffic laws, monitoring compliance, and investigating accidents to enhance road safety. The LTO contributes by overseeing licensing, vehicle registration, and conducting inspections to ensure the qualifications and roadworthiness of drivers and vehicles. LGUs are crucial in local traffic planning, public education, and infrastructure development to coordinate traffic flow effectively. Meanwhile, academic institutions contribute through research, training programs, and policy recommendations, collectively forming a collaborative and comprehensive approach to achieve safe and efficient road traffic management.

The effective implementation of the traffic management framework involves a strategic and collaborative approach across key entities, including the Philippine National Police (PNP), Local Government Units (LGU), the Land Transportation Office (LTO), and academic institutions. Workshops and sensitization programs will introduce the framework to PNP officers, ensuring seamless integration into standard operating procedures. Collaboration with LGUs includes awareness campaigns, capacity-building, and advocacy for the adoption of the framework by local policymakers. For the LTO, training sessions and integration into licensing procedures are vital, accompanied by fostering collaborative enforcement efforts. Academic institutions contribute by incorporating the framework into curricula, encouraging ongoing research collaboration, and engaging students in practical applications. This comprehensive strategy ensures a smooth transition from research to practical application, fostering a shared commitment to updated traffic management strategies and regulations.

CONCLUSIONS

Traffic congestion is a prevalent issue in the 2nd district of Albay, primarily caused by factors such as high traffic volume, rush hours, numerous vehicles, and road users. The congestion levels are escalating, impacting the local area and gradually expanding its influence. Rush hours, especially during morning and evening commutes, contribute to congestion exacerbated by transportation systems and road construction. Traffic congestion, often linked to small or damaged roads resulting from traffic accidents, directly affects lifestyle, societal structure, and convenience, posing challenges in increasing traffic demand and transportation infrastructure.

Traffic congestion remains a significant problem, attributed to inadequate lighting, absence of traffic signals, confusing road signs, high volume of vehicles moving in a specific direction, population growth, increasing transportation

demand, and the rising ownership of private vehicles. These elements contribute to decreased public transport usage, funding, and challenges associated with road widening or construction, leading to additional problems and congestion.

Implementing a standardized traffic management framework is crucial to align stakeholders' perceptions regarding the factors contributing to traffic congestion. This framework will act as a guide in addressing traffic congestion issues. Under this framework, specific community activities, including traffic safety campaigns and propaganda, should be systematically and continuously promoted through collaboration among local government units, PNP, LTO, DPWH, and other stakeholders. The aim is to enhance public awareness, encourage adherence to traffic rules, and promote appropriate traffic behavior.

TRANSLATIONAL RESEARCH

The findings of this study could be translated into an action plan focusing on contributory factors in traffic congestion to address the pressing problems encountered. This could be endorsed through a diverse scope of institutional and education campaigns. Implementing this traffic management framework will help the PNP and the local community.

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