Assessment Of Traffic Congestion Within Guagua Town Proper As A Basis for Road Rerouting Plan

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Abstract: - This study is an assessment of the current road rerouting scheme in Guagua that will decongest the traffic situation within Guagua Town Proper. It utilized the descriptive-normative method of research. Important data and needed information were gathered through a survey questionnaire that was personally constructed by the researchers. The participants of the current study were the jeepney drivers, tricycle drivers, private vehicle drivers, students, and workers who normally enter the Guagua Town Proper zone. All the participants were selected randomly using the Slovin's formula and lottery sampling method. The statistical tools employed were the frequency tally, percentage and the mean distribution of grouped data. Based on the findings and conclusions drawn from the study, majority of the vehicles that passed through the roads of Guagua Town Proper were public utility vehicles. Findings further revealed that the traffic situation in Guagua Town Proper was already at a greater extent, thus it would take around, more or less, eleven to twenty minutes or eighteen minutes and thirty seconds on the average.

Key Words: Road Rerouting, Traffic, Vehicles, Roads.

I. INTRODUCTION

Heavy traffic has become a nightmare in the Philippines, specifically in Metro Manila and other developing areas. Everyone is directly affected by this current problem the country is facing. No one can escape the wrath of congested roads due to the overpopulation of cars and other transportation vehicles such as tricycles, jeepneys, and motorcycles. This has been considered one of the primary problems that the country is facing right now and it is very hard to find a solution to this problem. In Metro Manila, for instance, an estimate of about sixteen million people is living within the area, thus, traffic is undoubtedly inevitable. Waze, the world's largest community-based traffic and navigation app, had described Metro Manila traffic as "the worst traffic on earth".

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They further mentioned that *"Carmageddon"* is experienced by everyone these days. This has been an everyday struggle and causes great distress to every motorist and commuter in the Philippines, and sadly, it is getting extremely worse by the second. In a journal published by Carmudi, it was mentioned that it is only within the roads of the Philippines that they can experience sitting for 2-3 hours inside a cramped vehicle, all with their trusted mobile phone (or tablet) to fill in those wasted hours they could have spent doing something else more productive.

In addition to this, John Forbes, the senior advisor of the American Chamber of Commerce of the Philippines, stated that if the number of vehicles would continue to increase while there would be no development in roads and infrastructure, then Metro Manila will become "uninhabitable" by 2020. With all of this, it can't hide the fact that the Philippines is certain to reach *"carmageddon"*.

The same scenario is now experienced little by little by the people of Guagua, Pampanga. Traffic congestion is now building up within its roads, particularly within Guagua Town Proper. If such conditions are not given immediate attention,

there will be a high probability that the traffic situation within Guagua Town Proper will get worse than ever.

1.1 Review of Related Literature and Studies

Congestion is one of the most prevalent transport problems in the municipality agglomerations, usually above a threshold of road space capacity. Decades past, drivers would spend about 6-10 times round trips more time in congestion as they did in the latter part of the1990s. Congestion is particularly linked with economic trading, the high caliber in education, banking, commercial, etc., as the center in the 2nd District of Pampanga, which has increased the demand for transportation infrastructures. However, the supply of infrastructures has often not been able to keep up with the growth of mobility. Since vehicles spend the majority of the time parked, motorization has expanded to the demand for Public Utility Jeep and Motorization for Hire. A significant volume of *colorum* vehicles, parking spaces, sidewalks vendors also created space consumption problems particularly in the town proper area as stated by the head of the Guagua Municipal Planning and Development Department, Mrs. Elsa P. Pantino (2021).

On the other hand, as studied by Carmudi (2016), one of the primary causes of traffic density is the current transportation infrastructure within different places experiencing this problem of traffic congestion. Overall, what causes insufficient modes of mobility is the lack of quality infrastructures. The same dilemma in infrastructures was also experienced in Guagua Town Proper. Wherein, transport infrastructures are lacking since the growing population of road users, as well as pressure to develop modern infrastructures. Mrs. Elsa P. Pantino also added that it is important to underline that congestion in the proper area is dominantly caused by commuting patterns and little by truck movements. On average, infrastructure provision was not able to keep up with the growth in the number of vehicles, even more with the total number of vehicles-km. As promised by the Duterte administration, the country would experience a “golden age infrastructure” in the coming years, as they had allotted a record of $168 billion to be spent on 5,000 projects across the nation.

Another cause of traffic congestion is the road network used or the present traffic road schemes. These are the principal road arteries used within the area, however, given the density of vehicles within the concerned places the roads have become inadequate. In the study Guagua Public Transportation Route Plan conducted by the Guagua Municipal Planning and Development, many public transportation networks, or portions of them, were over or underutilized. During peak hours, overcrowding created discomfort for users as the system coped with a temporary surge in demand. While in the past, deficits were deemed acceptable because of the essential service public transit was providing for suburban mobility, its financial burden was provocative. In Metro Manila, every one-kilometer road would occupy 424 vehicles. Meanwhile, according to Ma Inah Louise N. Rodriguez, the Municipal Planning and Development Coordinator of Guagua, Guagua Town Proper only has 1km of road per 90 to 120 public vehicles. The road ratio per 1 kilometer of the road will still increase due to the inclusion of private vehicles that are using the road arteries. Findings of the study conducted by a body organized and commissioned by the Duterte administration revealed that 72% of the traffic congestion was brought by private commuting units. Hence, using such a study as a basis an additional 65 to 86 vehicles are being added to the 1 km road ratio within Guagua Town Proper. Clearly, these data indicate that the high number of vehicles on the road, which could be attributed to the high population, is one of the contributors to traffic congestion. On the other hand, research by the Guagua Municipal Planning and Development showed that the service characteristics of transportation modes and the passenger capacity per hour estimate, Jeepneys/UVS has a 50 - 1,300 per hour and Tricycles has an hourly passenger of 30 - 1,600. In addition to this was the number of private vehicles entering the Municipal Town Proper. This high population thus calls for an appropriate transportation system to allow for mobility within the Guagua Town Proper.

Relative to this, the existing traffic scheme layout implemented within areas of concern lacks holistic and intrinsic planning from the ground up. The poor design did not account for or look into the density of the city or the eventual propensity for vehicles. A classic example is a fact that the Metro cities host more vehicles than the roads could afford. Adding to this problem are the laws and policies that are in need to be implemented to mitigate such poor design are not properly enforced.

Another reason for traffic congestion as revealed by the commissioned body to study the problems of traffic is the increase in the purchasing power of most people in ASEAN countries to buy private vehicles added to vehicle density on roads. A good example of this purchasing power are those young professionals coming from the Metro mostly choose to acquire smaller cars like Toyota Wigo, Mitsubishi Mirage, and Honda Jazz, according to Euromonitor’s Consumer Lifestyles in the Philippines (2015). This is substantially due to the affordability of people to buy such cheap cars and with this is their benefit that they will no longer use public transport.

On the other hand, the congestion between vehicles within a particular region allows the circulation of other vehicles. Congestion occurs inevitably in highly urbanized sectors, like in the Municipality of Guagua, where the ratio between the population of people and the given area is not proportional and when the demand is high. It is even desirable in some cases up to a point because getting rid of it incurs higher costs than allowing it to persist. The main socio-economic repercussions of vehicle congestion include time waste (non-productivity; opportunity cost), delays, dissatisfied drivers or motorists or passengers, and the encouragement of road rage.

Time spent stuck in traffic might be deemed unproductive or a waste of time in general. The concept of opportunity cost is particularly relevant for persons who have better things to do than sit in traffic. Traffic congestion in highly populated places can be a major hindrance to getting products from one location to another. This could lead to a breakdown in confidence between parties that rely greatly on this regular delivery for their own enterprises' success. It can lead to circumstances like being late for work, crucial meetings, or school, which can result in lost business, disciplinary action, or other personal losses. When it comes to emergency situations, delays can also take the shape of traffic congestion, which can obstruct the flow of traffic ambulances, police cars, etc.

It also shows that “Road Rage” is one of the most known problems that resulted from heavy traffic congestion. Road Rage is the aggressive behavior of an automobile driver which includes rude gestures, verbal insults, and deliberate reckless driving that may endanger the lives of both the drivers and the people surrounding them.

Another significant effect of traffic congestion is connected to different health hazards such as psychological and health effects on an individual. Most of the people that are stuck in heavy traffic congestion had experienced health-related conditions like headaches, migraines, and dry cough. A study conducted by the American Journal of Preventive Medicine in 2021 found that most people tend to experience high blood pressure as they had been stuck for several hours in heavy traffic congestion. Furthermore, longer commuting entails a person to do less physical activity which can bring about other health consequences aside from the mentioned. According to a study by the World Bank recently, commuting stress is linked to anxiousness and tension, bodily pain and stiffness, impatience, and weariness, as well as lower workplace performance and satisfaction. These have all been psychologically linked to traffic as it intensifies these feelings.

In addition to this, one of the resulting effects of this problem is pollution. The enormous number of vehicles on roads will result in air pollution in the area. According to Earth Trends (2003), the leading source of air pollution comes from transportation vehicles as they produce 34% of the carbon dioxide emissions in Metro Manila. The record shows that those average vehicles that are using gasoline have a stoichiometric ratio of 14.7:1, as stated by Nice and Bryant (2000). This data indicates that there are 14.7 pounds of air that are being polluted in every pound of gasoline produced and released by cars. This is only for one car, and we have yet to consider the other thousands of vehicles being used every day. The same study was also cited in the research study of the Municipality of Guagua in the Guagua Public Transportation Route Plan, pollution from circulation, especially noise, has become a severe impediment to people's quality of life and even their health. Further, energy consumption by transportation has dramatically increased and so has the dependency on petroleum. These considerations are increasingly linked with peak mobility expectations wherein high energy prices incite a shift towards more efficient and suitable forms of transportation modernization. If such a problem continues to be experienced this problem will eventually result in too much-emitted carbon dioxide and could result in the destruction of the planet and its effect on the people. Due to these pollutants, Metro Manila had failed to attain the federal and state standards in terms of air quality.

Based on the reviewed literature and studies on traffic congestion within developing areas, it has become a necessity to address the problem of traffic congestion in Guagua Town Proper as early as possible to avoid further inconveniences and before the situation would become worse. Hence, this study was conceptualized to provide a new road rerouting traffic scheme that would alleviate traffic congestion.

1.2 Background of the Study

Citizens have the right to inquire as to what is causing such congestion. One of the causes, why developing areas within the country are jam-packed on a daily basis, is overpopulation in the country. Overpopulation results in traffic since most of those people use vehicles to drive to their destination a day. Furthermore, the mainstream use of narrow roads also contributes to the matter. Narrow roads can be very hard to fit hundreds of vehicles that pass daily. It can tighten the traffic since it can only accommodate a certain number of cars. Lastly, the disobedience of drivers is additionally an explanation for traffic. There are lots of drivers who would only think of how

they could escape through this traffic faster, not taking into account what would be the effect of their actions on other people. Cutting, taking up cars, and disobeying the road signs are only a couple of the various things that drivers do on the road which brings inconvenience to the more law-abiding drivers who are suffering from these actions which may then cause traffic.

The problem of traffic had a lot of effect in the country. One of the consequences of traffic that has brought the eye of the people is the congested roads. As the roads would not be able to cater the number of vehicles it brings inconvenience and hassle to a lot of people. Congested roads might as well be compared to a pack of sardines in a can. That is how tight and cramped the streets are on a day-to- day basis (Kristensen, 2014).

The current traffic situation in Guagua may be described in similar fashion where the vehicles that pass along the roads of Guagua Town Proper are like sardines that could fit inside a can. If this situation continues, it will get worse which is comparable to the situation that the commuting public within Manila are already experiencing. Unless acted upon, these annoying phenomena will be experienced by the Guaguaeños.

Thus, this study was an attempt to help the municipality of Guagua design a new traffic road alignment scheme that would address the current problem on traffic.

1.3 Background of the Locale

The Municipality of Guagua is one of the 21 towns of the Province of Pampanga, Philippines. Along with the towns of Lubao, Porac, Sta. Rita, Floridablanca, and Sasmuan, Guagua belongs to the 2nd District of Pampanga.

Fig.1. Location of Guagua, Pampanga
(https://www.alviera.ph/news/pampanga-philippines/)

Located on the western part of the province, Guagua is about 9.5 kilometers off the City of San Fernando, and approximately 77 kilometers from Metropolitan Manila. The town is bounded on the north by the towns of Bacolor and Sta. Rita; on the south by the towns of Sasmuan and Lubao; on the east, Macabebe and Sasmuan; and on the west, Porac and Floridablanca.

Guagua is one of Pampanga's highly populated towns. Based on their year 2020 PSA census, there are 128,893 inhabitants in Guagua, with 1.95 percent of growth rate in that same year.

Table.1. Population of Guagua, Pampanga

Guagua Town Population in 2020	Growth Rate
128,893	**1.95**

Guagua Town Plaza, located at Plaza Burgos, is within the Poblacion area along with the jurisdictional units of Bancal, San Nicholas 1st, San Pedro, San Rafael, San Roque, Sta. Filomena, Sto. Cristo, and Sto Niño.

Fig.2. Plaza Burgoz or Guagua Town Proper Floor Plan
(Municipal Planning and Development Office)

Based on the records from the Municipal Planning and Development Office, the lot area of Guagua Town Plaza is 5.7043km, with a population of 29,623 in Poblacion areas. To be specific, the populations per jurisdictional units are as

follows: Plaza Burgos – 278; Bancal – 6,896; San Nicholas 1st – 1,686; San Pedro – 5,490; San Rafael – 4,073; San Roque – 3,358; Sta. Filomena – 1,950; Sto. Cristo – 3,724; and Sto. Niño – 2,168. This will make up 26.07 percent of the total population within the town.

Table.2. Population of Poblacion Areas in Guagua, Pampanga

Guagua Town Plaza Population	
Plaza Burgoz	278
San Nicholas 1st	1,686
San Pedro	5,490
San Rafael	4,073
San Roque	3,358
Sta. Filomena	1,950
Sto. Cristo	3,724
Sto. Niño	2,168
Total	**29,623**

As stated by the study of Municipal Planning and Development of Guagua, the municipality has a high level of economic activity accumulation and concentration, as well as a complex geographical structure supported by transportation infrastructure. Being the center of the 2nd District of Pampanga, the greater its complexity and the potential for disruptions, particularly when this complexity is not effectively managed. Public productivity is highly dependent on the efficiency of its transport system to move labor, consumers and freight between multiple origins and destinations. Additionally, transport groups "terminals" within nearby municipalities are traversing the municipal town proper area, contributing to a specific array of problems. Some problems are ancient, like congestion, jeepneys, and tricycle *colorums*, road capacity, lack of business establishments parking space, while others are new like urban freight distribution or environmental impacts.

As eloquently stated by Aldwin C. Mallari, SAA I (CEO) of Traffic Regulatory Unit and Enforcement of Guagua, there have been 1,371 public utility jeepneys and 2,017 public utility tricycles that were permitted by the municipality to operate as public transport. Data also showed that in 2021 there was an accumulated 10,856 average daily passenger volume (pax/day) only from the routes from Guagua to Bacolor, Betis, Sta. Rita, Plaza, Lubao and Floridablanca. This data would continuously increase by 2022 with an average daily passenger volume (pax/day) of 11,046, still only coming from the said route. Adding to this was also the number of passengers coming from the other routes from Guagua Town Proper. The data did not include the private vehicles, delivery vans and trucks that passed through the roads of Guagua Town Plaza.

1.4 Statement of the Problem

The current study on how to decongest the traffic in Guagua Town Proper aimed to address the following sub – problems:

1. How is the traffic congestion in Guagua Town Proper be described and assessed?
   a. What is the status of Guagua Town Proper regarding the traffic congestion?
   b. What is the current traffic congestion engineering scheme employed within the Guagua Town Proper?
2. What are the possible causes and effects of traffic congestion in Guagua Town Proper?
3. How may the respondents be described in terms of the following dimensions:
   a. Level of awareness on the traffic condition in Guagua Town Proper?
   b. Level of Knowledge on the current traffic scheme?
   c. Level of Implementation and Obedience on the current traffic scheme employed?
   d. Is there a significant relationship between the Causes of traffic congestion and Level of awareness on the traffic condition in Guagua Town Proper, causes of traffic congestion s and Level of Knowledge on the current traffic scheme, and causes of traffic congestion s and Level of Implementation and Obedience on the current traffic scheme employed?
   e. Is there a significant relationship between the Level of awareness on the traffic condition in Guagua Town Proper and Level of Knowledge on the current traffic scheme, the Level of awareness on the traffic condition in Guagua Town Proper and Level of Implementation and Obedience on the current traffic scheme employed, and the Level of Knowledge on the current traffic scheme and Level of Implementation and Obedience on the current traffic scheme employed?
4. How can road rerouting solve the problem of traffic at Guagua Town proper?

a. Based on the findings of the study, what possible road rerouting plan may be recommended to address the traffic congestion problems along with the Guagua Town Proper?

1.5 Conceptual Framework

The researchers employed the Input – Process – Output framework (IPO Method) in developing the research undertaking. For the input part, the researchers considered the following: respondents' assessment on the traffic congestion status within Guagua, the causes of traffic; the effects of traffic among the town's people or constituents; the respondents' level of awareness on the current traffic situation; level of knowledge on the present traffic scheme employed; level of implementation and obedience; and the current traffic scheme being employed. Meanwhile, the researchers made use of the following data – gathering processes in developing the research study namely: survey questionnaire; informal interviews; observations and statistical treatments. Lastly, the utmost output desired within this study was to come up with a road rerouting plan that would decongest traffic within the Guagua town proper.

Paradigm Of the Manual System:

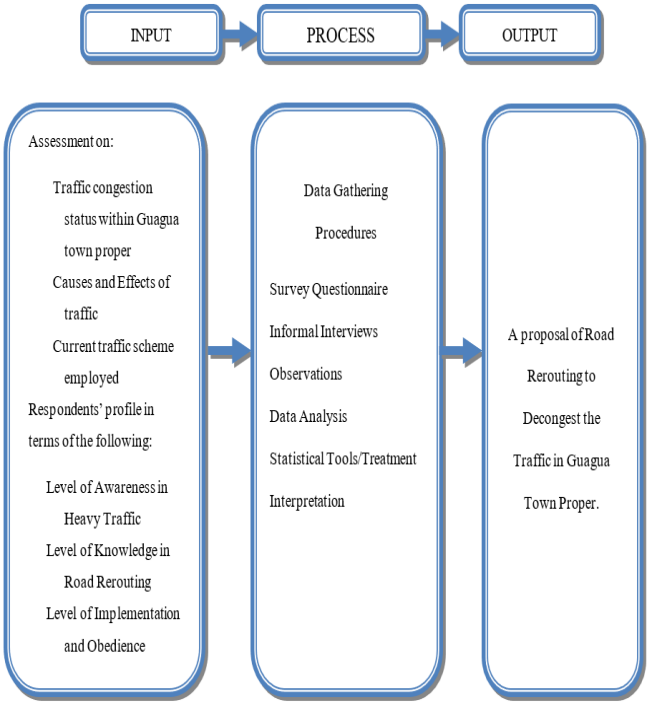

Fig.3. Input-Process-Output Diagram of the Manual Process

1.6 Significance of the Study

For the Municipality of Guagua, the proposed study aimed to serve as a reference guide for the municipality in finding solutions to the current problem of Guagua on traffic congestion. It was primarily aimed to realign the traffic flow in Guagua Town Proper to decongest the traffic situation. Subsequently, for the Municipality of Guagua, a faster flow of traffic could primarily contribute to the development of the municipality.

For the Drivers within Guagua, this research study would subsequently help the Public Utility Vehicles (PUJ) and Delivery Vehicles to have more convenient and faster travel around the Guagua Town Proper. It would also be a help so that they may get higher compensation per day due to faster traveling. A faster delivery system may also be experienced due to the new traffic flow.

For the Commuters, such as students, employees, and residents of Guagua, the new road rerouting of roads would give them faster commuting time so that they could arrive at the exact time they need to be.

Additionally, for future researchers, this study may provide guidance and proper information to other researchers in the region who may be contemplating to conduct similar research undertakings.

1.7 Scope and Delimitation

This study was limited to finding solutions to the continuous traffic problems that have been experienced by the commuters in Guagua Town Proper. In line with this, the researchers proposed a road rerouting scheme that will decongest the traffic at Guagua Town Proper. It also covered the perceptions of those people who are directly affected by the traffic.

The study considered selected participants such as jitney drivers, tricycle drivers, private vehicle drivers, students, and workers that normally enter the Guagua Town Proper zone.

1.8 Hypothesis

The researcher's null hypothesis was that there is no significant relationship between the respondents' profile in terms of their level of awareness on the current traffic situation of Guagua town proper; level of knowledge on the traffic scheme employed and the level of obedience and implementation on the scheme and the traffic congestion experienced within the area. The research came up with a proposal of the new road scheme that can solve the traffic congestion in Guagua Town proper.

1.9 Objectives of the Study

The current study on: "Assessment of Traffic Congestion Within Guagua Town Proper, as a Basis for Road Rerouting Plan" aims to eliminate the continuous problem experienced by commuters within the area that is congested with traffic. Through this study, a new management system was proposed to properly control the flow of vehicles which may afterward solve the problem of traffic, especially within Guagua Town Proper and the nearby barangays. This study may encourage commuters to have a change of attitude and behavior towards greater use of sustainable modes of transport, for example, public transport, collective transport, and walking and cycling. Improved access to public transport for all people and organizations in the area may be attained if the conditions for sustainable transport modes would be strengthened. It also aimed to give an idea to the Town Officials on how they could solve this problem in traffic. By eliminating this problem in traffic, it could increase the economic efficiency of Guagua Town.

Hence, the main objective of the study was to come up with a re – alignment or re – engineering plan along the roads of Guagua Town Proper which would subsequently alleviate the traffic congestion within the area.

1.10 Definition of Terms

CONGESTION – Overcrowding; clogging. A situation in which a place is crowded with people or vehicles, so that it is difficult to move around.

CARMAGEDDON – A state of extreme traffic congestion. A serious traffic jam which results from a major road being closed.

DECONGESTION – To diminish or end the congestion of.

DENSITY – The spatial property of being crowded together. The amount of something in a particular space or area.

JITNEY - a small bus or car following a regular route along which it picks up and discharges passengers, originally charging each passenger five cents.

ROAD REROUTING – is defined as the act of choosing a different path for travel. The process by which something is rerouted; a diversion or redirection.

ROAD WIDENING – To become, or to make something greater in width in order the traffic will lessen.

TRAFFIC – The movement of vehicles, ships, persons, etc., in an area, along a street, through an airplane, over a water route, etc.

TRAFFIC VOLUME – Is defined as the number of vehicles crossing a section of road per unit time at any selected period. It measures the point of passing during specified time travel.

TRAVEL TIME – A period of time spent traveling. Refers to the cost of time spent on transport. It includes costs to businesses of the time their employees and vehicles spend on travel, and costs to consumers of personal (unpaid) time spent on travel.

II. METHODOLOGY

2.1 Research Design

The research study employed a quantitative research design. A quantitative study is an inquiry into social or human problems based on testing a theory composed of variables, measured with numbers, and analyzed with statistical procedures in order to determine whether the predictive generalizations of that theory held true. (Creswell, J., 1994,2)

This study specifically employed the descriptive-normative method of quantitative research that goes beyond merely gathering and tabulation of data. It involves an element of interpretation of the meaning and significance of what was being discussed and assessed. The normative method part of the research was conducted through the employment of the survey questionnaire, while the descriptive method part of the research was done by giving descriptions and meanings of what was being surfaced in the gathering of data and information. According to Witney (2004), the descriptive method describes and interprets the data gathered. It is concerned with conditions of relationships that exist, practices that prevail, beliefs, processes that are going on, effects that are being felt, or trends that are developing. In this particular research on "Assessment of Traffic Congestion Within Guagua Town Proper as a Basis for Road Rerouting Plan", the data gathered through the survey questionnaire, interviews and observations were analyzed and interpreted in order to come up with a new road – rerouting scheme that would improve the traffic condition within the area.

2.2 Research Instrument

The main instrument that was employed in this study was a self-made survey questionnaire. In this method, written responses were given to the prepared questions which were intended to elicit answers to the problems of the study. The first part of the questionnaire covered the respondents' assessment on the current traffic situation within the Guagua town proper. The second part of the questionnaire dealt on the causes and effects of the traffic congestion

within the area. The current traffic scheme employed by the municipality of Guagua specifically within the town proper was tackled on the third part of the questionnaire which was then followed by the questions that describe the respondents' profile in terms of three dimensions namely: their level of awareness on the present traffic situation within the area; their level of knowledge on the traffic scheme used; and the level of implementation and obedience of the constituents on the on-going traffic scheme.

To further test the validity of the questionnaire, informal interviews were conducted as well as observations were done by the researchers. Interviews were also conducted among the officials of the different offices who are directly connected to the traffic management system of the municipality. The observation method was employed by the researchers as they investigated the current situation of the given phenomena and recorded the obtained outcomes. On top of this, the questionnaire also went through a series of validation by a licensed statistician.

To identify the traffic volume and density within the Guagua Town Proper, data were collected from the traffic office of the municipality. To further assess this data, actual observations were also conducted by the researchers in the area. With this collection of data and observations, the researchers were able to assess and identify what areas are congested and the peak hours of traffic. It subsequently helped in developing the new road rerouting plan within the area.

2.3 Research Respondents

The researcher employed a random sampling method in determining the respondents of the study. Random sampling is a method of selecting a sample size from a universe such that each member of the population has an equal chance of being included in the sample and all possible combinations of size have an equal chance of being selected in the sample. (Pagoso, 2000, p. 27). The researchers selected 100 respondents coming from the people that are directly affected by the congestion of traffic. The qualified respondents, in this study, were the jeepney drivers, tricycle Drivers, private vehicle drivers, people of Guagua, students, and workers within the Guagua Town Proper. Thus, to select the one hundred participants and to determine how many for each group or class were to be considered, stratified sampling was used where the distribution of samples is proportional to the total number of units in each stratum (Pagoso, 2000, p. 39).

2.4 Construction and Validation of Questionnaires

In this research, the proponents used one questionnaire for the jeepney or jitney drivers, tricycle drivers, private vehicle drivers, students, and workers that normally enter the Guagua Town Proper zone. The final draft of the questionnaires was presented as follows.

I. Assessment on the condition of traffic congestion in Guagua Town Proper
   a. What type of vehicle do you own?
      i. PUJ (Public Utility Jeep)
      ii. PUV (Private Utility Vehicle)
      iii. Commuter
      iv. Both commuter and owns a PUV (Private Utility Vehicle)
   b. Travel time within Guagua Town Proper only:
      i. Below 10 mins.
      ii. 11 mins. to 20 mins.
      iii. 21 mins. to 30 mins.
      iv. Above 30 mins.
   c. How long were you stuck on the traffic in Guagua Town Proper?
      i. Below 10 mins.
      ii. 11 mins. to 20 mins.
      iii. 21 mins. to 30 mins.
      iv. Above 30 mins.

II. How severe is the traffic congestion in Guagua Town Proper?
   i. At No Extent
   ii. At Lesser Extent
   iii. At Moderate Extent
   iv. At Greater Extent

III. The possible causes of traffic congestion in Guagua Town Proper:
   a. Smaller road area
   b. Ineffective routes implemented

c. Big volume of vehicles
d. Illegal street vendors
e. Illegal parking
f. Traffic violators
g. Others: _____

i. At No Extent
ii. At Lesser Extent
iii. At Moderate Extent
iv. At Greater Extent

IV. Effects of traffic congestion in Guagua Town Proper:
a. Waste of time
b. Non- productivity
c. Delays
d. Road Rage
e. Inconvenience
f. Others: _____
i. At No Extent
ii. At Lesser Extent
iii. At Moderate Extent
iv. At Greater Extent

V. Level of Awareness:
a. Extent of awareness on the number of vehicles that pass through Guagua Town Proper
b. Extent of awareness on the traffic congestion in Guagua Town Proper
c. Level of awareness on the presence of illegal street vendors

i. At No Extent
ii. At Lesser Extent
iii. At Moderate Extent
iv. At Greater Extent

VI. Level of Knowledge:
a. Level of knowledge on the prescribed road routes
b. Level of knowledge on allotted parking areas
c. Level of knowledge on the loading and unloading zones
d. Level of knowledge on pedestrian area
e. Level of knowledge on terminals

i. At No Extent
ii. At Lesser Extent
iii. At Moderate Extent
iv. At Greater Extent

VII. Level of implementation:
a. Follow strictly the routing scheme
b. Obedience to traffic rules
c. Use of correct pedestrian lane
d. Use of drop-off points
e. Use of correct parking places

i. At No Extent
ii. At Lesser Extent
iii. At Moderate Extent
iv. At Greater Extent

VIII. Assessment on how road rerouting can solve the problem of traffic at Guagua Town Proper:
a. Prevents delay
b. Smooth and efficient traffic situation
c. Increase productivity
d. More investment
e. Decrease road disputes
f. Others: _____

i. At No Extent
ii. At Lesser Extent
iii. At Moderate Extent
iv. At Greater Extent

2.5 Statistical Procedure

To systematically analyze and interpret the collected data, the researchers employed the following statistical procedures:

a. *Frequency Counts.* This tool is used to determine how many of the respondents had given their assessments in each indicator provided within the variable set in the questionnaire

b. *Weighted Mean.* This is utilized to categorize the responses of the participants

Formula:

$$\bar{x} = \frac{\Sigma fx}{n} (Equation\ 1)$$

Where:

$\bar{x}$ = mean

Σ = (sigma) the summative

fx = the product of the frequency and the weights of the summative

n = number of sample population

c. *Norms for interpretation.* In the proper interpretation of the results the Likert Scale will be used to analyzed the attitudes of options of the participants using the four-point scale.

Response Category	Descriptive Interpretation	Range Interval
1	At No Extent	1.00 – 1.75
2	At Lesser Extent	1.76 – 2.50
3	At Moderate Extent	2.51 – 3.25
4	At Greater Extent	3.26 – 4.00

d. *Pearson Product Moment Correlation (Pearson r)* This tool is used to determine whether there is a significant relationship between the profiles of the respondents in terms of the following variables: level of awareness on heavy traffic situation; level of knowledge on road rerouting; level of implementation and obedience of respondents on the existing traffic scheme and the other variable which is the traffic congestion scheme implemented.

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{\{n(\sum x^2) - (\sum x)^2\}\{n(\sum y^2) - (\sum y)^2\}}} \quad (Equation\ 2)$$

e. Test of Significance of r. This tool is employed to determine whether the obtained result for r is statistically significant.

$$t = r\sqrt{\frac{n-2}{1-r^2}} \quad (Equation\ 3)$$

2.6 Road Rerouting Plan Procedure

To come up with the new road rerouting plan, the study employed the Transportation Planning Process. The Transportation Planning Process was supposed to be comprehensive, with data on current conditions and historical growth being collected, analyzed, and interpreted. The purpose was to set goals and objectives, analyze the city's "current patterns of mobility," and estimate future demand patterns using trend-based modifications or a variety of investment possibilities. These potential packages were compared to the "do nothing" scenario as well as the aims and objectives established at the start of the process.

The Transport Planning Process was structured in accordance with the systems approach to analysis, signaling a shift away from decisions based on intuition and experience and toward an analytical approach. This study specifically utilized Thomson (1974) Transportation Planning Process, as follows:

Problem Definition:

The researchers identified what was the problem and what were the planning objectives.

Diagnosis:

The researchers identified how the problem originated with views from different perspectives, through the utilization of survey questionnaires.

Projection:

The researchers forecasted what would likely to happen in the future.

Constraints:

The researchers considered the three main types of constraints that limited the choice of alternatives (financial, political and environmental).

Options:

The researchers identified what were the range of options which could be used to achieve the planning objectives stated.

Formulation of Plans:

The researchers formulated the new road rerouting plan covering road and public transport alternatives and road map.

III. Results And Discussion

3.1 Survey Results

Table.3. Frequency and Percentage Distribution on the Assessment on the Traffic Condition in Guagua Town Proper in terms of the Types of Vehicles Used by the Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Both PUV's and PV's	9	9.0	9.0	9.0
	Private Vehicles (PV's)	16	16..0	16.0	25.0
	Public Utility Vehicles (PUV's)	34	34.0	34.0	59.0
	Commuters Using PUV's	41	41.0	5410	100.0
	Total	100	100.0	100.0	

Reflected in Table.3. is the assessment of the respondents on the traffic condition in Guagua Town Proper in terms of the different classification of vehicles used by the respondents. Data showed that forty one percent (41%) of the respondents, which is equivalent to forty-one out of one hundred respondents (41/100), use public utility vehicles as their mode of transport in going around Guagua. Furthermore, obtained responses also reveal that thirty four percent (34 %) or thirty-four of the one hundred respondents (34 / 100) used public utility owned vehicles, which are either public utility owned jeepneys or public utility owned tricycles. From the one hundred respondents, only sixteen of them used privately – owned vehicles, which is equivalent to sixteen percent (16 %). The remaining nine percent (9 %) or nine out of one hundred (9/100) respondents used both private vehicles and public utility vehicles.

Table.4. Frequency and Descriptive Statistics of the Assessment on the Traffic Condition in Guagua Town Proper in terms of the Travel Time Experienced by the Respondents

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Below 10 minutes	1	1.00	.10.00	5.50	
11 – 20 minutes	82	11.00	20.00	15.50	.
21 – 30 minutes	10	21.00	30.00	25.50	.
Above 30 minutes	7	31.00	60.00	45.50	.
Valid N (listwise)	100	1.00	60.00	18..50	8.10

The assessment of the respondents on their travel time within Guagua Town Proper alone, show that eighty percent (82 %) of them took around eleven to twenty minutes (11 to 20 minutes) before they had reached their destination. On the average, it took them around fifteen minutes and 30 seconds (15.5 minutes) to travel only around Guagua Town Proper. Ten of the respondents experienced travelling around the town proper for twenty-one to thirty minutes (21 – 30 minutes) or an average of twenty-five minutes and thirty seconds (25.5 minutes). Furthermore, seven of the respondents even experienced a travel time of above thirty minutes (above 30 minutes). Only one of the respondents mentioned that he/she took only below ten minutes to travel around Guagua Town Proper. On the average, his/her travel time is around five minutes and thirty seconds (5.5 minutes). The consolidated mean of the respondents' travel time reveals that the average travel time around Guagua Town Proper only averages to eighteen minutes and thirty seconds (18.5 minutes) and a standard deviation of eight and ten hundredths (8.10) minutes. This means that the assessment of the respondents on their travel time varies from the mean by eight standard deviations.

Table.5. Frequency and Descriptive Statistics of the Assessment on the Traffic Condition in Guagua Town Proper in terms of the Length of Time the Respondents have been Stuck in Traffic

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Below 10 minutes	6	1.00	.10.00	5.50	
11 – 20 minutes	50	11.00	20.00	15.50	.
21 – 30 minutes	44	21.00	30.00	25.50	.
Above 30 minutes	0	31.00	60.00	45.50	.
Valid N (listwise)	**100**	**1.00**	**60.00**	**19.30**	**5.99**

Based on the obtained information in Table.5., fifty percent (50 %) of the respondents have experienced being stuck in traffic within Guagua Town Proper for around eleven to twenty minutes. On the average, fifty out of one hundred respondents have been in traffic for around fifteen minutes and thirty seconds (15.5 minutes). Moreover, forty four percent of them have been stuck in traffic for around twenty-one to thirty minutes. The average time that the forty-four respondents have experienced lasts for around twenty-five minutes and thirty seconds. Only six of the respondents have experienced being stuck in traffic for ten minutes and below. This information reveals a clear description on the traffic condition in Guagua Town Proper which may last from fifteen minutes to twenty-five minutes.

Table.6. Frequency and Descriptive Interpretation of the Respondents' Assessment on the Traffic Condition in Guagua Town Proper in terms of the Traffic Congestion Extent of Seriousness

Descriptive Statistics

X	f	Mean	Std. Deviation	Descriptive Interpretation
1 (At No Extent)	0	1.00	0.00	
2 (At Lesser Extent)	4	8.00	14.14	
3 (At Moderate Extent)	4	12.00	3.10	At Greater Extent.
4 (At Greater Extent)	92	368.00	1.32	
Valid N (listwise)	**100**	**3.88**	**0.43**	

An assessment on the extent of seriousness of the traffic congestion in Guagua Town Proper reveals that the majority of them agree that the traffic condition in Guagua falls under the greater extent of seriousness. This description is scientifically based upon the obtained weighted mean of three and eighty-eight hundredths (3.88) and a general standard deviation of forty-three hundredths (0.43). The obtained standard deviation of forty-three hundredths (0.43) indicates that the assessment of the respondents on the extent of seriousness of the traffic condition along Guagua Town Proper do not vary much. This value shows that the assessment of the respondents on the extent of seriousness is almost the same.

Table.7. Frequency and Descriptive Interpretation of the Respondents' Assessment on Possible Reasons for Traffic Congestion

Descriptive Statistics

	1	2	3	4	Mean	Std. Deviation	Descriptive Interpretation
Smaller Road Area	0	3	2	95	3.92	0.37	At Greater Extent.
Ineffective Routes Implemented	1	2	1	96	3.92	0.42	At Greater Extent.
Big Volume of Vehicles	1	0	3	96	3.94	0.34	At Greater Extent.
Illegal Street Vendors	1	0	1	98	3.96	0.31	At Greater Extent.
Illegal Parking	0	2	4	94	3.92	0.34	At Greater Extent.
Traffic Violators	1	0	2	97	3.95	0.33	At Greater Extent.
Valid N (listwise)				**100**			

Results in Table.7. clearly confirm that the respondents agree that the main reason for the traffic congestion in Guagua Town Proper is caused by illegal street vendors. This is supported by an obtained mean of three and ninety-six hundredths (3.96) and a standard deviation of thirty-one hundredths. (0.31). Such value indicates that the respondents' assessment that illegal street vendors are the main possible cause for traffic conditions in Guagua do not vary. The respondents are in agreement in making such an assessment for the smaller the standard deviation, the smaller is the extent of variation in terms of their responses.

Second in the possible cause of traffic congestion are the traffic violators, as reflected with the obtained mean of three and ninety- five hundredths (3.95) and a standard deviation of thirty – three hundredths (0.33). Third in the assessment of the respondents is the big volume of vehicles that move around the Guagua Town Proper. The obtained mean three and ninety – four hundredths (3.94), which has a descriptive rating of at a greater extent, and a standard deviation of thirty – four hundredths (0.34). Getting the same mean of three and ninety – two hundredths (3.92) are illegal parking, smaller road area and ineffective routes implemented. Although, the three possible causes got the same mean that can all be statistically described as at a greater extent, the fourth on the list of possible causes is illegal parking because this variable got the smallest standard deviation of thirty – four hundredths (0.34) as compared to the other two which got

standard deviations of thirty – seven hundredths (0.37) and forty – two hundredths (0.32).

Table.8. Frequency and Descriptive Interpretation of the Respondents' Assessment on the Effects of Traffic Congestion

Descriptive Statistics

	1	2	3	4	Mean	Std. Deviation	Descriptive Interpretation
Waste of Time	1	0	5	94	3.92	0.04	At Greater Extent.
Non-Productivity	0	0	8	92	3.92	0.27	At Greater Extent.
Delays	0	3	3	94	3.91	0.38	At Greater Extent.
Road Range	1	3	12	84	3.79	0.54	At Greater Extent.
Inconvenience	0	3	6	91	3.98	0.41	At Greater Extent.
Valid N (listwise)				100			

An obtained mean of three and ninety – eight hundredths (3.98) and a standard deviation of forty -one hundredths (0.41) manifest that the respondents agree that traffic congestion brought about inconvenience among the travelers to a greater extent. Although this indicator got the highest mean, the assessment of the respondents on this specific indicator varied by forty - one hundredths as compared to the second on the list, which got a smaller standard deviation of four hundredths (0.04). The respondents strongly agree that much time is wasted at a greater extent due to traffic congestion. This is obtained from a mean of three and ninety – two hundredths (3.92). Third on the effect that traffic congestion brought to the travelers at Guagua Town Proper at a greater extent is non – productivity, with an obtained mean of three and ninety – two hundredths (3.92) and a standard deviation of twenty – seven hundredths (0.27). Another consequence that the respondents view to be brought by traffic congestion at a greater extent is delays, as manifested by a mean of three and ninety – one hundredth (3.91) and a standard deviation of thirty – eight hundredths (0.38). Lastly, the respondents are one in assessing that traffic congestion results in road rage at a greater extent. This claim is statistically supported by a mean of three and seventy – nine hundredths (3.79) and a standard deviation of fifty – four hundredths (0.54).

Table.9. Frequency and Descriptive Interpretation on the Respondents' Assessment on their Level of Awareness in terms of Different Variables

Descriptive Statistics

	1	2	3	4	Mean	Std. Deviation	Descriptive Interpretation
Number of Vehicles	2	0	7	91	3.87	0.49	At Greater Extent.
Traffic Congestion	1	0	8	91	3.89	0.40	At Greater Extent.
Presence of Illegal Street Vendors	1	2	4	93	3.89	0.45	At Greater Extent.
Valid N (listwise)				100			

Reflected in Table.9. are the level of awareness of the respondents in three indicators namely the number of vehicles that regularly pass through Guagua Town Proper, the traffic congestion within the area of concern and the presence of illegal street vendors. An analysis on the information obtained from the assessment of the respondents reveals that they are at a greater extent aware of the three indicators that exist within the area being studied. An obtained mean of three and eighty-nine hundredths (3.89) is shared both by the traffic congestion and the presence of illegal street vendors while a mean of three and eighty – seven hundredth is given to the number of vehicles that pass regularly through the roads of Guagua Town Proper. This information obviously shows that the respondent's level of awareness on the existence of these three indicators within the area of concern is at a greater extent. Thus, it cannot be claimed that the respondents are unaware of the current traffic condition in Guagua Town Proper. This information evidently supports that the respondents are fully aware of the present conditions in Guagua Town Proper.

Table.10. Frequency and Descriptive Interpretation on the Respondents' Assessment on their Level of Knowledge in terms of Different Indicators on Traffic Decongestion Measures

Descriptive Statistics

	1	2	3	4	Mean	Std. Deviation	Descriptive Interpretation
Prescribed Road Routes	0	3	20	77	3.74	0.50	At Greater Extent.
Allotted Parking Areas	1	1	19	79	3.76	0.51	At Greater Extent.
Loading and Unloading Zones	0	2	23	75	3.73	0.49	At Greater Extent.
Pedestrian Area	0	1	23	76	3.75	0.46	At Greater Extent.
Terminals	0	2	22	76	3.74	0.48	At Greater Extent.
Valid N (listwise)				100			

Shown on Table.10. is the assessment of the respondents' level of knowledge on indicators such as: knowledge on prescribed road routes; allotted parking areas; loading and unloading zones; pedestrian areas; and terminals. With an

obtained mean of three and seventy – six hundredths (3.76) and a standard deviation of fifty – one hundredth (0.51) is the respondents' level of knowledge on allotted parking areas. This value indicates that the respondents' knowledge on allotted parking areas is of great extent. Likewise, the respondents' level of knowledge on assigned pedestrian areas or lanes is also of great extent as manifested on the derived mean of three and seventy- five hundredths (3.75) and a standard deviation of forty – six hundredths (0.46). The level of knowledge of the respondents on designated terminals is also at great extent as can be noted from the obtained mean of three and seventy – four hundredths (3.74) and a standard deviation of forty – eight hundredths (0.48). Results also indicate that the respondents' level of knowledge on prescribed road routes around Guagua Town Proper is of great extent. This is taken from the mean of three and seventy – four hundredths (3.74) and standard deviation of fifty hundredths (0.50). Lastly, getting a mean of three and seventy – three hundredths (3.73) and a standard deviation of forty – nine hundredths, is the level of knowledge of the respondents on designated loading and unloading zones, which can be statistically interpreted as of great extent. The above-mentioned data confirm that the level of knowledge of the respondents on the different indicators employed by the Municipality in decongesting the traffic situation around Guagua Town Proper is at great extent. This information evidently supports that in spite that the respondents' level of knowledge on these traffic decongestion measures is at great extent still the problem of traffic congestion exists.

Table.11. Frequency and Descriptive Interpretation on the Respondents' Assessment on their Level of Implementation in terms of Different Indicators on Traffic Management Measures

Descriptive Statistics

	1	2	3	4	Mean	Std. Deviation	Descriptive Interpretation
Following strictly the Routing scheme	2	5	40	53	3.44	0.69	At Greater Extent.
Obedience to Traffic Rules	0	2	40	58	3.56	0.54	At Greater Extent.
Use of correct Pedestrian Lanes	1	3	42	54	3.49	0.61	At Greater Extent.
Use of Drop – Off Points	0	4	46	50	3.46	0.58	At Greater Extent.
Use of Correct Parking Places	1	3	47	49	3.44	0.61	At Greater Extent.
Valid N (listwise)				100			

As assessed by the respondents, they are in agreement that the level of implementation on following traffic rules is of great extent and obtained the highest mean of three and fifty – six hundredths (3.56) and the lowest standard deviation of fifty – four hundredths (0.54). The respondents' assessment on the level of implementation are almost the same. The respondents also agree that the level of implementation on the use of pedestrian lanes is at great extent, with a mean of three and forty – nine hundredths (3.49) and a standard deviation of sixty – one hundredth (0.61). A mean of three and forty – six hundredths (3.46) and a standard deviation of fifty – eight hundredth (0.58) supports that the respondents' agreement on the level of implementation on the use of drop – off points within Guagua town proper is at great extent. Similarly, they are also sharing the same assessment that the level of implementation on the use of parking places and following strictly the routing scheme is of great extent as they were both rated with a mean of three and forty – four hundredths (3.44) and standard deviations of sixty – one hundredth (0.61) and sixty – nine hundredths (0.69), respectively. This information also affirms that despite the level of implementation on traffic measures was assessed to a great extent, the problem on traffic around Guagua Town Proper remains unsolved and persisting.

Table.12. Frequency and Descriptive Interpretation on the Respondents' Assessment on how Road Alignment can Solve the Problem of Traffic at Guagua Town Proper

Descriptive Statistics

	1	2	3	4	Mean	Std. Deviation	Descriptive Interpretation
Prevents Delays	1	1	5	93	3.90	0.41	At Greater Extent.
Smooth and Efficient Traffic Situation	0	0	4	96	3.96	0.20	At Greater Extent.
Increase Productivity	1	2	2	95	3.91	0.43	At Greater Extent.
More Investment	0	1	4	95	3.94	0.28	At Greater Extent.
Decrease Road Disputes	0	2	2	96	3.94	0.31	At Greater Extent.
Valid N (listwise)				100			

The respondents strongly agree that the proposed road re – alignment can efficiently smoothen the traffic situation within Guagua Town Proper at a great extent as taken from the obtained mean of three and ninety – six hundredths (3.96) and a standard deviation of twenty hundredths (0.20). They also come to an agreement that the proposed road alignment will at a great extent bring more investment and will decrease road disputes, since the same mean of three and ninety – four hundredths was computed from these two

indicators, while their computed standard deviations are twenty – eight hundredths (0.28) and thirty – one hundredth (0.31), respectively. More so, they also come to terms that the proposed road alignment will at a great extent increase productivity since it will at a great extent prevent delays as deduced from the obtained means of three and ninety – one hundredth (3.91) and three and ninety hundredths (3.90) and standard deviations of forty – three hundredths (0.43) and forty – one hundredth (0.41). Based on the assessment of the respondents, the proposed road alignment can at a great extent address or solve the current traffic problem at Guagua Town Proper.

Table.13. Test of Relationship between the Possible Causes of Traffic Congestion and the Respondents' Assessment on the Level of Awareness, Level of Knowledge and Level of Implementation on the Traffic Condition at Guagua Town Proper

Correlations

		Awareness	Knowledge	Implementation	Causes
Awareness	Pearson Correlation	1	.189	.814	.500
	Sig. (2-tailed)		.879	.394	.667
	N	3	3	3	3
Knowledge	Pearson Correlation	.189	1	.585	-.049
	Sig. (2-tailed)	.879		.300	.938
	N	3	5	5	5
Implementation	Pearson Correlation	.814	.585	1	-.134
	Sig. (2-tailed)	.394	.300		.830
	N	3	5	5	5
Causes	Pearson Correlation	.500	-.049	-.134	1
	Sig. (2-tailed)	.667	.938	.830	
	N	3	5	5	6

Table.13. reveals that the level of awareness of the respondents on the three indicators namely number of vehicles that regularly pass through Guagua Town Proper, traffic congestion and the presence of illegal street vendors show moderately positive correlation with the causes of traffic congestion along Guagua Town Proper. This is evident from the obtained Pearson – r value of five tenths (0.5). However, a test of significance value of six hundred sixty-seven thousandths (0.667) shows that the computed value is greater than the critical probability value of five hundredths (0.05), thus the decision is not to reject the null hypothesis. This means that the relationship between the level of awareness of the respondents and the possible causes is not significant. These two indicators are moderately related, but they do not show significant relationship.

Between the respondents' level of knowledge on different indicators such as: prescribed road routes; allotted parking areas; loading and unloading zones; pedestrian lanes; and terminals, and the possible causes of traffic congestion, a Pearson – r value of negative forty – nine thousandths (-0.049) was obtained, which indicate a negligible correlation. Furthermore, a test of significance value of nine hundred thirty – eight thousandths (0.938) support the claim that there is no significant relationship between the two indicators since the null hypothesis is accepted.

A Pearson r – value of negative one hundred thirty – four thousandths (- 0.134) shows that there is a negligible correlation between the respondents' assessment on the existing level of implementation of traffic decongestion measures by the municipality and the causes of traffic congestion. Likewise, a test of significance value of eighty – three hundredths (0.83) supports that there is no significant relationship between the municipality's current level of implementation on traffic decongestion measures and the possible causes of traffic congestion. The null hypothesis was accepted since the computed value is greater than the critical p – value of five hundredths (0.05).

Table.14. Test of Relationship between the Respondents' Assessment on the Level of Awareness, Level of Knowledge and Level of Implementation on the Traffic Condition at Guagua Town Proper

Correlations

		Awareness	Knowledge	Implementation
Awareness	Pearson Correlation	1	.189	.814
	Sig. (2-tailed)		.879	.394
	N	3	3	3
Knowledge	Pearson Correlation	.189	1	.585
	Sig. (2-tailed)	.879		.300
	N	3	5	5
Implementation	Pearson Correlation	.814	.585	1
	Sig. (2-tailed)	.394	.300	
	N	3	5	5

A statistical analysis on the relationship between the respondents' level of awareness on the current traffic

condition in Guagua Town Proper and respondents' level of knowledge on the different traffic decongestion measures employed by the municipality reveal that there is a negligible correlation between the two as interpreted from the obtained Pearson r – value of one hundred eighty – nine thousandths (0.189). Further tests of significance indicate that the null hypothesis has failed to be rejected since the computed value is eight hundred seventy – nine thousandths (0.879). The computed value is greater than the critical p – value of five hundredths (0.05), thus the decision failed to reject the null hypothesis. Hence, there is no significant relationship between the respondents' level of awareness on the current traffic condition in Guagua Town Proper and the respondents' level of knowledge on the different traffic decongestion measures employed by the municipality.

A Pearson r – value of five hundred eighty – five thousandths (0.585) indicates that there is a moderately positive correlation between the respondents' level of awareness on the current traffic condition in Guagua Town Proper and respondents' assessment on the level of implementation on the different traffic management decongestion measures employed by the Guagua municipality. It can be deduced from the result that when the level of awareness of the respondents on the different indicators on the current traffic condition at Guagua Town Proper is increased it will, likewise, moderately increase or affect the current municipality's level of implementation on the different traffic management decongestion measures. Despite the Pearson r – value showing a moderate positive correlation between the two variables, further testing shows that the relationship is not that significant. A test of significance value of three tenths (0.3) confirms that the null hypothesis has failed to be rejected. Henceforth, there is no significant relationship between the respondents' level of awareness on the current traffic condition in Guagua Town Proper and respondents' assessment on the level of implementation on the different traffic management decongestion measures employed by the Guagua municipality.

Lastly, an analysis on the relationship between the respondents' level of awareness on the different traffic decongestion measures employed by the municipality and the respondents' assessment on their level of implementation discloses that there is a high positive correlation between the two variables as justified from the obtained Pearson r – value of eight hundred fourteen thousandths (0.814). This result divulges that as the level of implementation of the municipality on the existing traffic management system is highly affected by the respondents' level of awareness on traffic decongestion measures. But, with the current situation in Guagua Town Proper, further tests of significance reveal that the relationship between the two variables is not significant. There is no significant relationship between the respondents' level of awareness on the different traffic decongestion measures employed by the municipality and the respondents' assessment on the level of implementation on the different traffic management measures. This claim can be justified by the obtained test of significance value of three hundred ninety – four thousandths (0.394) which is greater than the critical p – value of five hundredths (0.05). Consequently, the decision is a failure to reject the null hypothesis.

3.2 Interview Results

To further assess the current traffic situation in Guagua Town Proper, informal and formal interviews were conducted by the researchers. All interviewees agreed that Guagua Town Proper is experiencing traffic congestion on its road. Jason Mariano and Ernesto Gopez, a Jeepney Driver and Tricycle Driver, stressed that one of the problems that Guagua Town is experiencing is the problem of traffic. Jason Mariano also added that he had experienced being stuck in long traffic congestion within the roads of Guagua Town proper only, wasting more than 20 minutes being stuck in traffic. The same sentiment has also been expressed by the President of the Jeepney Organization of Dau-Maquiapo Route, Wilfredo Ronquilo. This claim is further affirmed by the Transport Regulations Unit and Enforcement Officer of the Municipality, Mr. Aldwin C. Mallari stated that it was true that one of the arising problems that the Municipality is experiencing through the years is the traffic congestion on its road.

When asked what causes this current problem, interviewees saw that the cause of the current problem is due to the overpopulation of vehicles, illegal vendors, illegal parking, violations of traffic rules and the current traffic flow. Ernesto Gopez, a tricycle driver, emphasized that one of the causes of traffic he sees in his everyday experience is that the dropping points are not being followed and illegal parking is one of the major causes of traffic. In addition to this, Benito Acetra, a jeepney driver, stated that the problem of traffic is caused by the mass volume of vehicles that enters Guagua Town Proper.

On the other hand, the Intelligent of Highway Patrol Group of the Municipality, Juan A. Aquilo, stated that the volume of vehicles that enters the Guagua Town Proper increases to the point that the roads within the Town proper could not accommodate the number of vehicles. He also added one of the major contributing factors to the number of vehicles is the numerous numbers of tricycles that enter the Guagua Town Proper. As an effect of the congested roads of Guagua Town Proper, drivers and commuters experience being stuck in traffic for several minutes causing inconvenience, being late in their destination or agenda and income lost for public utility drivers. Just like Krystal Gaile Dava and Riza L. David, both a commuter, who experienced being late at work and in school due to the traffic they experienced in Guagua Town Proper.

To solve this current traffic congestion problem, the researchers asked the interviewees about their stand on having a new road rerouting plan to decongest the current traffic congestion within the Guagua Town Proper. The researchers got positive feedback from the interviewees that the one way to solve the traffic congestion on the roads of Guagua Town Proper is to have a new road rerouting plan. Drivers like Ernesto Gopez, Benito Aceletra and Wilfredo Ronquilo, agreed that this new plan can be a solution to the traffic congestion that the Guagua Town Proper is experiencing. Both the Municipal Transport Regulations Unit and Enforcement Officer and the Intelligent of Highway Patrol Group of the Municipality, Aldwin C. Mallari and Juan A. Aquilo, affirm that having a new road rerouting plan can be able to solve the current problem of traffic congestion that the Guagua Town is experiencing. The Municipal Transport Regulations Unit and Enforcement Officer, Mr. Aldwin C. Mallari, also added that due to the current and fixed road plans and infrastructures within the Guagua Town Proper the infrastructure or road widening projects could not be able to be taken into consideration because it will subsequently affect all the current infrastructure alongside the roads of the Guagua Town Proper. With this, Mr. Aldwin C. Mallari, also saw that what can be done to solve or even just lessen the traffic congestion within the Guagua Town Proper is having a road rerouting plan to decongest the roads of Guagua Town Proper.

3.3 Traffic Volume Results

Table.15. Traffic Volume Results

Passenger/Vehicle Load/Volume Count				
MODE	A.M. COUNT	P.M. COUNT	TOTAL	PERCENTAGE
All Private Vehicles (Car/Taxi/Van/Pick-up)	204	166	370	13.14%
Jeepney	1015	674	1689	59.98%
Van For Hire (AUV, GT Express)	0	30	30	1.07%
Bus and Mini Bus	0	0	0	0%
Goods vehicle/ 2-Axle Truck	0	74	74	2.63%
Truck (3 or more axles)	17	1	18	0.64%
Motorcycle	137	133	271	9.62%
Tricycle	185	180	365	12.96%
TOTAL	1558	1258	2816	100%

Source: Transport Regulatory Unit and Enforcement of the Municipality of Guagua

Data shown above are based on the Municipal Passenger/Vehicle Load/Volume Count conducted by the Local Public Transportation Route Planning and Management of Municipality of Guagua, last January 28, 2020, during the Guagua Town Proper recorded peak hours of 7:00-8:00 am and 4:00 to 5:00 pm. Data shows that in a day there are a total of 2,816 vehicles entering the Guagua Town Proper from am to pm. This data shows that Jeepney Vehicles are the most dominant vehicles that enter Guagua Town Proper, obtaining 59.98% of the total vehicle count or 1689 total jeepneys. Next in line are the private vehicles having a total of 370 with 13.14%. On the other hand, motorcycles and tricycles get a percentage of 9.62% and 12.96% respectively, having a vehicle count of 271 and 365. The Good Vehicles that enter Guagua Town have a total number of 74 vehicles (2.63%). Vans for hire only get an 1.07% along with the 0.64% of the trucks entering the Guagua Town Proper. Lastly, data shows that there was no bus or minibus entering the Guagua Town Proper.

IV. Conclusion And Recommendation

4.1 Summary of Findings

Based on the results of the study, findings revealed that the majority of the people going around Guagua Town Proper uses Public Utility Vehicles such as tricycles and jeepneys as their mode of transportation. Commuters availing public transport made up forty one percent. In addition, were the thirty four percent respondents who use and own public utility vehicles. Thus, findings revealed that the roads of Guagua Town Proper were busy with public-utility vehicles moving around the area continuously. This finding was in contrast with the findings of the study conducted by a body organized and commissioned by the Duterte administration which revealed that seventy two percent of the traffic congestion was brought about by private commuting units. In the case of Guagua Town Proper traffic congestion was mainly brought by the swarming number of public utility vehicles. Such findings can be supported by data provided by Aldwin C. Mallari, SAA I (CEO) of Traffic Regulatory Unit and Enforcement of Guagua, that there are 1,371 public utility jitneys and 2,017 public utility tricycles that were permitted by the municipality to operate as public transport. Data also showed that in 2021 there is an accumulated 10,856 average daily passenger volume (pax/day) only from the routes from Guagua to Bacolor, Betis, Sta. Rita, Plaza, Lubao and Floridablanca. This data would continuously increase by 2022 with an average daily passenger volume (pax/day) of 11,046, still only coming from the said route.

The study revealed that the consolidated average travel time within Guagua Town Proper alone takes more or less eleven to twenty minutes or eighteen minutes and thirty seconds on the average. Such data result is very remarkable considering that the lot area of Guagua Town Proper is only 5.7043 kilometers (Guagua Municipal Planning and Development, 2021). Getting the ratio between the travel time and the lot area of Guagua Town Proper, it would take a commuter three to four minutes to cover a lot area of one kilometer. This finding would significantly show the administrator of the Guagua Municipal Planning and Development that the traffic situation in the town is a critical area of concern. Such a finding has been greatly supported by the result that fifty percent of the respondents experienced being stuck in the traffic for around fifteen minutes and thirty seconds on the average.

Another significant finding revealed in the study was the assessment on the extent of seriousness of the traffic congestion in Guagua Town Proper. Majority of the respondents agreed that the traffic condition in Guagua fell under the greater level of seriousness. Such a finding was verified by doing an actual observation on the situation. Using the Google Map application, the total travel time from Diosdado Macapagal Memorial Hospital to Guagua Public Market will only take nine to twelve minutes travel time at most.

However, findings showed the actual travel time within the Guagua Town Proper to Diosdado Macapagal Memorial Hospital, a 3.1 km route, takes 22 minutes. A disparity of ten to thirteen minutes between the suggested travel time and actual travel time has been noticed. This result clearly supported the claim that the level of seriousness of the traffic congestion in Guagua Town Proper was already at a great extent and preventive measures should already be taken to avoid worsening the situation.

Findings of the study showed that the alarming situation of traffic congestion within Guagua town proper was greatly caused by illegal street vendors, traffic violators and the big bulks or volume of vehicles. Thus, these findings strongly suggest that the traffic management system of Guagua Town Proper must be manned by competent and highly trained traffic enforcers. The study of Recio and Gomez (2013) confirmed that one of the basic concerns brought by illegal street vending is slowing down traffic and pedestrian flow. Moreover, the Department of Interior and Local Government's issuance of MC2019-121 issued to all local government units ordering them to clear roads of illegal structures and constructions to ensure speedy and smooth flow of vehicular traffic. It was mentioned in the issuance that street vending could ultimately cause traffic congestion because the sidewalks become limited for pedestrians who then walk on the streets which impede or obstruct the flow of vehicular traffic. Findings on the traffic congestion due to traffic violators were supported by the study conducted by PhilKotse (2020). In the said study, it was stated that traffic congestion has been caused by traffic violations such as wrong way entry, lane stealing, traffic light violations and others. It was also mentioned in the study that vehicular traffic is fluid-like. When vehicular traffic flow was suddenly jammed by street violators like lane stealing, the consequence of such an act will flow down the road just like a ripple on fluid like water. The traffic congestion caused by big volume of vehicles has been in consonance with the documentary compilations of Alberto Bull (2019) which concluded that the existence of an excessive number of private and public transport vehicles had helped significantly in increasing congestion, as noted in a number of cities within urbanized areas.

The effects of traffic congestion within Guagua Town Proper were at great extent. Findings presented that heavy traffic

greatly affects the town's people which bring inconveniences among the Guaguaeños. Much of their time is wasted in traffic resulting in non – productivity and delays. This finding conformed with the findings of Matthias Sweet findings, which was cited by Emily Badger in 2019. Badger mentioned that the findings of Sweet showed that traffic congestion caused people to come to work or in school late and deliveries cannot arrive on time.

Findings, further presented that the town people within Guagua Town Proper as well as the commuters' level of awareness on the different variable that caused current traffic congestion condition within the area was at great extent. The Guaguaeños were very much aware on the different factors considered which may contribute to the town's current traffic condition namely the number of vehicles that move around the roads of the town proper each day, the current traffic condition of the town and the presence of illegal street vendors.

Presented also in the findings was the level of knowledge of the town's folk and commuters on the different indicators showing the traffic decongestion measures taken by the municipal officials and personnel. The residents' level of knowledge on the existing traffic decongestion measures was at great extent. Furthermore, findings revealed that the level of implementation on the different indicators on the town's traffic management scheme was at great extent yet there is a continuous build-up of traffic within the Guagua Town Proper.

Findings of the study revealed that there was no significant relationship between the possible causes of traffic congestion and the respondents' level of awareness, level of knowledge, and the level of implementation on the traffic condition within Guagua Town Proper. There was no significant relationship between the respondents' level of awareness on the traffic condition of the town and the causes of traffic congestion. Also, there was no significant relationship between the respondents' level of knowledge on the different traffic decongestion measures and the causes of traffic congestion. Furthermore, there was no significant relationship between the level of implementation of the town's traffic management scheme and the causes of traffic congestion.

Moreover, statistical results supported the findings that there is no significant relationship between the respondents' level of awareness on the different indicators that are contributory to the town's traffic condition and the respondents' level of knowledge on the different traffic congestion measures. Likewise, there was no significant relationship between the respondents' level of awareness on the different indicators that were contributory to the town's traffic condition and the town's level of implementation of the different indicators showing the town's traffic management scheme. In addition, there was no significant relationship between the respondents' level of knowledge on the different traffic congestion measures and the town's level of implementation of the different indicators showing the town's traffic management scheme.

Findings showed that a new road rerouting scheme may greatly solve the traffic congestion which may prevent delays thus resulting in more investment, increase in productivity, smooth and effective traffic situation and decrease in road disputes.

4.2 Conclusions

From the findings of the study, the following conclusions were drawn.

- First, the level of severity of the traffic congestion in Guagua Town Proper was already at a great extent.
- Second, the traffic congestion was brought primarily by the presence of illegal street vendors which caused the pedestrians to use the main roads thus, obstructing the flow of traffic, the number of traffic violators and the numerous numbers of vehicles passing through its road every hour.
- Third, traffic bulk up within Guagua Town Proper was also disturbing since it would take around eighteen minutes and thirty seconds to move within the Guagua Town Proper area only. The amount of time that commuters experienced when stuck on traffic averaged to at least fifteen minutes and thirty seconds.
- Fourth, traffic congestion in Guagua Town Proper greatly affected the town's economic status due to lesser productivity, delays and inconveniences.
- Fifth, another significant conclusion drawn from the findings was the great extent of awareness of the town's folk on the traffic congestion condition of the area, thus their lack of awareness caused them to use their private vehicles which added up to the bulk of vehicles crossing the Guagua Town Proper roads.
- Sixth, the level of knowledge and the level of implementation on the existing traffic scheme were to a great extent, yet there was a continuous build-up of traffic which implicitly suggested its inefficiency and thus required modification.
- Seventh, there was no significant relationship between the causes of traffic congestion within Guagua Town Proper and the respondents' level of awareness on the different indicator's contributory to the traffic

condition of the town, the level of knowledge on traffic decongestion measures and the municipal level of implementation on the traffic management scheme.

- Lastly, there was no significant relationship between the respondents' level of awareness on the different indicators that are contributory to the town's traffic condition and the respondents' level of knowledge on the different traffic congestion measures. There was no significant relationship between the respondents' level of awareness on the different indicators that are contributory to the town's traffic condition and the town's level of implementation of the different indicators showing the town's traffic management scheme. There was no significant relationship between the respondents' level of knowledge on the different traffic congestion measures and the town's level of implementation of the different indicators showing the town's traffic management scheme.

Recommendations:

Deduced from the findings and conclusion of the research study, the researchers came up with the following recommendation:

- Produce a simulation of the proposed road rerouting plan that will ensure and validate the effectiveness of the traffic flow.
- Improve the designated terminals for the convenience of both commuters and PUJ (Public Utility Vehicle) drivers.
- Include data regarding the road fatalities and crash road rage affecting the traffic flow of the Guagua Town proper.
- Present and consider the measurement of roadway width in formulating the road rerouting plan.
- Provide roofing in the pedestrian sidewalk to give shade for the pedestrians.
- Strictly implement designated parking areas and drop-off areas within the area of the Guagua Town proper.
- Formulate an ordinance on transferring illegal sidewalk vendors on designated places within the area. Ensure that no vendors shall use the sidewalks.
- Design a parking area that will prevent illegal parking.
- Strictly screen the giving of transportation permits for public utility vehicles to lessen the bulk of vehicles passing the Guagua Town Proper.
- Hire well-trained and fully competent traffic enforcers that will man the traffic management system within the area.
- Conduct an awareness campaign on the newly designed road rerouting traffic scheme to educate the town's people and increase their level of awareness.
- Use this research for future studies.

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