A Vissim Simulated-Based Analysis of Traffic Congestion in Palawe Bridge, San Fernando Pampanga: A Proposed Traffic Modifications

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Abstract: - This study summarizes the current road traffic congestion measures and provides a constructive insight into the development of a sustainable and resilient traffic management system. Traffic congestion causes delays, inconvenience and economic losses to drivers and air pollution. By using traffic count daily and weekly, measurements are detailed therefore results help to improve the overall transportation systems sustainability to initiate mitigation strategies. A microscopic simulation model called VISSIM can optimize control systems, forecast their behavior before they are put into use, and forecast operational network performance. In VISSIM, a simulation road net similar to that of a driving simulator is drawn, and the traffic simulation parameters are set up to allow the simulation to run and the output of traffic flow characteristics. After running a traffic simulation, the influenced traffic flow indicators are obtained. This allows for the measurement of the effects that adverse weather has on the characteristics of traffic flow.

Key Words: — ***Traffic Signal, Traffic Flow, Level of Service, Pre-Time Signal Control.***

I. INTRODUCTION

The bridge is a way to keep roads connected across physical obstacles like gaps, railroads, barriers, and waterways. In addition to using interchanges rather than optical signals to reduce congestion delays at busy traffic intersections (Hu et al., 2020). On the bridges, this condition causes a few serious issues, including traffic congestion. Traffic congestion is a major issue in our daily lives. In many locations, the sudden increase in traffic can be attributed to several factors (Zhang & Batterman, 2018).

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The primary reason is that there has been an increase in the population, which has led to an increase in the number of cars and trucks on the road. In addition, there are a few other factors that contribute to traffic congestion, such as inadequate infrastructure, inadequate capacity management, work zones, special events, emergencies, uncontrollable demands, etc.

Traffic congestion is a widespread global phenomenon brought on by the growth of automobiles and their infrastructure, high population densities, and the proliferation of rideshare and delivery services. Diverse points of view have been used by researchers to define congestion. In terms of the state of traffic flow, the most common definition of congestion is when travel demand exceeds road capacity (Afrin & Yodo, 2020). Congestion, when the normal flow of traffic is disrupted by a high density of vehicles, results in excessive travel time, according to the delay-travel time perspective. Another way to define congestion is the increase in the cost to road users caused by the disruption of normal traffic flow. According to Kesuma et. al (2019) Congestion can have both material and non-material effects, such as time and opportunities lost due to the psychological impact of increased pressure on human life and energy inefficiencies and pollution.

The factors that are correlated with congestion and how congestion spreads from one road to another can be uncovered by analyzing and revealing the correlated patterns in traffic congestion (Marfia et al., 2018). Additionally, it can facilitate the development of a variety of applications, such as those for road planning, traffic condition prediction, and congestion impact analysis, among others. As a result, both individuals and governments stand to gain. In many cities worldwide, traffic congestion is a major issue. The prediction of congestion and analysis of traffic flows make up most of the previous research, but the correlation between congestion and road segments has not yet been investigated (Wang et al., 2017). The researchers discovered some significant patterns that facilitate the development of various transportation applications and lead to a correlation between high and low congestion. Governments and their citizens have paid close attention to understanding, easing traffic congestion, and further combating it (Unidas, 2020). Traffic congestion prediction, traffic condition estimation, the impact and correlation of traffic congestion, and traffic flow propagation have all been the subject of extensive research to study congestion from various perspectives.

One of the most significant challenges that traffic engineers have faced in managing the traffic congestion issue, particularly during peak times, is accurately predicting traffic flow in real time (Nagy & Simon, 2018). However, in order to comprehend the traffic characteristics in the transportation networks, the time series of the collected traffic data becomes essential. Different distributions due to specific events, such as traffic congestion, can be captured by studying the behavior of the traffic data, specifically the time series collected by traffic monitoring devices. Common situations, such as peak times and tourist destinations, can result in traffic congestion. Through prediction and planning, decision-makers can better manage traffic congestion in major cities by analyzing the irregular traffic pattern over time. However, due to the absence of consistent patterns, short-term time series with irregular traffic patterns can be difficult to analyze and predict (NCHRP et al., 2017).

Due to rapid urban population growth, an increasing number of urban vehicles are being driven. Modern urbanization is moving more quickly. The urban road is getting more and more complicated, and the issues with urban traffic are getting worse (Liu & Wu, 2018). When traffic congestion occurs in large cities, if it is not addressed promptly, it will result in increasingly crowded areas and even traffic paralysis. Researchers from both domestic and foreign universities have made significant progress in forecasting research in order to anticipate the traffic congestion issue (Koźlak & Wach, 2018). In order to create effective traffic management and control systems, precise traffic measurements are essential. Monitoring traffic congestion is essential for long-term traffic management as well as for increasing driving comfort and safety. As a result, improving traffic management and safety requires systematic traffic congestion detection (Harrou et al., 2020).

As traffic congestion has become more difficult to solve, the issue of controlling traffic signals at intersections has become even more pressing. It takes into account a variety of factors, including real-time strategies, signal timing constraints, rapid advancements in traffic systems, and practical implementation. The factors' interactions are stochastically complicated. (Eom, 2020)

Traffic management that makes use of information technology has the potential to reduce vehicle delays and increase the capacity of traffic intersections (Dresner & Stone, 2016). At intersections with traffic lights, adaptive traffic control is well-established in cities. When the traffic flow is isolated and has an interval distribution that is primarily exponential, adaptive regulation is mostly used at the lights.

The concept of the level-of-service of traffic in a section of a road is used to evaluate the perceived service quality of the road by drivers passing through the section (Kita, 2018). These measures of the level of service, such as traffic density and traffic flow rate, are not the level of service itself; rather, they are merely characteristics of traffic conditions that have a strong relationship to the level of service provided by the traffic and do not necessarily reflect the drivers' perception of the quality of service. It is also impossible to evaluate and compare the level of service between road sections of various types due to the various measures used for roads or road sections of various types (Athol, 2017).

A pre-timed control signal is the simplest form of signalization. In pretimed signal control, the cycle length, stages, green times, and, what's more, change stretches are preset. The sign is refreshed through this tedious cycle. There are a number of pre-set timing patterns that can be used, depending on the controller equipment. Different time plans can be initiated by the time clock at predetermined times of the day with multifil controllers (Chen & Hu, 2019). Pretimed signal control is set by Webster's postponement model. The timing plan can be continuously adjusted in response to the demand for traffic-thanks to-traffic actuated signal control.

II. METHODOLOGY

The researchers will make a model using traffic simulation VISSIM Software. Driving behavioral parameters as the research methodology will be use in this investigation. Each aspect of the research will be described in detail in this section: duration of the queue of traffic congestion, the number of vehicles categorized, and the number of turning motions.

2.1 Development of Ideas

The research method will begin with generating ideas. This phase consists of three sections: gathering of data and information from related literature, review of VISSIM software driving behavioral parameters, and development of simulation design.

2.1.1 Gather Data and Information from the Literature Review

The research begins with the review of related studies and literature. Initial studies stated that "The simulation result shows that travel time and delay time are both reduced under the control of traffic signals in different time periods."One of the most economical techniques to reduce traffic congestion in metropolitan arterial networks is traffic signal timing optimization and control" by Agbolosu-Amison (2012).

2.1.2 Review the VISSIM Software Driving Behavioral Parameters

The materials that will be use during the investigation will comply with the VISSIM Software Driving behavioral parameters. These will be employed in the micro simulation VISSIM software analysis to design the intersection motion turning.

2.1.3 Development of Simulation Design

Using the data acquired, the researchers will developed a model of the selected location with a traffic signal by utilizing the data obtained.

2.2 Setting the Appropriate Traffic Signal Design and Preparing the Calibration of VISSIM

This phase outlines the calibration of the simulation software and the validation of parameters that will be used in the study.

2.2.1 VISSIM Calibration

VISSIM is a microscopic traffic simulation system that can assess traffic operation conditions within the limitations of traffic signal and traffic composition and output all different types of traffic evaluation characteristics in the form of file. VISSIM was developed by VISSIM Corporation. As a result, it is an essential instrument for conducting traffic analyses and application evaluations during the building of transport infrastructure.

2.2.2 Validation of VISSIM Calibration Parameters

VISSIM calibration refers to the process of modifying the various parameters of the simulation model to the point when the model accurately portrays the conditions in the field. During the calibration phase, the settings of VISSIM that govern the behavior of the network formed inside it are adjusted so that the model can recreate the field conditions.

According to Guo and Ma (2016), to achieve actuated control, the following parameters need to be used:

- The minimum green time (Gmin) – Each phase sets a period of minimum green time in the early time. Regardless of whether the phase or other phases has a car come, the phase must ensure the minimum green time. Setting minimum green time should consider several factors: a) should ensure vehicles that stop between detector and stop line can all out of the stop line. b) should ensure pedestrians can safely pass the street, usually set to 7-13s.
- Unit extension time (G0) – as an important parameter, can judge whether to stop the flow of traffic. Unit extension time plays a decisive role for the efficiency of the traffic signal. Setting unit extension time should consider several factors:
    - Gmin should ensure the vehicle can leave the stop line from the detector.
    - The unit extension time should increase traffic efficiency; the timing was adjusted to meet the demands of real transportation

rather than waiting for unfollowed cars to pass through a crossing.

- In a phase, all individual detectors are usually associated, so the number of lanes must be noted when determining the unit extension time.

- The maximum permissible green time (Gmax) – Green time is limited by max time in order to maintain an appropriate green-time rate. When the phase reaches the axis, the signal system will be forced to shut, and the other phase will become green. Gmax is the signal time of ideal cycle and green-time-rate allocated to each phase of the green time, which is set between 30 and 60 seconds.
- Traffic flow (Q) – The continuous movement of vehicles on the road creates the flow of traffic. A real-time test, which can directly use traffic volume as an input into the control scheme optimization process, can be used in the method of confirming traffic.
- Time advances (h) – The definition of headway is the time interval of a portion of a vehicle queue consisting of successive cars moving on the same lane. Headway plays a significant part in actuated signal control and is a major component in changing the phase. Manual counts and image analysis may be employed to determine the time headway. In addition, the average and saturation flow may be used to compute the time headway.

$$h = 3600 / S$$

where S is the saturation flow

2.3 Data Gathering

After the calibration of VISSIM, the researchers will begin gathering the required parameters as cited from the related literature. Creating simulations will follow the data collection.

2.3.1 Data Collection

The Palawe Bridge San Fernando, Pampanga is a heavily congested during peak hours. The traffic flow, vehicle classified count, and timing and phasing arrangement of traffic enforcers will be collected.

2.3.1-1 Geometric Data

The geometric arrangement of the intersection is essential for the VISSIM modeling to ensure the results (Vajeeran, De Silva, 2019). Gathering of geometric details include measuring the width of the lanes, shoulder width, length of the intersection was gathered from Google Maps.

2.3.1-2 Traffic Flow

The traffic flow, vehicle classified count, and turning movements will be taken manually. The peak hour will be determined upon surveying; thus, collection of data will be divided in three sets of hours from 7A.M to 9A.M, 11A.M to 1P.M, and 4P.M to 6P.M on Monday. The peak hour of the place in the morning, noon and in the afternoon, the collection of data will continue on Tuesday, Wednesday, Thursday, Friday, Saturday and Sunday for 2 hours in the morning, 2 hours in noon and 2 hours in the afternoon in the peak hour.

2.3.1-3 Control Data

The timing and phasing arrangement of the traffic police as well as their interventions will be noted. The researchers will advise the traffic enforcers to do their manual control during the peak hour.

According to Vajeeran and De Silva (2019), simulating the manual control in VISSIM software is highly impossible. Following their methodology, the researchers will get the average of the cycle time, phase time, and phase arrangements used by the traffic enforcers for each cycle. The timing and phase arrangements will be modeled as a traffic signal with restrained conflicting movements in the VISSIM software to simulate the manual control on the field.

2.3.2 Building VISSIM Model

The geometry of the location will be coded through the graphical user interface of VISSIM. There will be simulations that will be created to fully evaluate the ideal traffic control for the place, no signal (all traffic yields), and traffic signal. The software will be calibrated and validated to suit the Philippines' behavior before using it for the analysis.

2.4 Results, Analysis, and Evaluation of Data

The researchers will discuss, analyze, and evaluate the results of the data. It will evaluate the effectiveness of traffic signals through simulations.

2.4.1 Evaluation of the Effectiveness of Pre-Timed Signal Control through Simulations

The analysis will be done using a micro simulation approach. PTV VISSIM traffic simulation software will be used as the analyzing tool. To evaluate the effectiveness of pre-timed signal control through simulation, delay will be the determining factor of this research as recommended by the related literature since the delay reflects the vehicle's block time and loss of travel time. According to Guo, et.al., (2016), travel time reflects the traffic condition of the vehicle's overall travel time, which is the important parameter of the traffic benefit. Reduced travel time can improve operating efficiency of traffic facilities and punctuality of transportation vehicles, save the travel time of passengers, and reduce the cost of public transportation management.

III. Result And Discussion

This section presents the result and discussion of the data gathered by the researchers. The contents of this chapter are the delay comparison on the actual traffic and the simulation data.

3.1 Delay comparison on the actual traffic and simulation data

The primary goals of the traffic count survey are to measure current traffic volume on important thoroughfares, assess current traffic conditions, calibrate current OD matrices, and measure vehicle turning movements at specific location.

The researchers manually record the turning movement counts at the place by tabulating each movement (left, through, and right) from every street approaching the location. The researchers surveyed the place from the residents and the researchers have identified three rush hours each day (morning, noon, and afternoon). The counts were taken two hours each for the peak hours. The classification of the vehicles was motorcycle, three-wheeled motor vehicles, private vehicles, jeepneys, and trucks. The summary of results of the traffic counts are the following:

Traffic Data Count: A total of 7 days

Table 3.1-1 Magliman Traffic Data Count

CLASSIFICATION	MORNING 7:00A.M – 9:00A.M			NOON 11:00A.M – 1:00P.M			AFTERNOON 4:00P.M – 6:00P.M		
	RIGHT	THROUGH	LEFT	RIGHT	THROUGH	LEFT	RIGHT	THROUGH	LEFT
2 - Wheel	354	405	624	218	206	513	205	281	376
3 - Wheel	144	167	413	88	103	217	89	128	166
Passenger Car	89	153	432	55	104	253	50	125	162
Jeep	5	11	36	4	16	18	15	33	16
Truck	0	0	0	0	0	0	0	0	0

Table 3.1-2 San Fernando NB Traffic Data Count

CLASSIFICATION	MORNING 7:00A.M – 9:00A.M			NOON 11:00A.M – 1:00P.M			AFTERNOON 4:00P.M – 6:00P.M		
	RIGHT	THROUGH	LEFT	RIGHT	THROUGH	LEFT	RIGHT	THROUGH	LEFT
2 - Wheel	58	942	103	69	725	89	116	399	126
3 - Wheel	134	419	185	131	472	229	114	395	330
Passenger Car	14	1145	169	59	670	195	74	447	265
Jeep	0	154	0	0	127	0	0	101	0
Truck	0	180	0	0	123	0	0	64	0

Table 3.1-3 Cabalantian Traffic Data Count

CLASSIFICATION	MORNING 7:00A.M – 9:00A.M			NOON 11:00A.M – 1:00P.M			AFTERNOON 4:00P.M – 6:00P.M		
	RIGHT	THROUGH	LEFT	RIGHT	THROUGH	LEFT	RIGHT	THROUGH	LEFT
2 - Wheel	611	212	171	553	150	204	393	135	160
3 - Wheel	307	90	70	237	64	84	168	57	88
Passenger Car	1156	169	150	943	154	223	687	125	217
Jeep	170	57	8	159	8	78	122	10	46
Truck	245	10	0	136	32	52	94	35	50

Table 3.1-4 San Fernando SB Traffic Data Count

CLASSIFICATION	MORNING 7:00A.M – 9:00A.M			NOON 11:00A.M – 1:00P.M			AFTERNOON 4:00P.M – 6:00P.M		
	RIGHT	THROUGH	LEFT	RIGHT	THROUGH	LEFT	RIGHT	THROUGH	LEFT
2 - Wheel	658	995	406	641	692	249	553	516	142
3 - Wheel	281	433	174	273	284	108	238	215	65
Passenger Car	0	2260	197	0	1461	182	0	675	129
Jeep	6	260	16	6	201	21	6	122	13
Truck	0	204	14	0	144	15	3	61	11

3.2 Traffic Count Data

The traffic count data gathered were used to calculate the peak hour factor in morning. The PHF average per lane was then calculated to compute the PHF converted peak hourly volume for every leg on the location. These converted peak volumes were the volumes used in the simulation model. The percentage distribution of vehicles passing through the location were calculated to direct the flow of traffic on the model.

The peak hour volume is just the sum of the volumes of the four 15-minute intervals within the peak hour. The peak hour factor (PHF) is found by dividing the peak hour volume by four times the peak 15-minute volume.

$PHF = 200 / (4 * 767) = 0.9588$

PHF average per lane = the average of the 7 days PHF

Average hour volume = the average of the 7 days' hour volume

Max volume = PHF average per lane X Average hour volume

Average per day = average of the 7 days 2-hour traffic count

Table 3.2-1 Morning Count Data

STREET	DAY	2-HOUR TRAFFIC COUNT	PEAK VOL	PEAK HOUR VOL	PHF	PHF AVE. PER LANE	AVE. H. VOL	MAX VOL	AVE./DAY
MAGLIMAN	MON	1464	200	767	0.9588	0.887	943	836	948.571
	TUES	1041	177	585	0.8263				
	WEDNES	1098	190	610	0.8026				
	THURS	898	140	396	0.9496				
	FRI	638	104	336	0.8077				
	SATUR	774	119	393	0.9496				
	SUN	727	119	408	0.8571				
SAN FERNANDO NB	MON	1271	194	680	0.8763	0.828	570	472	1099.71
	TUES	1148	167	609	0.9117				
	WEDNES	1107	185	620	0.8378				
	THURS	1153	199	579	0.7274				
	FRI	1185	211	609	0.7216				
	SATUR	1029	145	505	0.8707				
	SUN	1271	194	680	0.8763				
CABALANTIAN	MON	779	119	386	0.8109	0.819	530	434	1039
	TUES	1256	189	638	0.8439				
	WEDNES	1178	215	595	0.6919				
	THURS	1125	165	591	0.8955				
	FRI	958	154	521	0.8458				
	SATUR	969	145	455	0.7845				
	SUN	1008	152	523	0.8602				
SAN FERNANDO SB	MON	1245	188	711	0.9455	0.879	499	439	1814.71
	TUES	1942	268	930	0.8675				
	WEDNES	1875	277	977	0.8818				
	THURS	1958	337	1055	0.7826				
	FRI	1942	277	977	0.8818				
	SATUR	1845	277	977	0.8818				
	SUN	805	251	972	0.9681				

Table 3.2-2 Noon Count Data

STREET	DAY	2-HOUR TRAFFIC COUNT	PEAK VOL	PEAK HOUR VOL	PHF	PHF AVE. PER LANE	AVE. H. VOL	MAX VOL	AVE./DAY
MAGLIMAN	MON	1569	225	874	0.9711	0.906	636	576	858.429
	TUES	988	154	525	0.8523				
	WEDNES	1012	193	559	0.7241				
	THURS	697	101	362	0.8960				
	FRI	681	121	310	0.6405				
	SATUR	504	79	268	0.8481				
	SUN	558	99	344	0.8687				
SAN FERNANDO NB	MON	778	112	392	0.875	0.821	486	399	917.143
	TUES	1115	171	597	0.8728				
	WEDNES	1007	178	594	0.8343				
	THURS	1143	187	607	0.8115				
	FRI	631	113	296	0.6549				
	SATUR	940	144	448	0.7778				
	SUN	806	128	470	0.9180				
CABALANTIAN	MON	908	157	558	0.8885	0.827	457	378	864.14
	TUES	867	123	429	0.8720				
	WEDNES	858	136	437	0.8033				
	THURS	941	148	477	0.8057				
	FRI	768	122	374	0.7664				
	SATUR	840	134	455	0.8489				
	SUN	867	147	471	0.8010				
SAN FERNANDO SB	MON	1048	156	527	0.8446	0.829	463	384	1234.43
	TUES	1210	176	591	0.8395				
	WEDNES	1282	180	666	0.925				
	THURS	1271	173	663	0.9581				
	FRI	1301	183	685	0.9358				
	SATUR	1305	183	689	0.8925				
	SUN	1224	`68	634	0.9435				

Table 3.2-3 Afternoon Count Data

STREET	DAY	2-HOUR TRAFFIC COUNT	PEAK VOL	PEAK HOUR VOL	PHF	PHF AVE. PER LANE	AVE. H. VOL	MAX VOL	AVE./DAY
MAGLIMAN	MON	1711	294	924	0.7857	0.873	419	366	896.857
	TUES	1013	175	557	0.7957				
	WEDNES	1041	164	508	0.7744				
	THURS	1053	161	534	0.8292				
	FRI	415	79	244	0.7722				
	SATUR	394	69	240	0.8696				
	SUN	651	105	318	0.7571				
SAN FERNANDO NB	MON	714	103	356	0.8641	0.773	425	329	845.857
	TUES	1045	177	589	0.8319				
	WEDNES	1264	175	631	0.9014				
	THURS	1259	201	604	0.7512				
	FRI	365	64	169	0.6602				
	SATUR	677	123	334	0.6789				
	SUN	597	102	294	0.7206				
CABALANTIAN	MON	895	147	546	0.9286	0.864	371	321	676.714
	TUES	714	105	378	0.9				
	WEDNES	649	106	320	0.7547				
	THURS	606	95	321	0.8447				
	FRI	633	101	359	0.8886				
	SATUR	610	103	330	0.8010				
	SUN	630	93	346	0.9301				
SAN FERNANDO SB	MON	776	126	400	0.7937	0.798	475	379	785.143
	TUES	853	136	455	0.8364				
	WEDNES	853	136	455	0.8364				
	THURS	797	107	411	0.9603				
	FRI	652	99	350	0.8838				
	SATUR	807	134	457	0.8526				
	SUN	758	108	408	0.9444				

3.2.1 Magliman Traffic Data

The provided data showcases the traffic volume and direction of vehicles passing through the Magliman in San Fernando, Pampanga. The data is classified based on the type of vehicle and the day of the week during the morning rush hour. The vehicle classification includes 2-wheel and 3-wheel vehicles, passenger cars, jeepneys, and trucks. This data can be utilized to evaluate traffic volume and patterns at the Magliman and design effective traffic management solutions to alleviate congestion during the morning rush hour.

The final row of the table displays the average number of vehicles passing through the Magliman for each vehicle type and direction during the morning rush hour, along with the sum of the averages.

Average = average per directions

Sum of the average = sum of all directions

Percentage Distribution = sum of the average per classification / sum of the average

Table 3.2.1-1 Magliman Morning Traffic Data

MAGLIMAN – MORNING 7:00A.M – 9:00A.M		CLASSIFICATION					Sum
		2 - Wheel	3 - Wheel	Passenger Car	Jeepney	Trucks	
Monday	Left Turn	64	146	170	21	0	401
	Through	51	36	30	3	0	120
	Right Turn	34	17	18	0	0	69
Tuesday	Left Turn	65	28	37	2	0	132
	Through	65	27	21	4	0	117
	Right Turn	27	12	11	0	0	50
Wednesday	Left Turn	87	37	36	3	0	163
	Through	79	38	42	1	0	160
	Right Turn	25	11	12	0	0	48
Thursday	Left Turn	82	35	41	2	0	160
	Through	75	28	31	3	0	137
	Right Turn	27	11	11	0	0	49
Friday	Left Turn	76	32	38	5	0	151
	Through	30	13	6	0	0	49
	Right Turn	57	24	20	1	0	102
Saturday	Left Turn	90	49	54	2	0	195
	Through	24	12	12	0	0	48
	Right Turn	79	45	10	4	0	138
Sunday	Left Turn	82	34	56	1	0	173
	Through	30	13	11	0	0	54
	Right Turn	61	24	7	0	0	92
Average	Left Turn	78	52	62	5	0	196
	Through	51	24	22	2	0	98
	Right Turn	44	21	13	0	0	78
Sum Of The Average		173	155	85	7	0	420
Percentage Distribution		0.4119	0.3690	0.2024	0.0167	0	1

Table 3.2.1-2 Magliman Noon Traffic Data

MAGLIMAN – NOON 11:00A.M – 1:00P.M		CLASSIFICATION					Sum
		2 - Wheel	3 - Wheel	Passenger Car	Jeepney	Trucks	
Monday	Left Turn	78	34	41	2	0	155
	Through	27	6	13	2	0	48
	Right Turn	30	13	5	0	0	48
Tuesday	Left Turn	75	32	45	1	0	153
	Through	21	16	24	3	0	64
	Right Turn	24	10	8	0	0	42
Wednesday	Left Turn	68	29	40	4	0	141
	Through	20	18	14	3	0	55
	Right Turn	32	13	9	0	0	54
Thursday	Left Turn	66	29	34	3	0	132
	Through	37	17	6	2	0	62
	Right Turn	29	12	8	0	0	49
Friday	Left Turn	100	43	41	2	0	186
	Through	28	10	23	4	0	65
	Right Turn	36	15	8	0	0	59
Saturday	Left Turn	67	29	28	3	0	127
	Through	51	26	12	2	0	91
	Right Turn	28	13	9	0	0	50
Sunday	Left Turn	59	21	24	3	0	107
	Through	22	10	12	0	0	44
	Right Turn	39	12	8	4	0	63
Average	Left Turn	73	31	36	3	0	143
	Through	29	15	15	2	0	61
	Right Turn	31	13	8	1	0	52
Sum Of The Average		134	58	58	6	0	256
Percentage Distribution		0.5234	0.2266	0.2266	0.0234	0	1

Table 3.2.1-3 Magliman Afternoon Traffic Data

MAGLIMAN – AFTERNOON		CLASSIFICATION					Sum
		2 - Wheel	3 - Wheel	Passenger Car	Jeepney	Trucks	
Monday	Left Turn	56	25	22	4	0	107
	Through	21	14	6	17	0	58
	Right Turn	23	10	5	15	0	53
Tuesday	Left Turn	42	19	18	2	0	81
	Through	8	11	2	3	0	24
	Right Turn	27	11	7	0	0	45
Wednesday	Left Turn	57	25	24	2	0	108
	Through	35	15	9	3	0	62
	Right Turn	28	11	4	0	0	43
Thursday	Left Turn	71	30	16	2	0	119
	Through	35	13	17	2	0	67
	Right Turn	47	21	9	0	0	77
Friday	Left Turn	43	19	28	2	0	92
	Through	55	25	27	2	0	109
	Right Turn	25	11	7	0	0	43
Saturday	Left Turn	47	20	23	2	0	92
	Through	40	18	34	3	0	95
	Right Turn	31	14	8	0	0	53
Sunday	Left Turn	60	28	31	2	0	121
	Through	87	32	30	3	0	157
	Right Turn	24	11	10	0	0	45
Average	Left Turn	54	24	23	2	0	103
	Through	40	18	18	5	0	81
	Right Turn	29	13	7	2	0	51
Sum Of The Average		123	55	48	9	0	235
Percentage Distribution		0.5234	0.2340	0.2042	0.0383	0	1

3.2.2 Cabalantian Traffic Data

The provided data showcases the traffic volume and direction of vehicles passing through the Cabalantian in San Fernando, Pampanga. The data is classified based on the type of vehicle and the day of the week during the morning rush hour. The vehicle classification includes 2-wheel and 3-wheel vehicles, passenger cars, jeepneys, and trucks. This data can be utilized to evaluate traffic volume and patterns at the Cabalantian and design effective traffic management solutions to alleviate congestion during the morning rush hour.

The final row of the table displays the average number of vehicles passing through the Cabalantian for each vehicle type and direction during the morning rush hour, along with the sum of the averages.

Average = average per directions

Sum of the average = sum of all directions

Percentage Distribution = sum of the average per classification / sum of the average

Table 3.2.2-1 Cabalantian Morning Traffic Data

CABALANTIAN – MORNING 7:00A.M – 9:00A.M		CLASSIFICATION					Sum
		2 - Wheel	3 - Wheel	Passenger Car	Jeepney	Trucks	
Monday	Left Turn	50	21	34	2	0	107
	Through	25	7	33	8	5	78
	Right Turn	31	14	27	16	13	101
Tuesday	Left Turn	19	6	5	0	0	30
	Through	8	3	8	9	5	33
	Right Turn	82	63	253	22	78	498
Wednesday	Left Turn	14	7	10	0	0	31
	Through	27	3	2	0	0	32
	Right Turn	106	62	249	24	69	510
Thursday	Left Turn	29	11	31	2	0	73
	Through	40	21	28	10	9	108
	Right Turn	108	46	156	22	21	353
Friday	Left Turn	17	8	19	2	0	46
	Through	35	23	37	12	14	121
	Right Turn	97	42	161	31	23	354
Saturday	Left Turn	22	9	27	2	0	60
	Through	31	19	40	9	15	114
	Right Turn	97	42	156	27	18	340
Sunday	Left Turn	20	8	24	0	0	52
	Through	46	14	21	9	10	100
	Right Turn	90	38	154	28	23	333
Average	Left Turn	24	10	27	2	0	63
	Through	30	13	24	8	8	83
	Right Turn	87	44	179	24	35	369
Sum Of The Average		141	64	210	36	28	479
Percentage Distribution		0.2944	0.1336	0.4384	0.0752	0.0585	1

Table 3.2.2-2 Cabalantian Noon Traffic Data

CABALANTIAN – NOON 11:00A.M – 1:00P.M		CLASSIFICATION					Sum
		2 - Wheel	3 - Wheel	Passenger Car	Jeepney	Trucks	
Monday	Left Turn	19	11	25	6	5	66
	Through	34	15	26	1	0	76
	Right Turn	34	15	120	21	18	208
Tuesday	Left Turn	14	6	32	12	7	71
	Through	22	9	21	2	0	54
	Right Turn	78	33	148	19	16	294
Wednesday	Left Turn	45	12	44	9	7	117
	Through	15	6	18	1	0	40
	Right Turn	88	38	152	21	22	321
Thursday	Left Turn	38	19	32	10	5	104
	Through	17	8	24	2	0	51
	Right Turn	99	43	136	19	25	322
Friday	Left Turn	15	14	36	17	12	94
	Through	20	8	17	1	0	46
	Right Turn	68	29	111	27	19	254
Saturday	Left Turn	36	7	29	14	8	94
	Through	21	9	20	1	0	51
	Right Turn	90	38	142	22	18	310
Sunday	Left Turn	37	15	25	10	7	94
	Through	21	9	28	0	0	58
	Right Turn	96	41	134	30	18	319
Average	Left Turn	29	12	32	11	7	91
	Through	21	9	22	1	0	53
	Right Turn	79	34	135	23	19	290
Sum Of The Average		129	55	189	35	26	434
Percentage Distribution		0.3042	0.1297	0.4458	0.0825	0.0613	1

Table 3.2.2-3 Cabalantian Afternoon Traffic Data

CABALANTIAN – AFTERNOON 4:00P.M – 6:00P.M		CLASSIFICATION					Sum
		2 - Wheel	3 - Wheel	Passenger Car	Jeepney	Trucks	
Monday	Left Turn	57	24	20	4	7	112
	Through	22	10	22	2	0	56
	Right Turn	36	15	103	16	11	181
Tuesday	Left Turn	15	6	11	6	1	39
	Through	17	7	23	2	0	49
	Right Turn	62	26	96	21	15	220
Wednesday	Left Turn	17	11	34	9	7	78
	Through	20	8	21	1	0	50
	Right Turn	57	24	98	17	15	211
Thursday	Left Turn	14	13	34	8	4	73
	Through	12	5	2	0	0	19
	Right Turn	71	31	91	21	15	229
Friday	Left Turn	19	16	68	8	8	119
	Through	21	9	20	1	0	51
	Right Turn	58	25	81	16	9	189
Saturday	Left Turn	13	8	23	7	12	63
	Through	20	8	21	2	0	51
	Right Turn	55	24	108	16	13	216
Sunday	Left Turn	25	10	27	4	11	77
	Through	23	10	16	2	0	51
	Right Turn	54	23	110	15	16	218
Average	Left Turn	24	13	31	7	7	82
	Through	20	8	18	1	0	47
	Right Turn	55	24	98	17	13	207
Sum Of The Average		99	45	147	25	20	336
Percentage Distribution		0.2925	0.1343	0.4388	0.0746	0.0597	1

3.2.3 San Fernando Northbound Traffic Data

The provided data showcases the traffic volume and direction of vehicles passing through the San Fernando Northbound in San Fernando, Pampanga. The data is classified based on the type of vehicle and the day of the week during the morning rush hour. The vehicle classification includes 2-wheel and 3-wheel vehicles, passenger cars, jeepneys, and trucks. This data can be utilized to evaluate traffic volume and patterns at the San Fernando Northbound and design effective traffic management solutions to alleviate congestion during the morning rush hour.

The final row of the table displays the average number of vehicles passing through the San Fernando Northbound for each vehicle type and direction during the morning rush hour, along with the sum of the averages.

Average = average per directions

Sum of the average = sum of all directions

Percentage Distribution = sum of the average per classification / sum of the average

Table 3.2.3-1 San Fernando NB Morning Traffic Data

SAN FERNANDO NB – MORNING 7:00A.M – 9:00A.M		CLASSIFICATION					Sum
		2 - Wheel	3 - Wheel	Passenger Car	Jeepney	Trucks	
Monday	Left Turn	13	6	2	0	0	21
	Through	87	37	194	24	35	377
	Right Turn	11	5	0	0	0	16
Tuesday	Left Turn	15	21	27	0	0	63
	Through	143	39	210	22	78	492
	Right Turn	8	29	0	0	0	37
Wednesday	Left Turn	10	68	47	0	0	125
	Through	160	101	16	22	67	366
	Right Turn	12	49	2	0	0	63
Thursday	Left Turn	17	68	52	0	0	137
	Through	146	70	10	24	69	319
	Right Turn	6	42	11	0	0	59
Friday	Left Turn	6	3	1	0	0	10
	Through	139	60	277	20	56	552
	Right Turn	8	3	1	0	0	12
Saturday	Left Turn	20	9	14	0	0	43
	Through	143	60	223	26	72	524
	Right Turn	6	3	0	0	0	9
Sunday	Left Turn	22	10	26	0	0	58
	Through	124	52	215	16	49	456
	Right Turn	7	3	0	0	0	10
Average	Left Turn	15	26	24	0	0	65
	Through	135	60	164	22	61	442
	Right Turn	8	19	2	0	0	29
Sum Of The Average		158	105	190	22	61	536
Percentage Distribution		0.2948	0.1959	0.3545	0.0410	0.1138	1

Table 3.2.3-2 San Fernando NB Noon Traffic Data

SAN FERNANDO NB – NOON 11:00A.M – 1:00P.M		CLASSIFICATION 2 - Wheel	3 - Wheel	Passenger Car	Jeepney	Trucks	Sum
Monday	Left Turn	13	5	12	0	0	30
	Through	91	40	156	17	25	329
	Right Turn	13	5	9	0	0	27
Tuesday	Left Turn	13	97	28	0	0	138
	Through	110	136	14	19	43	322
	Right Turn	9	17	4	0	0	30
Wednesday	Left Turn	15	56	38	0	0	109
	Through	101	65	18	17	55	256
	Right Turn	13	40	7	0	0	60
Thursday	Left Turn	13	55	48	0	0	116
	Through	106	98	13	21	48	286
	Right Turn	6	56	12	0	0	74
Friday	Left Turn	9	4	27	0	0	40
	Through	78	34	92	18	45	267
	Right Turn	11	5	12	0	0	28
Saturday	Left Turn	13	6	18	0	0	37
	Through	119	54	201	19	43	436
	Right Turn	8	4	7	0	0	19
Sunday	Left Turn	13	6	24	0	0	43
	Through	120	45	176	16	49	406
	Right Turn	9	4	8	0	0	21
Average	Left Turn	13	33	28	0	0	37
	Through	104	67	96	18	44	329
	Right Turn	10	19	8	0	0	37
Sum Of The Average		127	119	132	18	44	440
Percentage Distribution		0.3151	0.2952	0.3275	0.0447	0.1092	1

Table 3.2.3-3 San Fernando NB Afternoon Traffic Data

SAN FERNANDO NB – AFERNOON 4:00P.M – 6:00P.M		CLASSIFICATION 2 - Wheel	3 - Wheel	Passenger Car	Jeepney	Trucks	Sum
Monday	Left Turn	15	6	22	0	0	43
	Through	60	26	116	18	18	238
	Right Turn	43	18	14	0	0	75
Tuesday	Left Turn	20	113	22	0	0	155
	Through	67	88	17	14	23	209
	Right Turn	19	11	5	0	0	35
Wednesday	Left Turn	17	90	78	0	0	185
	Through	63	89	17	18	23	210
	Right Turn	13	42	11	0	0	66
Thursday	Left Turn	16	98	87	0	0	201
	Through	63	111	15	18	33	240
	Right Turn	12	31	10	0	0	53
Friday	Left Turn	15	6	15	0	0	36
	Through	21	20	47	9	10	107
	Right Turn	8	4	14	0	0	26
Saturday	Left Turn	22	9	23	0	0	54
	Through	70	31	132	12	15	260
	Right Turn	8	3	9	0	0	20
Sunday	Left Turn	21	8	18	0	0	47
	Through	55	30	103	12	18	218
	Right Turn	13	5	11	0	0	29
Average	Left Turn	18	47	38	0	0	103
	Through	57	56	64	14	20	211
	Right Turn	17	16	11	0	0	44
Sum Of The Average		92	119	133	14	20	378
Percentage Distribution		0.2570	0.3324	0.3715	0.0391	0.0559	1

3.2.4 San Fernando Southbound Traffic Data

The provided data showcases the traffic volume and direction of vehicles passing through the San Fernando Southbound in San Fernando, Pampanga. The data is classified based on the type of vehicle and the day of the week during the morning rush hour. The vehicle classification includes 2-wheel and 3-wheel vehicles, passenger cars, jeepneys, and trucks. This data can be utilized to evaluate traffic volume and patterns at the San Fernando Southbound and design effective traffic management solutions to alleviate congestion during the morning rush hour.

The final row of the table displays the average number of vehicles passing through the San Fernando Southbound for each vehicle type and direction during the morning rush hour, along with the sum of the averages.

Average = average per directions

Sum of the average = sum of all directions

Percentage Distribution = sum of the average per classification / sum of the average

Table 3.2.4-1 San Fernando SB Morning Traffic Data

SAN FERNANDO SB – MORNING 7:00A.M – 9:00A.M		CLASSIFICATION 2 - Wheel	3 - Wheel	Passenger Car	Jeepney	Trucks	Sum
Monday	Left Turn	48	21	27	2	2	100
	Through	48	39	210	30	49	376
	Right Turn	69	29	0	0	0	98
Tuesday	Left Turn	66	29	24	3	2	124
	Through	151	64	335	49	80	696
	Right Turn	88	38	0	1	0	127
Wednesday	Left Turn	36	16	34	3	1	90
	Through	190	81	315	44	66	676
	Right Turn	104	44	0	1	0	149
Thursday	Left Turn	55	23	24	3	2	107
	Through	147	64	345	34	57	647
	Right Turn	104	44	0	1	0	149
Friday	Left Turn	66	28	28	2	2	126
	Through	177	76	374	40	52	719
	Right Turn	85	36	0	1	0	122
Saturday	Left Turn	71	31	31	2	3	138
	Through	156	54	345	34	54	643
	Right Turn	102	44	0	1	0	147
Sunday	Left Turn	64	26	29	1	2	122
	Through	126	55	336	29	52	598
	Right Turn	106	46	0	1	0	153
Average	Left Turn	58	25	28	2	2	115
	Through	142	62	323	37	59	623
	Right Turn	94	40	0	1	0	135
Sum Of The Average		294	127	351	40	61	873
Percentage Distribution		0.3368	0.1455	0.4021	0.0458	0.0693	1

Table 3.2.4-2 San Fernando SB Noon Traffic Data

SAN FERNANDO SB – NOON 11:00A.M – 1:00P.M		CLASSIFICATION 2 - Wheel	3 - Wheel	Passenger Car	Jeepney	Trucks	Sum
Monday	Left Turn	17	14	21	1	1	54
	Through	76	15	182	23	40	336
	Right Turn	92	38	0	1	0	131
Tuesday	Left Turn	37	16	25	4	1	83
	Through	101	44	174	26	56	401
	Right Turn	94	40	0	1	0	135
Wednesday	Left Turn	30	13	28	4	3	78
	Through	122	52	219	26	38	457
	Right Turn	92	39	0	0	0	131
Thursday	Left Turn	43	13	21	5	3	85
	Through	102	50	231	13	47	443
	Right Turn	94	40	0	1	0	135
Friday	Left Turn	27	11	21	2	3	64
	Through	130	55	231	37	25	478
	Right Turn	87	38	0	2	0	127
Saturday	Left Turn	50	21	30	3	2	106
	Through	88	37	232	45	39	441
	Right Turn	99	43	0	0	0	142
Sunday	Left Turn	45	20	36	2	2	105
	Through	73	31	192	31	39	366
	Right Turn	83	35	0	1	0	119
Average	Left Turn	36	15	26	3	2	82
	Through	99	41	209	29	41	417
	Right Turn	92	39	0	1	0	131
Sum Of The Average		227	95	135	33	43	631
Percentage Distribution		0.3582	0.1506	0.3720	0.0516	0.0676	1

Table 3.2.4-3 San Fernando SB Afternoon Traffic Data

SAN FERNANDO SB – AFERNOON 4:00P.M – 6:00P.M		CLASSIFICATION					Sum
		2 - Wheel	3 - Wheel	Passenger Car	Jeepney	Trucks	
Monday	Left Turn	17	12	23	2	2	56
	Through	77	28	75	18	22	220
	Right Turn	68	29	0	1	2	100
Tuesday	Left Turn	15	6	14	3	1	39
	Through	99	42	121	17	17	296
	Right Turn	76	33	0	1	0	110
Wednesday	Left Turn	20	8	18	2	2	50
	Through	75	32	111	12	16	246
	Right Turn	83	36	0	1	0	120
Thursday	Left Turn	22	10	15	1	1	49
	Through	55	22	110	19	24	230
	Right Turn	92	40	0	0	0	132
Friday	Left Turn	15	6	10	2	1	34
	Through	51	22	71	12	16	172
	Right Turn	66	29	0	1	0	96
Saturday	Left Turn	29	13	25	2	2	71
	Through	88	38	107	16	18	267
	Right Turn	83	35	0	0	1	119
Sunday	Left Turn	24	10	24	1	2	61
	Through	71	31	80	28	14	224
	Right Turn	85	36	0	2	0	123
Average	Left Turn	20	9	18	2	2	51
	Through	74	31	96	17	18	236
	Right Turn	79	34	0	1	0	114
Sum Of The Average		173	74	115	20	20	402
Percentage Distribution		0.4302	0.1840	0.2856	0.0501	0.0501	1

3.3 Vehicle Distribution per Lane (percentage)

For each direction, the data includes the maximum volume of vehicles expected that day, as well as the percentage of vehicles making left turns, going straight through, and making right turns.

Average = average of the left turn direction / average of the three directions.

Average = average of the through turn direction / average of the three directions.

Average = average of the right turn direction / average of the three directions.

Table 3.3-1 Morning Vehicle Distribution per Lane (percentage)

STREET	DAY	MAX VOL	LEFT TURN	THROUGH	RIGHT TURN
MAGLIMAN	MONDAY TUESDAY WEDNESDAY THURSDAY FRIDAY SATURDAY SUNDAY	439	0.55020	0.21419	0.23561
SAN FERNANDO NB	MONDAY TUESDAY WEDNESDAY THURSDAY FRIDAY SATURDAY SUNDAY	472	0.13397	0.79167	0.07436
CABALANTIAN	MONDAY TUESDAY WEDNESDAY THURSDAY FRIDAY SATURDAY SUNDAY	434	0.11053	0.09408	0.79539
SAN FERNANDO SB	MONDAY TUESDAY WEDNESDAY THURSDAY FRIDAY SATURDAY SUNDAY	836	0.12874	0.71792	0.15334

Table 3.3-2 Noon Vehicle Distribution per Lane (percentage)

STREET	DAY	MAX VOL	LEFT TURN	THROUGH	RIGHT TURN
MAGLIMAN	MONDAY TUESDAY WEDNESDAY THURSDAY FRIDAY SATURDAY SUNDAY	384	0.57965	0.11947	0.30088
SAN FERNANDO NB	MONDAY TUESDAY WEDNESDAY THURSDAY FRIDAY SATURDAY SUNDAY	399	0.21291	0.69716	0.08993
CABALANTIAN	MONDAY TUESDAY WEDNESDAY THURSDAY FRIDAY SATURDAY SUNDAY	378	0.12520	0.11951	0.75528
SAN FERNANDO SB	MONDAY TUESDAY WEDNESDAY THURSDAY FRIDAY SATURDAY SUNDAY	576	0.11905	0.66113	0.21982

Table 3.3-3 Afternoon Vehicle Distribution per Lane (percentage)

STREET	DAY	MAX VOL	LEFT TURN	THROUGH	RIGHT TURN
MAGLIMAN	MONDAY TUESDAY WEDNESDAY THURSDAY FRIDAY SATURDAY SUNDAY	379	0.58333	0.11212	0.27653
SAN FERNANDO NB	MONDAY TUESDAY WEDNESDAY THURSDAY FRIDAY SATURDAY SUNDAY	329	0.31497	0.54030	0.14474
CABALANTIAN	MONDAY TUESDAY WEDNESDAY THURSDAY FRIDAY SATURDAY SUNDAY	321	0.15323	0.17413	0.67264
SAN FERNANDO SB	MONDAY TUESDAY WEDNESDAY THURSDAY FRIDAY SATURDAY SUNDAY	366	0.11722	0.61601	0.26677

3.4 Vehicle Count and Delay

3.4.1 Vehicle Count and Delay (Unsignalized)

Peak Time refers to the times of day when traffic is the heaviest. The table lists three peak time periods: Morning (7:00AM - 9:00AM), Noon (11:00AM - 1:00PM), and Afternoon (4:00PM - 6:00PM). Vehicle Count indicates the number of vehicles that were recorded during each peak time period. For instance, during the morning peak period, there were 16,378 vehicles counted, at noon there were 13233 and, in the afternoon, there were 10220 vehicles counted. Vehicle Delay is a measure of how much time each vehicle spends delayed in traffic during each peak period. It is usually measured in seconds or minutes per vehicle. During the morning peak period, the average vehicle delay was 95.86 seconds per vehicle, at noon was 94.86 seconds per vehicle and in the afternoon was 152.99 seconds per vehicle.

Table 3.4.1-1 Vehicle Count and Delay (Unsignalized)

PEAK TIME	VEHICLE COUNT	VEHICLE DELAY (sec)
MORNING 7:00A.M – 9:00A.M	15,666	95.86
NOON 11:00A.M – 1:00P.M	12,038	94.86
AFTERNOON 4:00P.M – 6:00P.M	9,213	152.99

3.4.2 Vehicle Count and Delay (Pre-Timed Traffic Signal)

The Peak Time column specifies the times of day when traffic is typically heaviest, with three peak periods listed: Morning (7:00 AM - 9:00 AM), Noon (11:00 AM - 1:00 PM), and Afternoon (4:00 PM - 6:00 PM). The Vehicle Count column indicates the number of vehicles recorded during each peak time period. During the Morning peak period, there were 16,378 vehicles counted, at noon there were 13233 and in the afternoon there were 10220 vehicles counted. The Vehicle Delay column shows the amount of time that each vehicle was delayed in traffic during the corresponding peak period. For instance, during the Morning peak period, the average vehicle delay was 234.23 seconds, or just over 3.9 minutes. In this case, all three peak periods have relatively high vehicle counts, with the Morning period having the highest count of 16,378 vehicles. The Afternoon period, however, has the highest average vehicle delay time of 251.33 seconds, or over 4.2 minutes.

Table 3.4.2-1 Vehicle Count and Delay (Pre-Timed Traffic Signal)

PEAK TIME	VEHICLE COUNT	VEHICLE DELAY (sec)
MORNING 7:00A.M – 9:00A.M	15,666	234.23
NOON 11:00A.M – 1:00P.M	12,038	230.85
AFTERNOON 4:00P.M – 6:00P.M	9,213	251.33

IV. Conclusion

4.1 Conclusion

The Based on the VISSIM results of vehicle delay times at the Palawe Bridge, San Fernando Pampanga, the researchers concluded that the installation of a pre-timed signal control does not result in a reduction in delay times when compared to the current traffic control which is unsignalized. Pre-timed signal control generally results in high delays and emissions, showing that they may not be as profitable as the assessed models as the unsignalized or completely incited other options. Nevertheless, it is essential to acknowledge this analysis's limitations. Safety, pedestrian movement, and long-term infrastructure costs have not been taken into account, despite the fact that total delays, petroleum consumption, and emissions are the primary focus of the cost-benefit analysis. A more in-depth analysis should incorporate the aforementioned factors before conclusively determining the best signalization strategy for a specific location.

Leaders' ought to painstakingly consider the presentation of every option in contrast to the particular necessities and qualities of a given district. Further examination and more comprehensive assessments, thinking about every pertinent component, will assist with deciding the best answer for traffic signalization to limit delays, diminish ecological effects, and upgrade traffic across the board in general.

The null hypothesis that the installation of a pre-timed signal control will not reduce delay in the Palawe Bridge, San Fernando, Pampanga, area cannot be rejected in light of these findings. The data in this case suggests that putting in place a pre-timed signal at the Palawe Bridge in San Fernando may not be the best way to improve traffic flow. To improve traffic flow and decrease vehicle delays, elective traffic signal techniques ought to be thought of.

References

[1]. Afrin, T., & Yodo, N. (2020). A survey of road traffic congestion measures towards a sustainable and resilient transportation system. Sustainability (Switzerland).

[2]. Alghamdi. (2019). 2019 15th International Wireless Communications & Mobile Computing Conference (IWCMC).

[3]. Clark, C. (2022). Optimizing Traffic Signals to Reduce Intersection Wait Times. Texas a&M Today.

[4]. Eom, M. (2020). The traffic signal control problem for intersections: a review - European Transport Research Review. SpringerOpen.

[5]. Harrou, F., Zeroual, A., & Sun, Y. (2020). Traffic congestion monitoring using an improved kNN strategy. Measurement: Journal of the International Measurement Confederation.

[6]. Li, G., Lai, W., Sui, X., Li, X., Qu, X., Zhang, T., & Li, Y. (2020). Influence of traffic congestion on driver behavior in post-congestion driving. Accident Analysis and Prevention.

[7]. R, A., & E, L. (2019). Effectiveness of adaptive control of traffic light intersection on isolated multi-lane intersections. E3S Web of Conferences, 110.

[8]. Ribeiro, I. (2017). The fully actuated traffic control problem solved by global optimization and complementarity. Semantic Scholar.

[9]. Sources, E. t., Wang, Y., Cao, J., Li, W., Gu, T., & Shi, W. (2017). Exploring traffic congestion correlation from multiple data sources. Pervasive and Mobile Computing.

[10]. Li Wen, C., & Ta Yin, H. (2019). Flow equilibrium under dynamic traffic assignment and signal control—an illustration of pretimed and actuated signal control policies. IEEE Transactions on Intelligent Transportation Systems, 1266-1276.

[11]. Gireesh, B., & Sunil, B. (2021). Study and Analysis of Road Widening and Strengthening. 1771-1779.

[12]. Hu, Z., Zhou, J., Zhang, S., He, S., & Yu, B. (2020). Restriction Analysis of Transport Policy for Bridges Using the Trajectory Data. Journal of Advanced Transportation.

[13]. Koźlak, A., & Wach, D. (2018). Causes of traffic congestion in urban areas. Case of Poland. SHS Web of Conferences, 1019.

[14]. Lee, S.-K., Park, S.-Y., Kim, D.-N., & Lee, H.-J. (2018). Estimation of Effectiveness of a Vehicle-Actuated Signal Control System on Work Zone Operations for a Two-Lane Highway. Procedia - Social and Behavioral Sciences, 653-661.

[15]. Nagy, A., & Simon, V. (2018). Survey on traffic prediction in smart cities. Pervasive and Mobile Computing, 148-163.