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Traffic Flow Management: Enhancing Traffic Operations at Two Adjacent Intersections in Poblacion, San Isidro, Nueva Ecija Using PTV VISSIM

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ABSTRACT: Traffic congestion has become a major concern in Población, San Isidro, Nueva Ecija, Philippines particularly at the intersections near General de Jesus College and Jollibee–San Isidro. This study analyzed existing traffic conditions and proposed traffic management solutions using PTV VISSIM microscopic simulation. All required simulation inputs were obtained through field observations and traffic surveys, which served as the basis for developing both the existing and enhanced simulation models. Several strategies were evaluated, including the installation of traffic signals, improvement of pavement markings and signage, redesignation of loading and unloading zones, and the introduction of one-way routes. Simulation results showed a significant reduction in vehicle delays and notable improvements in the Level of Service (LOS), with most movements shifting from congested operations (LOS D–F) to stable and acceptable flow conditions (LOS A–C). These findings demonstrate that data-driven and simulation-based analysis can effectively identify congestion issues and assess the impact of targeted interventions. This research directly supports SDG 9 (Industry, Innovation, and Infrastructure) by promoting innovative traffic technologies and SDG 11 (Sustainable Cities and Communities) through the development of safer, more efficient, and sustainable urban transport systems for San Isidro.

KEYWORDS: Traffic Simulation, Two Intersections, PTV VISSIM, Traffic Management, Level of Service(LOS)

I. INTRODUCTION

Traffic congestion has become a recurring and increasingly critical issue in developing municipalities such as Poblacion, San Isidro, Nueva Ecija. The intersections near General de Jesus College and the Jollibee–San Isidro area experience persistent delays due to high vehicle volume, limited traffic control devices, and unregulated turning movements. These inefficiencies slow roadway performance, increase fuel consumption, and reduce mobility for daily commuters. Despite the strategic importance of these intersections, no simulation- based analysis has been conducted to evaluate potential improvements, creating a significant gap in local traffic management studies.

To address this, the study uses PTV VISSIM, a microscopic simulation model that can reflect heterogeneous traffic flow, driver behavior, and lane interactions. Its capability to mimic real-world conditions makes it suitable for assessing interventions such as signal timing adjustments, improved road markings, turning regulations, and rerouting options. The research also supports Ambisyon Natin 2040's vision of improved mobility and community livability, as well as SDG 9 and SDG 11, which promote innovative infrastructure and sustainable urban systems.

By focusing on two adjacent intersections in Poblacion, San Isidro—one near the town plaza and another along the main road linking nearby communities—the study aims to develop an optimized traffic flow plan that enhances Level of Service (LOS), reduces congestion, and improves overall mobility. Through microscopic simulation, the research provides evidence-based solutions that can guide local planning and contribute to more efficient and resilient transport systems.

A. General Objective

The main objective of this study is to formulate a traffic management plan to address the traffic congestion at two intersections in Poblacion, San Isidro, Nueva Ecija, Philippines. Specifically, it seeks to answer the following issues:

B. Specific Objectives

1. Determine the existing traffic condition by collecting the data required for PTV VISSIM, including the Traffic Data, Roadway and Geometric Data, and the Traffic Control and Operational Data;
2. Analyze traffic data during regular and peak hours;

3. Create a simulation for improved traffic flow and determine the level of service (LOS); and
4. Compare the level of service (LOS) of the existing traffic flow model and enhanced traffic flow model

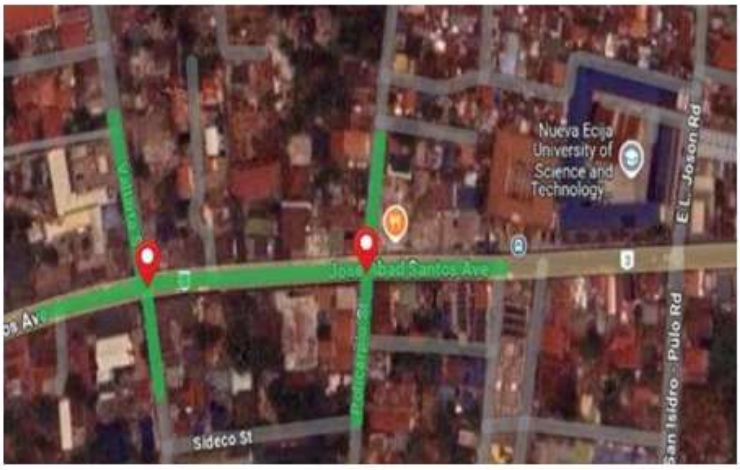

Figure 1. Locale of the Study

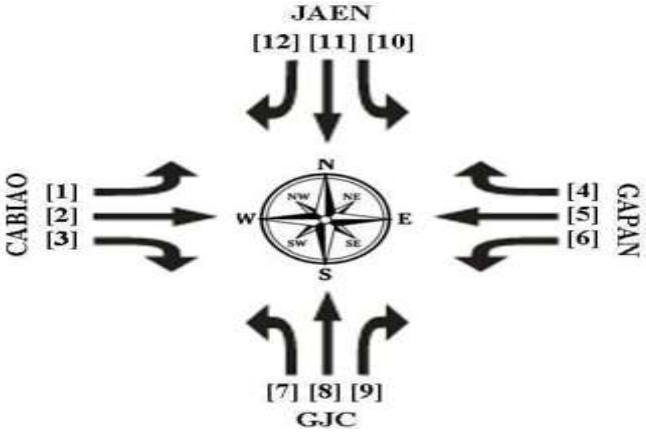

Figure 2. Presentation of Turning Movement

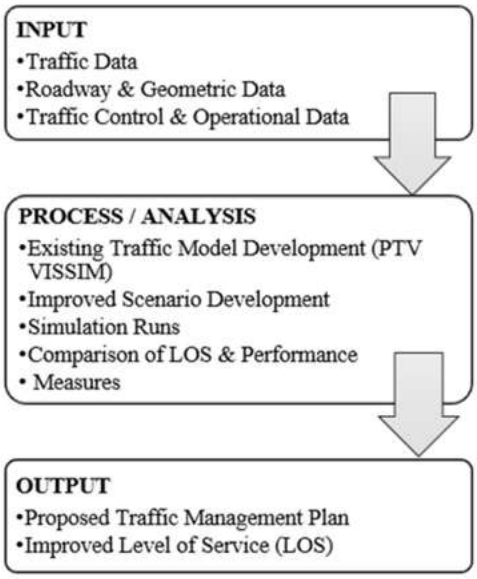

Figure 3. Research Flow

II. METHODOLOGY

The study employed field observations, manual traffic counting, and roadway measurements to gather essential traffic data at two connected intersections in Poblacion, San Isidro, Nueva Ecija. Collected data included traffic volume, vehicle classification, turning movements, roadway geometry, and existing traffic control devices. Traffic surveys were conducted during weekday peak hours to capture representative congestion conditions, and video recordings were used to validate manual counts and minimize data errors. The validated data were encoded into PTV VISSIM to develop a microscopic simulation model of the existing traffic conditions. Various traffic management strategies, including traffic signal installation, improved signage and pavement markings, redesignation of loading and unloading zones, and a one- way scheme, were then simulated to create an enhanced model. Vehicle delay and Level of Service (LOS) were used as performance indicators to compare the existing and improved conditions and assess the effectiveness of the proposed traffic management measures.

III.RESULTS AND DISCUSSION

Traffic assessment at the two connected intersections revealed high vehicle volumes dominated by tricycles and motorcycles, particularly during weekday mornings. Limited traffic control devices, unclear pavement markings, and poorly managed loading and unloading activities contributed to congestion. Simulation of existing conditions using PTV VISSIM confirmed these issues, with several movements operating under LOS E and F.

Traffic analysis showed that the most severe congestion occurred during weekday morning peak hours, with the highest vehicle volumes recorded between 7:30 AM and 7:45 AM. Compared to other time periods, this peak hour experienced longer delays and queue formations due to increased school, commercial, and commuter activities.

The enhanced simulation model incorporated traffic signals, improved signage and pavement markings, redesigned loading and unloading zones, and a one-way scheme. Results showed a substantial reduction in vehicle delays, with most movements improving to LOS A–C, indicating smoother and more stable traffic flow.

Comparison of existing and enhanced conditions demonstrated significant improvements in intersection performance. Movements previously operating under congested conditions showed notable LOS improvements, while already efficient flows were maintained, confirming the effectiveness of the proposed traffic management measures.

Table 1. Summary of Vehicle Volume per Designation

	Flow no.	Area of Flow	From Intersection of GJC	From Intersection of Jollibee
Westbound (WB)	1	Cabiao to Jaen	30	8
	2	Cabiao to Gapan	232	330
	3	Cabiao to GJC	74	0
Eastbound (EB)	4	Gapan to Jaen	125	43
	5	Gapan to Cabiao	190	362
	6	Gapan to GJC	71	2
Southbound (SB)	7	GJC to Cabiao	1	90
	8	GJC to Jaen	10	28
	9	GJC to Gapan	4	40
Northbound (NB)	10	Jaen to Gapan	70	58
	11	Jaen to GJC	98	3
	12	Jaen to Cabiao	16	27
TOTAL (PASS BY INTERSECTION)			921	991

Table 2. Level of Service (LOS) Criteria for unsignalized Intersection (HCM 2010)

Level Of Service (LOS)	Average Control delay (s/veh)	Description
A	0-10	Free Flow
B	>10-15	Stable Flow (Slight Delays)
C	>15-25	Stable Flow (Acceptable Delays)
D	>25-35	Approaching Unstable Flow
E	>35-50	Unstable Flow
F	>50	Forced Flow (Congested)

This section presents the combined implementation results, where all proposed traffic management measures are integrated into a single enhanced model.

Table 3. PTV VISSIM simulation results on Level of Service (LOS)

Flow No.	Existing Model		Enhanced Model	
	Level of Service	LOS Value	Level of Service	LOS Value
GJC Intersection				
1	LOS F	6	LOS C	3
2	LOS F	6	LOS D	4
3	LOS F	6	LOS D	4
4	LOS C	3	LOS C	3
5	LOS D	4	LOS C	3
6	LOS C	3	LOS C	3
7	LOS A	1	LOS A	1
8	LOS E	5	LOS A	1
9	LOS C	3	LOS A	1
10	LOS C	3	LOS D	4
11	LOS F	6	LOS C	3
12	LOS B	2	LOS D	4
Jollibee Intersection				
1	LOS F	6	LOS C	3
2	LOS E	5	LOS D	4
3	LOS A	1	LOS A	1
4	LOS F	6	LOS C	3
5	LOS F	6	LOS C	3
6	LOS A	1	LOS A	1
7	LOS D	4	LOS C	3
8	LOS D	4	LOS D	4
9	LOS E	5	LOS C	3
10	LOS D	4	LOS B	2
11	LOS F	6	LOS A	1
12	LOS D	4	LOS C	3

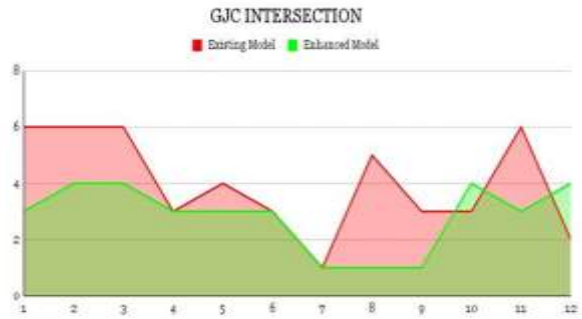

Figure 4. GJC Intersection LOS Comparison

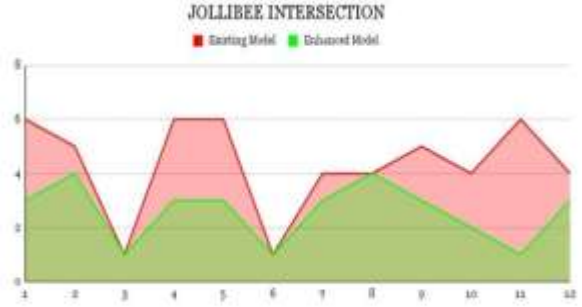

Figure 5. Jollibee Intersection LOS Comparison

CONCLUSIONS

The assessment of the two intersections in Poblacion, San Isidro showed that existing traffic conditions operate under heavy congestion due to high vehicle volume, inadequate traffic control devices, insufficient signage, and uncoordinated movements. PTV VISSIM simulation confirmed that many traffic flows functioned at LOS D to F, indicating unstable and oversaturated operations.

The enhanced traffic model, which applied the proposed enhancements for the intersections including the installation of traffic lights, improved pavement markings and signage, organized loading and unloading areas, and a one- way route showed better overall performance in the simulation. Many traffic movements that previously operated under LOS D to F improved to LOS A to C, indicating reduced delays and smoother traffic flow.

These findings show that the proposed traffic management plan effectively addresses the major causes of congestion and enhances intersection performance. The results emphasize the value of data-driven analysis and simulation-based planning in developing practical and sustainable traffic solutions.

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