

Evaluating the Effectiveness of Proposed Overpass on Total Crossing Time and Pedestrians' Perceived Safety in Crossing at Unsignalized Crosswalk (Olivarez Plaza Mall) Brgy. Batong Malake, Los Baños, Laguna

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Abstract: This paper evaluated the effectiveness of a proposed overpass in total crossing time and pedestrian perceived safety at unsignalized crosswalks in Olivarez Plaza Mall in Brgy. Batong Malake, Los Baños. This study employed the Mann-Whitney U Test to compare the total crossing time of an actual unsignalized crosswalk and a simulated overpass, revealing that the unsignalized crosswalk had a shorter total crossing time. The Shapiro-Wilk R test was utilized to determine whether the data sets were normally distributed and to support the use of a non-parametric test further. Pedestrians' perceived safety was determined using the 5-point Likert Scale, with Cronbach's Alpha to measure the consistency of the questions. The study uses the Jamovi Data analysis software to accurately compute the data and ensure correct and precise data calculation. The results show that the one-week period produces negative mean differences, indicating that total crossing time in the crosswalk is faster than a simulated overpass. Shapiro-Wilk R test implied that the calculated p value of < 0.05 defines the group of data as not normally distributed, requiring the use of the Mann-Whitney U Test. The reliability test revealed that the value resulted in 0.910, which is interpreted as excellent. The findings highlight that a proposed overpass should be further enhanced for efficient crossing and provide the perception of pedestrians on their safety when crossing in an unsignalized crosswalk or an overpass.

Keywords: Unsignalized crosswalk, Overpass, Pedestrian Delay, Total Crossing Time, Perceived Safety

I. Introduction

Pedestrian delay is the time a pedestrian has to wait before crossing the street at a signalized or unsignalized crosswalk [1]. Critical Gap is the time when pedestrians will not cross the street if they perceive the gap between vehicles to be too short, based on what they think is acceptable to them [2]. Pedestrians at unsignalized crosswalks were more inclined to check in both directions and cross the road when they see an opportunity [3].

In the annual report 2022, in the Philippines, 14.66% of pedestrians are involved in car accidents, and 9.66% of pedestrians are involved in motorcycle accidents, resulting in either death or injury [4]. This indicates that crosswalks are unsafe for people without proper road control systems, even though they are designed for the safety of pedestrians.

Barangay Batong Malake, Los Baños, Laguna is an urban barangay with a population of 12,578 which represents 10.9% of the whole population in the municipality of Los Baños [5]. The Olivarez Plaza Mall has a pedestrian lane in front of it which is frequently used by pedestrians in the area.

Furthermore, the annual average daily traffic in the Barangay, Batong Malake, national highway is 31,995 vehicles per day, and the national highway in front of Olivarez Plaza Mall has an effective carriageway width of 15.9 meters, which consists of 4 lanes that have a two-way directional flow [6]. The driver's awareness of yield and the pedestrian's perception of risk significantly impact the safety of pedestrians when crossing the street [7]. Conflict involves evasive action by the vehicles and pedestrians when they are on a collision course. Evasive actions include pedestrians.

In addition, the Highway Capacity Manual (HCM) instilled that a delay time that is between 20 to 30 seconds it suggests a moderate to high likelihood of risk-taking behavior which causes the pedestrians to find shorter gaps than the critical gap between the headways of the moving traffic for them to cross the other side of the street, this poses a great risk not just for the pedestrian but also for the driver.

When a pedestrian decides to wait for a safe gap between vehicles, their total crossing time also takes longer, which will inconvenience the pedestrian. Additionally, during peak hours, the volume of vehicles increases as well as the volume of pedestrians in the area, which causes delays for both vehicles and pedestrians crossing the street.

Moreover, simulation software is a trend nowadays in forecasting and simulating traffic and pedestrian movements on roads. AnyLogic is a traffic simulation software launched in 2000. On the other hand, AnyLogic can run microscopic and macroscopic simulations. The software lets the user input data such as flow rate, walking speed, and the model dimensions for the simulation. AnyLogic covers simulation from different transportation fields such as pedestrian traffic, road and highway traffic, manufacturing, warehouse logistics, and railroads.

The actual total crossing time is gathered at the unsignalized crosswalk at the front of Olivarez Plaza Mall from Monday to Sunday at 6:00-9:00 AM to 4:00-7:00 PM. The simulated total crossing time is gathered through the use of AnyLogic PLE simulation software. The pedestrian perceived safety is gathered using a 5-point likert scale questions on the pedestrians that are crossing the unsignalized crosswalk.

This study is about determining if an overpass will be effective in total crossing time and pedestrian perceived safety of pedestrians on the Olivarez Plaza Mall unsignalized crosswalks, which is near schools and is a loading and unloading zone for both buses and jeepneys alike.

Moreover, between 2022 and 2024, there were 14 accidents between vehicles and pedestrians in Brgy. Batong Malake, of which 8 occurred in the pedestrian lane in front of the Olivarez Plaza Mall. The recorded accidents injured the victims, and most of the vehicles involved were cars and motorcycles. This causes significant safety concern among pedestrians.

II. Methodology

Total population increases lead to an increased volume of vehicles and pedestrians. Different means of transportation were designed to improve the flow of vehicles and enhance the safety of road users. Numerous studies have been conducted to determine the effectiveness of a proposed overpass and the factors needed when implementing it.

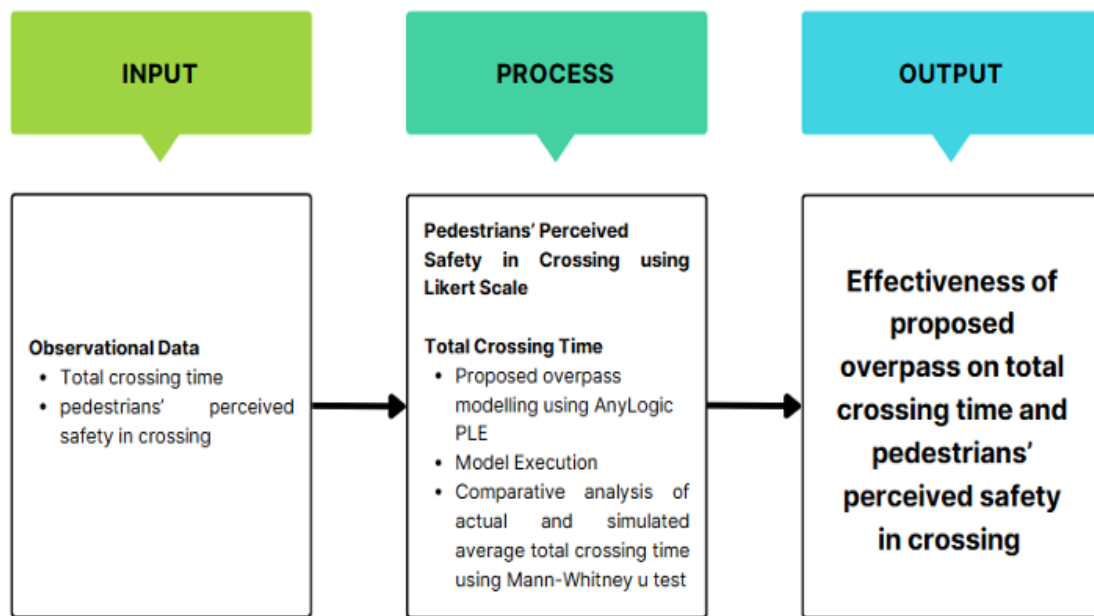


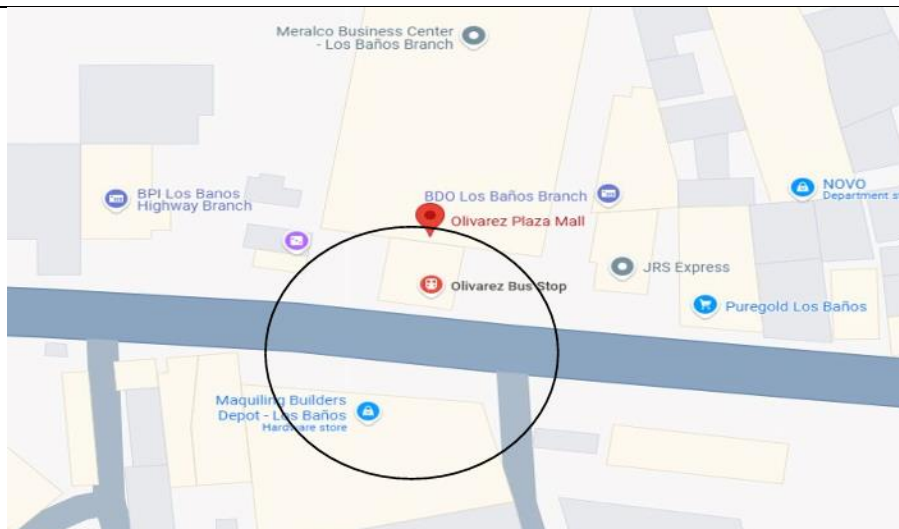
Figure 3.1: Input-Process-Output model

Figure 3.1 will show the conceptual framework using the Input Process-Output (IPO) Model. The model will represent the input and process used to determine the effectiveness of a proposed overpass on total crossing time and pedestrians' perceived safety. The process includes collecting data such as total crossing time and perceived safety, using AnyLogic simulation and the Mann-Whitney U Test, and a survey using a 5-point Likert scale. The output is the conclusion on the effectiveness of the overpass at Brgy. Batong Malake, Los Baños, Laguna.

The researchers used a quantitative research approach. Quantitative design involves systematic investigation and collection of numerical data, tested using the Mann-Whitney U Test with a one-tailed hypothesis.

It explained the data collected, the statistical treatment, and the results. It uses tables and graphs for clear understanding [8]. The study compared total pedestrian crossing time at the actual site and the simulated time using AnyLogic. A Likert Scale was used to measure perceived safety.

The research locale is the crosswalk in front of Olivarez Plaza Mall, Brgy. Batong Malake, Los Baños, Laguna. It is a four-lane roadway used to obtain data on perceived safety and crossing time.



Data Collection

The study used video cameras and surveys to gather data on crossing time and perceived safety. A Likert scale survey was distributed to 400 respondents, exceeding the Raosoft-calculated 377 sample size. Crossing time was measured by observation. AnyLogic was used for simulation comparison. The study evaluated the crosswalk and proposed overpass to help assess pedestrian lane and traffic control management.

Video recording was done from February 10–16, 2025, during peak hours (6:00–9:00 AM and 4:00–7:00 PM). 400 respondents completed a Likert scale survey. AnyLogic simulated the overpass crossing time for comparison.

Collected in two ways: simulated and actual.

- Total crossing time includes waiting time.
- AnyLogic PLE simulated average crossing time using its pedestrian library.

Survey with 5-point Likert scale (1–5). 400 surveys were collected using convenience sampling.

Data gathered from February 10–16, 2025, during morning and afternoon peak hours to determine total crossing time.

Data Analysis

Pedestrian Crossing Time

Measured from initiation to road crossing. Simulated times were gathered using AnyLogic, which can run up to 50,000 population.

Mann-Whitney U Test

Nonparametric method to compare two groups. Used to compare actual and simulated times. Jamovi software was used for accuracy.

$$U = n_1 n_2 + \frac{n_1(n_1+1)}{2} - R_1$$

Where:

U = Mann-Whitney U statistic

R= The sum of ranks for the group

n1= The number of observations in group 1

n2= The number of observations in group 2

Shapiro-Wilk R Test

Used to check if data is normally distributed to decide on parametric or non-parametric analysis. Jamovi was used.

$$W = \frac{(\sum_{i=1}^n a_i x_{(i)})^2}{\sum_{i=1}^n (x_i - \bar{x})^2}$$

Where:

$x_{(i)}$ = sample values sorted in ascending order

$\bar{x}$ = sample mean

Pedestrian Perceived Safety

Mean used to interpret Likert scale results.

Cronbach's Alpha

Used to determine Likert scale reliability and consistency. Results obtained using Jamovi.

$$\alpha = \frac{N\bar{c}}{v + (N-1)\bar{c}}$$

α = Average variance

N = Number of items

$\bar{c}$ = Average inter-item covariance among the items

III. Results and Discussion

The total crossing time is the time a pedestrian takes to cross the road, including their waiting time. Data for this time was collected in the morning and afternoon and analyzed using Jamovi. The mean crossing time reflects the average, with a lower mean indicating faster crossing. In a Mann-Whitney U test, a p-value greater than 0.05 suggests the actual crossing time is shorter than the simulated one. In the Shapiro-Wilk Test, a p-value less than 0.05 indicates non-normal data, requiring the use of non-parametric tests like the Mann-Whitney U Test.

Table 4.1.1: Summary of Descriptive Statistics Values for Actual Total Crossing Time

DAYS	Mean	Standard Deviation	Median
Monday	38.7	32.9	22.0
Tuesday	35.3	26.1	33.6
Wednesday	57.9	35.3	60
Thursday	43.4	32.9	40.1
Friday	41.6	39.4	30.3
Saturday	49.6	33.7	41.4

Sunday	37.3	24.4	33.7
Average	43.9		

Table 4.1.2: Summary of Descriptive Statistics Values for Simulated Total Crossing Time

DAYS	Mean	Standard Deviation	Median
Monday	99.5	15.0	93.1
Tuesday	95.5	8.64	92.2
Wednesday	94.7	7.89	92.3
Thursday	94.6	8.11	91.3
Friday	98.6	16.5	97.7
Saturday	90.1	4.57	90.7
Sunday	96.1	7.33	97.9
Average	95.9		

The average total crossing time on the unsignalized crosswalk is 43.9 seconds, and the average total crossing time from the simulated overpass is 95.9 seconds. This means that, on average, the pedestrians are crossing 52 seconds faster on the unsignalized crosswalk than on the simulated overpass. Moreover, all of the individual means from Monday to Sunday on the unsignalized crosswalks are faster than the simulated overpass.

Table 4.1.3: Summary of Mann Whitney and Shapiro Wilk P Values

DAYS	Mean Difference	Mann-Whitney P Value	Shapiro-Wilk value
Monday	-72.1	1	0.002
Tuesday	-66.8	1	0.008
Wednesday	-35.6	1	0.009
Thursday	-55.6	1	0.009
Friday	-66	1	<0.001
Saturday	-48.3	1	0.018
Sunday	-62.3	1	0.006

The statistical analysis from day 1 up until day 7 of the covered period all suggest a p value of 1, and the unsignalized crosswalk in all of the observed days has a mean that is lower than the simulated overpass. Moreover, the test states that there is no statistical evidence that the total crossing time on the simulated overpass is shorter than the unsignalized crosswalk. These points point out that the simulated overpass is not effective in reducing the pedestrians' total crossing time on the unsignalized crosswalk, and the overpass is not an efficient means of crossing for the pedestrians, as they are taking longer to cross on the simulated overpass than the unsignalized crosswalk even though the pedestrians experience waiting time on the unsignalized crosswalk.

All of the Shapiro-Wilk p-values from Monday up until Friday are less than 0.05, which indicates that the data are not normally distributed and supports the use of the non-parametric Mann-Whitney U Test.

Pedestrians Perceived Safety Analysis

Gender Ratio

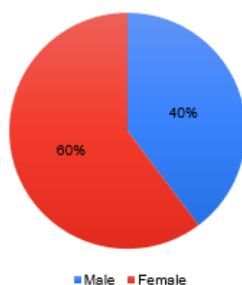


Figure 3.1: Gender Ratio.

Figure 3.1 shows the percentage of pedestrians based on gender. It shows that 241 respondents were female, indicating 60% of the total respondents. On the contrary, 159 are male, showing 40% of the total respondents. As shown above, it is specified that the majority of the pedestrians crossing the unsignalized crosswalks are female.

Number of Respondents Based on their Age

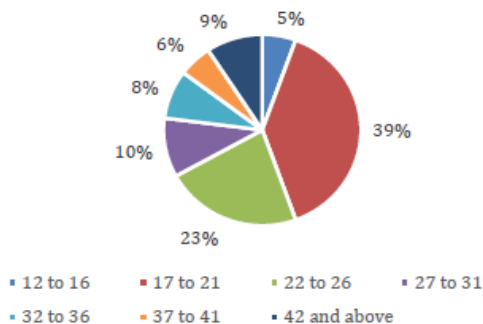


Figure 3.2: Number of Respondents Based on their Age.

Figure 3.2 above indicates the pedestrians based on their age. Ages from 17 to 21 show the highest percentage, with 39% of total respondents, equal to 156 respondents. 22 to 26-year-olds have 92 respondents, indicating 23%. The ages of 27 to 31 show 10% of the 400 respondents. Those 42 and above demonstrate 9%, while those aged 32 to 36 have 8%. 24 out of 400 respondents were between the ages of 37 and 41, equivalent to 6%, while the ages of 12 to 16 got the lowest number of respondents, showing 5% or 20% of total respondents. Figure 3.2 concluded that most of the respondents' ages were around 17 to 21.

Table 3.4: Table of Interpretation.

Table of Interpretation	
1.00-1.80	Strongly Disagree
1.81-2.60	Disagree
2.61-3.40	Neutral
3.40-4.20	Agree
4.21-5.00	Strongly Agree

Table 3.4 explains the interpretation of the mean values for the questions in the questionnaire. 1.00-1.80 means that the respondents "Strongly Disagree" with the statement, 1.81-2.60 means that the respondents "Disagree" with the statement, 2.61 - 3.40 means that the respondents are "Neutral" to the statement, 3.41 - 4.20 means that the respondents "Agree" with the statement and 4.21 - 5.00 means that the respondents "Strongly Agree" with the statement.

Table 3.5: Results of Pedestrians' Perceived Safety (Likert Scale).

Question	Mean	Rating	Conclusion
1. <i>A pedestrian overpass will improve pedestrian safety when crossing the road.</i>	4.21	Strongly Agree	This supports the notion that an overpass will improve pedestrian safety.
2. <i>Using a pedestrian overpass will feel safer than crossing the road at the current crosswalk.</i>	4.28	Strongly Agree	This means that the pedestrians feel safer using an overpass than crossing the road at the current crosswalk.
3. <i>An overpass will encourage more pedestrians to use a safer crossing option.</i>	4.15	Agree	Majority of the respondents believe that the implementation of an overpass will encourage more pedestrian to seek safer options for crossing the road.
4. <i>A pedestrian overpass will provide a long-term solution to pedestrian safety problems at this location.</i>	4.18	Agree	This positive response suggests that the respondents think that an overpass will improve the safety of the pedestrians in the long run.
5. <i>A pedestrian overpass will help to reduce accidents and injuries involving pedestrians.</i>	4.29	Strongly Agree	The high mean indicates that most of the respondents believes that the overpass will significantly reduce accidents and injuries involving pedestrians.

Question one (1) is about whether an overpass will improve pedestrian safety when crossing the road. The data revealed that indicator number four (4), "Agree," has the highest response of 199. Indicator number five (5), "Strongly Agree," has a response of 156, and indicator number three (3), "Neutral," has a response of 23. Indicator number one (1), "Strongly Disagree," has the lowest response of 6. Generally, the overall computed mean value of perceived perception in safety is 4.21, interpreted as "Strongly Agree" by whether an overpass will improve pedestrian safety when crossing the road. This supports the notion that an overpass will enhance pedestrian safety.

Question two (2) is about whether using an overpass will feel safer than crossing the road at the current crosswalk. Indicator number four (4) "Agree" has the highest response of 204. Indicator number five (5), "Agree," has a response of 163, and indicator number three (3), "Neutral," has a response of 16. while indicator number one (1) "Strongly Disagree" has only 2 responses. This figure has the overall mean of 4.28 interpreted as "Strongly Agree". This high mean indicates that the respondents feel much safer using an overpass compared to the existing crosswalk, proving that the overpass is favorable for pedestrian safety. This means that the pedestrians feel safer using an overpass than crossing the road at the current crosswalk.

Question three (3) is about whether an overpass will encourage more pedestrians to use a safer crossing option. Indicator number four (4), "Agree," obtained the highest number of responses, 199. The indicator number five (5) "Strongly Agree" has the response of 143, and the indicator number three (3) "Neutral" has the response of 34. Indicator number two (2) "Disagree" has a response of 21, and indicator number one (1) "Strongly Disagree" has the lowest response of 3. The overall mean of 4.15 is interpreted as Agree. Based on the finding, pedestrians will be encouraged to use a safer crossing option. Most of the respondents believe that the implementation of an overpass will encourage more pedestrians to seek safer options for crossing the road.

Question four (4) is about whether the overpass will provide a long-term solution to pedestrian safety concerns at this location. The data revealed that the fourth indicator, number four (4), “Agree”, had a response of 201. The indicator number five (5), “Strongly Agree”, with the response of 149, and indicator number three (3), “Neutral”, has the response of 27. Indicator number two (2) “Disagree” has a response of 18, and indicator number one (1) “Strongly Disagree” has the lowest response of 5. The overall mean value is 4.18, which falls under “Agree”. The result of this finding showed that the respondents believed the idea that an overpass would provide a long-term solution to safety concerns at the location of the crosswalk. This positive response suggests that the respondents think that an overpass will improve the safety of the pedestrians.

Question five (5) is about whether the overpass will significantly reduce accidents and injuries involving pedestrians. The data revealed that indicator number four (4), “Agree,” has the highest number of response values of 188. The indicator number five (5), “Strongly Agree”, with the response of 174, and indicator number three (3), “Neutral”, has the response of 22. Indicator number two (2) “Disagree” has a response of 13, and

indicator number one (1) “Strongly Disagree” has the lowest response of 3. Generally, the overall computed mean value of perceived pedestrian safety is 4.29 and interpreted as “Strongly Agree”. The high mean indicates that most of the respondents believe that the overpass will significantly reduce accidents and injuries involving pedestrian

Cronbach’s Alpha

Scale Reliability Statistics		Cronbach’s Alpha
scale		0.910

The Likert scale for pedestrians perceived safety scored 0.91 “Excellent” in the Jamovi Cronbach’s Alpha test which indicates that the questions of the questionnaire are effectively measuring the same construct. This also indicates that that questionnaire is reliable for measuring the pedestrians perceived safety.

IV. Conclusion

The researchers accumulated data from Olivarez Plaza Mall in Brgy. Batong Malake, Los Baños, the mean total crossing time from the actual crosswalk is 43.4 seconds, while the mean total crossing time from the simulated overpass is 95.59 seconds.

The mean total crossing time for the simulated overpass is longer than the actual total crossing time. The researchers used a Mann-Whitney U test to compare the total crossing times of the unsignalized crosswalk and the simulated overpass.

The Mann-Whitney U test tests the hypothesis that from Monday to Sunday, the test renders a result that the total crossing time on the overpass does not improve the total crossing time of the pedestrians on the unsignalized crosswalk. This means that the overpass is not effective in reducing the total crossing time of pedestrians on the current unsignalized crosswalk. Instead, they will experience longer total crossing times in the simulated overpass than in the crosswalk, despite having a waiting time on the crosswalk, which is less or non-existent on an overpass.

The researchers used the 5-point Likert Scale to collect data on pedestrians' perceived safety. A survey was conducted with 400 respondents to assess the perceived safety of a proposed overpass. The pedestrians strongly agree to the idea of an overpass to improve the safety of pedestrians who are crossing the crosswalk. Based on the results, the overpass is effective in improving the pedestrians' perceived safety if an overpass is present in the area. It will be an effective solution to improve their safety, as it will provide a long-term solution to pedestrian safety concerns and will reduce accidents and injuries involving pedestrians in the area.

Overall, the findings of the effectiveness of an overpass on the total crossing time turn out to be ineffective, but it is effective on the pedestrians' perceived safety on the current unsignalized crosswalk. Ultimately, an overpass will still be effective in the area despite having longer crossing times, as the majority of pedestrians tend to choose their safety over their convenience. Studies also suggest that pedestrians tend to be more cautious at a crosswalk when there is a presence of a large vehicle like a bus because they feel unsafe, and the Olivarez Plaza Mall is a drop-off and pick-up point for buses and jeepneys alike.

References

1. U.S. Department of Transportation. (2008). FY 2008 DOT annual performance report. <https://www.transportation.gov/mission/budget/fy2008-dot-annual-performancereport>
2. Highway Capacity Manual. (2000). HCM2000 Highway Capacity Manual. https://sjnavarro.wordpress.com/wpcontent/uploads/2008/08/highway_capacital_manual.pdf
3. Mitman, M. F., Ragland, D. R., & Zegeer, C. V. (2008). Marked-crosswalk dilemma: Uncovering some missing links in a 35-year debate. *Transportation Research Record*, 2073(1), 86-93. <https://escholarship.org/content/qt13r7q036/qt13r7q036.pdf>
4. Metro Manila Accident Reporting and Analysis System. (2022). Driving Safely is Road Safety. https://mmda.gov.ph/images/Home/FOI/MMARAS/MMARAS_Annual_Report_2022.pdf

5. Philippine Statistics Authority. (2020). 2020 census of population and housing: 2020 CPH population counts declared official by the President. Retrieved from <https://psa.gov.ph/content/2020-census-population-and-housing-2020-cphpopulation-counts-declared-official-president>
6. Department of Public Works and Highways. (2023). Road Traffic Information. <https://www.dpwh.gov.ph/dpwh/gis/rti>
7. Fu, T., Miranda-Moreno, L., & Saunier, N. (2018). A novel framework to evaluate pedestrian safety at non-signalized locations. *Accident Analysis & Prevention*, 111, 23-33.
<https://www.sciencedirect.com/science/article/abs/pii/S0001457517304025>
8. University of Southern California Libraries. (2024). Quantitative research methods: Writing guide. USC Libraries Research Guides. <https://libguides.usc.edu/writingguide/quantitative>