Pedestrianization in Baguio City

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ABSTRACT: Baguio City is well known as the "Summer Capital of the Philippines." This has affected the vehicular and pedestrian movements in Lower Session Road, which led to the proposal of pedestrianization of the area. Pedestrianization is a traffic-calming method wherein a portion of Lower Session Road is closed for vehicles to give way to pedestrians. However, before executing this method, perception surveys were handed out to pedestrians, business owners, car users, and public utility drivers for the researchers to know their origin, destination, factors which they think are important when they are walking and the effect of pedestrianizing said road with respect to their daily activities. Although the survey response from the different groups gave positive feedback, the respondents' main concern is the congestion that will affect the neighboring streets when Lower Session Road is closed. Knowing this, rerouting is a top priority to spread the vehicular traffic evenly.

Keywords: pedestrianization, Baguio city, traffic calming

1. INTRODUCTION

Baguio City occupies about 57 square kilometers of hilly land about 1,524 meters high in the southwestern portion of the Cordillera Central mountain range in northern Luzon in the Philippines. It is completely surrounded by the province of Benguet, which Baguio used to be a town of before being made into an independent city ("All About Baguio City Philippines," n.d.). Also known as the Summer Capital of the Philippines, it is also one of the tourist spots mostly visited in the country. The current population is at 345,366 with an annual 2.36% increase, which is relatively higher than its capacity at 26,000. Unlike other attractions that can be found in the country, Baguio City probably has the most visitor attractions clustered in a relatively small area compared to other tourist destinations in the Philippines. This has relatively impacted the urban core of the city due to overcrowding of the area considering the number of people using its streets, specifically pedestrian walkways. The design of its downtown streets is not expandable risking its survival (Akers, n.d.). As a result, the city's population density is relatively higher at the East and South sides.

One of these tourist attractions is the Session Road. Session Road is the main thoroughfare of Baguio City and its commercial center, with a variety of shops, stores, offices lining each side. It is also considered as the most expensive of all Baguio real estate due to its location. Its location has also affected the volume of pedestrian traffic causing congestion in the area. This has led to several proposals regarding the pedestrianization of the area. Pedestrianization is the removal of vehicular traffic from city streets. For example, in Hong Kong, pedestrianization is defined by the transport department as "to restrict vehicle access to a street or area for exclusive use of pedestrians". Its importance of pedestrianisation in developing countries is increasing continuously because vehicular access is overcoming in cities more resulting to reduction of pedestrians in urban spaces (Iranmanesh, 2008). In an experiment conducted, pedestrianization was done on Session Road where one side was closed from 3:00 pm to midnight. The objectives of this are keeping the air clean, enlivening the spirit of community and giving importance to people rather than cars. This experiment became an avenue for the people to use the roads as a place where they can dine and interact with other

people. This has also reduced the pollution in the area even for a short period of time (Alabanza, 2012).

Through the years, the population of Baguio City has greatly increased from its actual capacity at 26 000 to its current population at approximately 345 000, and is still continuing to increase year by year. With the growing population of the city, traffic congestion has become a problem. Disturbance in traffic flow along Lower Session Road is caused by the insufficient capacity of the existing route to accommodate the volume of vehicles that traversed it. Whenever there is an increase in the volume of motorists on the said route, buildup of traffic is experienced especially during peak hours. Therefore, the study concerning the pedestrianization of Lower Session Road in Baguio City is necessary and timely in order to determine the level of effectiveness said pedestrianization provide to the community of Baguio City to reduce traffic congestion. In addition to that, rerouting the traffic flow and conveniently distributing the volume of traffic flow into other roads that are not optimized can ease traffic congestion. The main objective of the study is to analyze the effects of pedestrianization to the vehicular and pedestrian movements in Baguio City.

2. THEORY/CONCEPTS

2.1 Perception Survey

Perceptions are the way people organize and interpret their sensory input, or what they see and hear, and call it reality. Perceptions give meaning to a person's environment and make sense of the world (Erickson, 2013).

A perception survey is used to determine the opinion of the people regarding the existing situation of their environment. This is used to know the parameters such as the expansion of walkway for comfort, speed and safety that are needed to consider in improving the current condition of the area, answer problems that the study wants to tackle, analyze trends, and set solutions. In order to be successful, it is imperative that a perception survey must be both reliable and valid. The right questionnaires must be asked to obtain meaningful usable responses to increase safety performance.

2.2 Traffic Engineering Studies

Traffic stream is made up of individual interaction of drivers, vehicles, physical elements of roadway, and general environment (Garber and Hoel, 2012). There are two types of traffic stream facilities, the uninterrupted flow and the interrupted flow. Uninterrupted flow facilities are sections of highways in rural areas with no traffic signals, stop or yield signs, and at-grade intersections. Meanwhile, interrupted flow facilities are sections of highways with traffic signals, stop or yield signs, un-signalized at-grade intersections, and curb parking maneuver. There are two major types of traffic stream parameters, macroscopic and microscopic. Both parameters require the volume or rate of flow, speed, and density. The only difference is that in microscopic, the speed of individual vehicles is recorded.

Traffic volume studies are conducted to collect data on the number of vehicles and/or pedestrians that pass a point on a highway facility during a specified period of time. Traffic volume is defined as the number of vehicles passing a point on a highway. Rate of flow represents flows that exist for periods of time less than an hour. Hourly volumes are used to design highways to adequately serve the peak-hour traffic volume in the peak direction of flow. Peak hour is the single hour of the day with the highest hourly volume (Garber and Hoel, 2012).

The peak hour factor is the relationship between the hourly volume and the maximum rate of flow within the hour. It could be computed using the formula (Garber and Hoel, 2012):

$$PHF = \frac{V}{4V_{15}} \quad \text{(Equation 2.2.1)}$$

Where

PHF = peak hour factor
V = Total volume within the hour
V15 = Maximum volume of a 15-minute period, within the peak hour

When the peak hour factor is known, it can be used to estimate a maximum flow rate within an hour based on the full-hour volume:

$$v = \frac{V}{PHF}$$ (Equation 2.2.2)

Where

v = maximum rate of flow within the hour
V = total volume of the peak hour

2.3 Pedestrian Studies

Pedestrian studies focus on the pedestrian traffic flow giving an analysis of pedestrian facilities. Pedestrian activity can be a major component in urban street capacity analysis, and pedestrian characteristics are an important factor in the design and operation of transportation systems. The concentration of pedestrian can be equated to the establishments, public events, and other major traffic generators situated in an area. Pedestrian safety, trip patterns, and convenience are also necessary consideration in all multi-modal traffic and transportation studies (Garber and Hoel, 2012).

The qualitative measures of pedestrian flow involves the freedom to choose desired speeds and to bypass others, ability to cross a pedestrian traffic stream and generally maneuver without conflicts. Other qualitative measures that contribute to the walking experience are comfort factors, convenience factors and safety. Comfort factors include weather protection, climate control and transit shelters. Convenience factors include the environmental factors or the characteristics of the available facilities such as walkway distance and other features that makes pedestrian travel easy. Safety involves the reduction of vehicular and pedestrian interaction provided by control devices separating pedestrian and vehicular traffic (Garber and Hoel, 2012).

2.3.1 Pedestrian Speed-Density Relationships

This relationship explains that as the volume and the density of pedestrian increases, the pedestrian speed declines. Degree of mobility of the people decreases due to the decline in space allotted for an individual (Transportation Research Board, 2000).

2.3.2 Speed-Flow Relationships

As flow increases, speed declines because of closer interactions with other pedestrians. When a critical level of crowding occurs, movement becomes more difficult, and both flow and speed decline (Transportation Research Board, 2000).

2.3.3 Flow-Density Relationships

Increase flow of pedestrians means an increase in the density. This concept is explained in the equation below:

$$\text{Flow} = \frac{speed}{space} = \text{speed x density}$$ (Equation 2.3.3.1)

2.3.4 Walkway Level of Service Criteria

According to Transportation Research Board (2000), the level of service of walkways are evaluated based on speed of pedestrians, ability of pedestrians to cross pedestrian streams and ability to maintain flow in the direction opposing a major pedestrian flow. The LOS Criterion is used in defining the degrees of convenience or service in highways, can be used in analyzing pedestrian facilities.

Table 1 represents the recommended ranges of pedestrian levels of service in walkways. This table could also be found in the 2000 HCM (Highway Capacity Manual) as recommended by the TRB (Transportation Research Board). The level of service criteria is dependent upon some pedestrian variables such as the sidewalk pedestrian space, pedestrian average speed and flow rate.

Table 1 Level of Service Criteria for Walkways and Sidewalks

Levels of Service (LOS)	Average Speed (m/s)	Flow Rate (ped/min/m)

A	> 1.30	≤ 16
B	> 1.27 – 1.30	> 16 – 23
C	> 1.22 – 1.27	> 23 – 33
D	> 1.14 – 1.22	> 33 – 49
E	> 0.75 – 1.14	> 49 – 75
F	≤ 0.75	Variable

Source: Transportation Research Board (2010)

1. Level of Service A – pedestrians basically move in desired paths without altering their movements in response to other pedestrians. Walking speeds are freely selected, and conflicts between pedestrians are unlikely.
2. Level of Service B – sufficient area is provided to allow pedestrians to freely select walking speeds, to bypass other pedestrians, and to avoid crossing conflicts with others. At this level, pedestrians begin to be aware of other pedestrians, and to respond to their presence in the selection of walking path.
3. Level of Service C – sufficient space is available to select normal walking speeds and to bypass other pedestrians in primarily unidirectional streams. Where reverse-direction or crossing movements exist, minor conflicts will occur, and speeds and volume will be somewhat lower.
4. Level of Service D – freedom to select individual walking speed and to bypass other pedestrians is restricted. Where crossing or reverse-flow movements exist, the probability of conflict is high, and its avoidance requires frequent changes in speed and position.
5. Level of Service E – insufficient space is provided for passing of slower pedestrians. Cross- or reverse-flow movements are possible only with extreme difficulties. Design volumes approach the limit of walkway capacity, with resulting stoppages and interruptions to flow.
6. Level of Service F – all walking speeds are severely restricted, and forward progress is made only by "shuffling." there is frequent, unavoidable contact with other pedestrians. Cross- and reverse-flow movements are virtually impossible.

2.3.5. Analysis Procedure for Walkways

Computations for walkways are based on peak 15-minute pedestrian counts. The pedestrian unit flow rate, in ped/min/ft, is computed as:

$$v = \frac{V_{P15}}{15W_E} \quad \text{(Equation 2.3.5.1)}$$

Where V_{P15} = peak 15-min pedestrian flow

W_E = effective walkway

3. DATA, RESULTS, and ANALYSIS

3.1 Pre-Survey Questionnaire

A large number of samples result to more accurate results. However, higher number of samples would mean higher expenditure and higher time and effort exerted. Dr. Smith (2013) discussed the calculation for the correct sample size of consequential research for the target population. The factors needed for the sample size computations are the margin of error, confidence level, and the standard deviation. The population size of the study area is not important.

Margin of error or confidence interval is the amount of error researchers would allow in their data. It determines how higher or lower the population mean is allowed for the sample mean fall. A margin error of 5% is normally used for the calculation. On the other hand, confidence level is the degree of certainty that the actual mean will fall within the confidence interval. The most common confidence intervals are 90% confident, 95% confident, and 99% confident. Lastly, the standard deviation depends on how heterogeneous a sample population is. The more that the population is

varied, the more respondent is required to obtain higher precision. Dr. Smith added that 50% degree of variability of a normal distribution curve would be appropriate since it is more conservative.

Having 50% suggests that equal proportion of the sample does not or does have the characteristic the researchers wanted to observe. And, 95% confidence level with a Z-score of 1.65 will yield an accurate actual mean. Considering time constraints to gather data, using 95% as confidence interval is forgiving yet it is still conservative. If the population size is unknown and there are no other previous data related to the study, this formula should be utilized:

$$N = \left(\frac{Z\sigma}{D}\right)^2 \qquad \text{(Equation 3.1.1)}$$

where:

N – sample size
Z – equivalent Z-score of confidence level
σ – standard deviation
D – margin of error

Thus, the sample size is computed to be:

$$N = \left(\frac{1.65(0.5)}{0.05}\right)^2 = 272\ samples$$

At least 272 respondents should be surveyed in Session Road, Baguio City.

The current population in Baguio City is 315,800. Assuming that the target sample size is at 272, an appropriate representation of each sub-group should be calculated. Using stratified random sampling method, the number of samples is computed. Calculations are done using the concept of proportionality.

Table 4.1 Forms of Transportation and their Corresponding Population Volume

Form of Transportation	Population
Pedestrians	232 952
Business Owners	14 846
Private Vehicles	60 002
Public Utility Vehicles	8 000

Sources: http://moocharoo.ph/stats/benguet/baguio-city, http://news.pia.gov.ph/article/ view/ 41488525809/drivers-operators-hold-rally-vs-jeepney-phase-out-in-baguio, http://www.competitive.org.ph/cmcindex/pages/historical/?lgu=Baguio

Public utility vehicle drivers : $\frac{8\ 000}{315\ 800} = \frac{x}{272}$; x = 7 samples
Private vehicle users: $\frac{60\ 002}{315\ 800} = \frac{x}{272}$; x = 52 samples
Business owners: $\frac{14\ 846}{315\ 800} = \frac{x}{272}$; x = 13 samples
Pedestrians: $\frac{232\ 952}{315\ 800} = \frac{x}{272}$; x = 201 samples

However, to obtain a more conclusive data, the researchers decided to survey at least 500 respondents in Baguio City. In line with this, the researchers gathered a total of 526 surveys, with 345 from pedestrians, 79 from car users, 68 from business owners, and 34 from public utility vehicle drivers during the data gathering period from January to April 2017 in Baguio City.

A pre-survey was conducted to know how long the people are willing to walk to get to their desired destination. From their answers, the researchers would be able to measure the distance of their proposed area of pedestrianization (as shown in Figure 5.1).

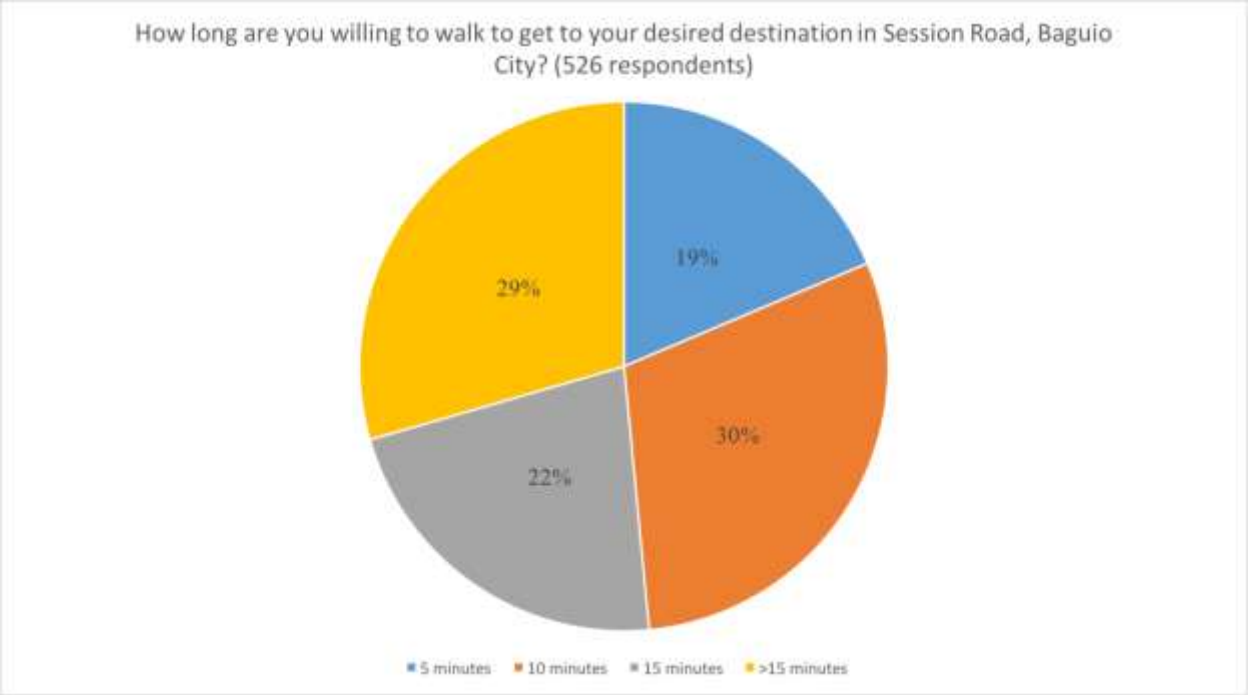


Figure 1 Pre-survey questionnaire

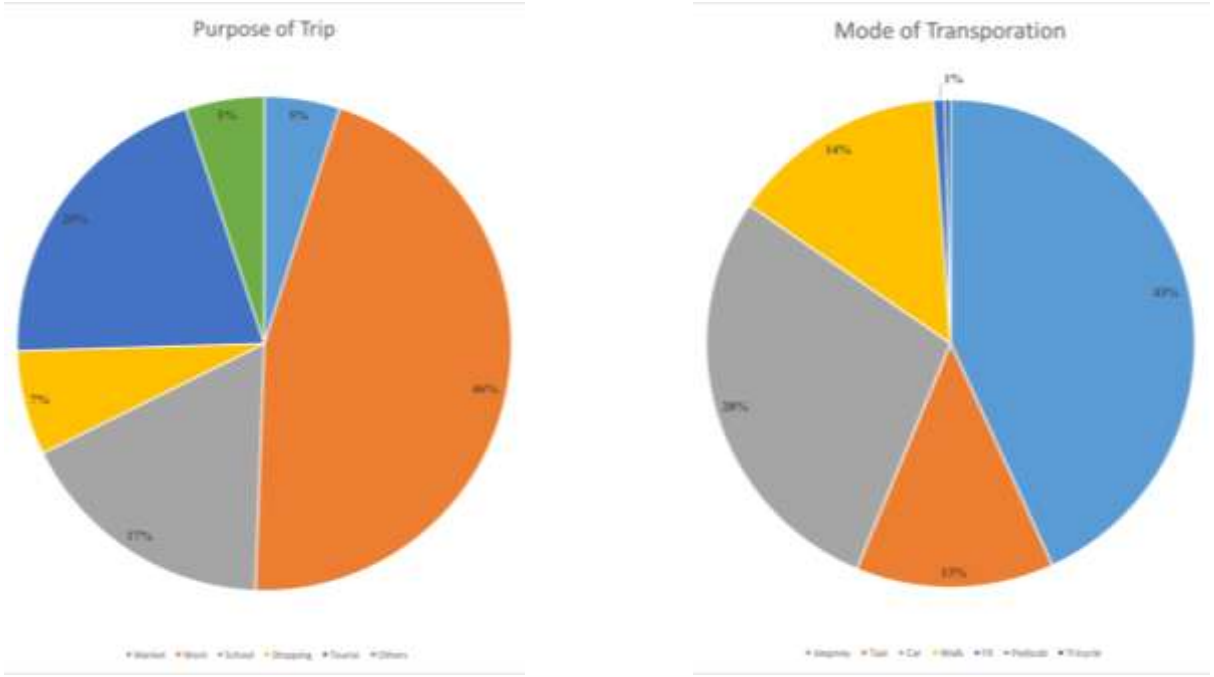
Out of the 526 respondents, 157 or 30% of them are willing to walk for 10 minutes. Next, 155 respondents or 29% of the 526 respondents do not mind walking for more than 15 minutes while 116 or 22% of them do not mind walking for a span of 15 minutes. Lastly, the least chosen option, with only 98 out of 526 respondents agreeing, is walking for 5 minutes. The result of the pre-survey questionnaire signifies that the respondents do not necessarily disapprove of walking for a long period of time since the last option is walking for 5 minutes.

3.2 Household Information

Table 2. Summary of household information

Age	
18-25	3
26-33	24
34-41	12
42-49	26
50 and above	14
Gender distribution	
Male car users	72
Female car users	7
Male pedestrians	198
Female pedestrians	147
Male PUV drivers	32
Female PUV drivers	2
Male business owners	33
Female business owners	35

Occupation	
Employees	241
Students	120
Business owners	68
Independent professionals	45
Others	52
Monthly income	
200,000 and above	8
150,000-199,999	2
100,000-149,999	4
75,000-99,999	3
50,000-74,999	16
25,000-49,999	47
15,000-24,999	73
10,000-15,000	77
5,000-9,999	86
Less than 5,000	97
none	113



(a) (b)

Figure 2(a) Trip Purpose and (b) Mode of transportation

Figure 2(a) illustrated the purpose of the trip of the respondents from Baguio City. 240 or 46% of the 526 respondents are en route to their work, since most of the people surveyed are either employees, business owners, or independent professionals. 107 or 20% of the 526 respondents are tourists visiting Baguio City, followed by 90 respondents or 17% of the 526 respondents going to school. The number of respondents with the purpose of shopping is 36 or 7% of the 526 respondents, while the number of respondents that do not belong to any of the choices is 27 or 5% of the 526 respondents. Lastly, going to the market is the least chosen option with only 26 out of 526 respondents choosing the aforementioned purpose of trip.

For Figure 2(b), the main mode of transportation for the community of Baguio City is through the use of PUJs or Public Utility Jeepneys, coming from 227 out of 526 the respondents or 43% of the respondents. The next mode of transportation is through the use of private cars, with 159 votes or 28% of the whole, followed by walking with 75 votes. Taxis are also widely used with 69 votes or what 13% of the respondents use on a daily basis. FX and Tricycles are rarely used with only 4 and 2 votes respectively. Lastly, no one in our respondents used a pedicab to get to their destination. As for the mode of transportation the public transportation drivers operate, 23 or 67.65% of them use jeepneys while 11 or 32.35% of them use taxis.

3.3 Perception Survey

Data collected from the perception survey are presented through graphical representation. The respondents include business owners, public utility vehicle drivers, pedestrians and private car users.

The result of the survey given to the business owner group gives an overview of how pedestrianization can affect their establishments located in Session Road. Summary of their responses are shown in Figure 3.

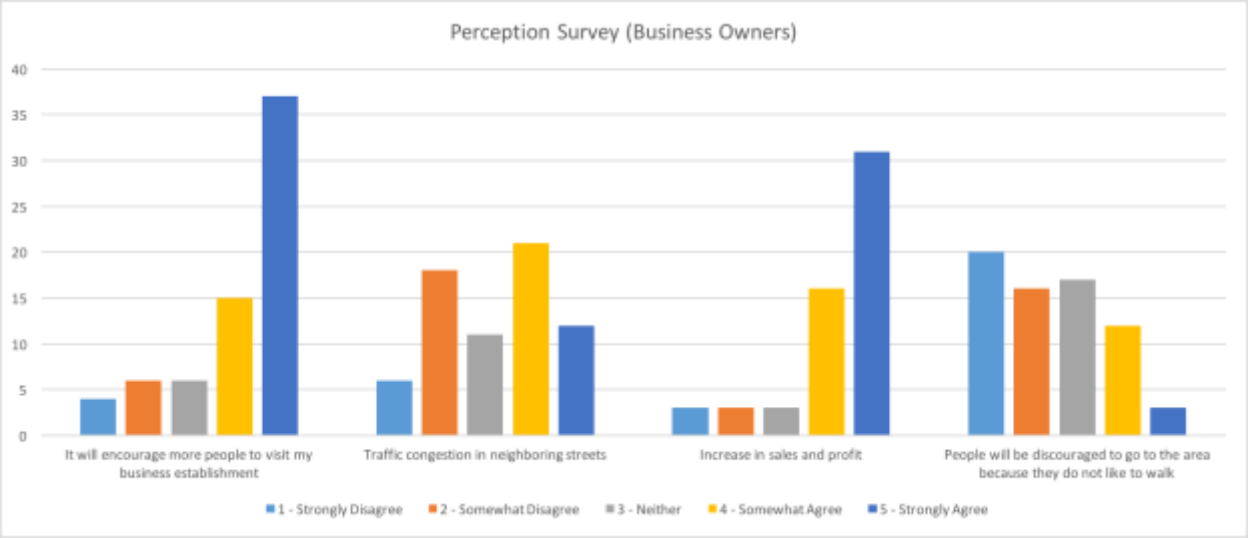


Figure 3. Perception survey (business owners)

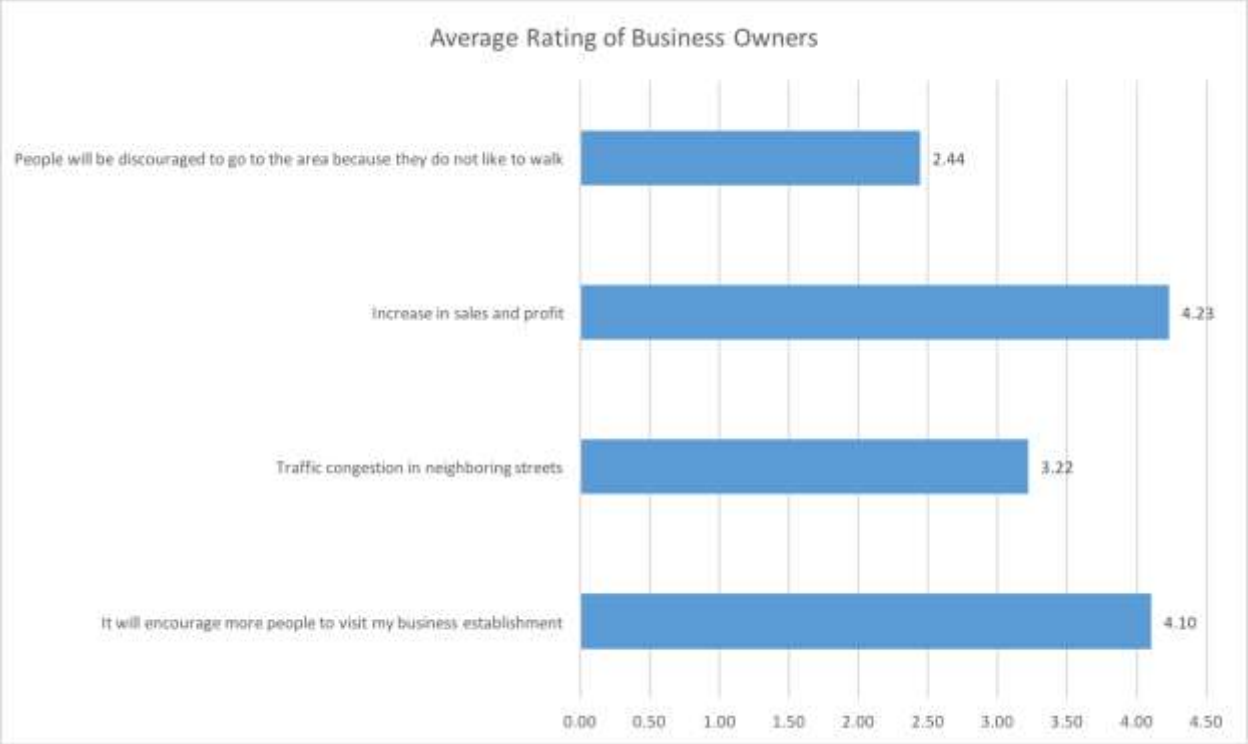


Figure 4. Average rating of business owners

The results in Figure 4 about the responses of the business owners showed the average rating of the respondents' answers to the perception survey, which followed the Likert scale. In this way, the average ratings would follow the scale with 1 as strongly disagree and 5 as strongly agree. As the results show, the respondents expressed mild disagreement, a rating of 2.44, regarding the discouragement of people to walk to Session Road. Likewise, they agreed, with a rating of 4.23 and 3.22 respectively, that pedestrianizing Lower Session Road would increase their sales and profit and it would encourage more people to visit their business establishments. However, business owners also expressed their mild agreement, a rating of 4.10, regarding the traffic congestion in neighboring streets.

Collected survey from the PUV Drivers group aids in determining whether or not the proposed scheme will be more of an advantage to them. Graphical representation of their responses are shown in Figure 5.4.3.

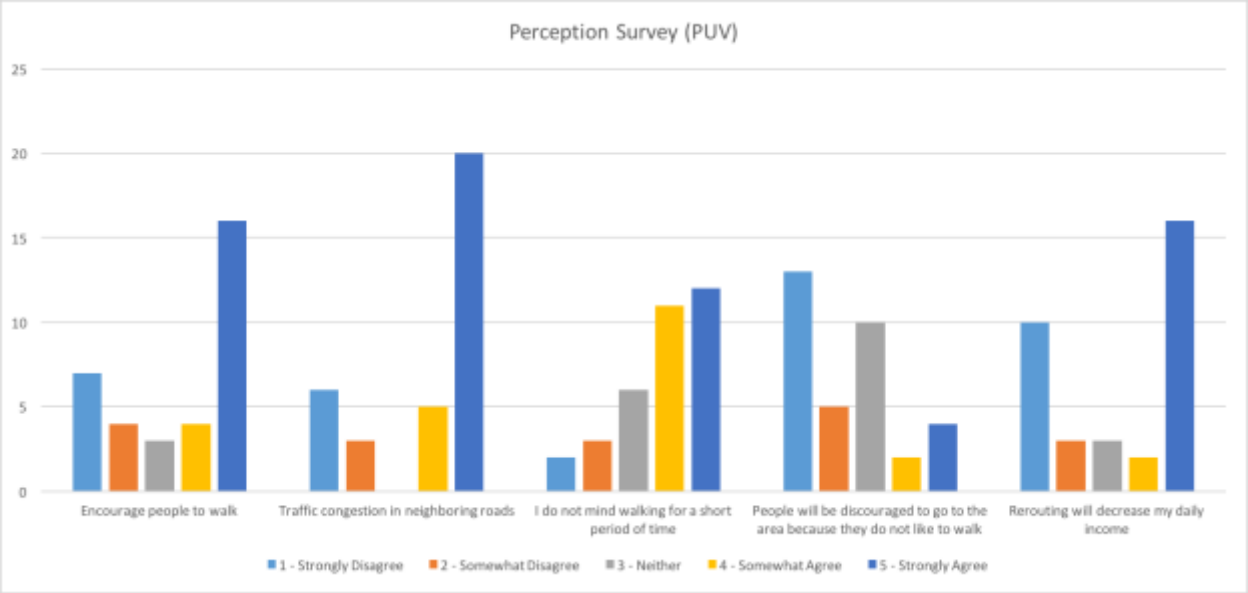


Figure 5. Perception survey (PUV)

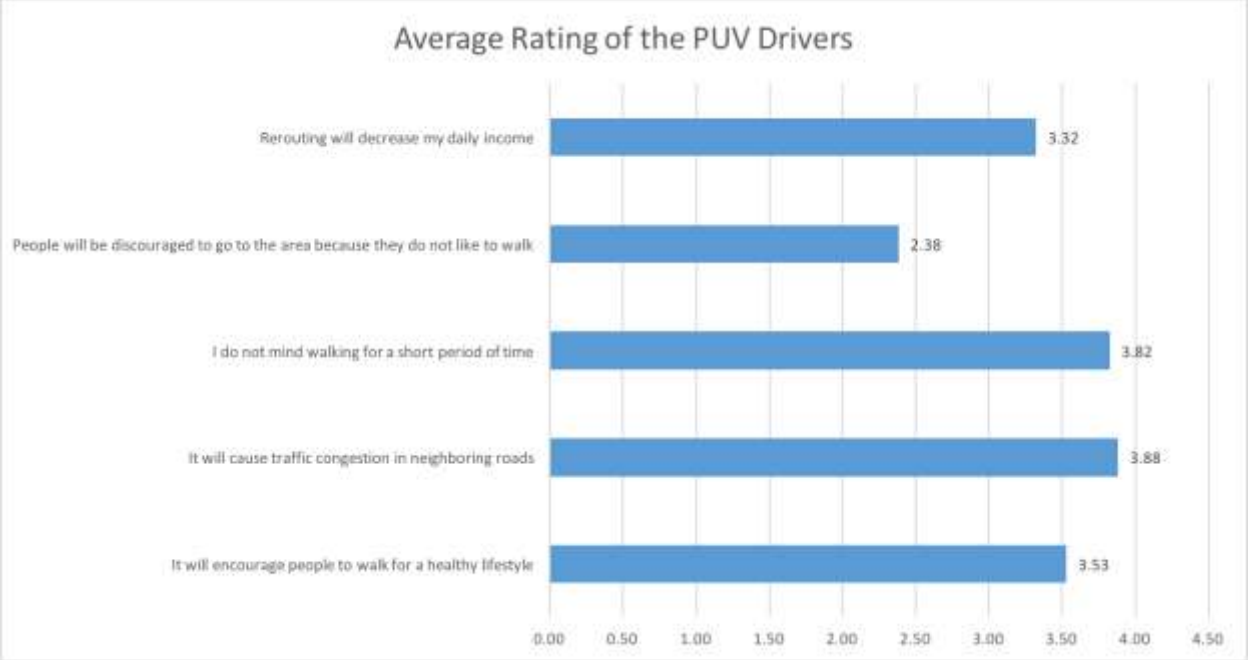


Figure 6. Average rating of the PUV drivers

From the 5-point Likert scale, the researchers were able to calculate the average rating of the PUV Drivers who answered the survey (as shown in Figure 6). The same scale will be used for the average rating, with 1 being they strongly disagree and 5 being they strongly agree. For PUV drivers, pedestrianizing Lower Session Road would encourage the people to walk for a healthy lifestyle since they do not mind walking for a short period of time, a rating of 2.38. On the side note, based on their opinion, rerouting will decrease their daily income, and will cause traffic congestion in neighboring roads, with ratings of 3.32 and 3.88 respectively. They expressed agreement, with a rating of 3.32, on the fact that this may discourage people to visit Lower Session road.

Figure 5.4.5, as shown below, presented the summary of the perspective of the pedestrians on changing the existing traffic scheme in Lower Session Road.

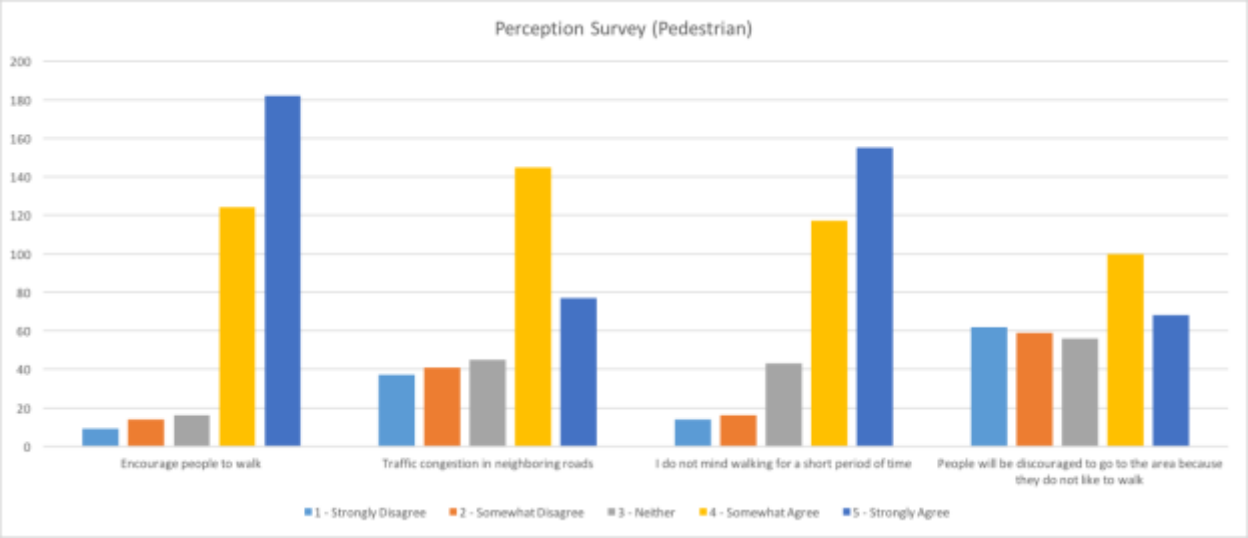


Figure 7 Perception survey (pedestrians)

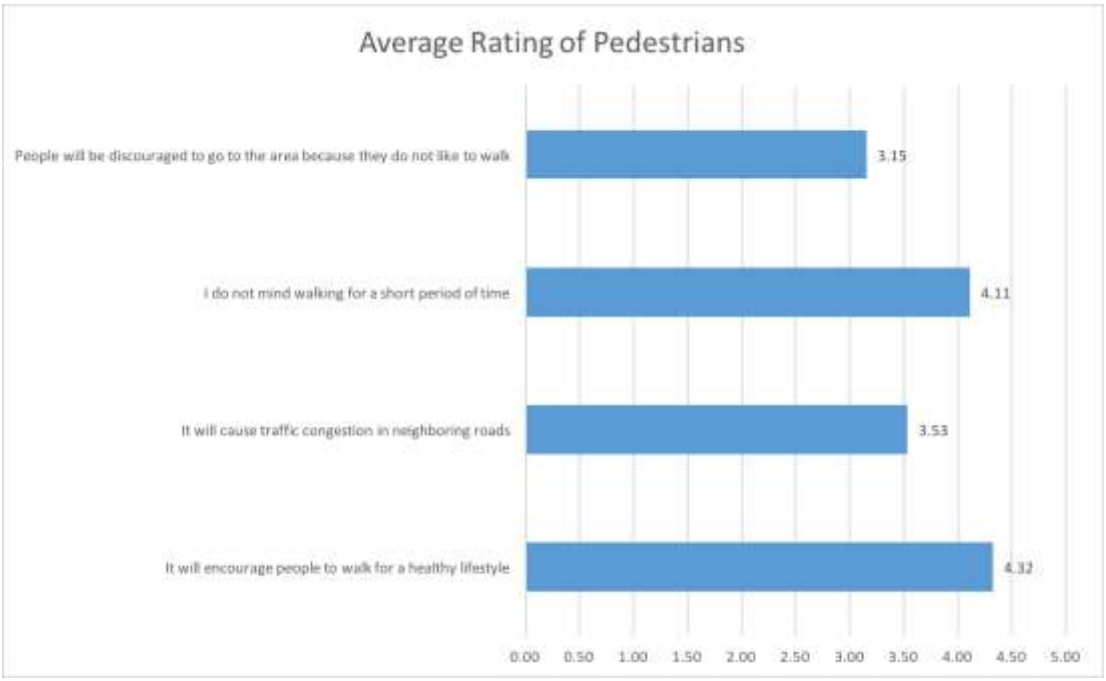


Figure 8. Average rating of pedestrians

Based from the perspective of the pedestrians asked to answer the survey (as shown in Figure 7), closing one side of Lower Session Road could encourage people to walk because they too do not mind walking for a short period of time, with ratings of 4.32 and 4.11. They somehow agree, a rating of 3.15, that this can discourage people to go to the area and this can cause traffic congestion in neighboring roads. This is based from the Likert scale with 1 as they strongly disagree and 5 as they strongly agree.

Figure 9 illustrated the answers of the car users in the perception survey that was presented to them during the data gathering of the researchers.

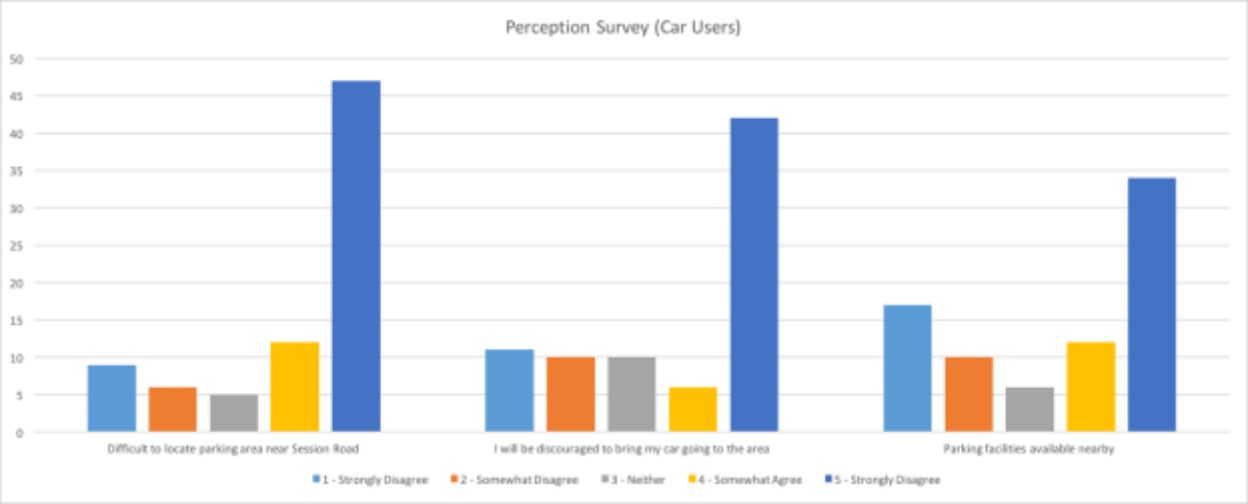


Figure 9 Perception survey (car users)

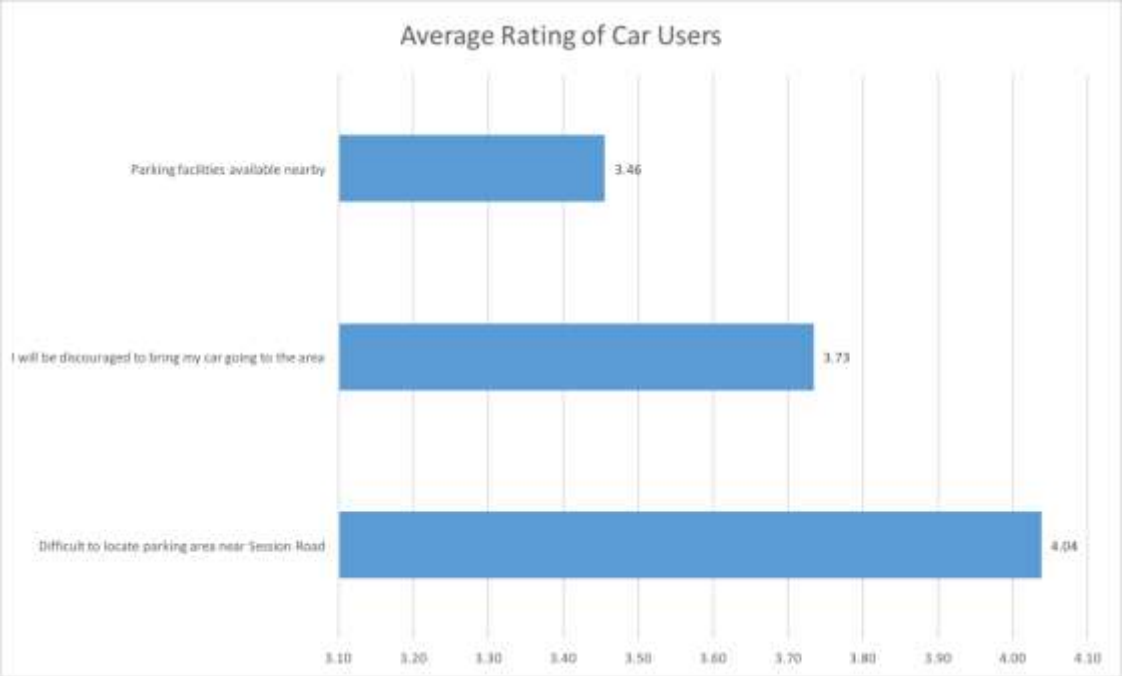


Figure 10. Average rating of car users

Figure 10 showed that if the pedestrianization in Lower Session Road is implemented, a rating of 3.73 means that the number of cars will be decreased due to their discouragement to bring their car to the area. Although they think that parking facilities are available nearby, it is still difficult to locate parking area near Session Road. The average rating is calculated to get the best possible data for car users and the same scale applies, 1 as strongly disagree and 5 as strongly disagree.

3.4 Pedestrian Count

A video trap was setup on three different locations namely SM Baguio, Porta Vaga, and Baguio Public Market to investigate the existing walking speed of the people along Session Road. Lengths of the trap are at 5 m, 18.2 m, and 14.5 m for SM Baguio, Porta Vaga, and Baguio Public Market respectively. Different factors were considered such as the age, traveling as group, with bag, with child, time of day that the people are walking, and the number of seconds it takes for a person to traverse a specific distance. These factors are considered relatively to the speed as shown in the tables that follow.

Table 2. Volume of pedestrians at Porta Vaga, Session Road

Porta Vaga	Going Down	Going Up	Total
1:00 – 1:15	473	319	792
1:15 – 1:30	157	221	378
1:30 – 1:45	197	336	533
1:45 – 2:00	521	365	886
			2589

Using Equation 2.2.1, the peak hour factor (PHF) in the area is 0.73053. Peak hour factor can range between 0.25 and 1. Higher numbers indicate a flatter peak meaning the volume is constant within the given hour. This value signifies that the volume is somehow constant throughout the hour. In this case, the PHF of 0.73 is indicative of a very sharp peak for an urban environment, and characterizes small towns and cities. This value is plugged-in in Equation 2.2.2 to calculate for flow rate. For Porta Vaga, the pedestrian flow rate is at 59.07 ped/min; while the average speed of the area is at 1.079 m/s. Based on the data gathered, the Level of Service at Porta Vaga, Session Road is E when Table 1 was used. This means that the space provided is insufficient for passing of slower pedestrians. Cross- or reverse-flow movements are possible only with extreme difficulties. Design volumes approach the limit of walkway capacity, with resulting stoppages and interruptions to flow.

Table 3 Volume of pedestrians at SM Baguio

SM Baguio	Total
1:00 – 1:15	638
1:15 – 1:30	574
1:30 – 1:45	571
1:45 – 2:00	768
	2551

For SM Baguio, the peak hour factor is 0.830404; the flow rate is 51.2 ped/min; and the average speed is 0.933231 m/s. Using Table 3.1, the Level of Service in the area is also E similar to Porta Vaga, Session Road.

Table 5.5.3 Volume of pedestrians at Baguio City Public Market

Baguio City Public Market	Total
2:30-2:45	650
2:45-3:00	556
3:00-3:15	610
3:15-3:30	617
	2433

For the Baguio City Public Market, the peak hour factor is 0.93576923; the flow rate is 43.33 ped/min; and the average speed is 1.014077 m/s. Using Table 3.1, the Level of Service in the area is also E.

Table 4. Correlation data for pedestrian count in Session road

		Speed	Age	Gender	WithChild	Group	WithBag	GoingDown	Morning
Speed	Pearson Correlation	1	-.603**	.056*	-.178**	-.088**	.070**	.202**	-.110**
	Sig. (2-tailed)		.000	.017	.000	.000	.003	.000	.000
	N	1800	1800	1800	1800	1800	1800	1800	1800
Age	Pearson Correlation	-.603**	1	.001	.012	-.020	-.161**	-.135**	.078**
	Sig. (2-tailed)	.000		.981	.620	.393	.000	.000	.001
	N	1800	1800	1800	1800	1800	1800	1800	1800
Gender	Pearson Correlation	.056*	.001	1	-.077**	-.018	.019	-.030	.007
	Sig. (2-tailed)	.017	.981		.001	.441	.430	.208	.777
	N	1800	1800	1800	1800	1800	1800	1800	1800
WithChild	Pearson Correlation	-.178**	.012	-.077**	1	.247**	-.101**	-.098**	-.051*
	Sig. (2-tailed)	.000	.620	.001		.000	.000	.000	.030
	N	1800	1800	1800	1800	1800	1800	1800	1800
Group	Pearson Correlation	-.088**	-.020	-.018	.247**	1	-.354**	-.005	-.126**
	Sig. (2-tailed)	.000	.393	.441	.000		.000	.839	.000
	N	1800	1800	1800	1800	1800	1800	1800	1800
WithBag	Pearson Correlation	.070**	-.161**	.019	-.101**	-.354**	1	-.014	.276**
	Sig. (2-tailed)	.003	.000	.430	.000	.000		.549	.000
	N	1800	1800	1800	1800	1800	1800	1800	1800
GoingDown	Pearson Correlation	.202**	-.135**	-.030	-.098**	-.005	-.014	1	-.094**
	Sig. (2-tailed)	.000	.000	.208	.000	.839	.549		.000
	N	1800	1800	1800	1800	1800	1800	1800	1800
Morning	Pearson Correlation	-.110**	.078**	.007	-.051*	-.126**	.276**	-.094**	1
	Sig. (2-tailed)	.000	.001	.777	.030	.000	.000	.000	
	N	1800	1800	1800	1800	1800	1800	1800	1800

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

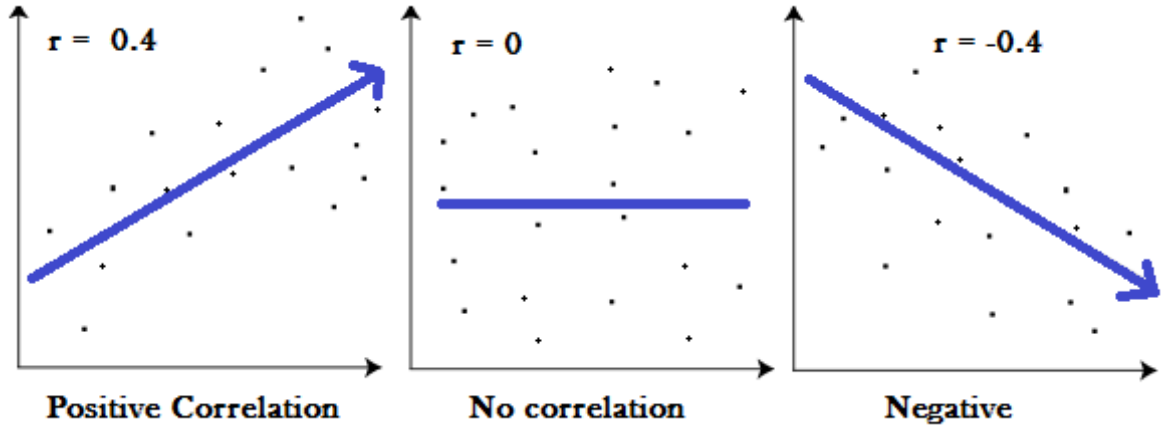


Figure 11 Pearson's correlation interpretation

Table 4 shows the correlation between sets of data to show how much they are related. In this data, the Pearson Correlation measure can be used to interpret the results shown in the table. Using this measure, certain scale is applied to determine the effect size. Values of effect size around 0.5 to 1 or -0.5 to 1 signifies high correlation; 0.3 to 0.5 or -0.3 to 0.5 means medium correlation; while 0.1 to 0.3 or -0.3 to -0.1 indicates low correlation. Low correlation shows the values for x do not affect the values for y. Based from the values on the table, only the relationship between speed and age has high correlation while the relationship between gender and speed, speed and with child, travelling as a group and speed, with bag and speed, and morning and speed have low correlations. As shown in

Figure 11, negative values for R tells that the relationship between x and y values are going down. For the data investigated, the speed represents the y value while the x represents different factors considered such as age, gender, whether they are traveling with child, traveling as a group, with bag, going down, and the time of day they are traversing the area. Taking into consideration the relationship between age and speed, the R value is negative. As shown in Figure 11, the expected graph is sloped downwards which means that as the x increases, y decreases. Therefore, as the age of the sample increases, their speed decreases. Analyzing the results, the data gathered tell that older people, people with child, those traveling as a group, and those who are traversing in the morning walk at a slower pace; while male travelers, pedestrians with bag, and those who are going down traverse the area faster.

Table 5.5.5 Regression statistics

Regression Statistics	
Multiple R	0.64600269
R Square	0.41731948
Adjusted R Square	0.41504338
Standard Error	0.21136765
Observations	1800

Table 5.5.6 ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	7	57.33940949	8.1913442	183.34882	5.49E-205
Residual	1792	80.05990315	0.0446763		
Total	1799	137.3993126			

Critical Value (T-test) = 1.961284
Critical Value (F-test) = 2.014681

Table 5.5.7 Regression Analysis

	Coefficient	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.5256	0.0226	67.4692	0.0000	1.4813	1.5700	1.4813	1.5700
Age	-0.0159	4.99E-04	-31.8498	8.78E-177	-0.0169	-0.0149	-0.0169	-0.0149
Gender	0.0266	0.0100	2.6536	8.03E-03	0.0069	0.0463	0.0069	0.0463
With child	-0.0919	0.0120	-7.6783	2.63E-14	-0.1153	-0.0684	-0.1153	-0.0684
Travelling as a group	-0.0218	0.0048	-4.5446	5.87E-06	-0.0312	-0.0124	-0.0312	-0.0124
With bag	-0.0168	0.0061	-2.7598	5.84E-03	-0.0288	-0.0049	-0.0288	-0.0049
Going Down	0.0598	0.0107	5.5700	2.93E-08	0.0388	0.0809	0.0388	0.0809
Morning	-0.0319	0.0105	-3.0372	2.42E-03	-0.0524	-0.0113	-0.0524	-0.0113

The value of R^2 for the given data is at 0.417. Although this value is somehow far from 1, it is considered as medium correlation. Based from the ANOVA table (Table 5.5.6), the number of Regression coefficients is 7, and the number of observations is 1 799. The regression coefficient will be used to determine the equation of the data. For the given data, the critical data is 2.01468711 which is relatively lower than the F value at 183.34882. This means that the collected data gives a degree of correlation. Given the values of the intercept and b, the equation of the graph is:

$$y = -.016x_1 + 0.027x_2 + -0.092x_3 + -0.022x_4 + -0.017x_5 + 0.060x_6 + -0.032x_7 + 1.526$$

As shown in Table 5.5.7, the values of t are at -31.84979, 2.653638, -7.67828, -4.544611, -2.759778, 5.5699718 and -3.037177 for the coefficients representing age, gender, with child, travelling as a group, with bag, going down, and morning respectively, are not within the range of the critical values. This means that the data passed the test and the data can be used. The P-values as shown in Table 5.57 are all less than the 5%. Passing the t-test and P-test means that the value of the slope of the equation has significance. Investigating on the confidence interval, the upper and lower interval, the values do not contain 0. This means that the relationship between speed and all the other factors can be concluded as linear.

3.5 EMME 4 Analysis

Figure 5.6.1 Map and EMME 4 Network of Baguio City

EMME 4 network was used to study the transportation activities of a sample in Baguio City. The Origin-Destination (OD) as answered in the pre-survey was used to create a matrix where the researchers come to know where people go to and from. The OD matrix created from the data collected was also used to locate the zones for proper execution of the program.

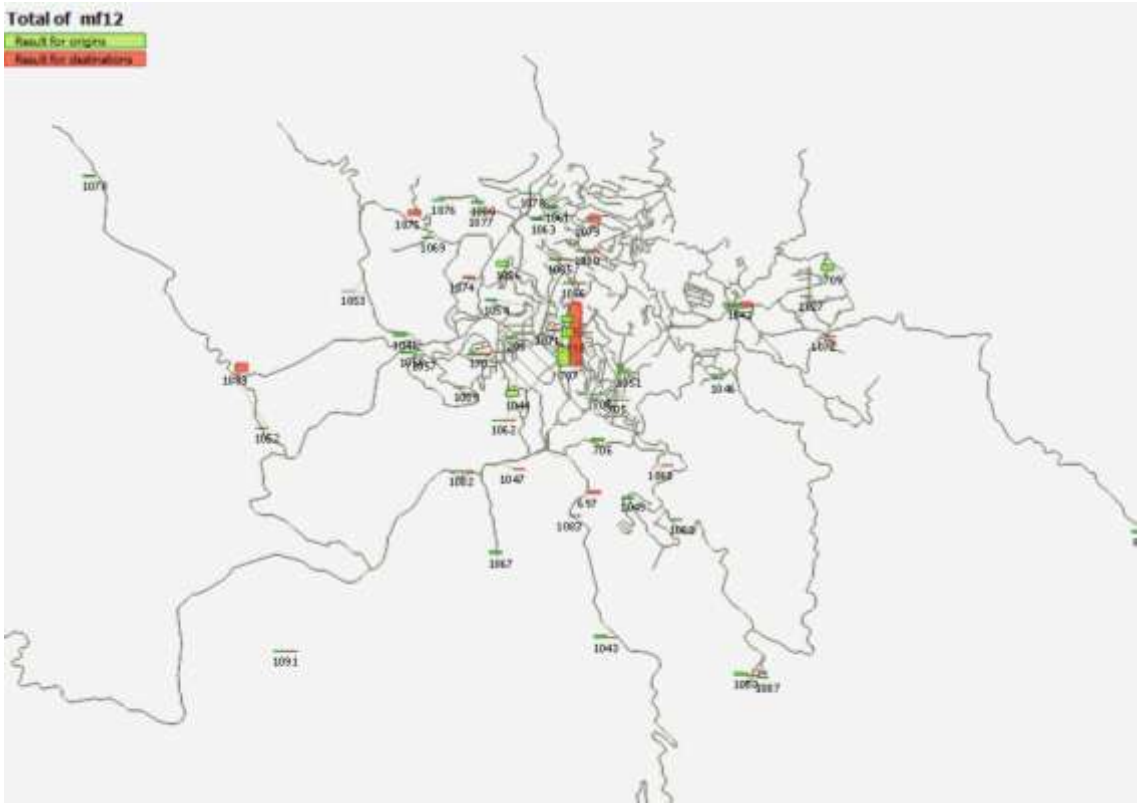


Figure 5.6.2 Network of Baguio City and pedestrian volume of every zone

Using EMME4 network, trip origin and destination of pedestrians was investigated. As seen on Figure 16, most of the samples come to and from Session Road. This is because it is the central business district of the city.

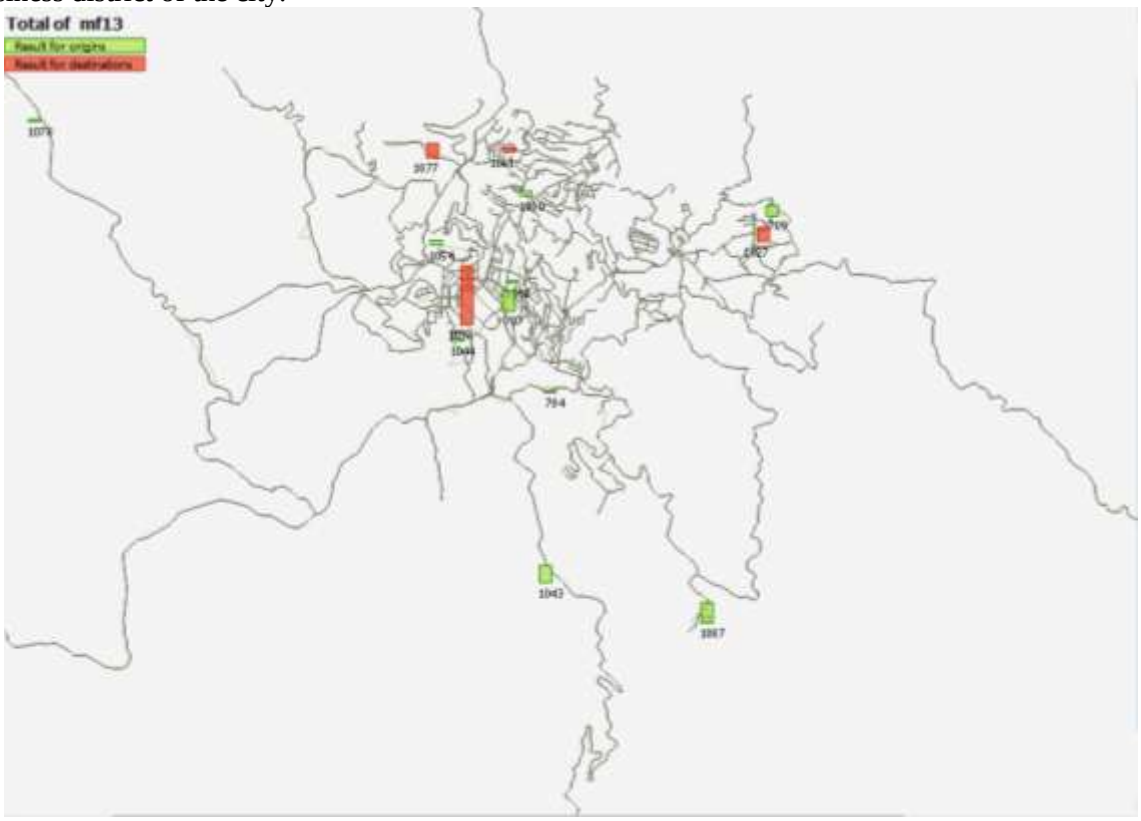


Figure 5.6.3 Baguio City Network and PUV Driver volume for each zone

Based from Figure 5.6.3, PUV drivers' most common destination is near Burnham Park. This is because a nearby Jeepney terminal is located in this area. It can also be seen in the figure that PUV drivers' origin are distributed at different areas such as: Loakan Road, Session Road and Camp 7.

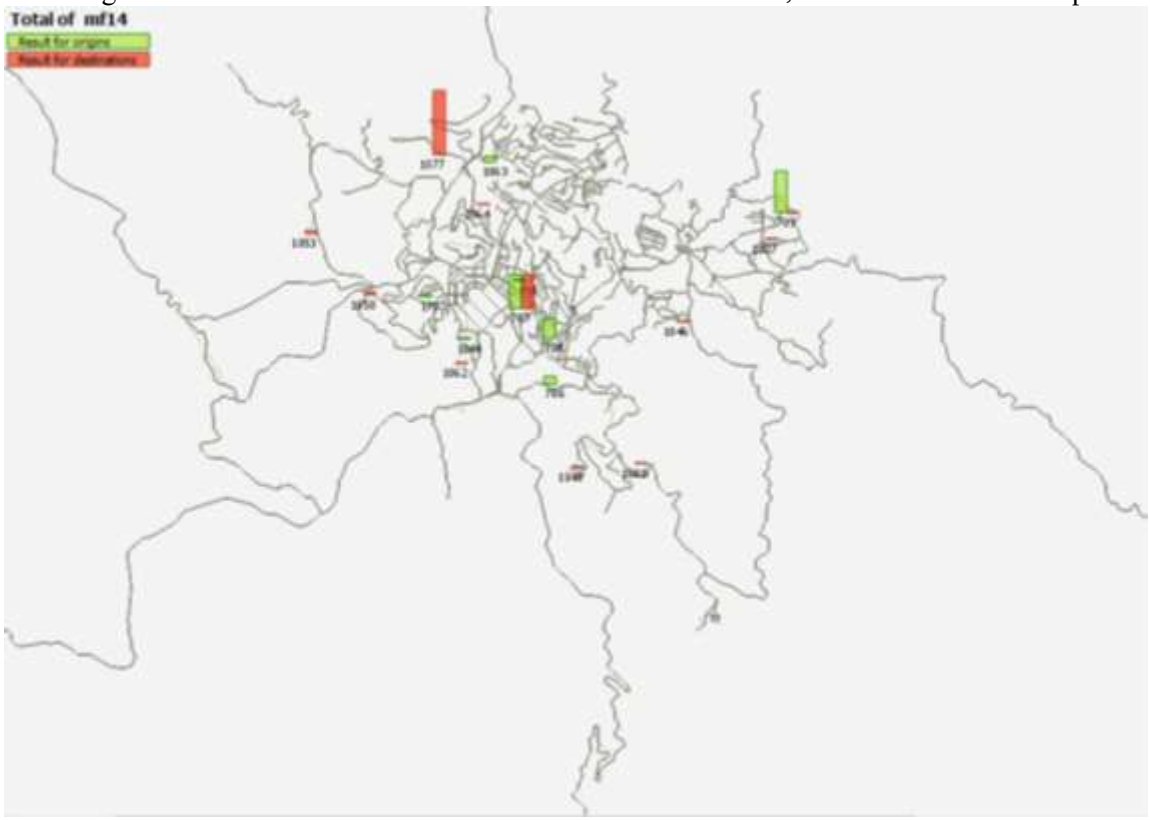


Figure 5.6.4 Network of Baguio city and volume of car users for each zone

For car users, most of them come from Mines View where Wright Park is located and a parking facility is available. Their most common destination is at East Quirino Hill.

Figure 5.6.5 Network of Baguio city and volume of business owners for each zone

Most of these business owners' destination is at Green Valley. As seen in Figure 5.6.5, their origin is distributed to different areas such as: Camp 7, Session Road, and Mines View.

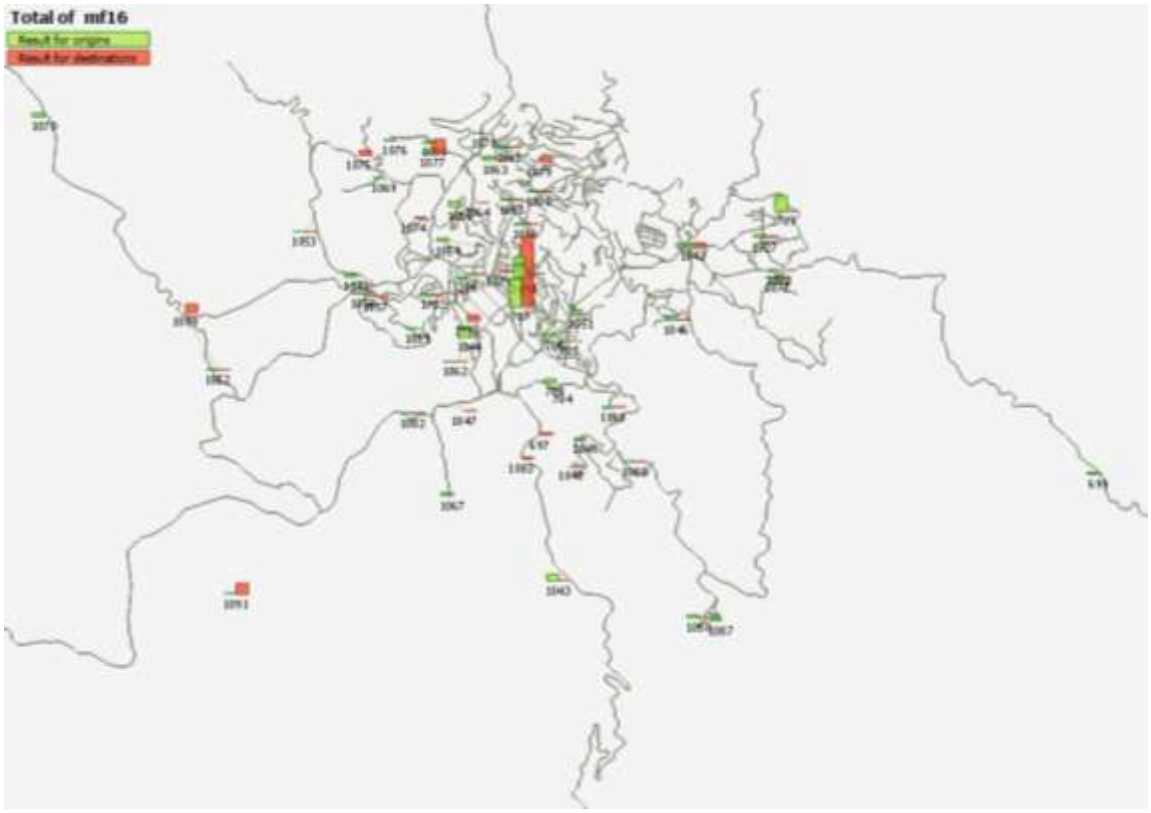


Figure 5.6.6 Network of Baguio city and total volume for each zone

As shown in Figure 5.6.6, getting the sum of all origins and destination for every zone, it is evident that most of the samples surveyed are concentrated in Session Road, Baguio City. Distributing the total number to 35% for Private vehicle users, and 65% for Public vehicle users, similar results was produced as seen in Figures 5.6.7 and 5.6.8.

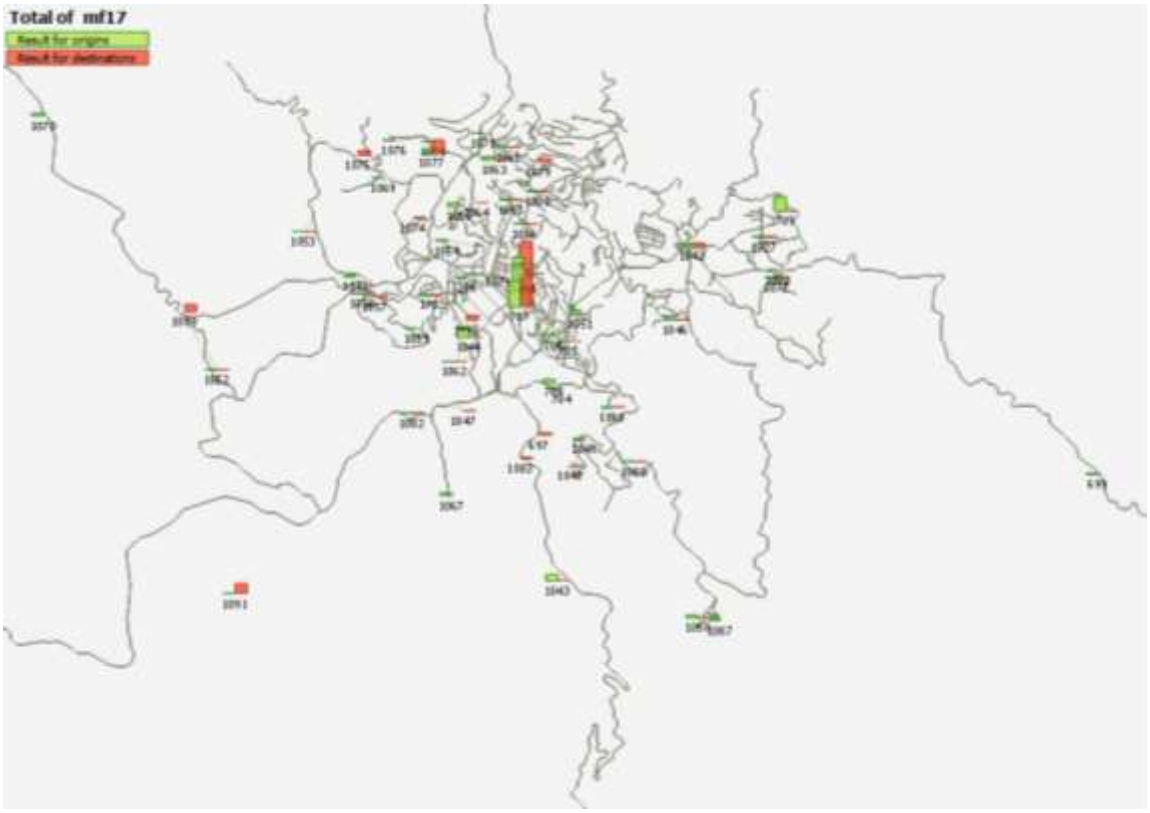


Figure 5.6.7 Network of Baguio city and volume of public vehicle users for each zone

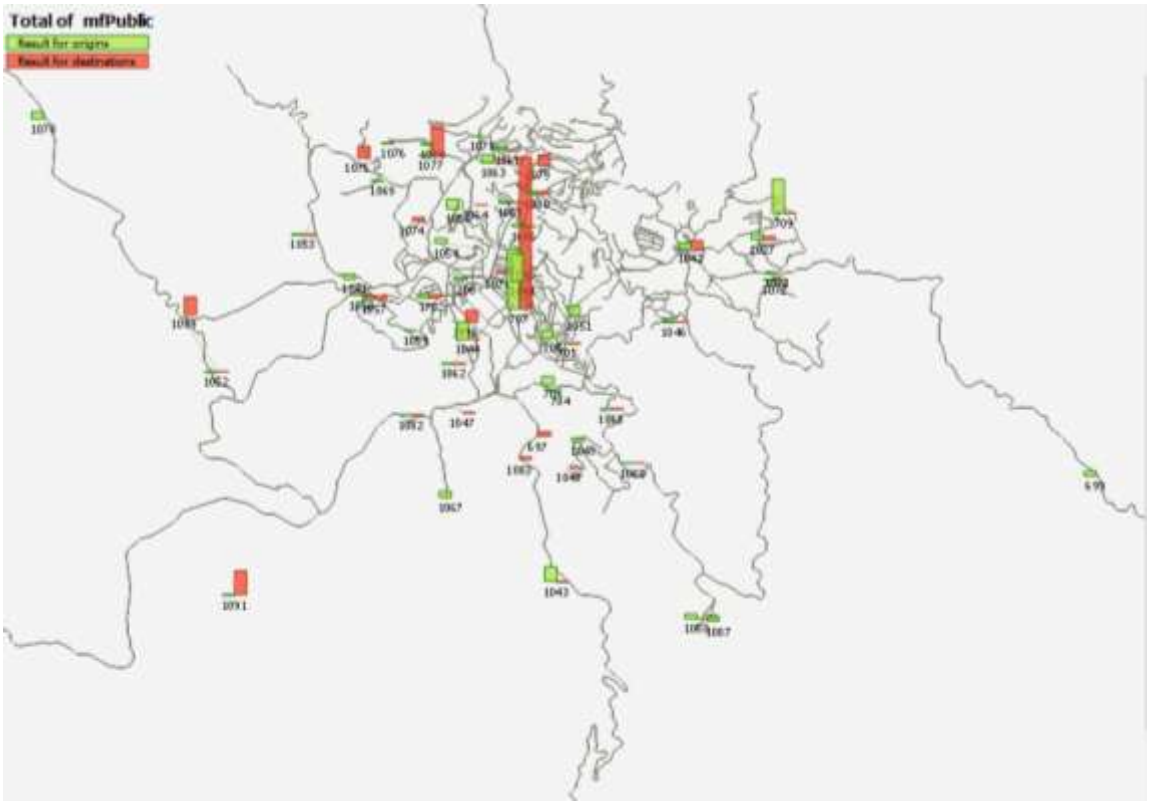


Figure 5.6.8 Network of Baguio city and volume of private vehicle users for each zone

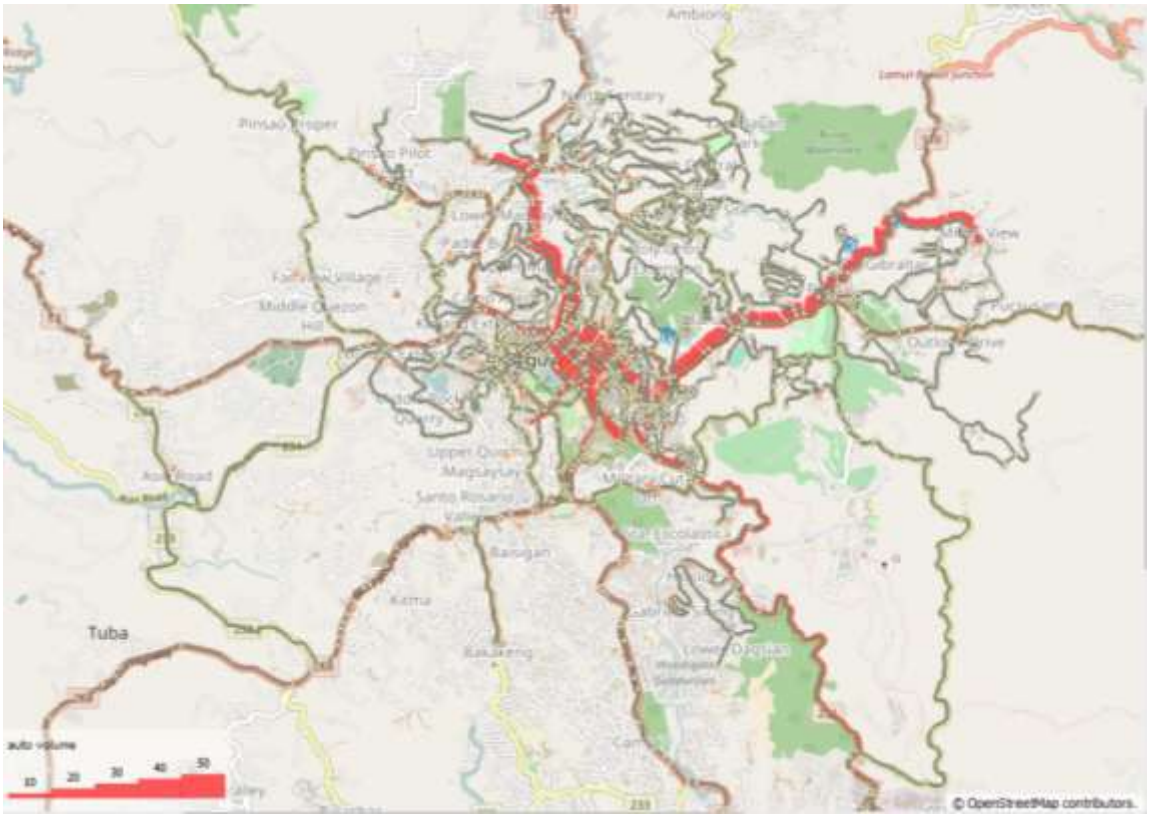
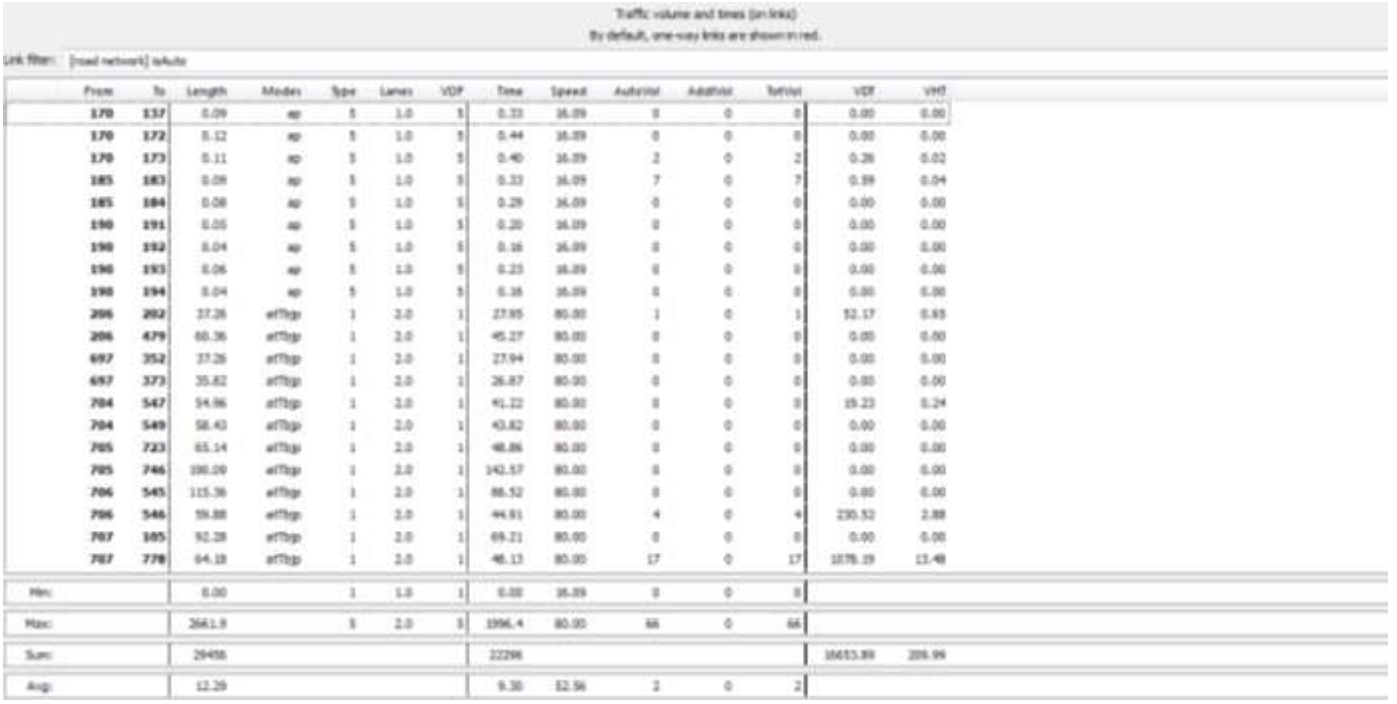


Figure 5.6.9 Map and Network of Baguio city with volume for each zone

Figure 5.6.9 shows that the volume of samples are concentrated in Session Road, Mabini, Gibraltar, Pacdal, Padre Burgos, and Burnham. All of these areas are leading to Session Road, Baguio City.



Traffic volume and times (on links)
By default, one-way links are shown in red.

Link filter: [road network] isAuto

From	To	Length	Modes	Type	Lanes	VDF	Time	Speed	AutoVol	AddVol	TotVol	VDF	VHT
170	137	0.09	ap	5	1.0	5	0.33	16.09	0	0	0	0.00	0.00
170	172	0.12	ap	5	1.0	5	0.44	16.09	0	0	0	0.00	0.00
170	173	0.11	ap	5	1.0	5	0.40	16.09	2	0	2	0.26	0.02
185	183	0.09	ap	5	1.0	5	0.33	16.09	7	0	7	0.59	0.04
185	184	0.08	ap	5	1.0	5	0.29	16.09	0	0	0	0.00	0.00
190	191	0.05	ap	5	1.0	5	0.20	16.09	0	0	0	0.00	0.00
190	192	0.04	ap	5	1.0	5	0.16	16.09	0	0	0	0.00	0.00
190	193	0.06	ap	5	1.0	5	0.23	16.09	0	0	0	0.00	0.00
190	194	0.04	ap	5	1.0	5	0.16	16.09	0	0	0	0.00	0.00
206	202	37.26	arTbp	1	2.0	1	27.95	80.00	1	0	1	52.17	0.93
206	479	60.36	arTbp	1	2.0	1	45.27	80.00	0	0	0	0.00	0.00
697	352	37.26	arTbp	1	2.0	1	27.94	80.00	0	0	0	0.00	0.00
697	373	35.82	arTbp	1	2.0	1	26.87	80.00	0	0	0	0.00	0.00
704	547	54.96	arTbp	1	2.0	1	41.22	80.00	0	0	0	19.23	0.24
704	549	58.43	arTbp	1	2.0	1	43.82	80.00	0	0	0	0.00	0.00
705	723	65.14	arTbp	1	2.0	1	48.86	80.00	0	0	0	0.00	0.00
705	746	190.09	arTbp	1	2.0	1	142.57	80.00	0	0	0	0.00	0.00
706	545	115.36	arTbp	1	2.0	1	86.52	80.00	0	0	0	0.00	0.00
706	546	59.88	arTbp	1	2.0	1	44.91	80.00	4	0	4	230.52	2.88
707	105	92.28	arTbp	1	2.0	1	69.21	80.00	0	0	0	0.00	0.00
707	778	64.18	arTbp	1	2.0	1	48.13	80.00	17	0	17	1078.19	13.48
Min:		0.00		1	1.0	1	0.00	16.09	0	0	0		
Max:		2661.9		5	2.0	5	1996.4	80.00	66	0	66		
Sum:		29456					22298					16453.89	209.99
Avg:		12.29					9.30	82.56	2	0	2		

Figure 5.6.10 Summary of traffic volume and times for every link

As seen on Figure 5.6.10, the speed is at 80 kph. This means that the pace at the area is fast contradictory to the average speed as calculated for pedestrian count. This is because the data used for the network is insufficient to fully represent the background traffic in the location.

4. CONCLUSION

Given the different factors to consider when walking, most of the respondents considered safe environment as the most important while the weight of baggage carried is the least considered. Other factors such as directness of path, distance and cleanliness were only somehow given consideration since according to the respondents, these were not a problem in the said location. Weather and scenery were also part of the least important since Baguio is known for its cold weather and its beauty. Traffic congestion affects highly the decision of the people to walk because of the pollution.

Different opinions were gathered regarding the proposed scheme. Contrary to popular belief, implementing pedestrianization along Session Road will not decrease the sales and profits of business establishments that are situated there. In addition to that, Figure 11 illustrated that business owners believe that more people will be encouraged to visit their establishment when the proposed pedestrianization is executed. For pedestrians and public utility vehicle drivers, figures 12 and 13 presented that walking will help promote healthy lifestyle and walking for a short period of time is not an inconvenience. On the side note, both groups think that the scheme can cause traffic congestion. Aside from this, public utility vehicle drivers also think that this will decrease their daily income. Though pedestrians think this will discourage people to visit the area, the PUV drivers said otherwise. Pedestrianization will also discourage private vehicle users to bring their vehicles along the area. This does not seem to be a problem since based on the results of the survey, parking facilities are available nearby but not along Lower Session Road. It will also help in alleviating the traffic congestion along the area since more people are inclined to not bring their private cars anymore.

5. RECOMMENDATION

Being the Summer Capital of the Philippines, tourists coming from different places are expected to visit Baguio City. Particularly in the areas of SM Baguio, Porta Vaga, and Baguio Public Market that are all found in Session Road which are often crowded by pedestrians, business owners,

public transport drivers and car users. Hence, affecting the traffic congestion that's present in the area. One way to ease the congestion is through implementing pedestrianization in which a part of an area would be close to vehicles to give way to pedestrians and rerouting would be executed.

The number of observed samples for pedestrian count is at 1 800 pedestrians. Using the statistical analysis, the number of observations were sufficient to show a correlation since it passed t-test and the p-test. Although this is the case, the value of R is only at 0.5 which shows a medium correlation. For the data to be considered as high correlation, it is suggested to increase the number of data samples. Another suggestion is to use the software QGIS. This software is for land use planning and it may help to have a better perception of the place and to be able to see if there will be an improvement of land use once implementation is done.

Future researchers can also consider parking studies for improvement of the study. From the research conducted, parking was only discussed based on the perception of the respondents whether the facilities are sufficient. By expounding this area of study, the capacity and demand for parking would be determine. This way, implementation of the said scheme would be effective in regulating the number of private vehicles traversing the area. Moreover, the research should also include studies about the effects of pedestrianization with respect to the environmental aspect. For the past few years due to unceasing visitation of tourists, increase of population, and continuous traffic congestion, there is an escalation of pollution in the area of Session Road. Explaining this study further would strengthen the possibility of pedestrianizing in the area.

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